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Menstrual health intervention and school attendance in Uganda (MENISCUS-2): A pilot intervention study

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Keywords:	Menstrual Health, School attendance, Menstrual Hygiene, Adolescent Health, Education

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3 **Menstrual health interventions and school attendance in Uganda (MENISCUS-2): A pilot**
4 **intervention study**
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Abstract

Objectives: Menstrual health management (MHM) is a public health challenge and there is a lack of evidence to inform interventions. The objective of this study was to pilot-test an intervention to improve MHM and school attendance in Uganda, in preparation for a cluster-randomised trial.

Design: Longitudinal study with pre-post evaluation of a pilot intervention

Setting: Two secondary schools in Entebbe, Uganda

Participants: Of the 473 eligible students in Secondary 2 (S2) at baseline, 450 (95.1%; 232 girls and 218 boys) consented/assented. Overall, 369 students (188 girls; 81.0%; and 181 boys; 83.0%) participated in the endline survey.

Intervention: The intervention package comprised training teachers to improve delivery of government guidelines for puberty education, training in use of a menstrual kit (including reusable pads) and pain management, a drama skit, provision of analgesics and improvements to school water and sanitation facilities.

Primary and secondary outcome measures: Feasibility and acceptability of delivering the intervention. Baseline and endline quantitative surveys were conducted, with qualitative interviews conducted at endline. School attendance was assessed using self-completed daily diaries among a nested closed cohort of 100 female students.

Results: The intervention was found to be acceptable and feasible to deliver from the qualitative and quantitative data. There were substantial reported improvements in menstrual-related stigma and anxiety, pain management, and some improvement in MHM knowledge of puberty and menstruation and Water, Sanitation and Hygiene (WASH) at endline compared with baseline, which were supported by qualitative findings. The diary data and qualitative data indicated a potential impact of the intervention on improving menstrual-related school absenteeism.

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3 **Conclusions:** The pilot study showed that the multi-component MHM intervention was
4 acceptable and feasible to deliver, and potentially effective on education and health outcomes.
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7 A cluster-randomised trial is needed to evaluate the intervention effects on MHM and school
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9 attendance.
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15 **Key words:** Menstrual Health, Menstrual Hygiene, Adolescents, Education, School
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17 Attendance
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19 20 21 22 **Article Summary**

23 24 **Strengths and limitations of this study:**

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28 • The study population are students in peri-urban secondary schools, which is important
29 given the recognised importance of girls' secondary education to future development, and
30 evidence that school absenteeism due to menstruation is problematic in secondary school
31 girls.
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35 • The study evaluated a multi-component menstrual health intervention that addresses
36 individual, behavioural and environmental barriers to good menstrual health and school
37 attendance.
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41 • This is the first menstrual health intervention to address menstrual pain – a major
42 contributor to school absence in girls
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46 • The intervention includes boys as well as girls, as sustainable changes in menstrual
47 management depend on addressing stigma about menstruation.
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INTRODUCTION

Poor menstrual health management (MHM) affects girls and women globally,[1-4] with many lacking knowledge, materials and facilities for safely managing menstruation without stigma.[2] Effective MHM interventions may lead to sustained benefits for health, productivity [3-5] and the environment [6] but there is little evidence to guide policies.[7-9] Systematic reviews identified nine MHM intervention trials with health, educational or psychosocial outcomes, with inconclusive results and high risk of bias.[5, 10]

Schools provide an important setting for addressing MHM challenges concerning stigma, lack of menstrual literacy and goods (menstrual products, improved water, sanitation and hygiene (WASH) facilities and pain management).[11] In 2014, the “MHM in Ten” initiative developed an agenda for addressing the barriers facing girls in schools in low-income contexts.[12] The first priority of the initiative is to generate rigorous evidence on whether improving MHM improves school attendance.[7, 8, 13]

The aim of this study was to pilot-test a multi-component school-based MHM intervention (“MENISCUS”) and to prepare for a future cluster-randomised trial (CRT) to evaluate the impact of the intervention on secondary school attendance, education, health and wellbeing outcomes in Wakiso District, Uganda.

METHODS

Study setting and participants

This pilot study was conducted in Entebbe Municipality in Wakiso District, Uganda. Entebbe has 13 registered secondary schools. Two day schools (one government and one private), both with students of low socio-economic status, were purposively selected. Eligible participants were all male and female students in the second school year (Secondary 2 (S2)).

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3 Written informed consent was sought from students aged ≥ 18 years, and from the
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5 parents/caretakers of those aged < 18 years, with student assent.
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8 9 **Intervention package**

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11 We had conducted a study in this setting to develop the intervention and found that effective
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13 MHM intervention needs to address stigma, education, attitudes and psychosocial well-being,
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15 and provide the goods defined above.[14] Following this, we finalised the pilot MENISCUS
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17 intervention, informed by social cognitive theory (SCT) which postulates that learning occurs
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19 in a social context and that personal factors, behavioural patterns and environmental aspects
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21 have bidirectional influences on one another.[15] Using the core constructs of SCT, we
22
23 developed a theory of change (ToC) (Figure 1) with stakeholders to articulate the aims of the
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25 intervention: i) increase girls' self-efficacy to manage their menstruation (e.g. through provision
26
27 of an MHM kit and pain-management options); ii) use observational learning to reinforce girls'
28
29 learning and that of boys, teachers and parents to create a more supportive MHM environment
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31 (through drama); and iii) provide positive reinforcement for behaviour change (through
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33 improving WASH facilities and reduced leakage/pain as a result of better MHM).
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39 The intervention was implemented in partnership with a local NGO, WoMena Uganda, and
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41 consisted of

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43 i. Puberty education: WoMena Uganda worked with an educational consultant to train 30
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45 teachers from the two schools to improve delivery of Ugandan Government guidelines for
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47 puberty education.
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49 ii. Drama Skit: To address stigma, attitudes and psychosocial issues about menstruation,
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51 WoMena Uganda trained school teachers and students to develop and perform drama
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53 skits. Topics included managing pain, teasing, parental responsibilities for supporting girls
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55 with menstruation and tracking the menstrual cycle.
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57 iii. Menstrual management kit: A kit, including a pack of 4 AFRipad reusable menstrual pads,
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59 a small towel, soap, water bottle, underwear and menstrual calendar, was distributed to
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3 all girls in S2. WoMena Uganda taught girls about effective pain relief strategies such as
4 stretching, using a hot-water bottle and trained teachers and prefects to deliver education
5 sessions on menstruation to girls and boys, on MHM and use of the re-usable pads to
6 girls only.
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11 iv. Pain management: The research team supplied each girl with vouchers to exchange for
12 up to six paracetamol tablets per month from the school nurse, senior teacher or a local
13 pharmacy.
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17 v. WASH facilities: The research team improved school WASH facilities: improving access
18 to water close to the sanitation facilities e.g. provision of water drums and stands (one
19 with clean water and one with soapy water), installing locks, repairing broken doors,
20 providing bins and providing toilet-paper holders.
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29 **Study design and evaluation**

30 The pilot study had a repeat cross-sectional design with a nested closed cohort. All
31 participants were asked to self-complete a quantitative survey at baseline (October 2017) and
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endline (August 2018) on tablets using Open-Data-Kit software. Questions included
knowledge of puberty and menstruation, perceptions of menstruation (using a 5-point Likert
scale), menstrual management practices at last menstrual period (LMP), reported pain and
pain management strategies, leakages during LMP, anxiety, behavioural and conduct
problems, using the 25-item Strengths and Difficulties Questionnaire (SDQ).

The nested closed cohort comprised a random sub-sample of 50 girls per school assessing
the feasibility of school attendance and menstruation patterns using self-completed daily
diaries. Cohort participants were given a booklet each term for daily recording of school and
class attendance, menstruation and pain.

Qualitative interviews were used to assess perceptions and acceptability of the intervention,
and its perceived impact on school attendance at endline. In-depth interviews (IDIs) were

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3 conducted with 20 female students sampled purposively (menstruating S2 girls with different
4 levels of reported baseline school attendance), 10 teachers (6 females and 4 males) and 10
5 parents who had attended the drama performance. Four focus-group discussions (FGDs)
6 were conducted (two with each sex). Semi-structured topic guides were used for both IDIs and
7 FGDs. Interviewers were the same sex as respondents and interviews were digitally recorded
8 with permission.
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18 Research assistants conducted nine unannounced WASH assessment visits per school using
19 a standardized checklist to assess availability, accessibility and functioning in terms of sanitary
20 waste disposal, availability of water, soap, hand-washing facilities and toilet paper; cleanliness
21 and privacy.
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28 **Data management and analysis**

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30 Electronically-captured data were exported to Stata version 15. The paper-based diary data
31 and WASH checklist data were entered using Microsoft Access. For the survey data, the
32 intervention effect on binary outcomes was estimated by comparing endline versus baseline
33 measures, using adjusted odds ratios (AOR) and 95% confidence intervals (95%CI) estimated
34 with random-effects logistic regression accounting for within-individual clustering. Effects on
35 continuous outcomes were similarly assessed with random-effects linear regression to
36 estimate the adjusted mean difference (AMD) and 95%CI. All analyses were adjusted for
37 school, gender and age (<16, >16 years) as fixed effects. Moderation by school and age group
38 were assessed using the likelihood ratio test. For the nested cohort, period-days were defined
39 from the diary data as the days of menstruation (bleeding) plus the day prior to menstruation,
40 with sensitivity analyses restricted to days of menstruation only.
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56 Audio-recordings were transcribed verbatim and translated into English. Data were analysed
57 using thematic content analysis, with two social scientists independently coding and checking
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3 results. Key themes and subthemes related to the objectives of the qualitative research were
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5 organised in a matrix and discussed by the team for appropriate interpretation.
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8 **Patient and public involvement**

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10 Community groups were involved throughout the formative work, with stakeholders'
11 workshops in August 2016 and October 2018, and a Theory of Change (ToC) workshop in
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13 April 2017. The ToC workshop included 35 invited participants (teachers, students and parents
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15 from the MENISCUS-1 and -2 schools, representatives from the Ministry of Education and
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17 Sports (MoES), Ministry of Health (MoH), the District Education Officer, Makerere University
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19 and NGOs working on menstrual health). In October 2018, we disseminated findings from
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21 MENISCUS-2 at a stakeholders' workshop, and elicited input into the future trial design. This
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23 meeting was attended by 60 participants, including representatives from MoES, MoH, Uganda
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25 National Council for Science and Technology (UNCST), Wakiso District Local Government
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27 Makerere University, AFRIpads, WoMena and Entebbe Municipal Council. MENISCUS-1 and
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29 2 schools were represented by head teachers, students and parents.
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37 **RESULTS**

38 **Socio-demographic characteristics**

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40 Of the 473 eligible S2 students at baseline, 450 (95.1%; 232 girls and 218 boys)
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42 consented/assented. Overall, 369 students (188 girls; 81.0%; and 181 boys; 83.0%)
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44 participated in the endline survey. At baseline, the mean age was 15.4 years (SD 1.31; range
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46 12-20) for girls and 16.2 (SD=1.5; range 13-21) for boys. Among the girls, 222 (95.7%) and
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48 183 (97.3%) had started menstruating at baseline and endline respectively. The majority
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50 (n=361; 80.2%) were Christian and 198 (44.0%) were of Ganda ethnicity. About half (50.6%)
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52 of participants' mothers had post-primary education, as did 73.5% of participants' fathers
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54 (excluding 74 mothers and 88 fathers where this information was unknown). Relatively few
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56 participants (n=59; 13.1%) had running water at home, and 54 (12.0%) had a flush toilet in the
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58 home.
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Feasibility and acceptability of implementing the intervention

There were high levels of uptake of the individual and behavioural intervention components (puberty education, drama skit, MHM kit, and pain management). Most students (81.3%) reported attending puberty-education sessions and 93.4% of girls reported receiving the MHM kit. Both schools performed the drama skit, and the qualitative interviews indicated that the skit increased MHM awareness and enabled some of the girls to talk about MHM with their parents, especially their fathers.

“When we all saw the skit, it gave us a starting point to initiate a discussion with our children. Even men got it” (Female Parent, 37 year old).

The WASH component was challenging to implement. At baseline, there were no sanitary disposal bins, lockable toilet paper holders, or functional water drums at either school. Both schools received these items as part of the intervention. At endline, in the private school, all the girls' cubicles were functional, clean and with a lockable door versus only 33% in the Government school, where facilities were shared with the community. Despite this, most girls (81.4%) reported improvements in toilet facilities at endline, which improved their comfort managing menstruation.

“The school environment is now conducive ... during our menstruation because the water is available, they give us water mixed with liquid soap; the toilet doors have locks, there is privacy, a person cannot interrupt you while changing the pad. Toilet paper is available whenever needed and the toilets are always clean.” (Female student, 17 years old; Private school).

Knowledge, misconceptions and perceptions of puberty and menstruation

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3 Knowledge of puberty and menstruation was poor at baseline and endline, especially among
4 boys. The proportion answering all nine knowledge questions correctly increased from 11.6%
5 to 23.9% (AOR=4.03, 95%CI 1.88-8.68) in girls, and from 4.1% to 12.7% (AOR=4.11, 95%CI
6 1.62-8.68-10.5) in boys (Table 1). There was also evidence of improvements in knowledge of
7 the menstrual cycle, particularly among girls, although endline knowledge remained poor
8 (29.3% of girls and 7.7% of boys answering all 3 questions correctly; Table 1).
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19 The proportion of girls answering at least eight of nine questions on their perceptions about
20 menstruation positively (i.e. questions about self-confidence, teasing and anxiety) increased
21 from 12.2% at baseline to 27.9% at endline (AOR=3.62, 95%CI: 1.85-7.11; Table 2). The
22 largest effects were reductions in the proportion of girls reporting teasing by boys about
23 menstruation (14.4% to 8.7%, AOR=0.43, 95%CI 0.19-0.96), girls feeling anxious about the
24 next period (58.6% to 34.4%, AOR=0.14, 95%CI 0.06-0.31) and girls avoiding physical activity
25 during menstruation (47.8% to 25.7%; AOR=0.27, 95%CI 0.15-0.50). There was no evidence
26 of moderation by age (Table 2) or school (results not shown).
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38 In qualitative interviews, girls and teachers said that they thought that fear, myths and negative
39 perceptions about menstruation were due to lack of knowledge. Participants suggested that
40 the intervention improved knowledge about puberty, menstruation, and girls' accounts
41 suggested a reduction of teasing by boys at school:
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48 *“Before MENISCUS, boys used to laugh at girls, for example when a girl stood up in class with*
49 *her dress stained, boys would laugh at her but after MENISCUS training, they stopped*
50 *laughing at girls and they now care about us” (Female student, 18 years old; Private school).*
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Table 1: Knowledge of puberty and menstruation, attitudes to menstruation and menstrual practices at baseline and endline, by gender

	Girls			Boys		
	Baseline (n=232)	Endline (n=188)	AOR (95% CI)	Baseline (n=218)	Endline (n=181)	AOR (95% CI)
All 9 knowledge questions correct ¹	27 (11.6%)	45 (23.9%)	4.03 (1.88-8.68)	9 (4.1%)	23 (12.7%)	4.11 (1.62-10.5)
Knowledge excluding fertility question	70 (30.2%)	120 (63.8%)	7.02 (3.67-13.45)	42 (19.3%)	73 (40.3%)	4.16 (2.15-8.04)
All 4 myth questions correct ²	39 (16.8%)	77 (41.0%)	5.44 (2.82-10.50)	22 (10.1%)	44 (24.3%)	3.99 (2.00-8.04)
All 3 menstrual cycle questions ³	12 (5.2%)	55 (29.3%)	19.45 (5.88-64.5)	4 (1.8%)	14 (7.7%)	3.95 (1.26-12.4)

¹ Knowledge questions were: i) Adolescence is the time between puberty and adulthood; ii) Changes in the body during puberty happen because of hormones; iii) The physical changes related to puberty usually start between 10 and 14 years of age in girls, and between 12 and 16 in boys; iv) Menstrual blood comes from the stomach where food is digested; v) Women stop menstruating after the age of about 45-50; vi) Menstruation in girls and women is normal; vii) Pregnant women menstruate; viii) When a girl gets her first period, her body is ready to have children; ix) During her period a girl can get pregnant

² Myth questions were: i) Painkillers cause problems having children; ii) When a girl has her period she is unclean; iii) Sanitary pads can cause sickness or infection; iv) It is healthy for a girl to run, dance or cycle during her period

³ Menstrual cycle questions were: i) What is period blood; ii) How long does a period usually last; iii) How many days are there usually between periods?

