

Young adolescent girls' knowledge of menstruation and puberty

A rapid evidence review

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Glossary

Absorbent

A product or material used to absorb menstrual flow; may be disposable (e.g. sanitary napkin) or re-usable (e.g. cloth, menstrual cup)

Amenorrhea

The absence of periods

Axillary hair

Hair in the underarm area

Catamenia

Blood and other matter discharged from the uterus at menstruation

Dysmenorrhea/Dysmenorrhoea/ Dysmenorrheic

Painful menses in women with normal pelvic anatomy; pain during periods

Irregular cycles (menstrual irregularities)

Unpredictable long and short cycles with varying degrees of blood loss.

Menarche (menarcheal)

First menstruation

Menorrhagia

Excessive, very heavy and prolonged bleeding; can lead to anaemia and be fatal if untreated

Menses

See menstruation

Menstrual cycle

Usually around 28 days but can vary from 21 to 35 days. Each cycle involves the release of an egg (ovulation) that moves into the uterus through the fallopian tubes. Tissue and blood start to line the walls of the uterus for fertilisation. If the egg is not fertilised, the lining of the uterus is shed through the the vagina along with blood. The bleeding generally lasts between two and seven days, with some lighter flow and some heavier flow days. The cycle is often

irregular for the first year or two after menstruation begins (House, Mahon et al. 2012).

Menstrual flow

The amount of blood and other matter discharged from the uterus during menstruation; often described as light, moderate, or heavy

Menstrual hygiene management

Includes: access to clean absorbents; facilities to change, clean or dispose of absorbents as needed; access to soap and water for cleaning the body; access to soap and water for cleaning absorbents (Sommer and Sahin 2013)

Menstrual hygiene management: hardware interventions

Interventions designed to address material deprivations such as the provision of absorbents, or improved Water, Sanitation and Hygiene (WASH) facilities (Hennegan and Montgomery 2016)

Menstrual hygiene management: software interventions

Interventions that address deficits in knowledge of menstruation and management by providing education (Hennegan and Montgomery 2016)

Menstrual hygiene products

Personal care products (e.g. sanitary napkin, tampon) used by people who are menstruating to absorb menstrual flow

Menstruation

The shedding of the uterine lining occurring on a regular basis in reproductive-aged females in monthly menstrual cycles

Oligomenorrhea

Light or infrequent periods (menstrual cycles of 35-90 days)

Period

See menstruation

Young adolescent girls' knowledge of menstruation and puberty

Periodicity

The interval between periods

Polymenorrhea

Frequent periods or short cycles (less than 21 days)

Premenstrual syndrome (PMS)

Consistent and severe pattern of emotional and physical symptoms, such as pain, bloating and mood changes that occur in the latter part of the menstrual cycle

Puberty

A time of rapid physical, psychological and cognitive changes. Hormonal changes lead females to experience their first menstruation (menarche). For males, hormonal

changes lead to the development of sperm (spermarche) and the first ejaculation (semenarche).

Pubescent

Reaching (or having reached) puberty

Sanitary hygiene products

See menstrual hygiene products

Secondary sex characteristics

Sex characteristics that appear during puberty in response to the release of hormones (e.g. development of breasts in girls, growth of testes in boys)

Acronyms

ASHAs	Accredited social health activists
FGDs	Focus group discussions
HICs	High-income countries
KP	Kishori Panchayat
LMICs	Low- and middle-income countries
MeSH	Medical subject headings
MHM	Menstrual hygiene management
PICOTS	Population, intervention (condition), comparison/control, outcome, time, setting
PMS	Premenstrual syndrome
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RAs	Research assistants
RCT	Randomised controlled trial
RER	Rapid evidence review
RH	Reproductive health
SRH	Sexual and reproductive health
SSKY	Saloni Swasth Kishori Yojna
STDs	Sexually transmitted diseases
TIAB	Title and abstract
WASH	Water, sanitation and hygiene
WoS	Web of Science

Executive summary

This rapid evidence review (RER) was commissioned to answer the research question:

How and what do girls aged 10-14 years know about puberty and menstruation in LMICs?

This review of the evidence represents an opportunity for learning. It is the first attempt that the authors are aware of to conduct a systematic description of the evidence – across a range of evidence types – relating to young (10-14 years) adolescent females. There is an understanding that significant proportions of girls in LMICs attain menarche without any understanding of what is happening to them or how to manage it. To date, however, there has not been a systematic synthesis of the evidence about girls' experience of knowledge (content, source, timing) about puberty, including menstruation. This review provides a base for future research. A key challenge for LMIC societies, policy-makers and programme managers is how to best support adolescent girls through adolescence, from pre-adolescence to early adulthood. The RER identifies gaps that future evidence must address in order to develop a better evidence base for decision-makers.

The RER systematically examines work published in English between 2006 and 2016 using a systematic approach to the evidence search in order to maximise replicability, transparency and the potential for future updating and expansion. The systematic search generated 7,758 items, of which 15 met the inclusion criteria. An additional 44 studies were identified as relevant, meeting all of the inclusion criteria apart from age. The RER reviews both included and relevant studies (n=59). Studies were not excluded on the basis of quality.

Summary of evidence

Included studies were conducted in eight countries, with three studies from sub-Saharan Africa. All of the included studies were published post-2007. Knowledge of menstruation is the most commonly reported outcome measure (n=12), followed by experiences of menstruation/puberty (n=11). Only three studies measure knowledge of puberty. The majority of studies (n=11) draw their research sample from school-based samples of adolescents; three

use a community-based sample and one study explicitly includes in- and out-of-school adolescents. Six of the included studies report on interventions.

Relevant studies are included in the results, as they are likely to contain information that is highly salient for this RER. Nearly half of these studies come from two countries (12 from India and seven from Nigeria), and 21 studies are from Asia. Within geographic regions, the studies are highly clustered by country. In sub-Saharan Africa, Nigeria (n=7) and Ethiopia (n=4) have significantly more studies than other countries. Of the 12 relevant studies that report on an intervention, 10 studies used a pre-post test design. Knowledge of menstruation is once again the most commonly reported outcome measure (n=28), followed by sources of information about menstruation/puberty (n=26) and menstrual hygiene practices (n=24). Knowledge of puberty is the least frequently reported outcome (n=7), illustrating a striking emphasis on menstruation (and MHM) compared to puberty.

Some studies (typically school-based) looked at interventions while others were descriptive. Some distinguished between 'hardware' interventions (designed to address material deprivations by providing sanitary pads or absorptive cloths, for example) and 'software' interventions (educating girls about what to expect during puberty and menstruation and how to manage menstruation).

Key findings

Across reported outcomes on menstruation and puberty, findings reveal that menstruation, as a field, is inadequately researched and understood. Evidence relating to the experiences of young adolescents who are likely to be pre-menarcheal or experiencing menarche is particularly sparse. Why is this the case? Menstruation as a topic of investigation and/or intervention has only recently begun to emerge in the literature. It is a nascent field, and the volume of evidence is out of step with the scale of the issues associated with menstruation and its management in general, and for young adolescents in particular.

Most girls know very little about puberty, menarche or menstruation before they experience it, and have few sources of reliable information. In terms of when they

receive information, menarche was the most common trigger for mother-daughter discussions on sexual and reproductive health. The information that girls receive is often inaccurate, rooted in myth or tradition rather than fact, and types of knowledge vary widely. In many settings socio-cultural norms and taboos are a major barrier to addressing these knowledge gaps.

There has been less research on young girls' knowledge about puberty than their knowledge about menstruation. Information and knowledge on sexuality and sexual feelings tends to be overlooked, with many studies focusing on the links between puberty and menstruation or physical changes to girls' bodies.

Most girls find it difficult to practise good menstrual hygiene; nearly as many studies reported menstrual hygiene practices (what girls do when they get their period/menses) as opposed to knowledge of menstruation (what they know about periods/menses). Most adolescent girls find menstrual hygiene management a struggle. Managing menstrual hygiene is particularly difficult at school, and is linked to anxiety and absenteeism.

Attitudes, myths and perceptions about menstruation affect how girls experience it. Fear, shame, stigma, secrecy and sexual vulnerability are all associated with menstruation. Many of the constraints girls face during menstruation are deeply rooted in sociocultural myths and taboos. Other people's attitudes towards a girl often change when she experiences puberty or menarche. They may expect her to change how she dresses or behaves (for instance, missing school for a few days each month or leaving altogether). There is also often an assumed readiness for more 'adult' roles. Some studies confirmed that menstruation is not always a source of bad or negative feelings.

Girls face many constraints on their daily activities during menstruation. Many of the negative emotions girls felt about menstruation were linked to problems with managing menstruation, particularly in school.

Evidence gaps

This review found several significant gaps in the evidence.

- There was little evidence of girls' participation in research and evidence generation; future work needs to facilitate girls' meaningful participation.
- There is much more evidence relating to older adolescents' knowledge of puberty and menstruation than young adolescents; given the average age of puberty and menarche onset, this means we know very little about the experiences of girls before and during early puberty.
- One of the biggest research gaps concerns girls who are out of school, as most studies use school-based samples. This gap is salient given the large numbers of out-of-school girls; we know very little about their experiences of managing puberty and menstruation.
- Evidence is needed from a much wider range of countries to provide a more comprehensive and robust evidence base to inform future programming and policy; most of the studies that met our inclusion criteria were clustered in four Asian countries.
- Little attention has been paid to the role of men and boys in girls' knowledge and experience of puberty and menstruation, not just family members but also teachers, health workers and peers. Puberty and menstruation are rarely viewed with a broader 'gender lens'.
- There is a need for future evidence to use consistent, evidence-based standards in the study of puberty and menstruation, adapted to context. Researchers need to use objective questions and consistent measures of what is 'acceptable' or 'appropriate' knowledge and what constitutes 'good' menstrual hygiene practices or management in different contexts.
- Finally, much more can be learnt about which interventions work best and how different interventions, both hardware and software, complement each other.

