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Menstrual hygiene management and school absenteeism among adolescent students in Indonesia: evidence from a cross-sectional school-based survey

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Abstract

OBJECTIVE   To assess the prevalence of menstrual hygiene management (MHM) knowledge and practices among adolescent schoolgirls in Indonesia, and assess factors associated with poor MHM and school absenteeism due to menstruation.

METHODS   A cross-sectional survey enrolled a representative sample of urban and rural school-going girls aged 12–19 years in four provinces of Indonesia. A semi-structured, self-administered questionnaire obtained socio-demographic characteristics, knowledge, practices and attitudes related to menstruation, MHM and school absenteeism. School water, sanitation and hygiene (WASH) facilities were also assessed. Univariate weighted population prevalence was estimated and multivariable logit regression analyses applied to explore associations.

RESULTS   A total of 1159 adolescent girls with a mean age of 15 years (SD = 1.8) participated. Most girls (90.8%, 95% confidence interval (95% CI) = 79.7–96.1) had reached menarche. Over half (64.1%, 95% CI = 49.9–76.2) reported poor MHM practices, and 11.1% (95% CI = 8.1–15.2) had missed one or more days of school during their most recent menstrual period. Poor MHM practices were associated with rural residence (Adjusted odds ratio (AOR) = 1.73, 95% CI = 1.13–2.64), province (various AOR), lower school grade (AOR = 1.69, 95% CI = 1.05–2.74) and low knowledge of menstruation (AOR = 3.49, 95% CI = 1.61–7.58). Absenteeism was associated with living in rural areas (AOR = 3.96, 95% CI = 3.02–5.18), province (various AOR), higher school grade (AOR = 3.02, 95% CI = 2.08–4.38), believing menstruation should be kept secret (AOR = 1.47, 95% CI = 1.03–2.11), experiencing serious menstrual pain (AOR = 1.68, 95% CI = 1.06–2.68) and showed mixed associations with school WASH facilities.

CONCLUSIONS   High prevalence of poor MHM and considerable school absenteeism due to menstruation among Indonesian girls highlight the need for improved interventions that reach girls at a young age and address knowledge, shame and secrecy, acceptability of WASH infrastructure and menstrual pain management.

keywords menstrual health, menstrual hygiene, school absenteeism, adolescent health, school-based survey, cross-sectional design, Indonesia

*Both authors contributed equally to the manuscript.

Introduction

Menstrual hygiene management (MHM) refers to the specific hygiene and health requirements of girls and women during menstruation, including the information, materials and facilities needed to manage menstruation effectively and privately. Girls and women in low and middle-income countries (LMICs) can face significant challenges in managing their menstruation [1–3]. Inadequate knowledge, lack of access to quality sanitary materials, taboos around menstruation and MHM, and poor water, sanitation and hygiene (WASH) facilities are common challenges that can negatively affect education, employment, health and psychosocial outcomes [1–4].

In school settings, lack of clean, functional, private and gender-specific WASH facilities, fear of blood leaking, poor access to sanitary materials and inappropriate responses by male students and teachers are commonly reported to be associated with poor MHM and absenteeism due to menstruation [5–8]. Fatigue and pain during menstruation also contribute to reduced attention and participation [7, 8]. In turn, frequent episodes of reduced participation and absenteeism can result in poor school performance, drop-out and reduced educational attainment [8], which can have long-term consequences for gender equality, economic and health outcomes [9–11]. However, schools are also important settings to improve MHM. They present a powerful platform to reach large numbers of adolescents with educational interventions to improve MHM knowledge and practices, and address harmful misconceptions and stigma.

In Indonesia, there is currently little context-specific research regarding MHM and no published studies on MHM in school settings. Although health education delivered in primary and secondary schools under the national School Health Programme (UKS) includes aspects of menstruation [12], limited data suggest that many girls are ill-prepared for menarche; the 2012 Indonesia Demographic and Health Survey reported that a quarter of adolescent girls had not discussed menstruation with anyone before menarche and 17% were not aware that menstruation was a physical sign of puberty [13]. Provision of basic WASH facilities also remains a challenge in school settings [14]; in 2016 the Ministry of Education and Culture reported that in Indonesia's more than 190 000 public primary schools, only one-fifth of school toilets were completely functional [15].

MHM-related knowledge, attitudes, practices and impacts among girls in Indonesia are not well understood and, as a result, an evidence-base for programming and interventions to improve MHM is lacking. To address this information gap, a school-based survey among adolescent girls was conducted in Indonesia to assess the prevalence of MHM practices and school absenteeism due to menstruation, to explore factors associated with poor MHM and absenteeism, and to identify key targets for policy and programme interventions.

Methods

Study design

This school-based, cross-sectional analysis was part of a larger mixed-methods study that also employed qualitative data collection methods (separate article forthcoming) to explore determinants and impacts of menstrual hygiene management at schools.

Study setting and site selection

The study was conducted in urban and rural schools in four provinces of Indonesia: Papua, East Java, South Sulawesi and Nusa Tenggara Timur (NTT) provinces. These provinces were selected to capture a diversity of socioeconomic, geographic, religious and cultural contexts. Sixteen urban and rural public secondary schools were randomly selected using a multi-stage cluster sampling strategy (Figure 1). First, in each province, one urban and one rural district were randomly selected from the Indonesian Central Bureau of Statistics' list of all districts using a random number generator.

Selected districts were Boven Digoel (rural) and Kota Jayapura (urban) in Papua province; Trenggalek (rural) and Kota Madium (urban) in East Java province; Selayar (rural) and Kota Makasar (urban) in South Sulawesi province; and Ngada (rural) and Kota Kupang (urban) in NTT province. Eligible schools included all public (government) junior secondary schools (Sekolah Menengah Pertama or SMP) comprising grades 7–9 (ages 12–15 years), and senior secondary schools (Sekolah Menengah Atas or SMA) comprising grades 10–12 (ages 15 years and over). A list of all eligible schools in each district was generated from the Ministry of Education and Culture's database and one SMP and one SMA school were randomly selected for each district using a random number generator.