Management of menstruation

The proportion of girls reporting using manufactured menstrual materials exclusively (i.e. reusable or disposable pads, tampons or menstrual cups) during their LMP increased from 73.0% at baseline to 89.1% at endline (AOR=4.14, 95%CI 2.04-8.40). At endline, most girls (n=155; 82.5%) reported using reusable pads during their LMP compared with 18.5% at baseline. There was some evidence of a decrease in reported leakage of blood through their clothing during LMP (47.4% at baseline vs 35.3% at endline; AOR=0.51, 95%CI 0.25-1.04), but no evidence of a difference in the proportion of girls reporting staining their underwear during their LMP (23.4% at baseline to 27.3% at endline (AOR=1.34, 95%CI 0.78-2.30). There was no evidence of effect-moderation by age or school (Table 2).

Knowledge and use of effective pain management methods

Most girls reported pain during menstruation at both baseline and endline (74.3% and 71.0%, respectively). Amongst these girls, there was evidence of an increase in the proportion who reported using painkillers during their LMP (46.7% at baseline to 60.8% at endline; AOR=1.87, 95%CI 1.05-3.34). Results were similar by school and age (Table 2). There was evidence of an increase in the proportion of girls who reported using ≥ 1 effective pain relief method during their LMP (49.7% at baseline to 77.8% at endline; AOR=4.24, 95%CI 2.16-8.33). Of the 232 girls who received a voucher for painkillers, 58 (25.0%) had redeemed 78 vouchers by endline: 77% used one voucher, 16% used two, and 7% used ≥ 2 .

The qualitative findings confirmed that non-pharmacological methods of pain relief were popular and effective.

"They [MENISCUS team] taught us how to do exercises to relieve pain and it worked for me so, the last time, I didn't use painkillers; I managed my periods by doing exercises and using reusable pads MENISCUS had provided." (Female student, 14 years old; Government school).

Table 2: Reported perceptions of menstruation, menstrual management, pain and pain management among girls, by age at baseline

	Age <16 years			Age ≥ 16 years		
	Baseline (n=115)	Endline (n=51)	AOR (95% CI)	Baseline (n=107)	Endline (n=132)	AOR (95% CI)
≥8 of 9 positive perceptions of menstruation ¹	14 (12.2%)	16 (31.4%)	5.25 (1.10-25.19)	13 (12.2%)	35 (26.5%)	2.98 (1.29-6.86)
Used manufactured menstrual materials only at LMP	86 (74.8%)	46 (90.2%)	3.40 (1.06-10.9)	76 (71.0%)	117 (88.6%)	4.24 (1.68-10.78)
Leaked blood at LMP	37 (50.0%)	12 (42.9%)	0.60 (0.18-2.04)	37 (45.1%)	24 (32.4%)	0.58 (0.28-1.18)
Underwear stained at LMP	31 (27.0%)	16 (31.4%)	1.14 (0.45-2.87)	21 (19.6%)	34 (25.8%)	1.49 (0.73-3.06)
Knew ≥4 effective pain management methods	30 (24.2%)	37 (67.3%)	10.80 (3.48-33.56)	30 (27.8%)	97 (72.9%)	21.62 (5.44-84.93)
Reported pain at last period	79 (68.7%)	36 (70.6%)	1.00 (0.37-2.65)	86 (80.4%)	94 (71.2%)	0.54 (0.26-1.10)
Used ≥1 effective pain management method ²	57 (72.2%)	34 (94.4%)	6.78 (1.49-30.8)	69 (80.2%)	85 (90.4%)	2.79 (0.95-8.21)
Used painkillers at LMP ³	32 (40.5%)	21 (58.3%)	2.16 (0.91-5.11)	45 (52.3%)	58 (61.7%)	1.70 (0.74-3.92)
Used other effective methods ²	39 (49.4%)	29 (80.6%)	4.22 (1.66-10.78)	43 (50.0%)	72 (76.6%)	6.83 (1.88-24.85)
Did nothing for pain at LMP ¹	20 (25.3%)	2 (5.6%)	0.17 (0.04-0.79)	17 (19.8%)	7 (7.5%)	0.18 (0.03-0.99)

¹ Perception questions were i) I prefer staying at home during my period rather than going to school; ii) I worry about being teased during my period; iii) During my period I feel less self-confident than during other days; iv) During my period I avoid physical activity (e.g. walking, running); v) I feel anxious about having my next period; vi) Boys tease me about my period vii) Girls tease me about my period; viii) I feel comfortable to talk to other girls at school about my period; ix) If I had a problem with managing my period, I would talk to another girl about it

² Effective methods (painkiller, drinking water, using hot water bottle, exercise, relaxing, foods with lots of water).

³ Among those with pain at LMP

Psychosocial well-being

The mean SDQ-25 score in girls decreased from 10.3 to 9.2 ($p=0.006$, adjusted for age and school), indicating improved behaviour and conduct. No decrease was seen among boys, in line with the ToC (9.88 at baseline vs 9.91 at endline; $p=0.98$).

Menstruation and school absence

In the cross-sectional surveys, a similar proportion of girls reported missing at least one school day due to menstruation in Term 2, 2017 (pre-baseline) and Term 2, 2018 (endline) (32.0% vs 32.8%; $OR=0.97$, 95%CI 0.57-1.66). Among the 100 cohort participants, data were collected from 81 students at endline. The AOR associated with missing school on period-days compared to non-period days decreased from $OR=2.17$ (95%CI 1.61-2.92) at baseline to $OR=1.29$ (95%CI 1.02-1.63) at endline (p -value for moderation =0.01; Table 3). Results were similar for class attendance (Table 3). The direct observation checks found high correlation with the self-completed diaries. Girls were seen on 328/330 (99.4%) of days when their diary stated they were present and were not seen on all 37 days when the diary stated that they were absent. School registers were incomplete and rarely completed by teachers.

Table 3: School and class attendance at baseline and endline among nested cohort participants, by period-day status

	Term 3 2017 (baseline) 99 girls		Term 2 2018 (end-line) 81 girls	
	Non period- day	Period- day ¹	Non period- day	Period-day
Number of days	2625	554	3829	787
N (%) not attending full day of school	8.5%	14.6%	11.6%	14.2%
Odds ratio (95% CI)²	OR=2.17 (1.61-2.92)		OR=1.29 (1.02-1.63)	
N (%) not attending all classes	11.4%	19.9%	17.3%	20.5%
Odds ratio (95% CI)	OR=2.12 (1.64-2.74)		OR=1.26 (1.04-1.54)	

¹ Includes days of menses plus day prior to menses (results similar when restricted to days of menses) obtained from daily diaries for 9 months

² Obtained from random effects logistic regression, allowing for within-girl clustering

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5 The qualitative interviews suggested that girls were more likely to attend school during
6 menstruation at endline than at baseline, with reasons including the training on pain
7 management, tracking their menstrual cycle, and having re-usable pads.
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13 *“Some girls totally don’t come to school every menstruation period. However, in our class,*
14 *missing school is now rare because we have learnt how to manage the periods, pain and we*
15 *have what to use. We now also know our cycle” (Girls FGD; Government school).*
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21 *“Before MENISCUS study gave us diaries, I didn’t know how to track my days. I used to come*
22 *to school and my uniform would get soiled. Sometimes, I could ask for a pass out to go back*
23 *home during my periods. [...] But when MENISCUS came, they gave us diaries, I started filling*
24 *them in and now I know my days; I come to school prepared.” (Female, 17 year old; Private*
25 *school).*
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34 **DISCUSSION**

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36 To our knowledge, this is the first MHM intervention to be pilot-tested that focused equally on
37 health promotion (psychosocial issues, stigma and knowledge) and goods (provision of pads
38 and analgesics, and improved WASH facilities).[16]
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46 **Feasibility and accessibility of implementing the intervention**

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48 The qualitative and quantitative data showed that the intervention was feasible and acceptable
49 to schools and stakeholders. A detailed process evaluation will be published separately. The
50 main challenge with implementation was maintenance of the WASH component. To improve
51 this component in a future trial, we will ask schools to establish an MHM Leadership Group (to
52 include teachers, parents and students) responsible for ensuring each intervention element is
53 delivered, maintained and sustained by the schools. Another challenge was that we did not
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3 obtain ethical approval to offer girls a menstrual cup, due to concerns about whether cup
4 insertion could lead to damage of the hymen and affect a girl's virginity. Further activities to
5 inform parents about menstrual cups and discuss concerns are underway.
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10 11 **Potential intervention effect on knowledge, menstrual practices and school attendance**

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13 The study was designed to assess feasibility and accessibility of implementing the
14 intervention, rather than assess the effectiveness. Although the findings suggest a potential
15 intervention effect on education and health outcomes, these results need to be interpreted
16 cautiously as the improvements reported may be partly due to i) older age at endline – there
17 may have been improvements in knowledge and self-confidence in managing menstruation
18 due to a cohort effect; ii) reporting biases - the outcome assessment team were involved with
19 implementation and this may have caused social desirability bias affecting responses on
20 attitudes or behaviours following the intervention; iii) biases due to the lack of a comparison
21 group, and the endline survey being conducted in a different term to baseline. For example,
22 girls reported higher levels of school attendance overall at baseline than at endline, and this
23 may be due to the baseline being conducted during an examination term.
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39 The study highlighted poor knowledge of menstruation, possibly due to cultural taboos and
40 norms,[14, 17] and lack of knowledge among students [18] parents and teachers hindering
41 discussion of puberty and menstruation.[14, 19-21] Three intervention components
42 addressed knowledge (puberty education, menstrual-management kit training, and drama
43 skit). To address stigma and effect a school-wide change in attitudes, the education and drama
44 sessions included boys. This pilot study showed that girls were less anxious about
45 menstruation, and reported less teasing by boys after the intervention, supporting the theory
46 of change, and previous qualitative work from Ghana that indicated reductions in shame and
47 improvements in self-confidence following provision of pads and puberty education.[22]
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3 At endline, compared with baseline, more girls reported use of only manufactured materials
4 during their LMP, and using these correctly. The high uptake of reusable pads was expected,
5 as these were provided free to all girls, but the continued use over follow-up, and favourable
6 qualitative reports, shows that pads were acceptable. Similar findings on correct use have
7 been seen in another study in Uganda where 98% of girls reported washing and using soap
8 for their AFRIPads [16] and in India,[23] where a school-based health-education intervention
9 led to improvements in washing clothes with soap, drying them in the sun and safe disposal.
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20 Previous studies show inconsistent evidence for a relationship between menstruation and
21 school absenteeism.[10, 14, 24-31] Documenting school attendance is often challenging in
22 LMICs due to incomplete or inaccurate school registers.[5, 14] Our diaries were popular, and
23 correlated well with direct observation. The improved school attendance during menstruation
24 in this study was attributed to improved pain management, knowledge to track menstrual
25 cycles, and the provision of reusable pads in qualitative interviews.
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35 **Innovative aspects of the MENISCUS intervention**

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37 1) *Multi-component focus.* Past and ongoing studies tend to focus on single-component
38 interventions.[5, 27] This study indicates synergies between the intervention elements e.g. the
39 drama skit reinforces puberty knowledge, reduces stigma and engages parents and boys. An
40 emerging view, aligned with our findings, is that poor MHM is a social problem and to be
41 effective, MHM interventions need to address the broader issues of menstrual stigma and
42 literacy as well as the provision of menstrual products or improving WASH facilities.[7] The
43 multi-component approach addresses both individual, behavioural and environmental barriers
44 to good MHM and school attendance.
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55 2) *Pain management.* Menstrual pain is a major contributor to school absence in girls in many
56 settings.[14, 17, 32, 33] This is the first MHM intervention to address this issue and we found
57 substantial improvements in pain management.[14] Further research is needed on this topic
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3 as misconceptions about use of painkillers are common in Uganda [14] and elsewhere.[34,
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10 3) *Inclusion of boys*. Most MHM interventions focus only on girls, yet sustainable changes in
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12 MHM depend on addressing stigma about menstruation. This study highlighted the importance
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14 of including boys which is aligned with SCT (i.e. the intervention provides positive
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16 reinforcement for behavioural change by improving the school environment). The focus on
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18 boys as well as girls is supported by WHO framework for Health Promoting Schools [36] and
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20 is aligned with a report commissioned by the Gates Foundation on Menstrual Health and
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22 Gender Equity.[37]

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26 4) *Urban secondary school setting*. Most intervention studies to date have been in primary
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28 schools, and in rural areas.[16, 32] MHM and school attendance is an issue in the peri-urban
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30 area in Entebbe where most girls can afford to buy disposable pads for some of the time.[14]
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32 A focus on MHM in secondary schools is important given the recognised importance of girls'
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34 secondary education to future development,[38] and evidence that school absenteeism due
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36 to menstruation is problematic in secondary school girls.[14, 39]

37 38 39 40 41 **CONCLUSION**

42
43 This pilot study showed that the MHM intervention was acceptable and feasible to implement.
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45 There were substantial reported improvements in stigma and anxiety, pain management, and
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47 some improvement in MHM knowledge of puberty and menstruation and WASH following a
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49 multi-component intervention. Based on SCT, we anticipate the results to be generalizable to
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51 other similar contexts with relatively low levels of MHM knowledge, stigma about discussing
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53 menstruation, and poor school WASH facilities. A phase-III trial is warranted to evaluate the
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55 impact of the intervention on school attendance, and on health, well-being and educational
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57 outcomes for definitive results to drive forward policy changes.
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Statements:

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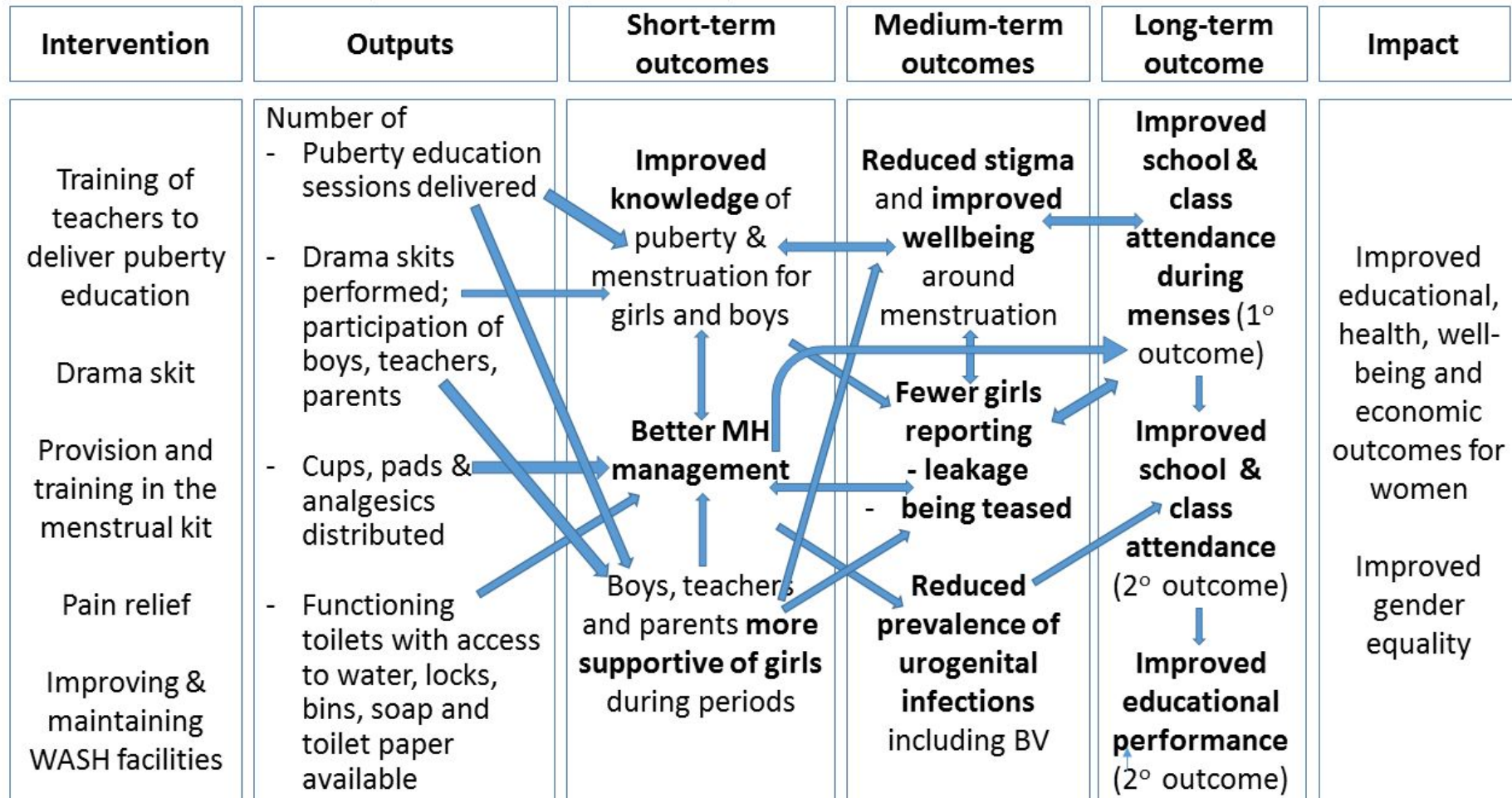
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Statements:

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Figure 1

Figure 1: Theory of change for the MENISCUS intervention



BMJ Open

Menstrual health intervention and school attendance in Uganda (MENISCUS-2): A pilot intervention study

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Keywords:	Menstrual Health, School attendance, Menstrual Hygiene, Adolescent Health, Education

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3 **Menstrual health intervention and school attendance in Uganda (MENISCUS-2): A pilot**
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Abstract

Objectives: Achieving good menstrual health and hygiene (MHH) is a public health challenge and there is a lack of evidence to inform interventions. The aim of this study was to pilot-test an intervention to improve MHH and school attendance in Uganda, in preparation for a future cluster-randomised trial.

Design: Longitudinal study with pre-post evaluation of a pilot intervention

Setting: Two secondary schools in Entebbe, Uganda

Participants: Of the 473 eligible students in Secondary 2 (S2) at baseline, 450 (95.1%; 232 girls and 218 boys) consented/assented. 369 students (188 girls; 81.0%; and 181 boys; 83.0%) participated in the endline survey.

Intervention: The intervention comprised training teachers to improve delivery of government guidelines for puberty education, training in use of a menstrual kit and pain management, a drama skit, provision of analgesics and improvements to school Water and Sanitation Hygiene (WASH) facilities.

Primary and secondary outcome measures: Feasibility and acceptability of delivering the intervention. Baseline and endline quantitative surveys were conducted, with qualitative interviews conducted at endline. School attendance was assessed using self-completed daily diaries among a nested closed cohort of 100 female students.

Results: The intervention was acceptable and feasible to deliver, and there were substantial reported improvements in MHH. The proportion of girls reporting anxiety about next period decreased from 58.6% to 34.4%, and reported use of effective pain management increased from 76.4% to 91.4%. Most girls (81.4%) reported improved school toilet facilities, which improved their comfort managing menstruation. The diary data and qualitative data indicated a potential impact of the intervention on improving menstrual-related school absenteeism.

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3 **Conclusions:** The pilot study showed that the multi-component MHM intervention was
4 acceptable and feasible to deliver, and potentially effective in improving menstruation
5 knowledge and management. A cluster-randomised trial is needed to evaluate rigorously the
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7 intervention effects on MHM and school attendance.
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15 **Strengths and limitations of the study:**
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18 • The study evaluated a multi-component menstrual health intervention that addresses
19 individual, behavioural and environmental barriers to good menstrual health and school
20 attendance.
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22 • The study population are students in peri-urban secondary schools, which is important
23 given the recognised importance of girls' secondary education to future development, and
24 evidence that school absenteeism due to menstruation is problematic for secondary school
25 girls.
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27 • This is the first menstrual health intervention to address menstrual pain – a major
28 contributor to school absence in girls
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30 • The intervention includes boys as well as girls, as sustainable changes in menstrual
31 management depend on addressing stigma about menstruation.
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33 • The conclusions are limited due to the lack of a control group, which means that the
34 improvements seen in knowledge, school attendance and wellbeing may reflect the girls
35 being older at endline or differences in attendance in different terms.
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INTRODUCTION

Many girls and women globally lack the knowledge, materials and facilities for safely managing menstruation without stigma.[1-4] Adequate menstrual hygiene management (MHM) is defined as i) using clean menstrual management material to absorb or collect menstrual blood, ii) that can be changed in privacy as often as necessary for the duration of a menstrual period, iii) using soap and water for washing the body as required, iv) having access to safe and convenient facilities to dispose of used menstrual management materials, v) understanding the basic facts linked to the menstrual cycle and vi) how to manage it with dignity and without discomfort or fear.[5] A recent systematic review of menstrual experiences among women and adolescent girls globally highlighted that interventions must address a broad range of issues including addressing stigma, knowledge, social support, restrictive behavioural expectations, and the physical and economic environment.[6] Aligned with this, the term menstrual health and hygiene (MHH) encompasses both MHM and the broader systemic factors that link menstruation with health, well-being, gender equality, education, equity, empowerment, and rights.[5]

Effective MHH interventions may lead to sustained benefits for health, productivity [3, 4, 7] and the environment [8] but there has been little rigorous evaluation of interventions to guide policies.[9-11] Schools provide an important setting for addressing MHH challenges concerning stigma, lack of menstrual literacy and goods (menstrual products, improved water, sanitation and hygiene (WASH) facilities and pain management).[12] In 2014, the “MHM in Ten” initiative developed an agenda for addressing the barriers facing girls in schools in low-income contexts.[13] The first priority of the initiative is to generate rigorous evidence on whether improving MHM improves school attendance.[9, 10, 14] A systematic review published in 2016 [15] concluded there was promising evidence of the effectiveness of MHH interventions on educational outcomes, but insufficient evidence of effect due to a small number of trials (N=8), a high risk of bias, and substantial heterogeneity. An earlier systematic review [7] of intervention and observational studies found that of the 11 studies (only one RCT)

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3 investigating the association between MHM and urogenital infections, seven found an
4 increased risk associated with “worse” MHM (defined differently for each study but generally
5 meaning not using disposable sanitary pads), one found the reverse to be true (an increased
6 risk from using disposable sanitary pads), and three found no association.
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13 The aim of this study was to pilot-test a multi-component school-based MHH intervention
14 (“MENISCUS”) and to prepare for a future cluster-randomised trial (CRT) which will evaluate
15 the impact of the intervention on secondary school attendance, performance, menstruation
16 knowledge, health and wellbeing outcomes in Uganda. Formative work in Wakiso District,
17 Uganda, showed that secondary school girls reported substantial embarrassment and fear of
18 teasing related to menstruation, reporting that this, together with menstrual pain and lack of
19 effective materials for menstrual hygiene management, led to school absenteeism, especially
20 in schools with low socio-economic catchment populations.[16] The issue is recognised by the
21 Ugandan Government, which has the political will to improve MHM.[17] However the
22 Government MHM guidelines for schools are not consistently implemented [18] for reasons
23 including lack of funding, unclear roles and responsibilities for MHM, with issues largely left to
24 the senior teachers.
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41 The objectives of the pilot study are to: i) Pilot a combined package of MHH intervention
42 elements developed in the formative work, delivered to a whole secondary school year for
43 nine months; ii) Measure the uptake and assess perceptions of each element of the
44 intervention package, and the package as a whole; iii) Pilot the use of daily diaries to estimate
45 school attendance, and compare attendance with estimates using registers, observation visits
46 and retrospective self-report; iv) Estimate school retention over a 9 month period; and v)
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54 Estimate the sample size for a future trial.
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METHODS

Study setting and participants

This pilot study was conducted in Entebbe Municipality in Wakiso District, Uganda. Entebbe has 13 registered secondary schools. Two day schools (one government and one private), both with students of low socio-economic status (SES), were purposively selected. In this context, low SES schools are characterised by parents with low income, lower education achievement and under resourced in terms of low grade of teachers and facilities such as infrastructure. Eligible participants were all male and female students in the second school year (Secondary 2 (S2)). Written informed consent was sought from students aged ≥ 18 years, and from the parents/caretakers of those aged < 18 years, with student assent. We also received written informed consent from teachers and parents/caretakers participating in interviews. Participation was voluntary, and confidentiality was ensured by conducting interviews in a private setting and keeping the data collected on secure servers without identifying information.

Intervention package

We previously conducted a study in this setting to develop the intervention and found that an effective MHH intervention needs to address stigma, education, attitudes and psychosocial well-being, and provide the goods defined above.[16] Following this, we finalised the pilot MENISCUS intervention, informed by social cognitive theory (SCT) which postulates that learning occurs in a social context and that personal factors, behavioural patterns and environmental aspects have bidirectional influences on one another.[19] Using the core constructs of SCT, we developed a Theory of Change (ToC) (Figure 1) with stakeholders to articulate the aims of the intervention: i) increase girls' self-efficacy to manage their menstruation (e.g. through provision of an MHM kit and pain-management options); ii) use observational learning to reinforce girls' learning and that of boys, teachers and parents to create a more supportive MHM environment (through drama); and iii) provide positive

Study design and evaluation

The design was a longitudinal cohort study. All participants were asked to self-complete a quantitative survey at baseline (October 2017) and endline (August 2018) on tablets using Open-Data-Kit software. Questions included knowledge of puberty and menstruation, perceptions of menstruation (using a 5-point Likert scale) (Table 1), menstrual management practices at last menstrual period (LMP), reported pain and pain management strategies, leakages during LMP, anxiety, and the 25-item Strengths and Difficulties Questionnaire (SDQ) which is globally used to screen for behavioural markers of potential mental health problems in children and adolescents, covering four domains (hyperactivity, conduct problems, peer problems and emotional problems).[20]

Table 1: Menstruation knowledge, myth and perception questions

Topic	
1. Menstruation knowledge statements (response True/False)	Adolescence is the time between puberty and adulthood
	Changes in the body during puberty happen because of hormones
	The physical changes related to puberty usually start between 10 and 14 years of age in girls, and between 12 and 16 in boys
	Menstrual blood comes from the stomach where food is digested
	Women stop menstruating after the age of about 45-50
	Menstruation in girls and women is normal
	Pregnant women menstruate
	When a girl gets her first period, her body is ready to have children
2. Myth statements (response True/False)	During her period a girl can get pregnant
	Painkillers cause problems having children
	When a girl has her period she is unclean
	Sanitary pads can cause sickness or infection
3. Menstrual cycle questions (closed responses)	It is healthy for a girl to run, dance or cycle during her period
	What is period blood?
	How long does a period usually last?
4. Menstruation perception statements (response (Yes/No))	How many days are there usually between periods?
	I prefer staying at home during my period rather than going to school
	I worry about being teased during my period
	During my period I feel less self-confident than during other days;
	During my period I avoid physical activity (e.g. walking, running)
	I feel anxious about having my next period
	Boys tease me about my period
	Girls tease me about my period
I feel comfortable to talk to other girls at school about my period	
If I had a problem with managing my period, I would talk to another girl about it	

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5 A nested cohort comprised a random sub-sample of 50 girls per school assessing the
6 feasibility of school attendance and menstruation patterns using self-completed daily diaries.
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8 Nested cohort participants were given a booklet each term for daily recording of school and
9 class attendance, menstruation and pain.
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15 Qualitative interviews were used to assess perceptions and acceptability of the intervention,
16 and its perceived impact on school attendance at endline. In-depth interviews (IDIs) were
17 conducted with 20 female students sampled purposively (menstruating S2 girls with different
18 levels of reported baseline school attendance), 10 teachers (six females and four males) and
19 10 parents who had attended the drama performance. Four focus-group discussions (FGDs)
20 were conducted (two with each sex) at the schools. Semi-structured topic guides were used
21 for both IDIs and FGDs. Interviewers were the same sex as respondents and interviews were
22 digitally recorded with permission.
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34 Research assistants conducted nine unannounced WASH assessment visits per school at
35 baseline and during follow-up, using a standardized checklist to assess availability,
36 accessibility and functioning in terms of sanitary waste disposal, availability of water, soap,
37 hand-washing facilities and toilet paper; cleanliness and privacy.
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45 Finally, a mixed-methods process evaluation was conducted to improve understanding of
46 intervention implementation. Details of this will be reported separately.
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51 **Outcomes**

52 Outcomes were knowledge of puberty and menstruation, attitudes towards menstruation and
53 menstrual practices (assessed by the proportion of students answering all knowledge, myth
54 and menstrual cycles correct respectively), knowledge and use of effective pain management
55 methods (assessed by the proportion of girls knowing, and reporting using, at least one
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3 effective pain relief method during their LMP if they reported pain), psychosocial wellbeing
4 (assessed by the mean SDQ-25 score) and school attendance (assessed by reported days
5 missing school in the daily diaries). The planned sample size of 200 girls (and 200 boys,
6 respectively) provides 85% power to detect an odds ratio of two between baseline and endline
7 assuming baseline prevalence of 20%, allowing for within-individual correlation (intracluster-
8 correlation=0.05).
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18 **Data management and analysis**