1 Background

More than a quarter (26%) of the world's population is female and of reproductive age, and most of them will menstruate monthly for between two and seven days (House, Mahon et al. 2012). Prior to first menstruation (menarche), each of these girls and women will have undergone puberty. The consequences of adolescents not being able to successfully navigate puberty and menstruation are wide-ranging:

- Many schools do not have the facilities to support either adolescent girls or female teachers to manage menstrual hygiene. This lack of infrastructure means that female teachers may struggle to perform their teaching duties, and girls may miss school whilst they are menstruating. Growing evidence documents the impact on girls' school attendance related to the problems of managing menstrual hygiene on the way to and during school (WHO and UNICEF 2013).¹
- Socio-cultural norms around female behaviour during menstruation may limit females' access to water and sanitation when they need it most in order to manage menstruation hygienically (House, Mahon et al. 2012). Poorly managed menstrual hygiene may be linked to urinary or reproductive tract infections.
- The management of puberty and menstruation might impact negatively on the psychosocial wellbeing of girls and women (e.g. stress, fear, embarrassment, shame). These feelings might be exacerbated in public spaces such as school (e.g. girls avoid answering teachers' questions because of concerns about standing up and revealing soiled clothing).
- Parents may withdraw a daughter from school because: puberty and menstruation are associated with reproduction and/or marriage; and/or they are concerned about potential sexual advances by male students and teachers (Kirk and Sommer 2006).

For many children entering adolescence today, their experiences may be very different from that of preceding generations. Compared with previous generations, young people today are more likely to start puberty earlier and healthier; more likely to spend greater time in school; have

greater access to sources of information (mass media, internet, mobile phones); and more likely to enter marriage and/or childbearing later (Boonstra 2015).

1.1 Puberty and menstruation

Puberty is a period of rapid physical, psychological and cognitive changes, including changes in brain chemistry; importantly, it 'is not a problem to be solved' (UNESCO 2014). It is a process that lasts for most of the second decade of life, with significant variation between young people; changes do not happen at a specific age or at a steady rate (UNAIDS 2004). Puberty in females begins around the ages of 10 and 11; in males, it begins about a year later. During puberty, the differences between girls and boys become more pronounced as the physical changes associated with puberty occur alongside a series of changes in: gender identity; the role of peers, and peer pressure; self-identity; risk-taking; and, intellectual and moral development (Brooks-Gunn 1987). There are significant differences in the timing of puberty between the sexes. On average, girls begin puberty 12-18 months earlier than boys; the median age of menarche for girls is 12 years where boys' first ejaculation occurs around age 13. Whilst global variation exists in age at menarche and age at puberty, the age at puberty is declining globally, attributable to improved health and nutrition; it is estimated that the age of puberty has declined by three years over the past two centuries (UNAIDS 2004). Girls typically start to menstruate between the ages of 10 and 19 (Thomas, Renaud et al. 2001). The age range of menarche is wide and can begin as young as eight years old (UNAIDS, Joint United Nations Program on HIV/AIDS et al. 2004, UNICEF 2011). Menarche is universal; hormonal changes associated with puberty mean that most girls, with few exceptions, will experience their first menstruation (menarche). Puberty, menarche and menstruation are almost universally experienced by the female sex. The ways in which puberty is presented and experienced by girls and boys is very different. Globally, there is a 'dominant narrative' of puberty

¹ UNICEF estimates that 1 in 10 school-age African girls 'do not attend school during menstruation' (WHO and UNICEF 2013).

as 'shameful for girls while in contrast celebrating male virility' (UNESCO 2014).

The onset of puberty or menarche may define a time when girls' roles change, including (Mmari, Gibbs et al. 2016):

- increased adult roles (possibly including (non-) consensual sexual activity, marriage and/or childbearing)
- changes in dress/deportment/behaviour (including reduction in 'child-like' behaviours such as play)
- cessation or interruption of schooling
- ability to be mobile (including the sorts of spaces permitted to visit/inhabit and with whom).

Despite the (almost) universality of puberty and menstruation, many girls in low- and middle-income countries (LMICs) are not (if at all) properly prepared for menarche (UNESCO 2014) and subsequent menstrual hygiene management (MHM).

1.2 Why should programming and research focus on early adolescents?

In LMICs interventions and research on adolescents tend to focus on older (15-19 years) ages (Igras, Macieira et al. 2014). Early or young (also known as very young) adolescents – defined as ages 10-14 years – incorporates the ages at which most people experience the beginning of physical changes, usually beginning with a physical growth spurt and followed by the development of secondary sexual characteristics. These more obvious physical changes are accompanied by significant brain development, including the reorganisation of neural networks with impacts on emotional, physical and mental abilities. During early adolescence the part of the brain that governs decision-making and reasoning (frontal lobe) starts to develop.

There is growing evidence from LMICs that significant proportions of girls attain menarche without any understanding of what is happening to them or how to manage it. To date, however, there has not been a systematic synthesis of the evidence about girls' experience of knowledge (content, source, timing) about puberty, including menstruation.

1.3 Sociocultural norms on menstruation and menstrual hygiene

'Given the social taboos often surrounding puberty, it is particularly important to give early adolescents all the information they need... For too many children, such

knowledge becomes available too late, if at all, when the course of their lives has already been affected and their development and well-being undermined' (UNICEF 2011).

Socio-cultural, including religious, understandings and norms relating to menstruation and MHM abound; the extent to which these norms impact (physically and/or psychosocially) on girls' and women's lives vary and operate at a range of scales, for example:

- restrictions on cooking and/or eating and/or fetching or touching drinking water
- prescribed behaviours around washing/bathing
- restrictions on discussing menstruation in everyday conversation
- school-going girls who are menstruating are harassed (name-calling, stone-throwing) by boys
- where shop owners are predominantly male, they may choose not to stock sanitary hygiene products, or it might be too embarrassing for a female to purchase these products from a male (economic barriers to girls' being able to purchase MH products notwithstanding).

The ways in which socio-cultural context impacts on a woman who is menstruating is context-specific; but all relate to practices rooted in assumptions of menstruation (and menstrual blood) being dirty or unclean or impure or polluting or dangerous. In Nepal, for example, the practice of *chaupadi* involves the menstruating woman: eating her meals separately; making no physical contact with other people or water sources; sleeping with little or no bedding (Robinson 2015). In some areas in Nepal, the menstruating woman must sleep outside in a separate hut; in winter this means sleeping in freezing conditions. Whilst the Nepal Supreme Court banned *chaupadi* in 2005, the practice continues, especially in more remote mountainous regions. Among Jewish communities in Ethiopia, the practice of women staying in a menstruation hut 'margam gojo' (lit. 'curse hut') is practised (Ciurel and Sharaby 2007). In Bangladesh, old menstrual cloths are buried in the ground for fear that evil spirits will be attracted to the menstrual blood (Seymour 2012). Practices might include restricting menstruating girls from going to the temple or mosque; touching cows or the cowshed; reading the Koran; or leaving their homes whilst menstruating. In Rwanda, where discussing menstruation in everyday conversation is taboo, schoolgirls try to conceal their menses. Menstruating girls who attend schools with lockable sanitation facilities are exposed to embarrassment and even ridicule when simply requesting

the key from teachers, as such a public request may be indicative of menstruation (Sommer, Vasquez et al. 2013). Section 4.7 reveals additional pervasive ways in which a wide range of socio-cultural practices related to menstruation impact girls' daily lives.

1.4 Puberty knowledge, information and education

Education about puberty is a 'crucial' (UNESCO 2014) aspect of adolescent development and needs to be both culturally- and age-appropriate spanning pre-adolescence to young adulthood. Puberty education is a subset of comprehensive sexuality education, itself a subset of health education. Recently (post-2000) there has been a growth in guidance about puberty education, including menstruation and its management, in LMICs (House, Mahon et al. 2012, Haver and Long 2015), with

some countries developing national guidelines (MDWS 2015). This recent growth in materials and toolkits reflects the growing understanding of the importance of aspects of puberty, and its management, for young people's social and economic lives. Key themes that cut across these guidance documents include the need for puberty and menstruation information to be:

- age appropriate
- culturally relevant
- taught to boys and girls (not necessarily at the same time)
- deal with both the software (e.g. knowledge) and hardware (e.g. absorbents, disposal) aspects of MHM.

School-based curricula dealing with puberty tend to be restricted to biological functions and tend not to deal with, for example, mention or discussion of increased sexual desire that accompanies puberty (UNESCO 2014).

2 Aim, objectives and research question

This rapid evidence review (RER) seeks to describe comprehensively what is (not) known about young female adolescents' knowledge about puberty and menstruation in LMICs – both the content and the source of that knowledge – as well as the approaches that enable girls to obtain this knowledge. This RER methodically identifies and maps evidence with the aim of systematically mapping and synthesising what we know about early adolescent (ages 10-14 years) girls' knowledge of puberty, including menstruation and MHM, in LMICs.

A key challenge for LMIC societies, policy-makers and programme managers is how to best support adolescent girls through adolescence, from pre-adolescence to early adulthood. The objective of this RER is to identify and synthesise evidence on the following research question: How and what do girls aged 10-14 years know about puberty and menstruation in LMICs? This RER categorises the range of interventions (if any), the type of literature and the study designs included. It also identifies knowledge gaps to inform future research and programming.

3 Methods

3.1 Rapid evidence review

This RER takes a purposive and structured approach to searching, gathering and including evidence. The scope and types of evidence included in an RER are normally broader than in a systematic review. The aim in this RER is to describe as widely as possible all of the literature relating to the topic without limiting the results to intervention studies that assess the strength or direction of the relationship.