Sample size, study participants and sampling

We determined a sample size of 886 participants was required to estimate prevalence (50%) of good MHM practice with a margin of error (95%) of 5%. As there were no published data on good MHM practices in Indonesia, a prevalence of good MHM practices of 50% was assumed to give the most conservative sample size
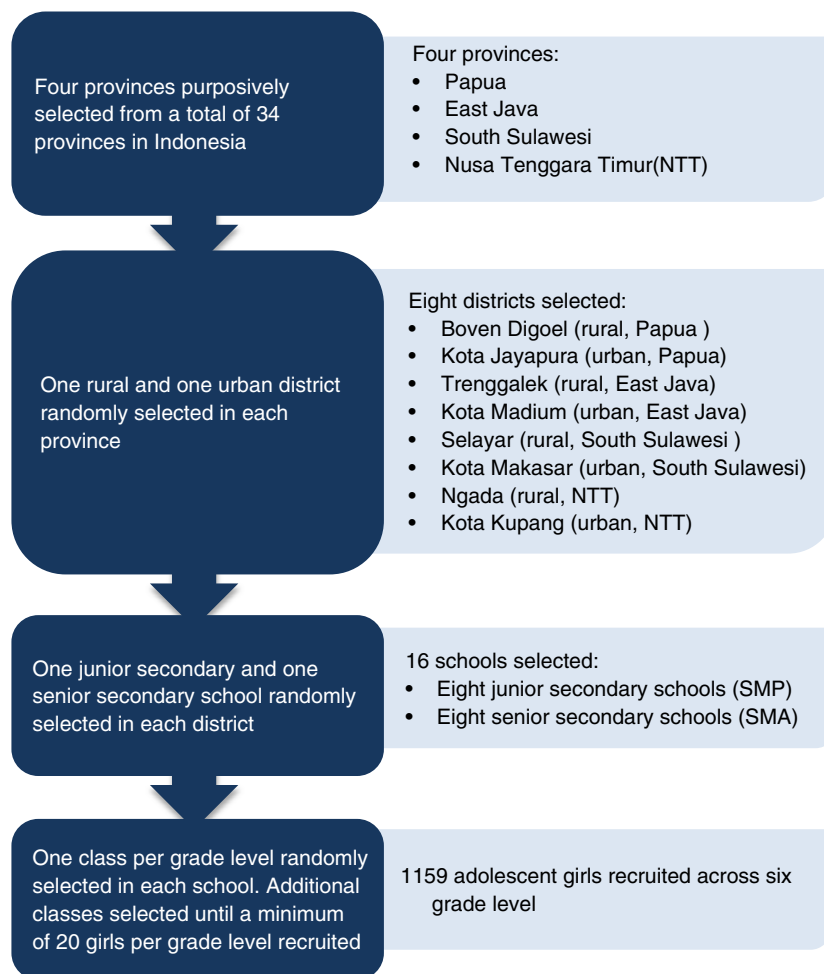
Figure 1 Flow diagram of sampling process. [Colour figure can be viewed at wileyonlinelibrary.com].

with respect to precision. This sample size was also based on an expected non-response rate of 15% and a design effect of 2 (approximately 20 students per grade per school, ICC = 0.05) to account for the complex sampling approach used in the study and associated inflation in standard error.

Participant sampling was a multi-staged process. At the first stage, schools were selected at random as described above. At the second stage, one class per grade level was randomly selected from a list of all school classes using an electronic random number generator. All girls aged 12–19 years attending a selected class and who were present in the class on the day of the survey and who were able and willing to give informed consent were eligible to participate. No additional inclusion or exclusion criteria were applied. All eligible girls were invited to complete a structured questionnaire. A minimum of 20 girls per

grade were recruited, with additional classes for each grade randomly selected until this quota of 20 was met.

Study procedures

Data were collected by two teams of trained, female researchers between October and November 2014. A pre-tested, semi-structured questionnaire in Bahasa Indonesia was self-administered by adolescent girls to quantify knowledge, attitudes, practices and impacts related to menstruation. The questionnaire was based on existing UNICEF and WaterAid tools [3, 16]. Explored themes were guided by the UNICEF/Emory University ecological framework for MHM research [16], and included socio-demographic factors, community and individual attitudes to menstruation, knowledge about menstruation and MHM, MHM practices, challenges managing

menstruation and self-reported social, health and educational impacts of menstruation. Written and verbal study information was provided in Bahasa Indonesia and voluntary informed consent obtained from all participants. For those participants under the age of 15, consent from a parent or guardian was obtained, in addition to the consent or assent of the individual participant. All parents of selected SMP schools were provided with a letter explaining the study purpose, procedures, potential risks and benefits, and that their adolescent may be invited to participate in the school-based study. Parents/guardians were asked to return a signed form if they consented to their adolescent participating. These forms were checked by field researchers prior to obtaining assent from the adolescent.

A structured observation checklist, designed based on an existing UNICEF tool [16], was used to assess water, sanitation, disposal and hygiene facilities, and provision of MHM education, in participating schools. The checklist was completed in each school (total 16) by a trained researcher in collaboration with the school principal or a delegate.

Study measures

Outcome variables were poor MHM practices and absenteeism due to menstruation. Menstrual hygiene practices were defined as poor when girls reported any one of the following behaviours: changing MHM materials less frequently than every 8 h; or not cleaning hands before and after changing MHM materials; or not washing the external genitalia at least once per day. Girls that reported using reusable MHM products, but did not wash materials with soap and water *and* dry materials in sunlight were also categorised as having poor MHM practices. These study measures were developed based on work by WaterAid, SHARE and DFID [3]. School absenteeism was defined as having missed one or more days of school as a result of menstruation during a girl's most recent menstrual period.