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20 Electronically-captured data were exported to Stata version 15. The paper-based diary data
21 and WASH checklist data were entered using Microsoft Access. For the survey data, the
22 intervention effect on binary outcomes was estimated by comparing endline versus baseline
23 measures, using adjusted odds ratios (AOR) and 95% confidence intervals (CI) estimated with
24 random-effects logistic regression accounting for within-individual clustering. This provides an
25 estimate of the odds ratio for outcomes assessed at endline compared with baseline,
26 independently of potential confounding variables. Effects on continuous outcomes were
27 similarly assessed with random-effects linear regression to estimate the adjusted mean
28 difference (AMD) and 95%CI. All analyses were adjusted for school, gender and age (<16,
29 >16 years) as fixed effects. Effect-moderation by school and age group were assessed using
30 the likelihood ratio test. For the nested cohort, period-days were defined from the diary data
31 as the days of menstruation (bleeding) plus the day prior to menstruation, with sensitivity
32 analyses restricted to days of menstruation only. Audio-recordings were transcribed verbatim
33 and translated into English. Data were analysed using thematic content analysis, with two
34 social scientists independently coding and checking results. Key themes and subthemes
35 related to the objectives of the qualitative research were organised in a matrix and discussed
36 by the team for appropriate interpretation.
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Participant and public involvement

Community groups were involved throughout the formative work, with stakeholders' workshops in August 2016 and October 2018, and a ToC workshop in April 2017. The ToC workshop included 35 invited participants (teachers, students and parents from the MENISCUS-1 and -2 schools, representatives from the Ministry of Education and Sports (MoES), Ministry of Health (MoH), the District Education Officer, Makerere University and NGOs working on menstrual health). In October 2018, we disseminated findings from MENISCUS-2 at a stakeholders' workshop, and elicited input into the future trial design. This meeting was attended by 60 participants, including representatives from MoES, MoH, Uganda National Council for Science and Technology (UNCST), Wakiso District Local Government Makerere University, AFRIpads, WoMena and Entebbe Municipal Council. MENISCUS-1 and two schools were represented by head teachers, students and parents.

RESULTS

Socio-demographic characteristics

Of the 473 eligible S2 students at baseline, 450 (95.1%; 232 girls and 218 boys) consented/assented. Overall, 369 students (188 girls; 81.0%; and 181 boys; 83.0%) participated in the endline survey. At baseline, the mean age was 15.4 years (SD 1.31; range 12-20) for girls and 16.2 (SD=1.5; range 13-21) for boys. Follow-up ranged from 8.6 to 9.6 months (median 9.00 months). Among the girls, 222 (95.7%) and 183 (97.3%) had started menstruating at baseline and endline respectively. The majority (n=361; 80.2%) were Christian and 198 (44.0%) were of Ganda ethnicity. About half (50.6%) of participants' mothers had post-primary education, as did 73.5% of participants' fathers (excluding 74 mothers and 88 fathers where this information was unknown). Relatively few participants (n=59; 13.1%) had running water at home, and 54 (12.0%) had a flush toilet in the home.

Feasibility and acceptability of implementing the intervention

There were high levels of uptake of the individual and behavioural intervention components (puberty education, drama skit, MHM kit, and pain management). Most students (81.3%) reported attending puberty education sessions and 93.4% of girls reported receiving the MHM kit. Both schools performed the drama skit, and the qualitative interviews indicated that the skit increased MHM awareness and enabled some of the girls to talk about MHM with their parents, especially their fathers.

“When we all saw the skit, it gave us a starting point to initiate a discussion with our children. Even men got it” (Female Parent).

“Trainings improved our self-esteem and confidence because nowadays we are not scared of coming to school. We are comfortable coming to school during our menstruation. Before the training some of us were shy and we couldn’t stand and talk in-front of people or parents about menstruation and puberty but now we can,” (FGD girls, Private school).

The WASH component was challenging to implement. At baseline, there were no sanitary disposal bins, lockable toilet paper holders, or functional water drums at either school (Table 2). Both schools received these items as part of the intervention. At endline, in the private school, all the girls’ cubicles were functional, clean and with a lockable door versus only 33% in the Government school, where facilities were shared with the community. Despite this, most girls (81.4%) reported improvements in toilet facilities at endline, which improved their comfort managing menstruation.

“The school environment is now conducive ... during our menstruation because the water is available, they give us water mixed with liquid soap; the toilet doors have locks, there is privacy, a person cannot interrupt you while changing the pad. Toilet paper is available whenever needed and the toilets are always clean.” (Female student, Private school).

Table 2: Summary of WASH facilities at baseline and during implementation

Component	Baseline (1 visit)		Follow up (8 visits)		
	Boys and girls		Girls		Boys
	<i>Both schools</i>	<i>Private school</i>	<i>Government school</i>	<i>Private school</i>	<i>Government school</i>
Bin	0%	>75%	100%	n/a	n/a
Toilet paper	0%	25%	0%	<25%	<25%
Functioning water drum	0%	100%	>75%	100%	>75%
Functioning water & soap drum	0%	>75%	25%	50-75%	25-50%

% of the 8 visits when the WASH component was present outside at least one toilet block in the school

Knowledge, misconceptions and perceptions of puberty and menstruation

Knowledge of puberty and menstruation was poor at baseline, especially among boys. The proportion answering all nine knowledge questions correctly increased from 11.6% to 23.9% (AOR=4.03, 95%CI 1.88-8.68) in girls, and from 4.1% to 12.7% (AOR=4.11, 95%CI 1.62-10.5) in boys (Table 3). There was also evidence of improvements in knowledge of the menstrual cycle, particularly among girls, although endline knowledge remained poor (29.3% of girls and 7.7% of boys answering all 3 questions correctly; Table 3).

The proportion of girls answering at least eight of nine questions on their perceptions about menstruation positively (i.e. questions about self-confidence, teasing and anxiety) increased from 12.2% at baseline to 27.9% at endline (AOR=3.62, 95%CI: 1.85-7.11). The largest effects were reductions in the proportion of girls reporting teasing by boys about menstruation (14.4% to 8.7%, AOR=0.43, 95%CI 0.19-0.96), girls feeling anxious about the next period (58.6% to 34.4%, AOR=0.14, 95%CI 0.06-0.31) and girls avoiding physical activity during menstruation (47.8% to 25.7%; AOR=0.27, 95%CI 0.15-0.50). There was no evidence of moderation by age (Table 4; $p \geq 0.2$ for effect modification for each variable) or school ($p \geq 0.1$ for effect modification for each variable; results not shown).

Table 3: Knowledge of puberty and menstruation, attitudes to menstruation and menstrual practices at baseline and endline, by gender

	Girls			Boys		
	Baseline (n=232)	Endline (n=188)	AOR (95% CI)	Baseline (n=218)	Endline (n=181)	AOR (95% CI)
All 9 knowledge questions correct ¹	27 (11.6%)	45 (23.9%)	4.03 (1.88-8.68)	9 (4.1%)	23 (12.7%)	4.11 (1.62-10.5)
Knowledge excluding fertility question	70 (30.2%)	120 (63.8%)	7.02 (3.67-13.45)	42 (19.3%)	73 (40.3%)	4.16 (2.15-8.04)
All 4 myth questions correct ²	39 (16.8%)	77 (41.0%)	5.44 (2.82-10.50)	22 (10.1%)	44 (24.3%)	3.99 (2.00-8.04)
All 3 menstrual cycle questions ³	12 (5.2%)	55 (29.3%)	19.45 (5.88-64.5)	4 (1.8%)	14 (7.7%)	3.95 (1.26-12.4)

¹ Knowledge statements were: i) Adolescence is the time between puberty and adulthood; ii) Changes in the body during puberty happen because of hormones; iii) The physical changes related to puberty usually start between 10 and 14 years of age in girls, and between 12 and 16 in boys; iv) Menstrual blood comes from the stomach where food is digested; v) Women stop menstruating after the age of about 45-50; vi) Menstruation in girls and women is normal; vii) Pregnant women menstruate; viii) When a girl gets her first period, her body is ready to have children; ix) During her period a girl can get pregnant

² Myth statements were: i) Painkillers cause problems having children; ii) When a girl has her period she is unclean; iii) Sanitary pads can cause sickness or infection; iv) It is healthy for a girl to run, dance or cycle during her period

³ Menstrual cycle questions were: i) What is period blood?; ii) How long does a period usually last?; iii) How many days are there usually between periods?

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3 In qualitative interviews, girls and teachers said that they thought that fear, myths and negative
4 perceptions about menstruation were due to lack of knowledge. Participants suggested that
5 the intervention improved knowledge about puberty, menstruation, and girls' accounts
6 suggested a reduction of teasing by boys at school:
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13 *“Before MENISCUS, boys used to laugh at girls, for example when a girl stood up in class with*
14 *her dress stained, boys would laugh at her but after MENISCUS training, they stopped*
15 *laughing at girls and they now care about us” (Female student, Private school).*
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22 **Management of menstruation**

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24 The proportion of girls reporting using manufactured menstrual materials exclusively (i.e.
25 reusable or disposable pads, tampons or menstrual cups) during their LMP increased from
26 73.0% at baseline to 89.1% at endline (AOR=4.14, 95%CI 2.04-8.40). At endline, most girls
27 (n=155; 82.5%) reported using reusable pads during their LMP compared with 18.5% at
28 baseline. There was some evidence of a decrease in reported leakage of blood through their
29 clothing during LMP (47.4% at baseline vs 35.3% at endline; AOR=0.51, 95%CI 0.25-1.04),
30 but no evidence of a difference in the proportion of girls reporting staining their underwear
31 during their LMP (23.4% at baseline to 27.3% at endline (AOR=1.34, 95%CI 0.78-2.30). There
32 was no evidence of effect-moderation by age or school (Table 4).
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45 **Knowledge and use of effective pain management methods**

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47 Most girls reported pain during menstruation at both baseline and endline (74.3% and 71.0%,
48 respectively). Amongst these girls, there was evidence of an increase in the proportion who
49 reported using painkillers during their LMP (46.7% at baseline to 60.8% at endline; AOR=1.87,
50 95%CI 1.05-3.34). Results were similar by school and age (Table 4). There was evidence of
51 an increase in the proportion of girls who reported using ≥ 1 effective pain relief method during
52 their LMP (76.4% at baseline to 91.5% at endline; AOR=3.43, 95%CI 1.58-7.40). Of the 232
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3 girls who received a voucher for painkillers, 58 (25.0%) had redeemed 78 vouchers by endline:
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5 77% used one voucher, 16% used two, and 7% used ≥ 2 .
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9 The qualitative findings confirmed that non-pharmacological methods of pain relief were
10 popular and effective.
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13 *“They [MENISCUS team] taught us how to do exercises to relieve pain and it worked for me*
14 *so, the last time, I didn’t use painkillers; I managed my periods by doing exercises and using*
15 *reusable pads MENISCUS had provided.” (Female student, Government school).*
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20 21 22 **Behavioural markers of psychosocial well-being**

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24 The mean SDQ-25 score in girls decreased from 10.3 to 9.2 ($p=0.006$, adjusted for age and
25 school), indicating improved behaviour and conduct. No decrease was seen among boys, in
26 line with the ToC (9.88 at baseline vs 9.91 at endline; $p=0.98$).
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30 31 32 **Menstruation and school absence**

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34 In the cross-sectional surveys, a similar proportion of girls reported missing at least one school
35 day due to menstruation in Term 2, 2017 (pre-baseline) and Term 2, 2018 (endline) (32.0%
36 vs 32.8%; OR=0.97, 95%CI 0.57-1.66). Among the 100 cohort participants, data were
37 collected from 81 students at endline. The AOR associated with missing school on period-
38 days compared to non-period days decreased from OR=2.17 (95%CI 1.61-2.92) at baseline
39 to OR=1.29 (95%CI 1.02-1.63) at endline (p -value for moderation =0.01; Table 5). Results
40 were similar for class attendance (Table 4). The direct observation checks found high
41 correlation with the self-completed diaries. Girls were seen on 328/330 (99.4%) of days when
42 their diary stated they were present and were not seen on all 37 days when the diary stated
43 that they were absent. School registers were incomplete and rarely completed by teachers.
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Table 4: Reported perceptions of menstruation, menstrual management, pain and pain management among girls, by age at baseline

	Age <16 years			Age ≥ 16 years		
	Baseline (n=115)	Endline (n=51)	AOR (95% CI)	Baseline (n=107)	Endline (n=132)	AOR (95% CI)
≥8 of 9 positive perceptions of menstruation ¹	14 (12.2%)	16 (31.4%)	5.25 (1.10-25.19)	13 (12.2%)	35 (26.5%)	2.98 (1.29-6.86)
Used manufactured menstrual materials only at LMP	86 (74.8%)	46 (90.2%)	3.40 (1.06-10.9)	76 (71.0%)	117 (88.6%)	4.24 (1.68-10.8)
Leaked blood at LMP	37 (50.0%)	12 (42.9%)	0.60 (0.18-2.04)	37 (45.1%)	24 (32.4%)	0.58 (0.28-1.18)
Underwear stained at LMP	31 (27.0%)	16 (31.4%)	1.14 (0.45-2.87)	21 (19.6%)	34 (25.8%)	1.49 (0.73-3.06)
Knew ≥4 effective pain management methods	30 (24.2%)	37 (67.3%)	10.80 (3.48-33.6)	30 (27.8%)	97 (72.9%)	21.62 (5.44-84.9)
Reported pain at last period	79 (68.7%)	36 (70.6%)	1.00 (0.37-2.65)	86 (80.4%)	94 (71.2%)	0.54 (0.26-1.10)
Used ≥1 effective pain management method ²	57 (72.2%)	34 (94.4%)	6.78 (1.49-30.8)	69 (80.2%)	85 (90.4%)	2.79 (0.95-8.21)
Used painkillers at LMP ³	32 (40.5%)	21 (58.3%)	2.16 (0.91-5.11)	45 (52.3%)	58 (61.7%)	1.70 (0.74-3.92)
Used other effective methods ²	39 (49.4%)	29 (80.6%)	4.22 (1.66-10.78)	43 (50.0%)	72 (76.6%)	6.83 (1.88-24.9)
Did nothing for pain at LMP ¹	20 (25.3%)	2 (5.6%)	0.17 (0.04-0.79)	17 (19.8%)	7 (7.5%)	0.18 (0.03-0.99)

¹ Perception questions were i) I prefer staying at home during my period rather than going to school; ii) I worry about being teased during my period; iii) During my period I feel less self-confident than during other days; iv) During my period I avoid physical activity (e.g. walking, running); v) I feel anxious about having my next period; vi) Boys tease me about my period vii) Girls tease me about my period; viii) I feel comfortable to talk to other girls at school about my period; ix) If I had a problem with managing my period, I would talk to another girl about it

² Effective methods (painkiller, drinking water, using hot water bottle, exercise, relaxing, foods with lots of water).