3.2 Inclusion and exclusion criteria

This review focuses on evidence relating to early adolescent (aged 10-14 years) girls' knowledge about puberty, menstruation, and menstrual hygiene. Evidence is included about both the content and source of girls' knowledge as well as the approaches used to deliver this knowledge. The PICOTS format (Figure 1) summarizes the main components of the research question.

Studies on any population in LMICs were considered. Peer-reviewed journal articles and (non-peer-reviewed) grey literature, including reports, books or book chapters, whether available in print or online, were eligible for inclusion. Potentially eligible studies included journal articles, and published and unpublished information from governments and other agencies, whether available in print or online, published in English.

Table 1: PICOTS criteria for inclusion

Population	Adolescent girls aged 10-14 years
Intervention (Condition)	Puberty and menstruation
Comparison/Control	None
Outcome	Knowledge
Time	1 January 2006 to 1 June 2016
Setting	LMICs
Middle East and North Africa	86.5
Sub-Saharan Africa	77.3

For inclusion, studies must have:

- included evidence relating to adolescent females aged 10-14 years. Studies that targeted people outside of this age range (e.g. ages 10-19 years) were only included if the population's mean age fit within the 10-14-year age range.
- stated as an outcome or aim to increase, or measure as an outcome, 10-14-year-old adolescent females' knowledge of puberty, menstruation or menstrual hygiene
- be published in English
- be published between 1/1/2006 and 1/6/2016.

The primary outcome of interest was knowledge of puberty, menstruation, and menstrual hygiene. Studies must have measured at least one of these outcomes:

- knowledge of menstruation
- menstrual hygiene practices
- knowledge of puberty
- attitudes, myths and/or perceptions of menstruation/puberty
- experiences of menstruation/puberty
- sources of information about menstruation/puberty.

Since the aim is to describe the nature and coverage of the evidence, quality was not assessed and was not a criterion for inclusion. Multiple references based on the same sample were also not excluded (as would be the case in a systematic review in order to avoid bias).

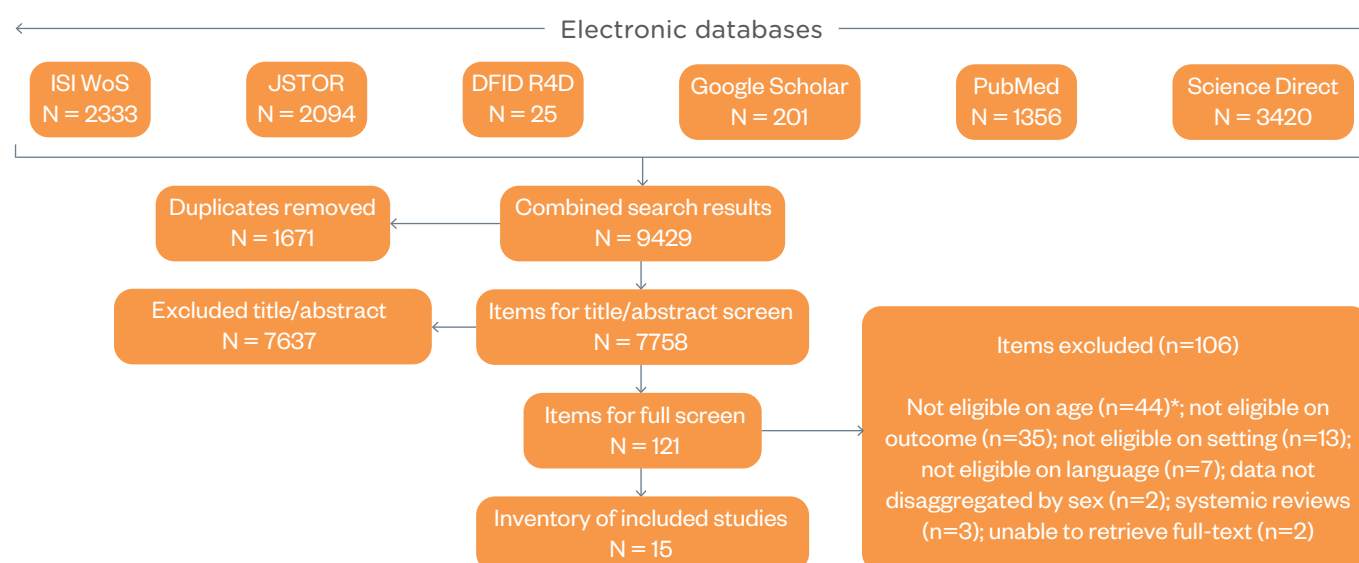
3.3 Searching and screening strategy

The searches and subsequent application of inclusion and exclusion criteria were conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow approach.² This approach ensures that the final product is compatible with the standards expected of a systematic search process for peer review publication (although the final product is not a systematic review). No assessments of items quality were made.

A series of four sets of search terms (Appendix A) were used in combination to cover the PICOTS. Searches

² <http://www.ncbi.nlm.nih.gov/pubmed>

Figure 1: Search and screening results



*Whilst excluded from the final inventory of included studies, these 44 studies are included as 'relevant excluded studies' in the analyses.

were not constrained by geographic location; studies that focus only on high-income countries (HICs) were excluded later at title and abstract (TIAB) screening. The final set of search terms were tested in three databases (PubMed, ISI Web of Science (WoS), ScienceDirect). We also tested specific search terms (e.g. period, maturity) that have been identified as inappropriate for this RER (Appendix B). The search terms have been crosschecked with Medical Subject Headings (MeSH) dictionaries. Search terms and their combinations were adapted to the particulars (e.g. wildcards, truncations, capacity for complex searches, MeSH facility) of each electronic database.

The search strategy involved systematic searches of five electronic databases and one targeted website. Three databases (PubMed³, ISI WoS⁴, ScienceDirect⁵) have sophisticated search facilities, and ensured a good coverage of peer-reviewed published literature with an emphasis on the more biomedical aspects of the social science literature. Searches of these three databases and Google Scholar incorporated all combinations (Sets 1, 2, 3, 4) of the search terms (Appendix A). To maximise the coverage of non-peer-reviewed materials and a likely broader range of social science materials, we also searched the JStor⁶ database and DFID R4D⁷ website with less sophisticated search facilities. These databases were

searched with a narrower set of search terms (Sets 1 and 2 only), reflecting the limitations of their search capabilities and the time available.

This search generated a total of 9,429 items for screening. After removing duplicates, the 7,758 remaining items were screened for inclusion in the RER, initially on the basis of TIAB. SL determined eligibility of all items, and unclear items were discussed with EC. When inclusion or exclusion could not be determined on the basis of TIAB, SL screened the full text. Decisions were made in favour of an inclusive approach where questions remained. A total of 15 items were included in the final inventory. We were unable to retrieve two further items for full-text screening. See Figure 1 for a flow diagram of the searching and screening strategy.

3.4 Data extraction, analysis and quality assessment

EC and SL both extracted data into SPSS for a randomly selected study in order to assure quality in data extraction. SL then extracted data from all additional studies. Data were extracted for analysis from all items included in the RER, including background information; population; a description of the intervention (when relevant); details of the type of literature (and study if relevant); and details of relevant outcomes measured.

3 <http://www.ncbi.nlm.nih.gov/pubmed>

4 <http://wok.mimas.ac.uk/>

5 <http://www.sciencedirect.com/>

6 <http://www.jstor.org/>

7 <http://r4d.dfid.gov.uk/>

We present the results in a narrative format, organised thematically. In our results we draw on two sets of studies:

- **Included studies:** studies that met all of the inclusion criteria.
- **Relevant excluded studies:** studies that met all of the inclusion criteria excluding age; these studies address menstruation and puberty among populations in which adolescents' mean age is older than 15 years.

We present results drawing from both sets, specifying whether it is an included or relevant study, in order to maximise the relevant material included for this RER.

4 Results

The screening generated a total of 15 studies that met all of the criteria for inclusion in the inventory. An additional 44 studies were deemed relevant excluded studies, as these studies met all of the inclusion criteria apart from age. These included and relevant studies examine knowledge of menstruation and puberty across the globe, though there is a preponderance of studies from select countries, such as India and Bangladesh. This abundance of country-specific case studies reflects the fact that these countries have conducted more work on the subject; it does not reflect worse menstrual hygiene challenges in those countries (House, Mahon et al. 2012). We also identified and summarise three relevant systematic reviews (section 4.10).

4.1 Included studies

Data from the 15 studies that met all of the inclusion criteria have been extracted (Appendix C) and summarised in Table 1. These studies were conducted in eight countries, with three studies from sub-Saharan Africa. All of the included studies were published post-2007. Knowledge of menstruation is the most commonly reported outcome measure (n=12), followed by experiences of menstruation/puberty (n=11). Only three studies measure knowledge of puberty. The majority of studies (n=11) draw their research sample from school-based samples of adolescents; three use a community-based sample and one study explicitly includes in- and out-of-school adolescents. Six of the studies report on interventions (Djalalinia, Tehrani et al. 2012, Moodi, Zamanipour et al. 2013, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Kapadia-Kundu, Storey et al. 2014, Sharma, Negi et al. 2015).

4.2 Relevant studies

An additional 44 studies, whilst not meeting the age criteria for the RER (ages 10-14 years), did meet all other criteria. Data from these 44 studies have been extracted (Appendix D) and summarised in Table 2. These 44 studies, excluded only on the basis of the age of the female adolescents, addressed menstruation and puberty among populations of older adolescents whose mean ages were 15 years or older. We decided, however, that these studies were likely to contain information that was highly – if not

absolutely – salient for this RER. Nearly half of these studies come from two countries (12 from India and 7 from Nigeria), and 21 studies are from Asia. Within geographic regions, the studies are highly clustered by country. In sub-Saharan Africa, Nigeria (n=7) and Ethiopia (n=4) have significantly more studies than other countries. The three articles from Tanzania are all by the same author (Sommer) and generated from the same research project. Of the 12 relevant studies that report on an intervention, 10 studies used a pre-post test design.