Independent variables measured included socio-demographic factors (grade, place of residence, rurality and religion), knowledge and attitudes regarding menstruation, receipt of information about menstruation, attitudes to menstruation, use of disposable sanitary pads, menstrual pain and availability of school WASH facilities (including functional lockable toilets, water or toilet paper for cleansing and bins for disposal of materials in latrines). A categorical menstruation knowledge variable was constructed based on correct responses to 15 basic menstruation knowledge questions (see Supplemental Material). Individuals were assessed as having low (0–5 correct responses out of 15), medium (6–10 correct

responses) or high (11–15 correct responses) menstruation-related knowledge.

Data analysis

Data were collected using hard copy questionnaire, with these data double-entered into a purpose-built electronic database (CSPro, US Census Bureau, USA). Prior to analysis, data were cleaned to identify and rectify any discrepancies in the double-entered data, to identify missing data (questions incorrectly skipped) and to remove any responses to questions participants were supposed to skip. Descriptive analyses are presented as province-specific sample proportions and total weighted population prevalence estimates. To provide correct population prevalence estimates in light of differential responses across regions and year levels, inverse probability post-stratification weights were derived for study participants using known student populations by region and year level [17]. Univariable and multivariable logit regression analyses were applied to provide both unadjusted and adjusted effect estimates in exploring factors associated with poor MHM and school absenteeism due to menstruation. Independent variables for inclusion in multivariable logit regression models were defined *a priori*, based on demonstrated associations in peer-reviewed publication and/or plausibility of an association based on grey literature and the authors' experience. To account for the lack of independence in observations resulting from the complex sampling approach used, the Huber/White sandwich cluster robust variance estimator [18] was used in logit regression analyses and Taylor-linearised variance estimation [19] for estimation of 95% confidence intervals in prevalence analyses. Statistical significance was determined at the 5% level.

Ethical considerations

Ethical approval for the study was provided by the Alfred Human Ethics Committee in Australia and the SurveyMETER Institutional Review Board in Indonesia. Permission to conduct the study at each site was obtained from the Provincial Department of Education, the relevant District Education Office and the school principal. No schools refused to participate.

Results

Characteristics of respondents

A total of 1159 adolescent girls attending 16 schools participated in the survey, with a mean age of 15 years

Table 1 Socio-demographic and biological characteristics of school-based adolescent girls in Indonesia, presented as province-specific and overall prevalence: counts and per cent (%)

Characteristic	East Java (*n* = 325)	NTT (*n* = 296)	South Sulawesi (*n* = 299)	Papua (*n* = 239)	Overall prevalence %* (95% CI)† (*n* = 1159)
Socio-demographic characteristics					
Age, mean years (SD)	14.9 (1.7)	15.2 (1.9)	14.8 (1.7)	15.0 (1.7)	15.0 (13.8–16.1)
Education Level, *n* (%)					
Grade 7	50 (15.4)	50 (16.9)	46 (15.4)	25 (10.5)	14.7 (6.0–31.9)
Grade 8	54 (16.6)	54 (18.2)	41 (13.7)	46 (19.3)	16.8 (6.7–36.2)
Grade 9	50 (15.4)	49 (16.6)	47 (15.7)	29 (12.1)	15.1 (6.0–32.9)
Grade 10	61 (18.8)	48 (16.2)	53 (17.7)	44 (18.4)	17.8 (8.0–35.0)
Grade 11	55 (16.9)	40 (13.5)	57 (19.1)	49 (20.5)	17.4 (7.8–34.4)
Grade 12	55 (16.9)	55 (18.6)	55 (18.4)	46 (19.3)	18.2 (8.2–35.9)
Setting, *n* (%)					
Urban	174 (53.5)	144 (48.7)	152 (50.8)	107 (44.8)	51.8 (17.8–84.1)
Rural	151 (46.5)	152 (51.4)	147 (49.2)	132 (55.2)	48.2 (15.9–82.2)
Religion, *n* (%)					
Islam	306 (94.2)	12 (4.1)	276 (92.3)	120 (50.2)	78.3 (72.3–83.3)
Catholic	4 (1.2)	174 (58.8)	4 (1.3)	46 (19.3)	10.6 (4.7–22.1)
Protestant	14 (4.3)	108 (36.5)	19 (6.4)	72 (30.2)	10.8 (5.0–21.8)
Hinduism	1 (0.3)	2 (0.7)	0 (0)	1 (0.4)	0.3 (0.1–1.3)
Menstruation characteristics					
Ever menstruated, *n* (%)	304 (93.5)	241 (81.4)	265 (88.6)	228 (95.4)	90.8 (79.7–96.1)
Age of menarche, mean years (SD)* (*n* = 1038)	12.1 (1.0)	13.2 (1.2)	12.6 (1.1)	12.3 (1.1)	12.4 (12.1–12.6)

SD, standard deviation.

*Population prevalence estimates weighted using inverse probability weights based on the female school populations in respective year levels and regions.

†Rao and Scott variance estimation use in estimation of 95% confidence intervals to take account of dependency in sampling at the school level.

(95% confidence intervals (95% CI) = 13.8–16.1; Table 1). Nearly half of participants were from a rural area (48.2%, 95% CI = 15.9–82.2). Almost all girls had menstruated at least once (90.8%, 95% CI = 79.7–96.1) and the average age of menarche was 12.4 years (95% CI = 12.1–12.6). Only three girls identified as having a disability. About three quarters of the population identified as Muslim (78.3%, 95% CI = 72.3–83.3), with only NTT province reporting a minority of Muslims (4.1%).

Knowledge and attitudes relating to menstruation and MHM

All respondents had heard of disposable sanitary pads (Table 2). Fewer had heard of reusable pads or cloths (14.8%, 95% CI = 7.6–26.9), tampons (1.6%, 95% CI = 0.3–7.6) or menstrual cups (0.1%, 95% CI = 0.0–0.7). Girls had an average score of 9.2 (SD = 2.4) from 15 basic true/false questions on menstrual-related knowledge. Questions that were most commonly answered incorrectly included: it is dangerous for a girl to do physical activity while menstruating (26.0% responded

correctly); menstrual blood contains harmful substances (21.2% responded correctly); and some foods should be avoided during menstruation (5.1% responded correctly; data not shown).