³ Among those with pain at LMP

Table 5: School and class attendance at baseline and endline among nested cohort participants, by period-day status

	Term 3 2017 (baseline) 99 girls		Term 2 2018 (end-line) 81 girls	
	Non period-day	Period-day ¹	Non period-day	Period-day
Number of days	2625	554	3829	787
N (%) not attending full day of school	8.5%	14.6%	11.6%	14.2%
Odds ratio (95% CI)²	OR=2.17 (1.61-2.92)		OR=1.29 (1.02-1.63)	
N (%) not attending all classes	11.4%	19.9%	17.3%	20.5%
Odds ratio (95% CI)	OR=2.12 (1.64-2.74)		OR=1.26 (1.04-1.54)	

The qualitative interviews suggested that girls were more likely to attend school during menstruation at endline than at baseline, with reasons including the training on pain management, tracking their menstrual cycle, and having re-usable pads.

“Some girls totally don’t come to school every menstruation period. However, in our class, missing school is now rare because we have learnt how to manage the periods, pain and we have what to use. We now also know our cycle” (Girls FGD; Government school).

“Before MENISCUS study gave us diaries, I didn’t know how to track my days. I used to come to school and my uniform would get soiled. Sometimes, I could ask for a pass out to go back home during my periods. [...] But when MENISCUS came, they gave us diaries, I started filling them in and now I know my days; I come to school prepared.” (Female, Private school).

¹ Includes days of menses plus day prior to menses (results similar when restricted to days of menses) obtained from daily diaries for 9 months

² Obtained from random effects logistic regression, allowing for within-girl clustering

DISCUSSION

To our knowledge, this is the first MHM intervention to be pilot tested that focused equally on health promotion (psychosocial issues, stigma and knowledge) and goods (provision of pads and analgesics, and improved WASH facilities).[21]

Feasibility and accessibility of implementing the intervention

The qualitative and quantitative data showed that the intervention was feasible and acceptable to schools and stakeholders. A detailed process evaluation will be published separately. The main challenge with implementation was maintenance of the WASH component. To improve this component in a future trial, we will ask schools to establish an MHM Leadership Group (to include teachers, parents and students) responsible for ensuring each intervention element is delivered, maintained and sustained by the schools. Another challenge was that we did not obtain ethical approval to offer girls a menstrual cup, due to concerns about whether cup insertion could lead to damage of the hymen and affect a girl's virginity. Further activities to inform parents about menstrual cups and discuss concerns are underway.

Potential intervention effect on knowledge, menstrual practices and school attendance

The study was designed to assess feasibility and accessibility of implementing the intervention, rather than assess the effectiveness. Although the findings suggest a potential intervention effect on education and health outcomes, these results need to be interpreted cautiously as the improvements reported may be partly due to i) older age at baseline – there may have been improvements in knowledge and self-confidence in managing menstruation due to a cohort effect; ii) reporting biases - the outcome assessment team were involved with implementation and this may have caused social desirability bias affecting responses on attitudes or behaviours following the intervention; iii) biases due to the lack of a comparison group, and the baseline survey being conducted in a different term to baseline. For example,

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3 girls reported higher levels of school attendance overall at baseline than at endline, and this
4 may be due to the baseline being conducted during an examination term. Iv) generalisability
5 – the extent to which are findings will hold in other geographic or socio-economic settings is
6 not clear.
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13 The study highlighted poor knowledge of menstruation, possibly due to cultural taboos and
14 norms [16, 22], and lack of knowledge among students [23] parents and teachers hindering
15 discussion of puberty and menstruation.[16, 24-26] Three intervention components addressed
16 knowledge (puberty education, menstrual-management kit training, and drama skit). To
17 address stigma and effect a school-wide change in attitudes, the education and drama
18 sessions included boys. The qualitative results indicated a preference for a boys-only puberty
19 education session, and this would be included in a future intervention. This pilot study showed
20 that girls were less anxious about menstruation, and reported less teasing by boys after the
21 intervention, supporting the theory of change, and previous qualitative work from Ghana that
22 indicated reductions in shame and improvements in self-confidence following provision of
23 pads and puberty education.[27] It also worth noting that although the SDQ has proven
24 reliability and validity in a number of studies across Europe, Asia, Australia and South
25 America[28-30], and has been used widely in Africa,[31] there has only been one psychometric
26 validation of the tool which found satisfactory internal consistency.[32]
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45 At endline, compared with baseline, more girls reported use of only manufactured materials
46 during their LMP, and using these correctly. The high uptake of reusable pads was expected,
47 as these were provided free to all girls, but the continued use over follow-up, and favourable
48 qualitative reports, shows that pads were acceptable. Similar findings on correct use have
49 been seen in another study in Uganda where 98% of girls reported washing and using soap
50 for their AFR|pads [21] and in India,[33] where a school-based health-education intervention
51 led to improvements in washing clothes with soap, drying them in the sun and safe disposal.
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3 Previous studies show inconsistent evidence for a relationship between menstruation and
4 school absenteeism.[15, 16, 34-41] Documenting school attendance is often challenging in
5 LMICs due to incomplete or inaccurate school registers.[7, 16] Our diaries were popular and
6 correlated well with direct observation. The improved school attendance during menstruation
7 in this study was attributed to improved pain management, knowledge to track menstrual
8 cycles, and the provision of reusable pads in qualitative interviews.
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18 **Innovative aspects of the MENISCUS intervention**

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20 1) Multi-component focus. Past and ongoing studies tend to focus on single-component
21 interventions.[7, 37] This study indicates synergies between the intervention elements e.g. the
22 drama skit reinforces puberty knowledge, reduces stigma and engages parents and boys. An
23 emerging view, aligned with our findings, is that poor MHH is a social problem and to be
24 effective, MHH interventions in many settings should address the broader issues of menstrual
25 stigma and literacy as well as the provision of menstrual products or improving WASH
26 facilities.[9] The multi-component approach addresses both individual, behavioural and
27 environmental barriers to good MHH and school attendance.
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39 2) Pain management. Menstrual pain is a major contributor to school absence in girls in many
40 settings.[16, 22, 42, 43] This is the first MHH intervention to address this issue and we found
41 substantial improvements in pain management.[16] Further research is needed on this topic
42 as misconceptions about use of painkillers are common in Uganda [16] and elsewhere.[44,
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51 3) Inclusion of boys. Most MHH interventions focus only on girls, yet sustainable changes in
52 MHH depend on addressing stigma about menstruation. This study highlighted the importance
53 of including boys which is aligned with SCT (i.e. the intervention provides positive
54 reinforcement for behavioural change by improving the school environment). The focus on
55 boys as well as girls is supported by WHO framework for Health Promoting Schools [46] and
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3 is aligned with a report commissioned by the Gates Foundation on Menstrual Health and
4 Gender Equity.[47]
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10 4) Urban secondary school setting. Most intervention studies to date have been in primary
11 schools, and in rural areas.[21, 42] MHH and school attendance is an issue in the peri-urban
12 area in Entebbe where most girls can afford to buy disposable pads for some of the time.[16]
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14 A focus on MHH in secondary schools in different settings is important given the recognised
15 importance of girls' secondary education to future development,[48] and evidence that school
16 absenteeism due to menstruation is problematic in secondary school girls.[16, 49]
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23 **CONCLUSION**

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25 This pilot study showed that the MHH intervention was acceptable and feasible to implement.
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27 There were substantial reported improvements in stigma and anxiety, pain management, and
28 some improvement in MHH knowledge of puberty and menstruation and WASH following a
29 multi-component intervention. Based on SCT, we anticipate the results to be generalizable to
30 other similar contexts with relatively low levels of MHH knowledge, stigma about discussing
31 menstruation, and poor school WASH facilities. A phase-III trial is warranted to evaluate the
32 impact of the intervention on school attendance, and on health, well-being and educational
33 outcomes for definitive results to drive forward policy changes.
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Figure Legend:

Figure 1: Theory of Change for the MENISCUS intervention

Statements:

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41 **Contributors:** HAW, LH, BT, DAR, JS, CB, SNe, SCF and CA contributed to the overall
42 conception and design of the study. CK, LH, SNa, RN, KN, PN, SNM undertook the data
43 collection. CK and HAW wrote the first draft of the manuscript. All authors contributed to the
44 interpretation of results and drafting of the manuscript. HAW and CT did the statistical
45 analyses. All authors take responsibility for the integrity of the data and the accuracy of the
46 data analysis. All authors read and approved the final manuscript. HAW is the guarantor.

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13 **Competing Interests:** None declared
14

15
16 **Disclaimer:** The content is solely the responsibility of the authors and does not necessarily
17 represent the official views of the funders.
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21 **Ethical approval:** Ethics approval was received from the UVRI Research Ethics Committee,
22 the Uganda National Council for Science and Technology (UNCST) and the London School
23 of Hygiene and Tropical Medicine.
24
25

26
27 **Data sharing statement:** Data will be made available in the LSHTM Data Compass
28 repository on request from the corresponding author (Helen Weiss [https://orcid.org/0000-](https://orcid.org/0000-0003-3547-7936)
29 [0003-3547-7936](https://orcid.org/0000-0003-3547-7936)) from the website <https://datacompass.lshtm.ac.uk/>
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34 **Patient request for publication:** Not required
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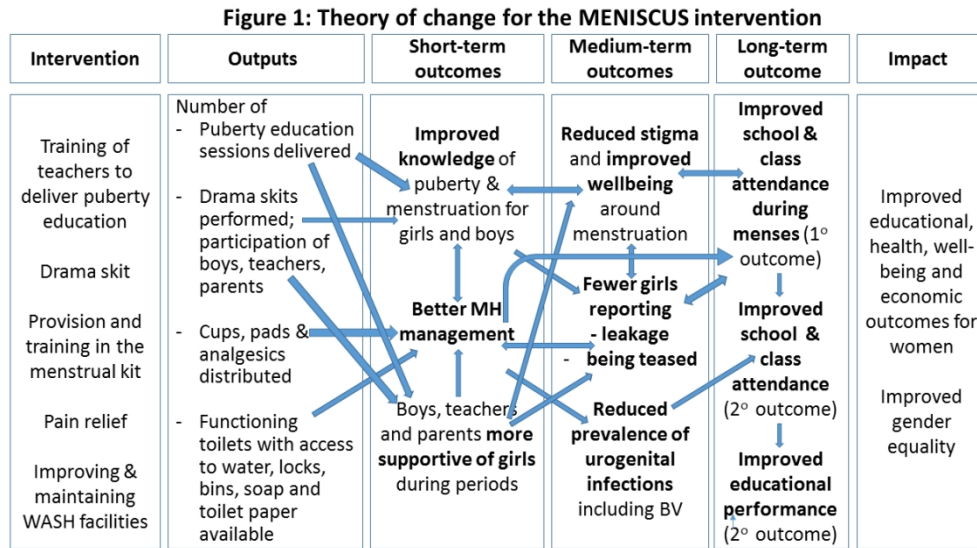


Figure 1: Theory of Change for MENISCUS intervention

338x190mm (96 x 96 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Page number
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8,11
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	8,11
		(b) For matched studies, give matching criteria and number of exposed and unexposed	n/a
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6, 9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8,9
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10
		(b) Describe any methods used to examine subgroups and interactions	10
		(c) Explain how missing data were addressed	n/a
		(d) If applicable, explain how loss to follow-up was addressed	n/a
		(e) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	11
		(c) Summarise follow-up time (eg, average and total amount)	11
Outcome data	15*	Report numbers of outcome events or summary measures over time	13-17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear	13-17

		which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	13-17
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13 and 15
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

BMJ Open

Menstrual health intervention and school attendance in Uganda (MENISCUS-2): A pilot intervention study

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Primary Subject Heading:	Global health
Secondary Subject Heading:	Epidemiology

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Keywords:	Menstrual Health, School attendance, Menstrual Hygiene, Adolescent Health, Education

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3 1 **Menstrual health intervention and school attendance in Uganda (MENISCUS-2): A pilot**
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5 2 **intervention study**
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1 **Abstract**

2 **Objectives:** Achieving good menstrual health and hygiene (MHH) is a public health challenge
3 and there is little evidence to inform interventions. The aim of this study was to pilot-test an
4 intervention to improve MHH and school attendance in Uganda, in preparation for a future
5 cluster-randomised trial.

6 **Design:** Longitudinal study with pre-post evaluation of a pilot intervention

7 **Setting:** Two secondary schools in Entebbe, Uganda

8 **Participants:** Of the 473 eligible students in Secondary 2 (S2) at baseline, 450 (95.1%; 232
9 girls and 218 boys) consented/assented. 369 students (188 girls; 81.0%; and 181 boys;
10 83.0%) participated in the endline survey.

11 **Intervention:** The intervention comprised training teachers to improve delivery of government
12 guidelines for puberty education, training in use of a menstrual kit and pain management, a
13 drama skit, provision of analgesics and improvements to school Water and Sanitation Hygiene
14 (WASH) facilities.

15 **Primary and secondary outcome measures:** Feasibility and acceptability of delivering the
16 intervention. Baseline and endline quantitative surveys were conducted, with qualitative
17 interviews conducted at endline. School attendance was assessed using self-completed daily
18 diaries among a nested cohort of 100 female students.

19 **Results:** There were high levels of uptake of the individual and behavioural intervention
20 components (puberty education, drama skit, MHM kit, and pain management). The proportion
21 of girls reporting anxiety about next period decreased from 58.6% to 34.4%, and reported use
22 of effective pain management increased from 76.4% to 91.4%. Most girls (81.4%) reported
23 improved school toilet facilities, which improved their comfort managing menstruation. The
24 diary data and qualitative data indicated a potential intervention impact on improving
25 menstrual-related school absenteeism.