Knowledge of menstruation is once again the most commonly reported outcome measure (n=28), followed by sources of information about menstruation/puberty (n=26) and menstrual hygiene practices (n=24). Knowledge of puberty is the least frequently reported outcome (n=7), illustrating a striking emphasis on menstruation (and MHM) compared to puberty.

More than half of relevant studies generate evidence from a school-based sample of adolescents (n=28), with one study focusing explicitly on in-school girls with learning disabilities (Altundag and Calbayram 2016). Most of these studies use questionnaire-based strategies to generate their evidence, which are presented descriptively, many without any measures of statistical significance. School-based samples represent a relatively straightforward sampling frame and recruitment strategy for adolescent girls, reflected in the volume of relevant items that use this approach. However, in settings where secondary school (which forms the majority of school-types in these studies) enrolment and attendance is not the norm for adolescent girls, this approach does introduce a major bias into the sorts of adolescents from whom data are being collected. Just six relevant studies (of which three are based on the same Tanzanian project (Sommer 2009, Sommer 2010, Sommer 2013)) include both in- and out- of school adolescents.

4.3 Outcome 1: Knowledge of menstruation

Knowledge about menstruation is important because it sheds light on the extent to which adolescents understand the changes affecting their body. Here, we separate out knowledge about menstruation and menstrual hygiene

Table 2: Summary table of included studies

Country	Nepal (1)	(Adhikari, Kadel et al. 2007)
	Bangladesh (2)	(Bosch, Hutter et al. 2008, Haque, Rahman et al. 2014)
	India (4)	(Shah, Nair et al. 2013, Chothe, Khubchandani et al. 2014, Kapadia-Kundu, Storey et al. 2014, Sharma, Negi et al. 2015)
	Iran (2)	(Djalalinia, Tehrani et al. 2012, Moodi, Zamanipour et al. 2013)
	Nigeria (2)	(Um, Yusuf et al. 2010, Iliyasu, Aliyu et al. 2012)
	Turkey (1)	(Isguven, Yoruk et al. 2015)
	Mexico (2)	(Marván and Molina-Abolnik 2012, Marván and Alcalá-Herrera 2014)
	Kenya (1)	(Mason, Nyothach et al. 2013)
Intervention	Yes (6)	(Djalalinia, Tehrani et al. 2012, Moodi, Zamanipour et al. 2013, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Kapadia-Kundu, Storey et al. 2014, Sharma, Negi et al. 2015)
Outcome measure	Knowledge of menstruation (12)	(Adhikari, Kadel et al. 2007, Bosch, Hutter et al. 2008, Um, Yusuf et al. 2010, Iliyasu, Aliyu et al. 2012, Marván and Molina-Abolnik 2012, Mason, Nyothach et al. 2013, Shah, Nair et al. 2013, Chothe, Khubchandani et al. 2014, Haque, Rahman et al. 2014, Marván and Alcalá-Herrera 2014, Isguven, Yoruk et al. 2015, Sharma, Negi et al. 2015)
	Menstrual hygiene practices (10)	(Adhikari, Kadel et al. 2007, Um, Yusuf et al. 2010, Djalalinia, Tehrani et al. 2012, Iliyasu, Aliyu et al. 2012, Mason, Nyothach et al. 2013, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Kapadia-Kundu, Storey et al. 2014, Isguven, Yoruk et al. 2015, Sharma, Negi et al. 2015)
	Knowledge of puberty (3)	(Iliyasu, Aliyu et al. 2012, Moodi, Zamanipour et al. 2013, Isguven, Yoruk et al. 2015)
	Attitudes, myths and/or perceptions about menstruation/puberty (5)	(Bosch, Hutter et al. 2008, Marván and Molina-Abolnik 2012, Mason, Nyothach et al. 2013, Chothe, Khubchandani et al. 2014, Marván and Alcalá-Herrera 2014)
	Experiences of menstruation/puberty (11)	(Adhikari, Kadel et al. 2007, Bosch, Hutter et al. 2008, Um, Yusuf et al. 2010, Djalalinia, Tehrani et al. 2012, Marván and Molina-Abolnik 2012, Mason, Nyothach et al. 2013, Shah, Nair et al. 2013, Chothe, Khubchandani et al. 2014, Haque, Rahman et al. 2014, Marván and Alcalá-Herrera 2014, Sharma, Negi et al. 2015)
	Sources of information about menstruation (10)/puberty (0)	(Adhikari, Kadel et al. 2007, Bosch, Hutter et al. 2008, Um, Yusuf et al. 2010, Djalalinia, Tehrani et al. 2012, Iliyasu, Aliyu et al. 2012, Mason, Nyothach et al. 2013, Shah, Nair et al. 2013, Marván and Alcalá-Herrera 2014, Isguven, Yoruk et al. 2015, Sharma, Negi et al. 2015)
Study type	Descriptive cross-sectional (quantitative) (5)	(Adhikari, Kadel et al. 2007, Um, Yusuf et al. 2010, Marván and Molina-Abolnik 2012, Marván and Alcalá-Herrera 2014, Isguven, Yoruk et al. 2015)
	Descriptive cross-sectional (qualitative) (2)	(Mason, Nyothach et al. 2013, Chothe, Khubchandani et al. 2014)
	Descriptive cross-sectional (mixed methods) (2)	(Bosch, Hutter et al. 2008, Iliyasu, Aliyu et al. 2012)
	Pre-post test (4)	(Moodi, Zamanipour et al. 2013, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Sharma, Negi et al. 2015)
	RCT (2)	(Djalalinia, Tehrani et al. 2012, Kapadia-Kundu, Storey et al. 2014)
Study population	In-school (11)	(Adhikari, Kadel et al. 2007, Um, Yusuf et al. 2010, Djalalinia, Tehrani et al. 2012, Marván and Molina-Abolnik 2012, Mason, Nyothach et al. 2013, Moodi, Zamanipour et al. 2013, Chothe, Khubchandani et al. 2014, Haque, Rahman et al. 2014, Marván and Alcalá-Herrera 2014, Isguven, Yoruk et al. 2015, Sharma, Negi et al. 2015)
	In-school and out-of-school (1)	(Shah, Nair et al. 2013)
	Community-based sample (3)	(Bosch, Hutter et al. 2008, Iliyasu, Aliyu et al. 2012, Kapadia-Kundu, Storey et al. 2014)

Table 3: Summary table of relevant excluded studies

Country	Nigeria (7)	(Moronkola and Oyeibami 2007, Adinma and Adinma 2008, Umeora and Egwuatu 2008, Adeokun, Ricketts et al. 2009, Adinma and Adinma 2009, Adefuye, Odusoga et al. 2010, Ogunfowokan and Babatunde 2010)
	Turkey (2)	(Cakir, Mungan et al. 2007, Altundag and Calbayram 2016)
	Taiwan (2)	(Chiou, Wang et al. 2007, Chang and Chuang 2012)
	Cambodia (2)	(Connolly and Sommer 2013, Sommer, Ackatia-Armah et al. 2015)
	Brazil (1)	(da Silva Bretas, Tadini et al. 2012)
	India (12)	(Dongre, Deshmukh et al. 2007, Dasgupta and Sarkar 2008, Kothari 2010, Unni 2010, Kumar and Srivastava 2011, Malleshappa, Krishna et al. 2011, Ravishankar 2011, Ray, Ghosh et al. 2011, Nair, Leena et al. 2013, Sharanya 2014, Kansal, Singh et al. 2016, Rani, Sharma et al. 2016)
	Ghana (2)	(Dolan, Ryus et al. 2014, Sommer, Ackatia-Armah et al. 2015)
	Iran (3)	(Fakhri, Hamzehgardeshi et al. 2012, Malek, Shafiee-Kandjani et al. 2012, Mosavi, Babazadeh et al. 2014)
	Saudi Arabia (1)	(Fetohy 2007)
	Ethiopia (4)	(Zegeye, Megabiaw et al. 2009, Gultie, Hailu et al. 2014, Sommer, Ackatia-Armah et al. 2015, Upashe, Tekelab et al. 2015)
	Bangladesh (2)	(Tasnim, Rahman et al. 2009, Kabir, Saha et al. 2015)
	Kenya (1)	(Hennegan and Montgomery 2016)
	Nepal (1)	(Pokharel, Kulczycki et al. 2006)
	South Africa (1)	(Ramathuba 2015)
	Pakistan (1)	(Shaikh and Rahim 2006)
	Tanzania (3)	(Sommer 2009, Sommer 2010, Sommer 2013)
	Malaysia (1)	(Wong and Khoo 2011)
Intervention	Yes (12)	(Pokharel, Kulczycki et al. 2006, Chiou, Wang et al. 2007, Dongre, Deshmukh et al. 2007, Fetohy 2007, Tasnim, Rahman et al. 2009, Malleshappa, Krishna et al. 2011, Ravishankar 2011, Fakhri, Hamzehgardeshi et al. 2012, Nair, Leena et al. 2013, Dolan, Ryus et al. 2014, Kabir, Saha et al. 2015, Altundag and Calbayram 2016)
Outcome measure	Knowledge of menstruation (28)	(Shaikh and Rahim 2006, Chiou, Wang et al. 2007, Dongre, Deshmukh et al. 2007, Fetohy 2007, Moronkola and Oyeibami 2007, Dasgupta and Sarkar 2008, Adeokun, Ricketts et al. 2009, Tasnim, Rahman et al. 2009, Zegeye, Megabiaw et al. 2009, Kothari 2010, Ogunfowokan and Babatunde 2010, Unni 2010, Kumar and Srivastava 2011, Malleshappa, Krishna et al. 2011, Ravishankar 2011, Wong and Khoo 2011, Connolly and Sommer 2013, Nair, Leena et al. 2013, Sommer 2013, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014, Sharanya 2014, Kabir, Saha et al. 2015, Ramathuba 2015, Sommer, Ackatia-Armah et al. 2015, Upashe, Tekelab et al. 2015, Kansal, Singh et al. 2016, Rani, Sharma et al. 2016)
	Menstrual hygiene practices (24)	(Pokharel, Kulczycki et al. 2006, Cakir, Mungan et al. 2007, Dongre, Deshmukh et al. 2007, Fetohy 2007, Adinma and Adinma 2008, Dasgupta and Sarkar 2008, Sommer 2009, Kothari 2010, Sommer 2010, Unni 2010, McMahon, Winch et al. 2011, Ravishankar 2011, Fakhri, Hamzehgardeshi et al. 2012, Connolly and Sommer 2013, Nair, Leena et al. 2013, Sommer 2013, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014, Kabir, Saha et al. 2015, Ramathuba 2015, Sommer, Ackatia-Armah et al. 2015, Altundag and Calbayram 2016, Kansal, Singh et al. 2016, Rani, Sharma et al. 2016)
	Knowledge of puberty (7)	(Shaikh and Rahim 2006, Sommer 2009, Tasnim, Rahman et al. 2009, Malleshappa, Krishna et al. 2011, Ravishankar 2011, Ray, Ghosh et al. 2011, Malek, Shafiee-Kandjani et al. 2012)
	Attitudes, myths and/or perceptions about menstruation/puberty (18)	(Chiou, Wang et al. 2007, Fetohy 2007, Adinma and Adinma 2008, Dasgupta and Sarkar 2008, Umeora and Egwuatu 2008, Sommer 2009, Kothari 2010, Sommer 2010, Kumar and Srivastava 2011, McMahon, Winch et al. 2011, Ravishankar 2011, Fakhri, Hamzehgardeshi et al. 2012, Connolly and Sommer 2013, Sommer 2013, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014, Sommer, Ackatia-Armah et al. 2015, Rani, Sharma et al. 2016)