Attitudes to menarche varied. Less than 5% of girls in most provinces reported that family and community celebrate a girl reaching menarche, except in South Sulawesi, where 37.5% (112/299) of girls reported that community and family do celebrate menarche. Almost a third of girls in South Sulawesi (31.1%, 93/299) and Papua (32.2%, 77/239) believed that the community considers it shameful or a taboo to discuss menstruation, whereas this was less than a fifth in East Java (16.3%, 53/325) and NTT (19.3%, 57/296). Approximately, a tenth or fewer girls reported that a menstruating girl is considered unclean by the community in Papua (10.9%), East Java (9.5%) and NTT (2.5%), but was reported by over a third of girls in South Sulawesi (34.1%, 102/299). In contrast, in the self-reported menstrual knowledge questions, only one-fifth of girls answered that it was false that girls are unclean during menstruation (21.0%, 95% CI = 16.5–26.4; not shown). At menarche, roughly one-third of all post-

Table 2 Knowledge and attitudes relating to menstruation and menstrual hygiene management, presented as province-specific and overall prevalence: counts and per cent (%)

Knowledge or attitude	East Java (n = 325)	NTT (n = 296)	South Sulawesi (n = 299)	Papua (n = 239)	Overall prevalence%‡ (95% CI)§ (n = 1159)
Knowledge of menstrual hygiene management					
Heard of disposable sanitary pad, n (%)	325 (100)	296 (100)	299 (100)	239 (100)	100
Heard of reusable pad or cloth, n (%)	35 (10.8)	19 (6.4)	88 (29.4)	46 (19.3)	14.8 (7.6–26.9)
Heard of tampon, n (%)	8 (2.5)	2 (0.7)	0 (0)	5 (2.1)	1.6 (0.3–7.6)
Heard of menstrual cup, n (%)	0 (0)	0 (0)	1 (0.3)	0 (0)	0.1 (0.0–0.7)
Knowledge, mean score, (SD)*	9.6 (2.1)	8.7 (2.4)	8.4 (2.3)	9.2 (2.5)	9.2 (8.3–10.0)
Community attitudes towards menstruation practices (as agreed and reported by girls)					
Menstruating girl is considered unclean, n (%)	31 (9.5)	6 (2.0)	102 (34.1)	26 (10.9)	14.3 (8.6–22.8)
Menarche is celebrated by family and community, n (%)	8 (2.5)	5 (1.7)	112 (37.5)	8 (3.4)	10.8 (3.6–28.2)
Considered shameful or taboo to discuss menstruation, n (%)	53 (16.3)	57 (19.3)	93 (31.1)	77 (32.2)	20.9 (14.5–29.1)
Attitudes towards first menstruation, n (%)†					
Happy	107/304 (35.2)	128/241 (53.1)	67/265 (25.3)	61/228 (26.8)	35.0 (26.5–44.7)
Proud	66/304 (21.7)	119/241 (49.4)	49/265 (18.5)	53/228 (23.3)	24.8 (16.3–35.9)
Embarrassed	78/304 (25.7)	78/241 (32.4)	105/265 (39.6)	82/228 (36.0)	30.4 (26.8–34.2)
Ashamed	3/304 (1.0)	11/241 (4.6)	12/265 (4.5)	10/228 (4.4)	2.5 (1.7–3.5)

*SD, standard deviation; Menstruation knowledge variable was constructed based on correct responses to 15 basic menstruation knowledge questions (see list of questions in Appendix S1).
†Responses among post-menarchal girls only (n = 1038).
‡Population prevalence estimates weighted using inverse probability weights based on the female school populations in respective year levels and regions.
§Rao and Scott variance estimation use in estimation of 95% confidence intervals to take account of dependency in sampling at the school level.

menarchal girls reported feeling happy (35.0%, 95% CI = 26.5–44.7) and one quarter reported feeling proud (24.8%, 95% CI = 16.3–35.9), whereas less than one-third of girls reported feelings of embarrassment (30.4%, 95% CI = 26.8–34.2), and very few reported a feeling of shame (2.5%, 95% CI = 1.7–3.5).

Menstrual hygiene management practices

Almost all post-menarchal girls (98.3%, 95% CI = 96.1–99.2) reported using commercial disposable sanitary pads during their most recent menstrual period, and less than 10% of girls reported using reusable cloths during their last period (6.6%, 95% CI = 4.1–10.3; Table 3). Over half of all girls changed menstrual material at least every 4–8 h (56.6%, 95% CI = 43.0–69.2) and most girls washed their genitals daily (94.6%, 95% CI = 83.2–98.4). Almost all girls either washed hands before *and* after changing materials (59.8%, 95% CI = 49.5–69.2), or just after changing materials (36.2%, 95% CI = 27.7–45.7). Of the few girls who reported reusing menstrual

materials during their last period (n = 27), almost three quarters washed the materials with soap and water (71.0%, 95% CI = 43.2–88.7), and nearly all dried materials in the sunlight (85.2%, 95% CI = 35.7–98.3). The most commonly reported methods for disposing of MHM materials was using a bin or landfill (54.4%; 95% CI = 27.9–78.6) or burying them (23.2%; 95% CI = 10.2–44.5).

Prevalence and correlates of poor menstrual hygiene management

Over half (64.1%, 95% CI = 49.9–76.2) of girls in this study reported poor MHM practices (Table 3). Intra-class correlation coefficient (ICC) for poor MHM was 0.14, indicating modest between-school heterogeneity. Independent correlates of poor MHM included living in a rural area (Adjusted odds ratio (AOR) = 1.73 (95% CI = 1.13–2.64), lower school grade (AOR = 1.69, 95% CI = 1.05–2.74), and low knowledge score (AOR = 3.49, 95% CI = 1.61–7.58, *vs.* high knowledge score; Table 4).