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3 1 **Conclusions:** The pilot study showed that the multi-component MHM intervention was
4
5 2 acceptable and feasible to deliver, and potentially effective in improving menstruation
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7 3 knowledge and management. A cluster-randomised trial is needed to evaluate rigorously the
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9 4 intervention effects on MHM and school attendance.
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15 6 **Strengths and limitations of the study:**
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18 7 • The study evaluated a multi-component menstrual health intervention that addresses
19
20 8 individual, behavioural and environmental barriers to good menstrual health and school
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22 9 attendance.
23
24 10 • The study population are students in peri-urban secondary schools, which is important
25
26 11 given the recognised importance of girls' secondary education to future development, and
27
28 12 evidence that school absenteeism due to menstruation is problematic for secondary school
29
30 13 girls.
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32 14 • This is the first menstrual health intervention to address menstrual pain – a major
33
34 15 contributor to school absence in girls
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36 16 • The intervention includes boys as well as girls, as sustainable changes in menstrual
37
38 17 management depend on addressing stigma about menstruation.
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40 18 • The conclusions are limited due to the lack of a control group, which means that the
41
42 19 improvements seen in knowledge, school attendance and wellbeing may reflect the girls
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44 20 being older at endline or differences in attendance in different terms.
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1 INTRODUCTION

2 Many girls and women globally lack the knowledge, materials and facilities for safely managing
3 menstruation without stigma.(1-4) Adequate menstrual hygiene management (MHM) is
4 defined as i) using clean menstrual management material to absorb or collect menstrual blood,
5 ii) that can be changed in privacy as often as necessary for the duration of a menstrual period,
6 iii) using soap and water for washing the body as required, iv) having access to safe and
7 convenient facilities to dispose of used menstrual management materials, v) understanding
8 the basic facts linked to the menstrual cycle and vi) how to manage it with dignity and without
9 discomfort or fear.(5) A recent systematic review of menstrual experiences among women and
10 adolescent girls globally highlighted that interventions must address a broad range of issues
11 including addressing stigma, knowledge, social support, restrictive behavioural expectations,
12 and the physical and economic environment.(6) Aligned with this, the term menstrual health
13 and hygiene (MHH) encompasses both MHM and the broader systemic factors that link
14 menstruation with health, well-being, gender equality, education, equity, empowerment, and
15 rights.(5)

16
17 Effective MHH interventions may lead to sustained benefits for health, productivity (3, 4, 7)
18 and the environment (8) but there has been little rigorous evaluation of interventions to guide
19 policies.(9-11) Schools provide an important setting for addressing MHH challenges
20 concerning stigma, lack of menstrual literacy and goods (menstrual products, improved water,
21 sanitation and hygiene (WASH) facilities and pain management).(12) In 2014, the “MHM in
22 Ten” initiative developed an agenda for addressing the barriers facing girls in schools in low-
23 income contexts.(13) The first priority of the initiative is to generate rigorous evidence on
24 whether improving MHM improves school attendance.(9, 10, 14) A systematic review
25 published in 2016 (15) concluded there was promising evidence of the effectiveness of MHH
26 interventions on educational outcomes, but insufficient evidence of effect due to a small
27 number of trials (N=8), a high risk of bias, and substantial heterogeneity. An earlier systematic
28 review (7) of intervention and observational studies found that of the 11 studies (only one

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3 1 RCT) investigating the association between MHM and urogenital infections, seven found an
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5 2 increased risk associated with “worse” MHM (defined differently for each study but generally
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7 3 meaning not using disposable sanitary pads), one found the reverse to be true (an increased
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9 4 risk from using disposable sanitary pads), and three found no association.
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14 6 The aim of this study was to pilot-test a multi-component school-based MHH intervention
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16 7 (“MENISCUS”) and to prepare for a future cluster-randomised trial (CRT) which will evaluate
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18 8 the impact of the intervention on secondary school attendance, performance, menstruation
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20 9 knowledge, health and wellbeing outcomes in Uganda. Formative work in Wakiso District,
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22 10 Uganda, showed that secondary school girls reported substantial embarrassment and fear of
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24 11 teasing related to menstruation, reporting that this, together with menstrual pain and lack of
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26 12 effective materials for menstrual hygiene management, led to school absenteeism, especially
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28 13 in schools with low socio-economic catchment populations.(16) The issue is recognised by
29
30 14 the Ugandan Government, which has the political will to improve MHM.(17) However the
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32 15 Government MHM guidelines for schools are not consistently implemented (18) for reasons
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34 16 including lack of funding, unclear roles and responsibilities for MHM, with issues largely left to
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36 17 the senior teachers.
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41 19 The objectives of the pilot study are to: i) Assess the feasibility and acceptability of
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43 20 implementing a combined package of MHH intervention elements developed in the formative
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45 21 work, delivered to a whole secondary school year for nine months; ii) Assess the outcomes of
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47 22 the intervention package at baseline and endline (knowledge and attitudes towards puberty,
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49 23 menstruation and pain management); iii) Pilot the use of daily diaries to estimate school
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51 24 attendance, and compare attendance with estimates using registers, observation visits and
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53 25 retrospective self-report; iv) Estimate school retention over a 9 month period.
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3 1 create a more supportive MHM environment (through drama); and iii) provide positive
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5 2 reinforcement for behaviour change (through improving WASH facilities and reduced
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7 3 leakage/pain as a result of better MHM).
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11 5 The intervention was implemented in partnership with a local NGO, WoMena Uganda, and
12
13 6 consisted of the following. Further details are given in Supplementary Table 1:

- 15
16 7 i. Puberty education: We used a Training of Trainers (ToT) model in which WoMena
17
18 8 Uganda worked with an educational consultant and her assistant to train 30 teachers from
19
20 9 the two schools to improve delivery of Ugandan Government guidelines for puberty
21
22 10 education to their students. The trained teachers were expected to develop a plan for
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24 11 delivering puberty training in their school and deliver the specified number of sessions to
25
26 12 both male and female students.
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28 13 ii. Drama Skit: To address stigma, attitudes and psychosocial issues about menstruation,
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30 14 WoMena Uganda facilitated students, with support from the school drama teacher, to
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32 15 develop and perform drama skits. Topics included managing pain, teasing, parental
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34 16 responsibilities for supporting girls with menstruation and tracking the menstrual cycle.
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36 17 iii. Menstrual management kit: A kit, including a pack of 4 AFRipads reusable menstrual
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38 18 pads, a small towel, soap, water bottle, underwear, a mirror and menstrual calendar, was
39
40 19 distributed to all girls in S2. WoMena Uganda trained teachers and prefects to deliver
41
42 20 education sessions on menstruation to girls and boys on MHH, pain relief strategies such
43
44 21 as stretching, using a hot-water bottle and use of the re-usable pads to girls only.
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46 22 iv. Pain management: The research team supplied each girl with vouchers to exchange for
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48 23 up to six paracetamol tablets per month from the school nurse, senior teacher or a local
49
50 24 pharmacy.
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52 25 v. WASH facilities: The research team improved school WASH facilities by improving
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54 26 access to water close to the sanitation facilities e.g. provision of water drums and stands
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56 27 (one with clean water and one with soapy water), installing locks, repairing broken doors,
57
58 28 providing bins and providing toilet-paper holders.
59
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2 Study design and evaluation

3 The design was a longitudinal study with pre-post evaluation of a pilot intervention. All
 4 participants were asked to self-complete a quantitative survey at baseline (October 2017) and
 5 endline (August 2018) on tablets using Open-Data-Kit software. Questions included
 6 knowledge of puberty and menstruation, perceptions of menstruation (using a 5-point Likert
 7 scale) (Table 1), menstrual management practices at last menstrual period (LMP), reported
 8 pain and pain management strategies, leakages during LMP, anxiety, and the 25-item
 9 Strengths and Difficulties Questionnaire (SDQ) which is globally used to screen for
 10 behavioural markers of potential mental health problems in children and adolescents, covering
 11 four domains (hyperactivity, conduct problems, peer problems and emotional problems).(20-
 12 22)

13 **Table 1: Menstruation knowledge, myth and perception questions**

Topic	
1. Menstruation knowledge statements (response True/False)	Adolescence is the time between puberty and adulthood
	Changes in the body during puberty happen because of hormones
	The physical changes related to puberty usually start between 10 and 14 years of age in girls, and between 12 and 16 in boys
	Menstrual blood comes from the stomach where food is digested
	Women stop menstruating after the age of about 45-50
	Menstruation in girls and women is normal
	Pregnant women menstruate
	When a girl gets her first period, her body is ready to have children
2. Myth statements (response True/False)	During her period a girl can get pregnant
	Painkillers cause problems having children
	When a girl has her period she is unclean
	Sanitary pads can cause sickness or infection
3. Menstrual cycle questions (closed responses)	It is healthy for a girl to run, dance or cycle during her period
	What is period blood?
	How long does a period usually last?
4. Menstruation perception statements (response Yes/No)	How many days are there usually between periods?
	I prefer staying at home during my period rather than going to school
	I worry about being teased during my period
	During my period I feel less self-confident than during other days;
	During my period I avoid physical activity (e.g. walking, running)
	I feel anxious about having my next period
	Boys tease me about my period

	Girls tease me about my period
	I feel comfortable to talk to other girls at school about my period
	If I had a problem with managing my period, I would talk to another girl about it

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2 A nested cohort comprised a random sub-sample of 50 girls per school assessing the
3 feasibility of school attendance and menstruation patterns using self-completed daily diaries.

4 Nested cohort participants were given a booklet each term for daily recording of school and
5 class attendance, menstruation and pain.

6
7 Qualitative interviews were used to assess perceptions and acceptability of the intervention,
8 and its perceived impact on school attendance at endline. In-depth interviews (IDIs) were
9 conducted with 20 female students sampled purposively (menstruating S2 girls with different
10 levels of reported baseline school attendance), 10 teachers (six females and four males) and
11 10 parents who had attended the drama performance. Four focus-group discussions (FGDs)
12 were conducted (two with each sex) at the schools. Semi-structured topic guides were used
13 for both IDIs and FGDs. Interviewers were the same sex as respondents and interviews were
14 digitally recorded with permission. The trustworthiness of the qualitative data was assessed
15 in accordance with the approaches suggested by Krefting (23) to ensure credibility,
16 applicability, dependability and confirmability of the data. The training, skill and careful
17 supervision and support of researchers in the conduct of qualitative data collection underpins
18 this approach (24).

19
20 Research assistants conducted nine unannounced WASH assessment visits per school at
21 baseline and during follow-up, using a standardized checklist to assess availability,
22 accessibility and functioning in terms of sanitary waste disposal, availability of water, soap,
23 hand-washing facilities and toilet paper; cleanliness and privacy.

24
25 Finally, a mixed-methods process evaluation was conducted to improve understanding of
26 intervention implementation. Details of this will be reported separately.

2 Outcomes

3 Outcomes were knowledge of puberty and menstruation, attitudes towards menstruation and
4 menstrual practices (assessed by the proportion of students answering all knowledge, myth
5 and menstrual cycles correct respectively), knowledge and use of effective pain management
6 methods (assessed by the proportion of girls knowing, and reporting using, at least one
7 effective pain relief method during their LMP if they reported pain), psychosocial wellbeing
8 (assessed by the mean SDQ-25 score) and school attendance (assessed by reported days
9 missing school in the daily diaries). The planned sample size of 200 girls (and 200 boys,
10 respectively) provides 85% power to detect an odds ratio of two between baseline and endline
11 assuming baseline prevalence of 20%, allowing for within-individual correlation (intracluster-
12 correlation=0.05).

14 Data management and analysis

15 Electronically-captured data were exported to Stata version 15. The paper-based diary data
16 and WASH checklist data were entered using Microsoft Access. For the survey data, the
17 intervention effect on binary outcomes was estimated by comparing endline versus baseline
18 measures, using adjusted prevalence ratios (APR), adjusted prevalence difference (APD) and
19 95% confidence intervals (CI) estimated using marginalised standardisation from random-
20 effects logistic regression accounting for within-individual clustering(25). This provides an
21 estimate of the prevalence ratio and prevalence difference for outcomes assessed at endline
22 compared with baseline, independently of potential confounding variables. Effects on
23 continuous outcomes were similarly assessed with random-effects linear regression to
24 estimate the adjusted mean difference (AMD) and 95%CI. All analyses were adjusted for
25 school, gender and age (<16, ≥16 years) as fixed effects. Effect-moderation by school and
26 age group were assessed using the likelihood ratio test. For the nested cohort, period-days
27 were defined from the diary data as the days of menstruation (bleeding) plus the day prior to
28 menstruation, with sensitivity analyses restricted to days of menstruation only. For the cohort

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3 1 analysis, random effects logistic regression was used to estimate APR and APD, adjusting for
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5 2 within-girl clustering. Audio-recordings were transcribed verbatim and translated into English.
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7 3 Data were analysed using thematic content analysis, with two social scientists independently
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9 4 coding and checking results. Key themes and subthemes related to the objectives of the
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11 5 qualitative research were organised in a matrix and discussed by the team for appropriate
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13 6 interpretation.
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9 **Participant and public involvement**

10 Community groups were involved throughout the formative work, with stakeholders'
11 workshops in August 2016 and October 2018, and a ToC workshop in April 2017. The ToC
12 workshop included 35 invited participants (teachers, students and parents from the
13 MENISCUS-1 and -2 schools, representatives from the Ministry of Education and Sports
14 (MoES), Ministry of Health (MoH), the District Education Officer, Makerere University and
15 NGOs working on menstrual health). In October 2018, we disseminated findings from
16 MENISCUS-2 at a stakeholders' workshop, and elicited input into the future trial design. This
17 meeting was attended by 60 participants, including representatives from MoES, MoH, Uganda
18 National Council for Science and Technology (UNCST), Wakiso District Local Government
19 Makerere University, AFRIpads, WoMena and Entebbe Municipal Council. MENISCUS-1 and
20 two schools were represented by head teachers, students and parents.
21

22 **RESULTS**

23 **Socio-demographic characteristics**

24 Of the 473 eligible S2 students at baseline, 450 (95.1%; 232 girls and 218 boys)
25 consented/assented. Overall, 369 students (188 girls; 81.0%; and 181 boys; 83.0%)
26 participated in the endline survey. At baseline, the mean age was 15.4 years (SD 1.31; range

12-20) for girls and 16.2 (SD=1.5; range 13-21) for boys. Follow-up ranged from 8.6 to 9.6 months (median 9.00 months). Among the girls, 222 (95.7%) and 183 (97.3%) had started menstruating at baseline and endline respectively. The majority (n=361; 80.2%) were Christian and 198 (44.0%) were of Ganda ethnicity. About half (50.6%) of participants' mothers had post-primary education, as did 73.5% of participants' fathers (excluding 74 mothers and 88 fathers where this information was unknown). Relatively few participants (n=59; 13.1%) had running water at home, and 54 (12.0%) had a flush toilet in the home.

10 **Feasibility and acceptability of implementing the intervention**

11 There were high levels of uptake of the individual and behavioural intervention components (puberty education, drama skit, MHM kit, and pain management). Most students (81.3%) reported attending puberty education sessions and 93.4% of girls reported receiving the MHM kit. Both schools performed the drama skit, and the qualitative interviews indicated that the skit increased MHM awareness and enabled some of the girls to talk about MHM with their parents, especially their fathers.

18 *"When we all saw the skit, it gave us a starting point to initiate a discussion with our children. Even men got it" (Female Parent).*

20 *"Trainings improved our self-esteem and confidence because nowadays we are not scared of coming to school. We are comfortable coming to school during our menstruation. Before the training some of us were shy and we couldn't stand and talk in-front of people or parents about menstruation and puberty but now we can," (FGD girls, Private school).*

24 The WASH component was challenging to implement. At baseline, there were no sanitary disposal bins, lockable toilet paper holders, or functional water drums at either school (Table 2). Both schools received these items as part of the intervention. At endline, in the private school, all the girls' cubicles were functional, clean and with a lockable door versus only 33%

1 in the Government school, where facilities were shared with the community. Despite this, most
 2 girls (81.4%) reported improvements in toilet facilities at endline, which improved their comfort
 3 managing menstruation.