Outcome measure	Experiences of menstruation/puberty (23)	(Cakir, Mungan et al. 2007, Chiou, Wang et al. 2007, Dongre, Deshmukh et al. 2007, Moronkola and Oyeibami 2007, Adinma and Adinma 2008, Dasgupta and Sarkar 2008, Adinma and Adinma 2009, Sommer 2009, Zegeye, Megabiaw et al. 2009, Adefuye, Odusoga et al. 2010, Kothari 2010, Ogunfowokan and Babatunde 2010, Sommer 2010, Kumar and Srivastava 2011, da Silva Bretas, Tadini et al. 2012, Fakhri, Hamzehgardeshi et al. 2012, Connolly and Sommer 2013, Nair, Leena et al. 2013, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014, Sharanya 2014, Sommer, Ackatia-Armah et al. 2015, Rani, Sharma et al. 2016)
	Sources of information about menstruation (26)/puberty (2)	(Shaikh and Rahim 2006, Cakir, Mungan et al. 2007, Dongre, Deshmukh et al. 2007, Fetohy 2007, Adinma and Adinma 2008, Dasgupta and Sarkar 2008, Umeora and Egwuatu 2008, Adeokun, Ricketts et al. 2009, Sommer 2009, Adefuye, Odusoga et al. 2010, Kothari 2010, Ogunfowokan and Babatunde 2010, Unni 2010, Kumar and Srivastava 2011, Ray, Ghosh et al. 2011, Wong and Khoo 2011, Chang and Chuang 2012, Fakhri, Hamzehgardeshi et al. 2012, Connolly and Sommer 2013, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014, Mosavi, Babazadeh et al. 2014, Sharanya 2014, Ramathuba 2015, Sommer, Ackatia-Armah et al. 2015, Upashe, Tekelab et al. 2015, Kansal, Singh et al. 2016, Rani, Sharma et al. 2016)
Study type	Descriptive cross-sectional (quantitative) (21)	(Shaikh and Rahim 2006, Cakir, Mungan et al. 2007, Moronkola and Oyeibami 2007, Adinma and Adinma 2008, Dasgupta and Sarkar 2008, Adeokun, Ricketts et al. 2009, Adinma and Adinma 2009, Zegeye, Megabiaw et al. 2009, Adefuye, Odusoga et al. 2010, Kothari 2010, Ogunfowokan and Babatunde 2010, Ray, Ghosh et al. 2011, Wong and Khoo 2011, Chang and Chuang 2012, Malek, Shafiee-Kandjani et al. 2012, Nair, Leena et al. 2013, Gultie, Hailu et al. 2014, Sharanya 2014, Ramathuba 2015, Upashe, Tekelab et al. 2015, Rani, Sharma et al. 2016)
	Descriptive cross-sectional (qualitative) (3)	(Sommer 2009, Sommer 2010, McMahon, Winch et al. 2011, da Silva Bretas, Tadini et al. 2012, Connolly and Sommer 2013, Sommer 2013, Mosavi, Babazadeh et al. 2014, Sommer, Ackatia-Armah et al. 2015)
	Descriptive cross-sectional (mixed methods) (5)	(Pokharel, Kulozycki et al. 2006, Umeora and Egwuatu 2008, Unni 2010, Kumar and Srivastava 2011, Kansal, Singh et al. 2016)
	Pre-post test (10)	(Chiou, Wang et al. 2007, Dongre, Deshmukh et al. 2007, Fetohy 2007, Tasnim, Rahman et al. 2009, Malleshappa, Krishna et al. 2011, Ravishankar 2011, Fakhri, Hamzehgardeshi et al. 2012, Dolan, Ryus et al. 2014, Kabir, Saha et al. 2015, Altundag and Calbayram 2016)
Study population	In-school (27)	(Pokharel, Kulozycki et al. 2006, Cakir, Mungan et al. 2007, Chiou, Wang et al. 2007, Fetohy 2007, Adinma and Adinma 2008, Dasgupta and Sarkar 2008, Adeokun, Ricketts et al. 2009, Adinma and Adinma 2009, Tasnim, Rahman et al. 2009, Zegeye, Megabiaw et al. 2009, Adefuye, Odusoga et al. 2010, Ogunfowokan and Babatunde 2010, Unni 2010, Malleshappa, Krishna et al. 2011, McMahon, Winch et al. 2011, Ray, Ghosh et al. 2011, Wong and Khoo 2011, Chang and Chuang 2012, da Silva Bretas, Tadini et al. 2012, Fakhri, Hamzehgardeshi et al. 2012, Malek, Shafiee-Kandjani et al. 2012, Nair, Leena et al. 2013, Gultie, Hailu et al. 2014, Ramathuba 2015, Sommer, Ackatia-Armah et al. 2015, Upashe, Tekelab et al. 2015, Rani, Sharma et al. 2016)
	In-school with disability (1)	(Altundag and Calbayram 2016)
	In-school and out-of-school (6)	(Sommer 2009, Kothari 2010, Sommer 2010, Connolly and Sommer 2013, Sommer 2013, Dolan, Ryus et al. 2014)
	Community-based sample (9)	(Shaikh and Rahim 2006, Dongre, Deshmukh et al. 2007, Umeora and Egwuatu 2008, Kumar and Srivastava 2011, Ravishankar 2011, Mosavi, Babazadeh et al. 2014, Sharanya 2014, Kabir, Saha et al. 2015, Kansal, Singh et al. 2016)
	Athletes (1)	(Moronkola and Oyeibami 2007)

from practice of MHM, although they are inextricably linked. Studies (12 included and 28 relevant) included a wide range of 16 outcome measures on knowledge of menstruation:

1. knowledge of cycle
2. unsafe period
3. ovulation timing
4. challenges to learning about menstruation
5. source of menstrual bleeding
6. knowledge of flow/bleeding/menstruation duration
7. knowledge of age at menarche
8. knowledge about menstrual hygiene
9. knowledge about irregular cycle length
10. cause of menstruation
11. preparedness for menstruation
12. age of cessation of menstruation (menopause)
13. emotional aspects of menstruation
14. relationship between menstruation and fertility/fecundity
15. what to do at menarche
16. route of urine vs. menstrual blood.

The ways in which studies asked adolescents about their knowledge of menstruation varied widely. Some studies – both included studies (Adhikari, Kadel et al. 2007, Isguven, Yoruk et al. 2015) and relevant ones (Fetohy 2007, Adinma and Adinma 2008) – framed their questions in terms of ‘normal’ age at menarche or duration of a menstrual cycle or flow. With one exception (Isguven, Yoruk et al. 2015), however, it is unclear how researchers were defining ‘normal’ or the rationale for their survey response categories. Wide variation also exists in how these survey questions are framed and their response categories constructed. In some studies, the ways in which aggregate ‘scores’ of knowledge about menstruation were computed is unclear (Fetohy 2007, Sharma, Negi et al. 2015).

Some studies did not report whether the response categories to surveys were closed or open ended (with post-hoc coding), making it impossible to determine how the results were produced. For example, a study from India reports asking, ‘Why does menstruation occur?’ This question produced the responses ‘marks the end of childhood’ (25.5%); ‘mechanism to excrete dirty blood’ (65.5%); and ‘process to reduce the heat in the female body’ (8.8%) (Kothari 2010). In Ethiopia in response to a question about the cause of menstruation, the responses include hormones (62.7%); curse of god (27.5%); caused by disease (23.7%) and don’t know (7.1%) (Upashe, Tekelab et al. 2015). In Nepal, responses to the question ‘what

is menstruation?’ are reported using three response categories, and it is unclear whether these were closed categories in the survey instrument (and if they were, whether the respondents knew the meaning of the words): physiological (6.0%); pathological (12.0%); and curse (82.0%) (Adhikari, Kadel et al. 2007).