Table 3 Menstrual hygiene management practices and prevalence of outcome variables among post-menarchal girls presented as province-specific and overall prevalence: counts and per cent (%)

Practices	East Java (n = 304)	NTT (n = 241)	South Sulawesi (n = 265)	Papua (n = 228)	Overall prevalence %‡ (95% CI)§ (n = 1038)
Materials used to manage menstrual bleeding during most recent menstruation, n (%)*					
Disposable sanitary pad	301 (99.0)	237 (98.3)	254 (95.9)	226 (99.1)	98.3 (96.1–99.2)
Reusable cloth	11 (3.6)	18 (7.5)	37 (14.0)	12 (5.3)	6.6 (4.1–10.3)
Cotton, mattress, sponge	1 (0.3)	0 (0)	1 (0.4)	0 (0)	0.3 (0.1–1.4)
Natural materials	0 (0)	0 (0)	1 (0.4)	0 (0)	0.1 (0.0–0.8)
Pantyliner	4 (1.3)	0 (0)	0 (0)	0 (0)	0.8 (0.1–6.6)
Disposal of MHM materials, n (%)					
Burnt	10 (3.3)	9 (3.7)	3 (1.1)	17 (7.5)	3.1 (2.0–4.7)
Bin or landfill	169 (55.6)	39 (16.2)	186 (70.2)	160 (70.2)	54.4 (27.9–78.6)
Pit latrine	16 (5.3)	16 (6.6)	4 (1.5)	2 (0.9)	4.4 (1.6–11.7)
Flush down latrine	19 (6.3)	128 (53.1)	8 (3.0)	12 (5.3)	11.8 (6.6–20.2)
Buried	73 (24.0)	49 (20.3)	64 (24.2)	37 (16.2)	23.2 (10.2–44.5)
Other	17 (5.6)	0 (0)	0 (0)	0 (0)	3.2 (1.2–8.4)
Changed material at least every 4–8 h or whenever soiled, n (%)	190 (62.5)	74 (30.7)	144 (54.3)	153 (67.1)	56.6 (43.0–69.2)
Washed genitalia at least once per day, n (%)	278 (91.5)	236 (97.3)	263 (99.3%)	227 (99.6)	94.6 (83.2–98.4)
Hand washing with soap before and/or after changing materials, n (%)					
Only before changing materials	3 (1.0)	12 (5.0)	10 (3.8)	10 (4.4)	2.3 (1.2–4.7)
Only after changing materials	80 (26.3)	122 (50.6)	136 (51.3)	93 (40.8)	36.2 (27.7–45.7)
Before and after changing materials	216 (71.1)	106 (44.0)	112 (42.3)	122 (53.5)	59.8 (49.5–69.2)
Cleaning of reusable MHM material, n					
Washed materials with soap	2/3	9/13	4/5	5/6	71.0 (43.2–88.7)
Dried materials in sunlight	2/3	13/13	4/5	5/6	85.2 (35.7–98.3)
Practices poor MHM† n (%)	168 (55.3)	201 (83.4)	199 (75.1)	139 (61.0)	64.1 (49.9–76.2)
Missed one or more days of school due to menstruation during most recent menstrual period, n (%)	20 (6.6)	36 (14.9)	52 (19.6)	35 (15.4)	11.1 (8.1–15.2)

*Multiple responses possible.

†Did not meet <u>all</u> of the following criteria: changed MHM materials more than every 8 h or more frequently, washed hands before and after changing MHM material, washed genitals at least once per day, and (for those using reusable materials) washed materials with water and soap and dried materials in sunlight.

‡Population prevalence estimates weighted using inverse probability weights based on the female school populations in respective year levels and regions.

§Rao and Scott variance estimation use in estimation of 95% confidence intervals to take account of dependency in sampling at the school level.

Moreover, girls living in NTT were more likely than those in East Java to experience poor MHM (AOR = 2.71; 95% CI = 1.59–4.61), while girls in Papua had significantly lower odds (AOR = 0.38; 95% CI = 0.18–0.80) than those in East Java of experiencing poor MHM. Several school MHM and WASH facilities' factors were associated with poor MHM during bivariate analysis, though none were significantly associated with poor MHM in the multivariate model. The exception was the lack of hand washing facilities near the girls' toilet, which was significantly associated with lower odds of poor MHM than having adequate hand washing facilities. A weak, non-significant association between poor

MHM and lack of sex-separated toilets at school (AOR = 2.47, 95% CI = 0.95–6.41; P = 0.064) was found in the multivariate model.

Prevalence and correlates of school absenteeism due to menstruation

About one in ten participants (11.1%, 95% CI = 8.1–15.2; ICC = 0.12) reported having missed one or more days during their most recent menstrual period; potentially somewhat less in East Java (6.6%, 20/304) than in the other provinces (Table 3). The most commonly reported main reasons for missing school due to

Table 4 Factors associated with poor MHM: odds ratio (OR) and adjusted odds ratio (AOR), 95% confidence interval (95% CI) and probability value (*P*-value), (N = 1034*)