4
 5 *“The school environment is now conducive ... during our menstruation because the water is*
 6 *available, they give us water mixed with liquid soap; the toilet doors have locks, there is*
 7 *privacy, a person cannot interrupt you while changing the pad. Toilet paper is available*
 8 *whenever needed and the toilets are always clean.” (Female student, Private school).*

10 **Table 2: Summary of WASH facilities at baseline and during implementation**

Component	Baseline (1 visit)		Follow up (8 visits)		
	Boys and girls		Girls		Boys
	Both schools	Private school	Government school	Private school	Government school
Bin	0%	6/8 (75%)	8/8 (100%)	n/a	n/a
Toilet paper	0%	2/8 (25%)	0/8 (0%)	1/8 (13%)	1/8 (13%)
Functioning water drum	0%	7/8 (88%)	7/8 (88%)	7/8 (88%)	7/8 (88%)
Functioning water & soap drum	0%	6/8 (75%)	2/8 (25%)	5/8 (63%)	3/8 (38%)

11 *% of the 8 visits when the WASH component was present outside at least one toilet block in the school*

12

13 Knowledge, misconceptions and perceptions of puberty and menstruation

14 Knowledge of puberty and menstruation was poor at baseline, especially among boys. The
 15 proportion answering all nine knowledge questions correctly increased from 11.6% to 23.9%
 16 (APR=2.18, 95%CI 1.47-3.22; p<0.001) in girls, and from 4.1% to 12.7% (APR=3.07, 95%CI
 17 1.49-6.32; p<0.001) in boys (Table 3). There was also evidence of improvements in knowledge
 18 of the menstrual cycle, particularly among girls, although endline knowledge remained poor
 19 (29.3% of girls and 7.7% of boys answering all 3 questions correctly; Table 3).

20

21 The proportion of girls answering at least eight of nine questions on their perceptions about
 22 menstruation positively (i.e. questions about self-confidence, teasing and anxiety) increased

1 from 12.2% at baseline to 27.9% at endline (APR=2.40, 95%CI: 1.59-3.62, $p<0.001$). The
2 largest effects were reductions in the proportion of girls reporting teasing by boys about
3 menstruation (14.4% to 8.7%, APR=0.57, 95%CI 0.34-0.97, $p=0.04$), girls feeling anxious
4 about the next period (58.6% to 34.4%, APR=0.57, 95%CI 0.46-0.69, $p<0.001$) and girls
5 avoiding physical activity during menstruation (47.8% to 25.7%; APR=0.55, 95%CI 0.42-0.71,
6 $p<0.001$). There was no evidence that the intervention effect differed by age (Table 4; $p\geq 0.2$
7 for intervention effect modification for each variable) or school ($p\geq 0.1$ for effect modification
8 for each variable; results not shown).

Table 3: Knowledge of puberty and menstruation, attitudes to menstruation and menstrual practices at baseline and endline, by gender

				Girls					
				Baseline (n=232)	Endline (n=188)	APR (95% CI) APD (95%CI)	Baseline (n=218)	Endline (n=181)	APR (95% CI) APD (95%CI)
All 9 knowledge questions correct ¹				27 (11.6%)	45 (23.9%)	2.18 (1.47-3.22) 13.4% (6.7-20.2%) P<0.001	9 (4.1%)	23 (12.7%)	3.07 (1.49-6.32) 8.5% (3.1-13.8%) P=0.002
8 knowledge questions (excluding fertility question) correct ¹				70 (30.2%)	120 (63.8%)	2.13 (1.73-2.63) 34.1% (25.7-42.0%) P<0.001	42 (19.3%)	73 (40.3%)	1.91 (1.44-2.54) 18.3% (10.7-26.0%) P<0.001
All 4 myth questions correct ²				39 (16.8%)	77 (41.0%)	2.54 (1.86-3.48) 25.3% (17.3-33.3%) P<0.001	22 (10.1%)	44 (24.3%)	2.56 (1.64-4.01) 15.2% (8.1-22.2%) P<0.001
All 3 menstrual cycle questions ³				12 (5.2%)	55 (29.3%)	6.38 (3.59-11.34) 25.8% (18.8-32.8%) P<0.001	4 (1.8%)	14 (7.7%)	3.70 (1.23-11.11) 5.3% (1.2-9.4%) P=0.02

¹ Knowledge statements were: i) Adolescence is the time between puberty and adulthood; ii) Changes in the body during puberty happen because of hormones; iii) The physical changes related to puberty usually start between 10 and 14 years of age in girls, and between 12 and 16 in boys; iv) Menstrual blood comes from the stomach where food is digested; v) Women stop menstruating after the age of about 45-50; vi) Menstruation in girls and women is normal; vii) Pregnant women menstruate; viii) When a girl gets her first period, her body is ready to have children; ix) During her period a girl can get pregnant

² Myth statements were: i) Painkillers cause problems having children; ii) When a girl has her period she is unclean; iii) Sanitary pads can cause sickness or infection; iv) It is healthy for a girl to run, dance or cycle during her period

³ Menstrual cycle questions were: i) What is period blood?; ii) How long does a period usually last?; iii) How many days are there usually between periods?

1 In qualitative interviews, girls and teachers said that they thought that fear, myths and negative
2 perceptions about menstruation were due to lack of knowledge. Participants suggested that
3 the intervention improved knowledge about puberty, menstruation, and girls' accounts
4 suggested a reduction of teasing by boys at school:

5
6 *“Before MENISCUS, boys used to laugh at girls, for example when a girl stood up in class with
7 her dress stained, boys would laugh at her but after MENISCUS training, they stopped
8 laughing at girls and they now care about us” (Female student, Private school).*

9 10 **Management of menstruation**

11 The proportion of girls reporting using manufactured menstrual materials exclusively (i.e.
12 reusable or disposable pads, tampons or menstrual cups) during their LMP increased from
13 73.0% at baseline to 89.1% at endline (APR=1.23, 95%CI 1.12-1.35, $p<0.001$). At endline,
14 most girls ($n=155$; 82.5%) reported using reusable pads during their LMP compared with
15 18.5% at baseline. There was weak evidence of a decrease in reported leakage of blood
16 through their clothing during LMP (47.4% at baseline vs 35.3% at endline; APR=0.76, 95%CI
17 0.57-1.02, $p=0.06$), but no evidence of a difference in the proportion of girls reporting staining
18 their underwear during their LMP (23.4% at baseline to 27.3% at endline (APR=1.19, 95%CI
19 0.87-1.63, $p=0.29$). There was no evidence of intervention effect-moderation by age or school
20 (Table 4).

21 22 **Knowledge and use of effective pain management methods**

23 Most girls reported pain during menstruation at both baseline and endline (74.3% and 71.0%,
24 respectively). Amongst these girls, there was evidence of an increase in the proportion who
25 reported using painkillers during their LMP (46.7% at baseline to 60.8% at endline; APR=1.26,
26 95%CI 1.03-1.55, $p=0.03$). Results were similar by age (Table 4) and school (results not
27 shown). There was evidence of an increase in the proportion of girls who reported using ≥ 1
28 effective pain relief method during their LMP (76.4% at baseline to 91.5% at endline;

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3 1 APR=1.19, 95%CI 1.08-1.32, p=0.001). Of the 232 girls who received a voucher for painkillers,
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5 2 58 (25.0%) had redeemed 78 vouchers by endline: 77% used one voucher, 16% used two,
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7 3 and 7% used ≥ 2 .
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11 5 The qualitative findings confirmed that non-pharmacological methods of pain relief were
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13 6 popular and effective.

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15 7 *“They [MENISCUS team] taught us how to do exercises to relieve pain and it worked for me*
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17 8 *so, the last time, I didn’t use painkillers; I managed my periods by doing exercises and using*
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19 9 *reusable pads MENISCUS had provided.” (Female student, Government school).*
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23 24 11 **Behavioural markers of psychosocial well-being**

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26 12 The mean SDQ-25 score in girls decreased from 10.3 to 9.2 (p=0.006, adjusted for age and
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28 13 school), indicating improved behaviour and conduct. No decrease was seen among boys, in
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30 14 line with the ToC (9.88 at baseline vs 9.91 at endline; p=0.98).
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33 34 35 16 **Menstruation and school absence**

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37 17 In the cross-sectional surveys, a similar proportion of girls reported missing at least one school
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39 18 day due to menstruation in Term 2, 2017 (pre-baseline) and Term 2, 2018 (endline) (32.0%
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41 19 vs 32.8%; APR=0.99, 95%CI 0.76-1.28, p=0.92). Among the 100 cohort participants, data
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43 20 were collected from 81 students at endline. The APR associated with missing school on
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45 21 period-days compared to non-period days decreased from 1.84 (95%CI 1.46-2.21) at baseline
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47 22 to 1.16 (95%CI 0.97-1.38) at endline (p-value for moderation=0.01; Table 5). Results were
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49 23 similar for class attendance (Table 5). The direct observation checks found high correlation
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51 24 with the self-completed diaries. Girls were seen on 328/330 (99.4%) of days when their diary
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53 25 stated they were present and were not seen on all 37 days when the diary stated that they
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55 26 were absent. School registers were incomplete and rarely completed by teachers.
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Table 4: Reported perceptions of menstruation, menstrual management, pain and pain management among girls, by age at baseline

	Age <16 years			Age ≥ 16 years		
	Baseline (n=115)	Endline (n=51)	APR (95% CI) APD (95% CI)	Baseline (n=107)	Endline (n=132)	APR (95% CI) APD (95% CI)
≥8 of 9 positive perceptions of menstruation ¹	14 (12.2%)	16 (31.4%)	2.76 (1.10-25.19) 21.0% (7.2-34.9%) P=0.001	13 (12.2%)	35 (26.5%)	2.23 (1.26-3.95) 14.6% (5.2-24.1%) P<0.001
Used manufactured menstrual materials only at LMP	86 (74.8%)	46 (90.2%)	1.21 (1.06-1.39) 15.7% (4.6-26.8%) P=0.006	76 (71.0%)	117 (88.6%)	1.25 (1.10-1.42) 17.6% (8.0-27.2%) P<0.001
Leaked blood at LMP	37 (50.0%)	12 (42.9%)	0.84 (0.54-1.30) -8.2% (-27.5-11.1%) P=0.41	37 (45.1%)	24 (32.4%)	0.73 (0.49-1.09) -12.1% (-27.1-2.8%) P=0.11
Underwear stained at LMP	31 (27.0%)	16 (31.4%)	1.07 (0.67-1.71) 18.4% (-11.5-15.1%) P=0.79	21 (19.6%)	34 (25.8%)	1.28 (0.82-1.99) 5.6% (-4.3%-15.5%) P=0.27
Knew ≥4 effective pain management methods	30 (24.2%)	37 (67.3%)	2.72 (1.93-3.84) 41.8% (27.9-55.7%) P<0.001	30 (27.8%)	97 (72.9%)	2.60 (1.93-3.51) 44.5% (34.3-54.7%) P<0.001
Reported pain at last period	79 (68.7%)	36 (70.6%)	1.00 (0.82-1.22) -0.01% (13.6-13.4%)	86 (80.4%)	94 (71.2%)	0.89 (0.78-1.01) -9.1% (-19.1-0.9%)

¹ Perception questions were i) I prefer staying at home during my period rather than going to school; ii) I worry about being teased during my period; iii) During my period I feel less self-confident than during other days; iv) During my period I avoid physical activity (e.g. walking, running); v) I feel anxious about having my next period; vi) Boys tease me about my period vii) Girls tease me about my period; viii) I feel comfortable to talk to other girls at school about my period; ix) If I had a problem with managing my period, I would talk to another girl about it

				P=0.99			P=0.08
Used ≥ 1 effective pain management method ¹	57 (72.2%)	34 (94.4%)	1.31 (1.12-1.54) 22.5% (10.2-34.9%) P<0.001		69 (80.2%)	85 (90.4%)	1.13 (1.00-1.27) 10.0% (2.9-19.9%) P=0.05
Used painkillers at LMP ²	32 (40.5%)	21 (58.3%)	1.45 (0.99-2.12) 18.2% (-1.6%-37.5%) P=0.06		45 (52.3%)	58 (61.7%)	1.16 (0.92-1.46) 8.3% (-4.5%-21.1%) P=0.21
Used other effective methods ²	39 (49.4%)	29 (80.6%)	1.63 (1.24-2.15) 31.1% (14.0-48.1%) P<0.001		43 (50.0%)	72 (76.6%)	1.55 (1.25-1.92) 27.3% (15.2-39.4%) P<0.001
Did nothing for pain at LMP ¹	20 (25.3%)	2 (5.6%)	0.22 (0.05-0.89) -19.7% (-31.9- -7.5%) P<0.001		17 (19.8%)	7 (7.5%)	0.36 (0.17-0.78) -12.8% (-21.8-3.7%) P<0.001

¹ Effective methods (painkiller, drinking water, using hot water bottle, exercise, relaxing, foods with lots of water).

² Among those with pain at LMP

Table 5: School and class attendance at baseline and endline among nested cohort participants, by period-day status

	Term 3 2017 (baseline) 99 girls		Term 2 2018 (end-line) 81 girls	
	Non period-day	Period-day ¹	Non period-day	Period-day
Number of days	2625	554	4111	838
N (%) not attending full day of school	8.5%	14.6%	12.7%	14.8%
APR (95% CI) ²	1.84 (1.46-2.31)		1.16 (0.97-1.38)	
APD (95% CI) ²	7.1% (3.1-10.2%) P<0.001		2.1% (-0.5% - 4.6%) P=0.10	
N (%) not attending all classes	11.4%	19.9%	18.2%	20.6%
APR (95% CI) ²	1.79 (1.47-2.17)		1.15 (0.99-1.32)	
APD (95% CI) ²	8.9% (5.4-12.5%) P<0.001		2.7% (-0.3 - 5.6%) P=0.07	

The qualitative interviews suggested that girls were more likely to attend school during menstruation at endline than at baseline, with reasons including the training on pain management, tracking their menstrual cycle, and having re-usable pads.

“Some girls totally don’t come to school every menstruation period. However, in our class, missing school is now rare because we have learnt how to manage the periods, pain and we have what to use. We now also know our cycle” (Girls FGD; Government school).

“Before MENISCUS study gave us diaries, I didn’t know how to track my days. I used to come to school and my uniform would get soiled. Sometimes, I could ask for a pass out to go back home during my periods. [...] But when MENISCUS came, they gave us diaries, I started filling them in and now I know my days; I come to school prepared.” (Female, Private school).

¹ Includes days of menses plus day prior to menses (results similar when restricted to days of menses) obtained from daily diaries for 9 months

² Obtained from random effects logistic regression adjusting for age and school, allowing for within-girl clustering

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2 DISCUSSION

3 To our knowledge, this is the first MHM intervention to be pilot tested that focused equally on
4 health promotion (psychosocial issues, stigma and knowledge) and goods (provision of pads
5 and analgesics, and improved WASH facilities).(26)

7 Feasibility and accessibility of implementing the intervention

8 The qualitative and quantitative data showed that the intervention was feasible and acceptable
9 to schools and stakeholders. A detailed process evaluation will be published separately. The
10 main challenges with implementation was maintenance of the WASH component and that we
11 did not obtain ethical approval to offer girls a menstrual cup, due to concerns about whether
12 cup insertion could lead to damage of the hymen and affect a girl's virginity.