Outcome 1: Findings from included studies

From descriptive (non-intervention) studies drawn from a wide range of countries and settings, it is clear that girls have inadequate knowledge about menstruation. Levels of knowledge about menstruation prior to menarche are low among early adolescents (aged 10-14 years) in a wide range of settings, a particularly troublesome finding given that the estimated global mean age at menarche is 14 years (range 13-16 years) (Morabia, Costanza et al. 1998). A study from Bangladesh reported that 64% of girls are ‘reaching menarche in fear’ (Bosch, Hutter et al. 2008).

Hearing about menstruation is not the same as knowing about menstruation. In a study from India with a mean respondent age of 13.7 years, 60.3% girls did not know about menstruation prior to menarche (Shah, Nair et al. 2013). Girls in this study identified the source of menstrual blood as: lower abdomen (14/164); urinary site (66/164); uterus (20/164); lower side (14/164); and don’t know (50/164). When asked about the path of urine and menstrual blood, 81/164 reported that they followed the same path and 21/164 reported ‘don’t know’ (Shah, Nair et al. 2013). A study from Nigeria also shows low generalised levels of knowledge about menstruation: 6.5% of adolescents were aware of the age range of menarche (Um, Yusuf et al. 2010). Qualitative evidence underscores this generalised picture of low levels of knowledge about menstruation, in particular prior to menarche:

‘When I first started my lower abdomen was stretching painfully and when I went back to the classroom everybody was asking me what was on my clothes, then I told them I don’t know.’ (Kenya) (Mason, Nyothach et al. 2013)

Several studies described the timing at which girls receive information about menstruation. A study by Illiyasu et al. from Nigeria incorporated responses from the mothers of adolescent girls, providing important insights into the dynamics of menstruation information provision. Whilst the majority of mothers agreed that adolescent girls should be informed of pubertal changes (88.6%) and menstrual hygiene (81.1%), nearly all (99%) of the 184 mothers

interviewed reported that mother-daughter discussions about sexual and reproductive health (SRH) issues were triggered by the onset of their daughters' menarche:

'Most mothers considered early initiation of home-based sexual education as dangerous, because, in their opinion, it will make the young ones curious, leading to experimentation with premarital sex. Mothers considered the development of breasts and the commencement of menstruation as signs that the girl is now mature, may start attracting the attention of men, and could get into trouble if not warned of the dangers lurking out there.' (Ilyasu, Aliyu et al. 2012)

Menarche as a trigger for girls learning about menstruation was also reported elsewhere:

'I saw blood from my vagina and I never knew anything. I went to my mother and I told her what I saw and she told me that is my monthly period. I should be careful.' (Kenya) (Mason, Nyothach et al. 2013)

Whilst most studies used survey-type questions to elicit information about knowledge about menstruation, some studies used different approaches. A study from India conducted a content analysis of questions about menstruation posed by girls aged 9-13 years (Chothe, Khubchandani et al. 2014). Examples of the sorts of questions posed, 'Do we become infertile if our sanitary pad that is left in open is eaten or sniffed by a snake?' and 'Why shouldn't we eat some type of fruits?', provide culturally- and contextually-relevant insights into the understandings of menstruation among young adolescents. In this study, it should be noted that, in addition to the researchers, teachers were present during these question-and-answer sessions with the girls, which may have influenced the sorts of questions that girls felt they could ask in the presence of teachers.

Some studies provided evidence of formative research in order to inform the design of the research instruments. Two studies by the same author from Mexico developed prompt sentences on the basis of many 'informal conversations with adolescent girls regarding this issue during last decade, and they have shared with us their experiences and concerns' (Marván and Molina-Abolnik 2012, Marván and Alcalá-Herrera 2014). The authors also collected data on age at menarche, grouping girls according to early vs. average vs. late maturers on this basis. Differences in the ways in which these three groups responded to the prompts underscore how important the timing of menstruation information is for girls' understanding. For example, 'I knew what was happening'

(63% vs. 85% vs. 91%, respectively, $p < .01$) and 'I knew what I should do' (58% vs. 78% vs. 80%, respectively, $p < .01$) shows how girls that experienced menarche early were much less well prepared than those who experienced it later.

Three of the included studies examined interventions addressing knowledge of menstruation (Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Sharma, Negi et al. 2015). All used a pre-post test design. Haque et al.'s intervention from Bangladesh involved six months of training on menstrual hygiene for schoolgirls and reported a significant ($p < .001$) impacts on some aspects of knowledge (e.g. menstruation blood is impure; age of normal cessation of menstruation) but not others (e.g. cause of menstruation, origin of menstrual blood) (2014). It is notable that the level of knowledge about the biological (as opposed to hygiene) content of the intervention was not significantly improved and remained relatively low (e.g. post-intervention 13.2% of girls knew the source of menstrual blood compared to 9.9% at baseline). This observation might provide some insight into how well different aspects of this menstrual education programme were developed and delivered. Critical issues in the design of this study should be noted. The authors report posing a questionnaire to girls in focus group discussion settings (possibly more accurately described as a group interview?), a technique that raises questions about the priming effect of a girl hearing previous answers and responses in a group setting.

Outcome 1: Findings from relevant studies

Whilst levels of knowledge about menstruation prior to menarche are generally low, the relevant studies illustrate greater variation in knowledge dependent on the age of respondents. Three studies in India report low awareness of menstruation before its onset: 35.1% of girls (Dongre, Deshmukh et al. 2007), 29.4% of girls (Kansal, Singh et al. 2016), and 30% of girls (Kothari 2010). Among secondary school age girls in India, 67.5% of girls reported being aware of menstruation prior to menarche (Dasgupta and Sarkar 2008), and 46.1% of adolescent girls reported not having received information prior to menarche (Nair, Leena et al. 2013). The reported phrasing of questions in some studies was unclear. For example, a different study from India appears to have used the question 'Were you aware that such an event would occur?' to elicit information about knowledge of menstruation prior to menarche in (Unni 2010). Among the relevant studies, an Ethiopian study with a median respondent age of 16 years reported the greatest percentage of respondents (79.3%) who had heard about

menstruation before attaining menarche (Upashe, Tekelab et al. 2015).

Studies from Africa show low generalised levels of knowledge about menstruation. In Nigeria, 3.1% of respondents knew the timing of ovulation in the menstrual cycle (Adeokun, Ricketts et al. 2009). Another study from Nigeria reported that only 22% of respondents knew the correct source of menstrual blood; 19% of respondents believed the source of menstrual blood to be an injury to the vagina and 20% believed it to be an injury to the stomach (Ogunfowokan and Babatunde 2010). In Ethiopia, 68.5% of adolescents reported that menstruation in early adolescence is 'not normal' (Gultie, Hailu et al. 2014). Qualitative evidence once again underscores this generalised picture of poor knowledge about menstruation, particularly prior to menarche:

'When I first started menstruating I was shocked because I had not learned about it before ... I was too embarrassed to tell my parents because I knew that they would not accept me and would say that I had bad behaviour. I could not tell them because they would say that I shamed the family and would shout at me.' (Ethiopia) (Sommer, Ackatia-Armah et al. 2015)

The types of knowledge that adolescents have about menstruation vary widely. In a South African study, whilst only 27% of respondents reported knowledge of the physical changes that relate to menarche prior to experiencing it, 94% reported being aware of the social and religious restrictions related to menarche before experiencing it (Ramathuba 2015).

Several studies asked detailed questions about respondents' understanding of the physiology of menstruation. A relatively common question across studies and context related to the source of menstrual bleeding, revealing divergent understandings. In South Africa, the source was identified as the uterus (67%); vagina (65%); abdomen (11%); and stomach (5%) (Ramathuba 2015). In Ethiopia, the source was identified as the uterus (60.9%); vagina (27.3%); abdomen (4.0%); bladder (2.1%); or don't know (5.2%) (Upashe, Tekelab et al. 2015). Caution should be used in the interpretation of some of these responses, however, as the question phrasing is not provided.

The role of male knowledge about menstruation – for both boys and men – is highlighted in policy and programmatic information not included in our search (House, Mahon et al. 2012). One example taken from research in Ethiopia underscores this issue:

'When I menstruated, my father saw me washing my underpants. I was very shocked and did not say a word. He asked me what it was and I told him nothing. He demanded an answer and picked up a stick to hit me. I dropped everything and ran to my mom. My mother told my father not to hit or scare me because it is normal for girls to experience this. My father said, 'I send her to school to learn, but instead she goes into the forest with anyone [to have sex] and comes back home.' My mother tried to explain, but my father did not believe her. He said that menstruation happens only after a girl has had sex with a man and that I am not ready. Then, he beat me and asked me to tell him who did this to me.' (Sommer, Ackatia-Armah et al. 2015)

A school-based intervention targeting students aged 14-19 years in India covering a range of topics (puberty changes, menstruation, MHM, ovulation and fertilization, conception, changes during pregnancy, antenatal care, contraception and sexually transmitted diseases (STDs)) was delivered for two hours per day on six consecutive days (Malleshappa, Krishna et al. 2011). It involved a didactic lecture followed by an 'interactive session' with participants. This intervention was unusual in that it explicitly included issues relating to physical changes during puberty (breasts enlarge, hips broaden, pubic hair growth), compared to the majority of other interventions that focused on menstruation and MHM more narrowly. Using a 50-item questionnaire to test knowledge, researchers found a significant ($p < 0.001$) post-intervention increase of 44.5% in girls' overall knowledge of the menstrual cycle, ovulation, fertility and pregnancy (Malleshappa, Krishna et al. 2011).