Independent variable	Unadjusted odds ratio (95% CI) ‡	*P*-value	Adjusted OR† (95% CI)‡	*P*-value
Residence				
Urban	1.0		1.0	
Rural	2.55 (1.94–3.34)	<0.01	1.73 (1.13–2.64)	0.011
Province				
East Java	1.0		1.0	
NTT	4.06 (2.71–6.12)	<0.01	2.71 (1.59–4.61)	<0.001
South Sulawesi	2.39 (1.67–3.42)	<0.01	1.43 (0.91–2.26)	0.12
Papua	1.26 (0.89–1.79)	0.19	0.38 (0.18–0.80)	0.011
School Grade				
7–9	1.51 (1.15–1.98)	<0.01	1.69 (1.05–2.74)	0.031
10–12	1.0		1.0	
Religion*				
Islam	1.0		1.0	
Catholic	2.87 (1.91–4.31)	<0.01	1.80 (0.83–3.92)	0.14
Protestant	1.34 (0.95–1.90)	0.10	1.49 (0.98–2.27)	0.064
Knowledge of menstruation				
Low (0–5 out of 15)	5.51 (2.28–13.31)	<0.01	3.49 (1.61–7.58)	0.002
Medium (6–10 out of 15)	1.90 (1.44–2.52)	<0.01	1.33 (0.78–2.26)	0.30
High (11–15 out of 15)	1.0		1.0	
First heard about menstruation				
4–11 years	1.0		1.0	
12–18 years	1.58 (1.19–2.10)	<0.01	1.04 (0.68–1.58)	0.87
MHM materials are available at school				
Yes	1.0		1.0	
No	2.86 (2.18–3.75)	<0.01	1.32 (0.81–2.16)	0.26
Toilet facilities available to change MHM material (reported by students)				
Yes	1.0			
No	1.66 (1.19–2.30)	<0.01	1.03 (0.70–1.53)	0.87
Number of girls per functional, sex-separated toilet?				
50 girls or less	1.0		1.0	
More than 50 girls	4.43 (2.89–6.80)	<0.01	0.84 (0.43–1.64)	0.61
No separate, functional toilets	3.19 (2.11–4.82)	<0.01	2.47 (0.95–6.41)	0.064
One or more sex-separated, functional, lockable toilet with water				
Yes	1.0		1.0	
No	1.63 (1.25–2.12)	<0.01	0.79 (0.31–2.06)	0.64
Girls individual toilet compartments have anal cleansing material (water/toilet paper)				
All	1.0		1.0	
Some	1.34 (1.02–1.76)	0.04	1.29 (0.82–2.04)	0.26
Girl's individual toilet compartments contain a container for disposing of materials				
Yes	1.0		1.0	
No	1.98 (1.52–2.60)	<0.01	1.11 (0.71–1.73)	0.66
Hand washing facility with water and soap inside latrine or close to girl's latrine				
Yes, facilities near girl's toilet and soap and water in >50% of these	1.0		1.0	
Yes, facilities near girl's toilet and water in >50% but soap in <50%	1.13 (0.52–2.46)	0.76	0.28 (0.11–0.70)	0.007
No facilities near girl's toilets, or no water	1.46 (0.67–3.14)	0.34	0.28 (0.16–0.50)	<0.001

*Four participants with Hindu religion were excluded due to small number.
†Adjusted for clustering and other potential confounders presented in the table.
‡Huber/White cluster robust variance estimation used to provide inferential statistics that take account of the dependency in sampling at the school level.

menstruation were pain (37.3%, 63/169; data not shown), feeling unwell (21.9%, 37/169), being afraid of staining clothes (14.2%, 24/169), fatigue (8.3%, 14/169), afraid of odour (5.9%, 10/169) and not having any cloths or pads (3.0%, 5/169). Possible responses selected by three or fewer participants are not listed here.

In the multivariate model, living in a rural area and/or in NTT province was strongly associated with school absenteeism, with girls in rural areas almost four times more likely to miss school due to menstruation than those in urban areas (Table 5). Girls in grades 10–12 were three times more likely to miss school due to menstruation during their most recent menstrual period (AOR = 3.02; 95% CI = 2.08–4.38) than those in earlier grades. For girls who believed that menstruation should be kept secret, the odds of school absenteeism were 47% higher than for those who did not believe menstruation should be kept secret (AOR = 1.47; 95% CI = 1.03–2.11). Knowledge of menstruation was not associated with school absenteeism. Odds of reported absenteeism were significantly higher among girls attending schools without water or toilet paper in all individual toilet compartments (AOR = 1.93, 95% CI = 1.45–2.56) and schools that had a bin present in each toilet cubicle (AOR = 2.97; 95% CI = 2.10–4.19). Girls attending schools with no functional, lockable and sex-separated toilets with water were less likely to miss school days (AOR = 0.35, 95% CI = 0.23–0.54).

Table 5 Factors associated with school absenteeism due to menstruation: odds ratio (OR) and adjusted odds ratio (AOR), 95% confidence interval (95% CI) and probability value (*P*-value), (*N* = 1038)

Independent variable	Unadjusted OR (95% CI)†	*P*-value	Adjusted OR* (95% CI)†	*P*-value
Residence				
Urban	1.0		1.0	
Rural	1.72 (1.20–2.46)	<0.01	3.96 (3.02–5.18)	<0.001
Province				
East Java	1.0		1.0	
NTT	2.49 (1.40–4.43)	<0.01	4.27 (2.40–7.58)	<0.001
South Sulawesi	3.47 (2.01–5.98)	<0.01	2.43 (1.95–3.02)	<0.001
Papua	2.58 (1.44–4.59)	<0.01	2.05 (1.44–2.92)	<0.001
School Grade				
7–9	1.0		1.0	
10–12	1.41 (0.97–2.04)	0.071	3.02 (2.08–4.38)	<0.001
Knowledge of menstruation				
Low (0–5 out of 15)	1.62 (0.73–3.60)	0.24	1.03 (0.48–2.23)	0.94
Medium (6–10 out of 15)	1.23 (0.82–1.85)	0.31	1.22 (0.65–2.29)	0.53
High (11–15 out of 15)	1.0		1.0	
Normally serious pain during menstruation (score 5 or more out of 10)				
No	1.0		1.0	
Yes	1.65 (1.14–2.40)	0.008	1.68 (1.06–2.68)	0.029
Menstruation is something that should be kept secret				
Yes	1.40 (0.98–1.99)	0.063	1.47 (1.03–2.11)	0.034
No	1.0		1.0	
Number of girls per functional, sex-separated toilet?				
50 girls or less	1.0		1.0	
More than 50 girls	1.62 (0.82–3.19)	0.16	0.73 (0.44–1.20)	0.21
No separate, functional toilets	1.64 (0.84–3.19)	0.15	1.67 (0.95–2.93)	0.077
One or more sex-separated, functional, lockable toilet with water				
Yes	1.0		1.0	
No	1.10 (0.76–1.58)	0.61	0.35 (0.23–0.54)	<0.001
Girls individual toilet compartments have anal cleansing material (water/toilet paper)				
All	1.0		1.0	
Some	2.00 (1.40–2.86)	<0.01	1.93 (1.45–2.56)	<0.001
Compartments contain a container for disposing of materials?				
Yes	1.02 (0.71–1.47)	0.92	2.97 (2.10–4.19)	<0.001
No	1.0		1.0	

*Adjusted for clustering and other potential confounders presented in the table.
†Huber/White cluster robust variance estimation used to provide inferential statistics that take account of the dependency in sampling at the school level.