14 Potential impact of an MHH intervention on knowledge and attitudes to puberty and 15 menstruation

16 The study highlighted poor baseline knowledge of menstruation, possibly due to cultural
17 taboos and norms (16, 27), and lack of knowledge among students (28) parents and teachers
18 hindering discussion of puberty and menstruation.(16, 29-31) Three intervention components
19 addressed knowledge (puberty education, menstrual-management kit training, and drama
20 skit). To address stigma and effect a school-wide change in attitudes, the education and drama
21 sessions included boys. The qualitative results indicated a preference for a boys-only puberty
22 education session. This pilot study showed that girls were less anxious about menstruation,
23 and reported less teasing by boys after the intervention, supporting the Theory of Change,
24 and previous qualitative work from Ghana.(32) It also worth noting that although the SDQ has
25 proven reliability and validity in a number of studies across Europe, Asia, Australia and South
26 America(21, 33, 34), and has been used widely in Africa,(22) there has only been one
27 psychometric validation of the tool which found satisfactory internal consistency.(35)

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5 2 At endline, compared with baseline, more girls reported use of only manufactured materials
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7 3 during their LMP, and using these correctly. The high uptake of reusable pads was expected,
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9 4 as these were provided free to all girls, but the continued use over follow-up, and favourable
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11 5 qualitative reports, shows that pads were acceptable. Similar findings on correct use have
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13 6 been seen in another study in Uganda where 98% of girls reported washing and using soap
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15 7 for their AFRIPads (26) and in India,(36) where a school-based health-education intervention
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17 8 led to improvements in washing clothes with soap, drying them in the sun and safe disposal.
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22 10 Overall, the findings suggest a potential intervention effect on education and health outcomes,
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24 11 but the results need to be interpreted cautiously as the improvements reported may be partly
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26 12 due to i) older age at endline – there may have been improvements in knowledge and self-
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28 13 confidence in managing menstruation due to a cohort effect; ii) reporting biases - the outcome
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30 14 assessment team were involved with implementation and this may have caused social
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32 15 desirability bias affecting responses on attitudes or behaviours following the intervention; iii)
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34 16 biases due to the lack of a comparison group, and the endline survey being conducted in a
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36 17 different term to baseline. For example, girls reported higher levels of school attendance
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38 18 overall at baseline than at endline, and this may be due to the baseline being conducted during
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40 19 an examination term; iv) generalisability – the extent to which are findings will hold in other
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42 20 geographic or socio-economic settings is not clear.
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22 **Methods to estimate school attendance**

23 We found strong evidence that the association between missing school and menstruation was
24 smaller by the end of the intervention period. This aligns with data from qualitative interviews,
25 in which girls attributed the improved school attendance during menstruation to improved pain
26 management, knowledge to track menstrual cycles, and the provision of reusable pads.
27 Previous studies show inconsistent evidence for a relationship between menstruation and
28 school absenteeism.(15, 16, 37-44) Documenting school attendance is often challenging in

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3 1 LMICs due to incomplete or inaccurate school registers.(7, 16) Our diaries, administered by
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5 2 the research team, were popular and correlated very well with direct observation.
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4 **Key recommendations**

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14 6 **1) Multi-component focus.** Past and ongoing studies tend to focus on single-component
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16 7 interventions.(7, 40) This study indicates synergies between the intervention elements e.g. the
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18 8 drama skit reinforces puberty knowledge, reduces stigma and engages parents and boys. An
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20 9 emerging view, aligned with our findings, is that poor MHH is a social problem and to be
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22 10 effective, MHH interventions in many settings should address the broader issues of menstrual
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24 11 stigma and literacy as well as the provision of menstrual products or improving WASH
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26 12 facilities.(9) A key finding from this study is that the multi-component approach addresses both
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28 13 individual, behavioural and environmental barriers to good MHH and school attendance.
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30 14 Based on our findings, these holistic MHH interventions may benefit from establishing an MHH
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32 15 Leadership Group (to include teachers, parents and students) responsible for ensuring each
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34 16 intervention element is delivered, maintained and sustained by the schools. We recommend
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36 17 that future MHH interventions are multi-component, which is also in line with a recent
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38 18 systematic review of girls' and women's experiences of menstruation in LMICs. (6) Given the
39
40 19 limitations of this study mentioned above, a full-scale cluster randomised trial is needed to
41
42 20 rigorously evaluate the impact of such an intervention on girls' health and wellbeing.
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47 22 **2) Inclusion of pain management strategies.** Menstrual pain is a major contributor to school
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49 23 absence in girls in many settings.(16, 27, 45, 46) This is the first MHH intervention to address
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51 24 this issue and we found substantial improvements in pain management (using both analgesic
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53 25 and non-analgesic methods).(16) Further research is needed on this topic as misconceptions
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55 26 about use of painkillers are common in Uganda (16) and elsewhere.(47, 48)
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3 1 **3) Inclusion of boys.** We recommend that MHH interventions are inclusive of boys and men.
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5 2 Most MHH interventions focus only on girls, yet sustainable changes in MHM depend on
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7 3 addressing stigma about menstruation. This study highlighted the importance of including
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9 4 boys which is aligned with SCT (i.e. the intervention provides positive reinforcement for
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11 5 behavioural change by improving the school environment). The focus on boys as well as girls
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13 6 is supported by WHO framework for Health Promoting Schools (49) and is aligned with a report
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15 7 commissioned by the Gates Foundation on Menstrual Health and Gender Equity.(50)
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20 9 **4) Implementation in diverse settings:** Most intervention studies to date have been in
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22 10 primary schools, and in rural areas.(26, 45) MHH and school attendance is an issue in the
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24 11 peri-urban area in Entebbe where most girls can afford to buy disposable pads for some of
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26 12 the time.(16) A focus on MHH in secondary schools in different settings is important given the
27
28 13 recognised importance of girls' secondary education to future development,(51) and evidence
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30 14 that school absenteeism due to menstruation is problematic in secondary school girls.(16, 52)
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34 16 **5) Piloting and validation of methods to assess the association between menstruation**
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36 17 **and school attendance.** In this study, daily diaries were the optimal method to assess the
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38 18 association of school attendance and menstruation. This may also be the case in other
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40 19 settings where school registers are not reliable, although they place some burden on the girls,
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42 20 and may not be accurately filled if there is little trust with the people collecting the data. Diaries
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44 21 have the advantage of providing data on menstruation for each girl, to enable the link with
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46 22 school attendance, and in this study, girls used the diaries to track their periods which reduced
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48 23 anxiety.
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53 25 **CONCLUSION**

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55 26 This pilot study showed that the MHH intervention was acceptable and feasible to implement.
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57 27 There were substantial reported improvements in stigma and anxiety, pain management, and
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59 28 some improvement in MHH knowledge of puberty and menstruation and WASH following a
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1 multi-component intervention. Based on SCT, we anticipate the results to be generalizable to
2 other similar contexts with relatively low levels of MHM knowledge, stigma about discussing
3 menstruation, and poor school WASH facilities. A phase-III trial is warranted to evaluate the
4 impact of the intervention on school attendance, and on health, well-being and educational
5 outcomes for definitive results to drive forward policy changes.

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3 **1 Figure Legend:**
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5 **2 Figure 1: Theory of Change for the MENISCUS intervention**
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10 **4 Statements:**

11 **5 Contributors:** HAW, LH, BT, DAR, JS, CB, SNe, SCF and CA contributed to the overall
12 conception and design of the study. CK, LH, SNa, RN, KN, PN, SNM undertook the data
13 collection. CK and HAW wrote the first draft of the manuscript. All authors contributed to the
14 interpretation of results and drafting of the manuscript. HAW and CT did the statistical
15 analyses. All authors take responsibility for the integrity of the data and the accuracy of the
16 data analysis. All authors read and approved the final manuscript. HAW is the guarantor.
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31 and Ministry of Health Uganda for their support.
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45 **19 Competing Interests:** None declared

46 **20 Disclaimer:** The content is solely the responsibility of the authors and does not necessarily
47 represent the official views of the funders.
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50 **22 Ethical approval:** Ethics approval was received from the UVRI Research Ethics Committee,
51 the Uganda National Council for Science and Technology (UNCST) and the London School
52 of Hygiene and Tropical Medicine.
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3 1 **Data sharing statement:** Data will be made available in the LSHTM Data Compass
4 repository on request from the corresponding author (Helen Weiss [https://orcid.org/0000-](https://orcid.org/0000-0003-3547-7936)
5 [0003-3547-7936](https://orcid.org/0000-0003-3547-7936)) from the website <https://datacompass.lshtm.ac.uk/>
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10 4 **Patient request for publication:** Not required
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For peer review only

Figure 1: Theory of change for the MENISCUS intervention

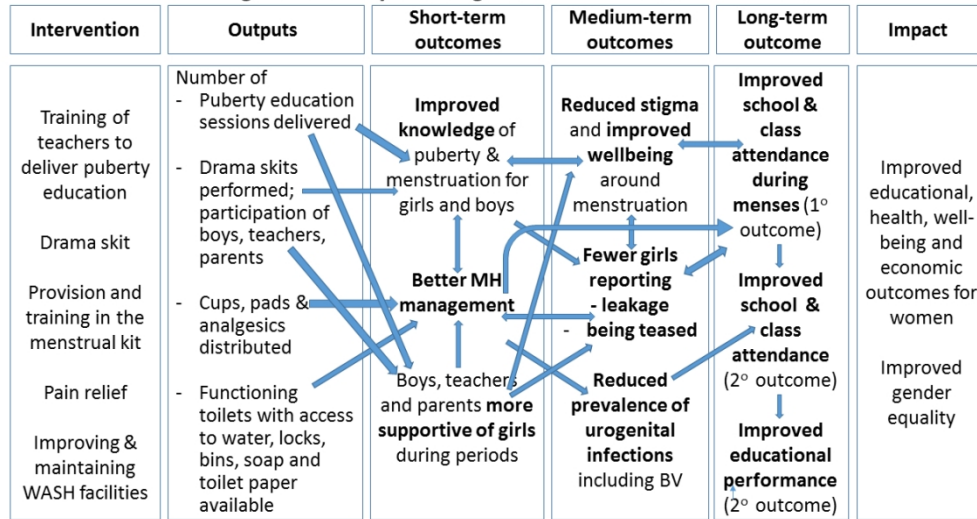


Figure 1: Theory of Change for MENISCUS intervention

338x190mm (96 x 96 DPI)

Supplementary Table 1: Description of the MENISCUS intervention

<p>MENISCUS intervention</p> <ol style="list-style-type: none"> 1. Puberty education 2. Drama skit 3. Menstrual management kit & training 4. Pain management 5. Water, Sanitation and Hygiene (WASH) improvements
<p>Materials & procedures</p> <ol style="list-style-type: none"> 1. Secondary year 2 teachers from both intervention schools and other relevant teachers selected by school management received 2 days of training in how to deliver puberty education according to government guidelines using the draft National Training of Trainers Manual on MHM compiled by the Ugandan Ministry of Education and Sports (MoES). 2. School Drama Groups with students from Secondary year 1 to year 4 received two facilitated drama skit sessions (one on menstrual health and one on the drama skit process) followed by follow-up visits to drama group practices. The MHM drama was performed by the drama groups at a parental meeting at each school (an annual general meeting and an specifically organised parental meeting). The meetings were attended by teachers, parents of secondary school students and some secondary year 2 students. 3. Secondary year 2 girl and boy students were invited to participate in an MHM training session. Secondary year 2 girl students were provided with a menstrual kit consisting of a pack of AFRipads reusable pads, a towel, soap, water bottle, knickers and menstrual calendar and an educational session on safe use and care of reusable menstrual products as well as pain management methods. Follow-up sessions were provided throughout the school year. 4. Students were provided with one voucher at baseline and throughout the study to redeem painkillers at school or a local pharmacy. All used vouchers were replaced per month. 5. WASH improvements consisted of installing locks, repairing broken doors, providing bins and toilet paper holders fixed to the wall, liquid hand washing soap and water drums.
<p>Who provided</p> <ol style="list-style-type: none"> 1. An independent educational consultant with support from WoMena Uganda staff members trained teachers from each school who are responsible for delivering puberty education in 2-days of puberty education training. The educational consultant was a professional trainer with expertise in education management. WoMena Uganda is a non-governmental organisation with expertise in programme design, monitoring and evaluation and education for menstrual health interventions. WoMena has a training team of young Ugandan menstrual health trainers (aged 20 -28, with educational backgrounds in social care, nursing, education), led by the Training Coordinator. The puberty education sessions were supported by the Training Coordinator and a trainer. 2. Two facilitated drama skit sessions were delivered by the WoMena Uganda Training Coordinator (supported by a Drama Skit facilitation guide developed by WoMena Uganda). Follow-up sessions with the Drama Groups were led by the school Drama Teacher and supported by an independent drama skit consultant, who was engaged in Drama Skit activities during MENISCUS-1 (a previous formative study carried out in Entebbe). 3. The MHM training session was delivered by selected schoolteachers and peers who had been trained in its delivery by WoMena Uganda. Training sessions were supported by a

<p>team of six Womena Uganda trainers and the Training Coordinator. Follow-up sessions were provided by WoMena Uganda.</p> <ol style="list-style-type: none"> 4. Painkiller vouchers could be redeemed for painkillers (paracetamol) from selected school teachers, nurse, senior women teachers and a local pharmacy. 5. WASH improvements were made by MRC/UVRI and maintained by the schools.
<p>How</p> <ol style="list-style-type: none"> 1. An education consultant and WoMena Uganda provided 2 days of group training in puberty education to teachers. 2. Two facilitated Drama Skit introduction sessions were held in each school by WoMena Uganda. Follow up sessions throughout terms 3 and 1 (of year 3) were carried out by the drama skit consultant. The drama performances were arranged by the school Drama Teachers in collaboration with school management as part of parental meetings. 3. Menstrual management kits and training of school teachers and peers was provided in group training sessions by WoMena Uganda 4. Painkillers and vouchers were delivered to schools / students by the MRC/UVRI and LSHTM research team.. 5. WASH improvements were made by MRC/UVRI and LSHTM and maintained by the schools.
<p>Where</p> <p>Staff training in puberty education was conducted outside the schools. All other activities with students and staff were conducted in schools.</p>
<p>When and how much</p> <ol style="list-style-type: none"> 1. Two days of training in puberty education to teachers delivered in April 2017. 2. Two, two-hour introductions facilitated by WoMena Uganda were delivered in October and November 2017. 21 follow up visits to drama skit practices were carried out between November 2017 and June 2018 (10 follow-up session planned). Two drama skit performances were carried out in July 2018. 3. Two, one-day Training of Trainers sessions delivered by WoMena Uganda in two schools to 11 female teachers, 11 female students and 2 males (drama teacher and school nurse) in May 2017. A one-day refresher training was held in September 2017, for selected female students (5) and female teachers (6) before delivery of training to students (not planned). Training to Secondary year 2 students (boys and girls) was delivered over 8 days in October and November (planned 7 days) over 17 training sessions (15 planned).

1 STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Page number
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8,11
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	8,11
		(b) For matched studies, give matching criteria and number of exposed and unexposed	n/a
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6, 9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8,9
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10
		(b) Describe any methods used to examine subgroups and interactions	10
		(c) Explain how missing data were addressed	n/a
		(d) If applicable, explain how loss to follow-up was addressed	n/a
		(e) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	11
		(c) Summarise follow-up time (eg, average and total amount)	11
Outcome data	15*	Report numbers of outcome events or summary measures over time	13-17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear	13-17

		which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	13-17
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13 and 15
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.