4.4 Outcome 2: Menstrual hygiene practices

We explicitly separate out findings relating to menstrual hygiene practices, focusing on practiced behaviours as opposed to knowledge of menstrual hygiene. These practices facilitate the effective management of menstruation. Nearly as many studies report menstrual hygiene practices as reported knowledge of menstruation. Studies (10 included and 24 relevant) included 14 outcome measures on menstrual hygiene practices that focus primarily on absorbents and cleansing:

1. type of absorbent used (including reasons for type used)
2. pad replacement skills
3. frequency of absorbent change (or number of pads)

- per day)
4. ability to access water/sanitation
 5. availability of absorbents
 6. absorbent disposal/re-use
 7. washing and drying of absorbents
 8. genital hygiene (frequency/type/product use)
 9. problems of absorbents
 10. school-related MHM issues
 11. bathing/washing practices
 12. storage of absorbents
 13. purchase of absorbents
 14. odour related to MHM.

Some studies consider sanitary pads to be any commercially branded or cloth pad, or they group sanitary pads and cotton in the analyses (Adhikari, Kadel et al. 2007, Djalalinia, Tehrani et al. 2012). Other studies separate sanitary pads from cloth pads and report on separate absorbents (Um, Yusuf et al. 2010, Shah, Nair et al. 2013, Haque, Rahman et al. 2014). Whilst one study claims that sanitary napkins are a hygienic practice and use of cloth is an unhygienic practice (Kansal, Singh et al. 2016), most studies considered new cloth or specialty cloth (e.g. falalin) to be hygienic. Use of sanitary pads is high among several studies; however, these studies tend to be limited to those classified as relevant studies. Among early adolescents in included studies, use of sanitary pads is low.

Outcome 2: Findings from included studies

Adolescent girls around the globe struggled with menstrual hygiene in nearly all the included studies. Chief concerns involved resources for bathing/washing and obtaining proper absorbents, ideally sanitary pads. Adolescent schoolgirls said that competing for scarce resources, such as soap and water, could cause familial conflict and even shame among girls who could not conceal that they were menstruating:

'Sometimes you want to take a bath three times and your mother quarrel's you that you are misusing her soap.' (P5 School J).

'Your parent will wonder why her daughter is bathing three times which she never does daily, and maybe you didn't fetch water for bathing so you will be forced to use water that was stored in the house and she might say you are misusing her water.' (P6 School D).

'I feel bad because I might be washing it where people are and also flies might be following me where am

washing them and I will be ashamed.' (P8 School J).'
(Kenya) (Mason, Nyothach et al. 2013)

'Stains of menstrual blood are visible on old cloths and it smells, we feel dirty and ashamed.' (India) (Shah, Nair et al. 2013)

This lack of resources and private spaces where girls could wash (both their menstrual dressings and their bodies) is related to menstrual stigma. In order to prevent others from knowing that they were menstruating, girls tried to wash late at night or early in the morning when family members were not around (Mason, Nyothach et al. 2013, Shah, Nair et al. 2013). In India, girls without access to bathroom facilities and running water hid used cloths in damp, dusty places (e.g. the backyard) until their next menstrual cycle (Shah, Nair et al. 2013). Other reasons for not bathing during menstruation, as reported by Iranian middle school students, include relatives' recommendation (43.5%), fear of pain (28.7%), fear of sickness (22.7%), and an unavailable bathroom (5.1%) (Djalalinia, Tehrani et al. 2012).

Apart from a Nigerian study that reported 93.8% of adolescent schoolgirls used sanitary pads during their last menstrual period (Um, Yusuf et al. 2010), use of sanitary pads was generally low among studies that separated out sanitary pads from other types of absorbents, like cloth pads. An intervention in Bangladesh found that 16.8% of schoolgirls used sanitary pads at baseline (Haque, Rahman et al. 2014), and another intervention in India found that only 1 of the 164 girls used sanitary pads at baseline (Shah, Nair et al. 2013). Use of new and old cloth as absorbents was far more prevalent. The aforementioned intervention study in Bangladesh reported baseline use of new and old cloths at 49.8% and 33.4% respectively (Haque, Rahman et al. 2014). In the India study, 90.2% of girls used old cloths at baseline (Shah, Nair et al. 2013).

Whilst most girls preferred and valued sanitary pads, the cost of sanitary pads made them unaffordable for many girls (Um, Yusuf et al. 2010, Mason, Nyothach et al. 2013, Shah, Nair et al. 2013). In Nigeria, 91.3% schoolgirls who opted for alternatives to sanitary pads claimed that pads were expensive (Um, Yusuf et al. 2010). Girls rationed pads or turned to alternative absorbent materials like old cloths, pieces of mattress, cotton wool, grass, polythene, and paper (Mason, Nyothach et al. 2013). Use of alternative absorbent materials involves risk. In addition to potential leaks and physical discomfort, qualitative evidence indicates that girls associate alternative and/or reused absorbents with illness and injury:

'Some cloths might infect you. For instance if you use damp cloths you might start itching then it turns to a wound.' (P1 School C).

'It can hurt you, if someone step on grass first – you will again use the same grass to manage your menses, it will make you sick. You can even contract malaria, isn't it?' (P3 School F).

'When you are using mattress it can cut into small pieces and it can get inside the vagina so she can get problem in the vagina.' (P9 School D). (Kenya) (Mason, Nyothach et al. 2013)

'After repeated use (3–4 menstrual cycles), old cloths become stiff and we get abrasions on the skin of our inner thighs.' (India) (Shah, Nair et al. 2013)

Only one study from Kenya discussed how or from whom girls received sanitary pads. Adolescent girls obtained branded sanitary pads from mothers, other relatives (e.g. fathers, brothers), and boyfriends. Mason et al. also reported that girls reported obtaining money for sanitary pads by exchanging sex, a narrative that appeared across schools:

'Some people exchange sex for money. The money is used to buy pads. Maybe she is being given money then they have sexual intercourse... sometimes is good, sometimes it's not because you need help, so you will just engage yourself into sex.' (Px School C). (Kenya) (Mason, Nyothach et al. 2013)

Among the included studies examining menstrual hygiene practices, five examined interventions (Djalalinia, Tehrani et al. 2012, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Kapadia-Kundu, Storey et al. 2014, Sharma, Negi et al. 2015). Four used a pre-post test design, and one study from India used a cluster RCT (Kapadia-Kundu, Storey et al. 2014). Four interventions involved MHM software interventions. Haque et al. delivered culturally acceptable menstrual education, including menstrual hygiene demonstrations, to schoolgirls over twelve 45-minute lessons delivered once every 15 days (2014). At follow-up, researchers found significant ($p < .05$) improvement in use of sanitary pads (increasing from 16% to 39%); the frequency of changing pads/cloths 4+ times per day (increasing from 8.4% to 77.2%); drying the absorbent outside in sunlight (increasing from 18.8% to 96.4%); disposal of the absorbent by burial/burning or putting in a dustbin (increasing from 56.5% to 82.0%); and cleaning the genitalia every time the toilet was used (increasing from 15.6% to 34.8%) or during bathing (increasing from 48.6% to 61.1%) (Haque, Rahman et al. 2014). They observed no significant differences in storing washed [reusable] cloths

or the material used to clean external genitalia. As these outcomes are self-reported, it is possible that they may differ from girls' actual behaviours.

Two educational interventions in Iran and India warrant further scrutiny. In Iran, researchers randomly allocated middle school students to one of three groups (control, trained by parents, trained by school health trainers) for a two-year training programme. When Djalalinia et al. measured menstrual hygiene practices post-intervention, they found that the trained groups (41.3% of those trained by school health trainers and 33.5% of those trained by parents) bathed more frequently during menstruation than the control group (25.2%) and were more likely to use sanitary pads or cotton as a menstrual absorbent (38.2% of those trained by school health trainers and 34.5% of those trained by parents versus 27.4% of those in the control group) (2012). This study reports 'many' limitations, however, including missing values in the data (Djalalinia, Tehrani et al. 2012). The education program implemented by Sharma et al. among high school girls in India found a significant ($p = 0.01$) impact on the frequency of changing sanitary pads, proper cleanliness of genitalia, and reuse of cloth after washing (2015). The findings in this study should also be interpreted with caution. While this RER did not assess quality, it is important to note that this study failed to include significant details about the study design, intervention, and outcomes.

Only the study by Shah et al. examined a MHM hardware intervention (2013). This intervention in rural India introduced falalin cloths, a low-cost, easily available red material with good absorption capacity. Qualitative findings indicate that the new absorbent was well received among girls:

'Falalin cloths are easy to wash.'

'The new cloth is good because it is easy to dry, stains are not visible as it is red coloured and we could dry it easily in an open place in sunlight.'

'We used to have skin abrasions on our inner thighs with the old cloths, but not anymore with the falalin.' (Shah, Nair et al. 2013)

Girls using falalin cloths reported the fewest (0.32) adverse quality of life issues (e.g. absent from school, skin abrasions), whereas girls using old cloths reported the highest (4.78). When the study ended, 68% of adolescent girls preferred falalin cloths, while 32% of girls preferred sanitary pads (Shah, Nair et al. 2013). None of the study subjects preferred old cloths.

Outcome 2: Findings from relevant studies

As found among included studies, relevant studies found that adolescent girls most often used cloth as a menstrual absorbent. Among adolescent secondary schoolgirls in India, 42.5% used old cloth pieces, 40% used both cloth pieces and sanitary pads, 11.25% girls used sanitary pads, and 6.25% girls used new cloth pieces (Dasgupta and Sarkar 2008). A different study in rural India among girls aged 15-19 years irrespective of educational status found that of 69.0% girls used cloth and 31.0% used sanitary napkins (Kansal, Singh et al. 2016). Secondary schoolgirls in South Africa most commonly used cloth (55%) followed by sanitary pads (37%), hand towels (26%) and newspaper (2%) (Ramathuba 2015). Only one study among schoolgirls in Ethiopia found commercial sanitary pads to be girls' primary MHM material: sanitary pads (49.18%), underwear (37.8%) and homemade pads (17.88%) (Gultie, Hailu et al. 2014).