Discussion

Our study identified poor MHM practices among half to three quarters of adolescent schoolgirls in Indonesia, and particularly among those in rural areas, in lower school grades, and with lower knowledge of menstruation. This is despite almost all girls reporting the use of disposable pads during their last menstruation, which is much higher than reported pad usage in urban and rural populations in other Asian and African countries [4, 20–22]. High use of disposable materials in the context of underdeveloped sewerage and waste management systems and the environmental and waste management implications of poor disposal practices should be considered in future WASH and MHM interventions [23, 24].

Comparing the prevalence of appropriate MHM across studies and regions is hampered by the absence of agreed criteria. This study developed criteria for measuring MHM based on globally recognised definitions and best practice guidance on the hygienic management of menstruation [3, 16]. In most studies, good MHM is measured through only one criterion: the type of absorbent materials used [1, 22]. An exception is a study of MHM practices in Uganda [22] that, like our study, adopted a multi-criteria, composite MHM measure. Similar to our findings, the Uganda study found a high prevalence of poor MHM practices among adolescent girls, and poor MHM practices were independent of the use of reusable or disposable materials [22].

Inadequate knowledge about menstruation and MHM proved an important and independent predictor of poor MHM among participants in this study, with those with lower knowledge more than three times more likely to report poor MHM than girls with high levels of knowledge. This is consistent with findings from studies in West Bengal, India and Ethiopia, where positive associations between knowledge and MHM among adolescent girls have been reported [25, 26]. Despite evidence of associations between knowledge and MHM practices, evidence of the impact of education interventions on improved MHM remains limited, and is urgently needed [27]. A recent systematic review of MHM interventions in LMICs concluded that there was some supporting evidence for education interventions to improve practices and reduce negative psychosocial consequences of menstruation [27]; however, unclear study measures and significant biases complicated interpretation. Independent of level of knowledge, younger adolescent girls (grades 7–9) in our study were more than one and half times more likely to report poor MHM than older adolescents (grades 10–12). Given that the average age of menarche in Indonesia is 12 years, interventions targeting younger

adolescents are likely to be important to improve MHM practices.

Of particular note for future interventions, girls in rural areas were more likely to report poor MHM compared to urban participants. The association between rural residence and poor MHM may reflect differences in the availability or quality of menstruation education as data show that sexual and reproductive health education is less commonly provided in rural areas [13]. The association between poor MHM and rural residence may also reflect differences in access to appropriate and affordable sanitary products, access to WASH facilities at the household level [28], or other unmeasured determinants of MHM. Urban–rural differences found in this study could also be partly attributable to socioeconomic status; although socioeconomic data were not collected in this study, the majority of Indonesia's poor live in rural areas [29] suggesting that rurality may be a proxy indicator for socioeconomic status.

Changing pads infrequently and not washing hands before and after changing MHM materials were the most commonly reported poor MHM practices in our study. The presence of menstrual materials or latrine facilities at schools showed no association with MHM, suggesting that these factors did not influence changing of MHM materials. Infrequent changing of menstrual pads may be attributed to a lack of appropriate, affordable menstrual hygiene materials, inappropriate design of school WASH facilities or embarrassment associated with changing menstrual materials at school [1], but further research is needed to elucidate these links. While the causes of infrequent pad changing and inadequate hand washing in our study population require further investigation, intervention studies demonstrate that educational interventions can be effective in improving use and changing of absorbent materials [1], and that community-based and message-based interventions drawn from elements of psychosocial theory may positively influence hand washing if delivered in a culturally appropriate and context-specific way [30].

Surprisingly, the absence of hand washing infrastructure at schools was found to reduce the odds of poor MHM. It is unlikely that lack of hand washing facilities contributes directly to improved MHM, especially since hand washing is a component of our MHM measure, but an indirect relationship may exist. Girls attending schools that lack water for personal hygiene may be more likely to return home to change MHM materials and returning home may enable better MHM practices. However, our interpretation is limited by the extent to which WASH infrastructure and utilisation of this infrastructure were assessed in this study. While we asked girls to report 'usual' MHM practices – which naturally encompasses

MHM practices at home, in the community, and at school – we only assessed WASH facilities at school. Understanding WASH conditions in girls' homes and communities could therefore have improved our understanding of the associations between WASH facilities and MHM. Furthermore, while this study assessed the presence of school WASH infrastructure, we did not quantify whether participants used these facilities. Studies assessing the impact of hygiene behaviour change interventions on hand washing practice demonstrate that presence of infrastructure alone is unlikely to sustainably improve hygiene behaviours [31, 32], suggesting that other factors are important in determining hand washing behaviour and therefore appropriate MHM practices. Our finding that hand washing infrastructure is associated with poor MHM may also be spurious and confounded by unmeasured variables. Nevertheless, this finding warrants further investigation; such studies should examine social norms, usability of infrastructure, and the determinants of hand washing behaviour change in this context.

More than one in ten girls missed at least one day of school due to menstruation during their last menstruation, and this varied considerably by province. This is lower than has been reported in studies from African contexts but is still substantial [4, 33, 34]. Studies on the education and health impacts of absenteeism are largely limited to high income settings but indicate that absenteeism is associated with poorer school completion and education outcomes, and poorer health outcomes [35, 36]. Data on absenteeism and its link to educational attainment are not routinely collected in Indonesia making it difficult to assess the contribution of absenteeism due to menstruation reported in this study to all-cause absenteeism, and the impact on educational outcomes. However, based on international studies [35, 36], it is plausible that absenteeism due to menstruation contributes to poorer education and health outcomes among Indonesian girls. This finding is therefore concerning and warrants further investigation.

Girls in higher grades were more likely to report absenteeism due to menstruation during their last menstrual period. Miiro *et al.* [34]. also found that missing school during a girl's most recent menstruation was associated with older age. While the reasons for the association were not discussed, they did find that older age was also associated with higher absenteeism overall, indicating age may be a factor for all-cause absenteeism among adolescent girls. Specific causes of menstruation-related absenteeism among older girls should be further investigated.

Pain was also associated with school absenteeism in our study as has been reported from studies with adolescent girls in Uganda [34]. Although evidence for delivering pain medication and its impact on absenteeism is limited [1], taboos and myths surrounding the use of pain medication during menstruation have been reported in other contexts [34, 37] and should be considered in the design of interventions to support pain management for menstruating girls in Indonesia. Delivering comprehensive sexual and reproductive health education programmes that address knowledge and practical skills relating to menstruation and MHM, including pain management, may contribute to reducing absenteeism in this context. Though evidence is limited for the impact of such interventions on MHM, education interventions have demonstrated positive effects in improving knowledge and addressing incorrect beliefs [1, 27], and could be applied to increasing knowledge of menstrual pain management.

School absenteeism was also associated with the belief that menstruation should be kept secret. This finding is consistent with those from qualitative studies in LMIC settings which demonstrate that taboos and negative attitudes, including shame and secrecy, contribute to unhygienic practices and school absenteeism [4, 33], and reinforce harmful norms and gender inequality [27, 37, 38]. Findings from these studies and ours highlight that addressing stigma, taboos and negative attitudes towards menstruation among girls, boys and communities should be prioritised along with improving knowledge [38, 39].

The relationship between WASH facilities at school and school absenteeism did not always follow a consistent pattern in our study, a finding also reported in other studies [1, 4, 33]. Girls attending schools without water or toilet paper in all individual toilet compartments were more likely to report absenteeism due to menstruation. Moreover, there was also a weak non-significant association between lack of gender-segregated, functional toilets and increased odds of school absenteeism. However, when this variable was extended to meet WHO and UNICEF's Joint Monitoring Programme basic indicator definition, which require facilities that are lockable and have water available, the absence of such facilities reduced the odds of school absenteeism. The presence of a bin in individual toilet compartments was also strongly associated with increased school absenteeism.

This finding is surprising and, although it may be confounded by unmeasured or unidentified factors, warrants further investigation, particularly in light of global monitoring mechanisms using the presence of a bin in latrines as a proxy indicator for adequate MHM facilities [14, 40]. Qualitative data from this study (article forthcoming) revealed fear and beliefs about the negative health consequences of burning soiled menstrual pads. As schools commonly reported burning waste from toilet bins, the

presence of a bin may be a sign of inappropriate or unacceptable disposal methods available at school, which may contribute to the observed association between bins inside school toilet compartments and absenteeism.

This study has some important limitations. Firstly, because the four provinces were purposefully selected to encompass diverse socioeconomic, cultural and geographical settings, these findings may not be generalisable to other settings in Indonesia. School absenteeism was assessed as full days missed, but emerging evidence suggests that girls often miss hours or half days of school, which is not captured in our data. Our study also relied on self-reported assessments of MHM practices and impacts of menstruation, which may be prone to over- or under-reporting. WASH data were also only collected from schools and not from households where girls reside, limiting the interpretation of associations between school WASH facilities and poor MHM, as poor WASH facilities at home may also play a role in determining MHM practices, as discussed above. Assessing the quality of school participation and performance as outcomes may have strengthened our study and permitted a more nuanced understanding of the impact of poor MHM on educational outcomes, beyond absenteeism [5, 41]. Additionally, there is a need to assess the impacts of poor MHM on other outcomes such as psychosocial wellbeing and mental health, which is often overlooked.

Despite these limitations, this study has identified some important targets to improve MHM in Indonesia, and possibly beyond. Schools remain an important platform to provide MHM interventions given high school participation rates, but interventions need to be delivered in early adolescence and with comprehensive content. Building programmes into school curricula, particularly through strengthening sexual and reproductive health education for boys and girls, may provide avenues for improving MHM knowledge, reducing stigma, fear and secrecy, and managing pain [38, 39, 42]. Our study has also highlighted substantial differences among provinces involved in this study, indicating the importance of locally appropriate and context-specific MHM interventions. It therefore has important practical implications in Indonesia, including that more efforts are needed to advocate for the integration of comprehensive MHM education, for example as part of comprehensive sexuality education programmes, in national curriculum and existing school health programmes (known as UKS in Indonesia). Additionally, our study suggests the need to build on recent improvements to the Educational Management Information System (EMIS), which tracks progress towards Sustainable Development Goals 4 and 6 relating to school WASH facilities [43], by including

MHM-specific indicators, which could facilitate further assessments of menstruation-related curriculum and/or WASH facilities. Building on the findings of this study, the Government of Indonesia and UNICEF have implemented a school-based MHM intervention that employs MHM comic books to stimulate discussion and address secrecy around menstruation, and to improve MHM knowledge among male and female 6th grade students. The analysis of findings from this intervention is underway, and will shed light on the effectiveness and limitations of this school-based approach.

In conclusion, high population prevalence of poor MHM among Indonesian adolescent girls, and a strong association between poor MHM and low knowledge, highlight the need for comprehensive education interventions in school settings, delivered during early adolescence to reach pre-menarchal girls, particularly in rural settings. This should be complemented with further research into the determinants of specific poor MHM practices found in this study, such as infrequent hand washing and pad changing. Reducing absenteeism is more complex, but should include efforts to address secrecy around menstruation and appropriate relief of menstrual pain. School-based comprehensive sexuality education that addresses MHM knowledge and practices – including hygiene practices and management of menstrual pain – as well as shame, stigma and teasing, may be avenues for addressing both poor MHM practices and absenteeism, but would need to be locally adapted. Consideration should also be given to the provision of pain medication at school for menstruating girls. While further research is needed into the appropriateness of WASH facilities for menstruating girls and the impact on absenteeism in Indonesia, ensuring that all toilet compartments have water or toilet paper may be an important first step in addressing absenteeism.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Supplementary materials.

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