Good menstrual hygiene is significantly associated with socioeconomic status, according to findings from India. Girls in higher economic classes maintained more menstrual hygiene practices than girls in the middle and lower classes (Kansal, Singh et al. 2016). One commonly used indicator of menstrual hygiene practice is the use of commercial sanitary pads or new cloth pads. Drying reused cloth out of sight and hiding it in unhygienic places can be problematic (Kansal, Singh et al. 2016). Although girls use cloth more often than sanitary pads, using cloth as a menstrual absorbent is not ideal. Girls report that cloth leaks and causes chafing (McMahon, Winch et al. 2011).

One reason why use of sanitary napkins may be low is that girls in relevant studies also reported issues accessing sanitary pads that can be expensive. Girls in rural Ghana could only access cloth for menstrual protection and walked long distances to school; as a result, three in four girls reported soiling garments during their last menstrual cycle (Dolan, Ryus et al. 2014). Though disposable sanitary pads are often available in peri-urban Ghana, girls there reported difficult access. Since few parents provided sanitary pads, girls would save their own money or engage in transactional sex (Dolan, Ryus et al. 2014). In India, adolescent girls were shy and uncomfortable buying sanitary napkins from the market or shops run by men (Kothari 2010, Kansal, Singh et al. 2016).

Managing menstrual hygiene was particularly challenging in the school environment. The potential for accidental leaks, soiling one's uniform, or menstrual odours caused stress among schoolgirls and interfered

with academic performance and concentration (Sommer 2010, Sommer 2013, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014). A lack of water and private sanitation facilities on school grounds caused further stress and anxiety for students, occasionally leading to school absenteeism (Sommer 2009, Dolan, Ryus et al. 2014, Gultie, Hailu et al. 2014). For girls living in boarding school facilities with minimal privacy, washing and drying cloth in secret was a particular challenge (Sommer 2013). Whilst Ghana's Ministry of Education has a policy that schools have sanitary pads available for emergencies, no schools visited by Dolan et al. had supplies available (2014).

4.5 Outcome 3: Knowledge of puberty

In this section, we explicitly separate out findings relating to puberty as opposed to menarche and/or menstruation. It is notable that across the included and relevant studies, far fewer (3/15 included and 7/44 relevant studies) deal with puberty more broadly than with menstruation. Studies (included and relevant combined) included nine outcome measures on knowledge of puberty:

1. breast enlargement
2. hip growth
3. pubic hair
4. average age at puberty
5. source of puberty knowledge
6. preferred source of puberty knowledge
7. 'normal' pubertal development
8. time between puberty and menarche
9. self identification as 'knowledgeable' about puberty.

Outcome 3: Findings from included studies

A study from Nigeria reported attitudes of mothers towards teaching their daughters about a variety of SRH issues. Most mothers (88.6%) agreed that adolescent girls should be informed about body changes at puberty (10.6% were undecided and 0.8% disagreed) (Iliyasu, Aliyu et al. 2012). In mothers' narratives about discussions with their daughters, issues of puberty were bound up with issues relating to appearance, dress, use of cosmetics, courtship, and sexuality and sexual behaviour.

Only one study, from Turkey, provided unambiguous definition of what the authors defined as 'normal' puberty development: breast development at ages 8-13 years; time from breast development to menarche of 2-4 years (Isguven, Yoruk et al. 2015). In this study, using a survey of

schoolgirls, there was no statistically significant relationship between the mother's education level and the level of knowledge of the student about pubertal development; three quarters (75.2%) of girls self-identified as being knowledgeable about puberty. When asked about the first symptom of puberty, girls reported: breast development (23.9%); pubic and axillary hair (23.4%); acne (31.5%); and I don't know (21.3%). More than half (50.7%) of girls reported that they did not know the average time period between the beginning of puberty and menarche and nearly a quarter (24.5%) did not know the average length of a menstrual cycle.

A study from Iran evaluated the effect of educational program about puberty health on female school student's knowledge using a pre-post test questionnaire. The mean [undefined] knowledge level among intermediate students was 5.03 ± 3.7 before intervention and 10.8 ± 4.8 after intervention. Among high school students, the mean [undefined] knowledge scores were 4.1 ± 2.3 pre-intervention and 8.7 ± 3.8 post-intervention. Both groups were reported by the authors to have experienced a significant difference between pre- and post-intervention results ($p < 0.001$). The absence of any detail about either the content of the educational programme or the ways in which the knowledge scores were developed, makes interpretation of this study difficult. The authors note that for reasons of shame and modesty, pre-pubertal girls tend not to discuss issues of puberty with their mother, and they suggest that school is the most appropriate source of puberty education.

Outcome 3: Findings from relevant studies

Like the included studies, the relevant studies showed low levels of knowledge about puberty. Whilst we did not assess quality, the studies included in this outcome were generally lacking. Many lacked information about how they assessed knowledge, what knowledge they assessed, and the significance levels. In India, a descriptive cross-sectional questionnaire-based survey of 521 secondary schoolgirls aged 10-19 years observed that levels of knowledge about puberty were: good (18.04%); moderate/some knowledge (60.65%); and very poor (21.31%) (Ray, Ghosh et al. 2011). The authors do not provide any detailed information on the construction of these response category groupings.

In Pakistan, Shaikh and Rahim assessed knowledge of puberty by simply asking male and female respondents whether they had ever heard or discussed the theme

'bodily changes during puberty' (2006). Whilst 58% of girls reported that they had heard or discussed this theme, the phrasing and vague nature of this question make it difficult to assess girls' actual knowledge of puberty. A study from Iran used a questionnaire to elicit information on a range of domains, including knowledge about puberty physiology amongst male and female high school students (Malek, Shafiee-Kandjani et al. 2012). The authors founds significant difference between boys and girls' puberty physiology knowledge (6.35 ± 0.063 vs. 5.10 ± 0.059 , $p = 0.000$) and summarised that 38% of boys had high level of knowledge about puberty physiology compared to 23% of girls. The content of the questions on puberty physiology were not reported.

A study of in- and out-of-school girls aged 16-19 years in Tanzania contributes qualitative knowledge, concluding that 'A significant gap in puberty information was revealed through analysis of girls' puberty questions, menstrual narratives, and the curriculum design activities. Although the primary and secondary school national curricula include topics on reproduction, sexual health and menstruation, girls' lacked and eagerly sought (from the researchers) knowledge about pubertal body change. The range of anonymous puberty questions that girls submitted to the researchers revealed the pragmatic nature of the information girls are seeking' (Sommer 2009). Examples of some of the puberty-questions asked anonymously by participants include:

- Why do some bleed for five days and others for three days?
- Having vaginal discharge (white, watery, like milk, heavy, from a vagina)? Is it a disease?
- Why do most of youth during adolescent age they cannot control their feelings or their emotions?

In addition to descriptive studies, several studies measured changes in knowledge after implementing educational interventions. An intervention study from India evaluated the effectiveness of an education programme on the knowledge of adolescent girls aged 14-19 years (Mallechappa, Krishna et al. 2011). The education package developed in consultation with parents, teachers and adolescent girls. It was organized in six sessions, each session lasting for two hours on six consecutive days. The programme included a didactic lecture by one of the educators followed by interactive sessions. Audio visual aids such as power point presentation using LCD projector, video films, charts, posters were used. Using a pre-post test design, the authors found significant ($p < 0.05$)

improvements in knowledge about physical development during puberty (breasts, hips, pubic hair).

A relevant intervention study from India used a pre-post test design to evaluate an education intervention among female unmarried adolescents aged 17-19 years (Ravishankar 2011). The authors do not report significance levels. They show (pre vs. post) true/false responses to knowledge statements: 'If a girl does not attain puberty at the age 14, she may be having biological problems' True (68.0 vs. 72.5) and 'Puberty start between 10-15 years in boys': True (29.0 vs 26.7). It is unclear on what evidence the statement regarding female puberty by age 14 as an indicator of biological problems is based.

In Bangladesh, researchers assessed the impact of a SRH information booklet on knowledge using a quasi-experimental pre-post test design (Tasnim, Rahman et al. 2009). The test questions are not included in the article, making it difficult to determine how researchers measured knowledge. Furthermore, the authors do not report significance levels. Despite these weaknesses, the study is rather unique in that it asks both sexes' knowledge of puberty changes in both boys and girls. The authors reported that whilst girls were initially more ignorant of physical changes than boys, girls made 'significant' improvements their knowledge between pre-test and post-test: increase of height and weight (30.6% vs. 59.4%); change in body curve (7.2% vs. 54.9%); menstruation (62.9% vs. 70%); and increase in breast size (13.7% vs. 57.2%) (Tasnim, Rahman et al. 2009).

4.6 Outcome 4: Attitudes, myths and/or perceptions about menstruation

Attitudes, myths and/or perceptions about menstruation directly impact the ways in which adolescent girls learn about and experience menstruation as well as the ways in which they practice menstrual hygiene. Studies (5 included and 18 relevant) included eight outcome measures on menstrual attitudes, myths and/or perceptions:

1. myths/taboo about menstruation in general/ menstrual blood/disposal of absorbents
2. menstrual Attitude Scale
3. beliefs about behaviour during menstruation
4. perceptions about menstrual blood
5. adolescent Menstrual Attitude Questionnaire
6. feelings about menstruation (secrecy/shame/fear)
7. physiological process
8. fertility.

Outcome 4: Findings from included studies

Included studies falling under this outcome addressed fear, shame, secrecy, sexual vulnerability, positive/negative attitudes, and sociocultural constraints rooted in myths and taboos. Sexual maturity and menstruation are also perceived as signs that girls are now mature, adult women who experience sexual attraction and can become pregnant (Mason, Nyothach et al. 2013). Yet, girls also recognise an increased vulnerability that accompanies these changes. Mason et al. note that Kenyan girls perceive pubescent, menstruating girls to be increasingly vulnerable to marriage, sexual advances and abuse. Qualitative insights illustrate these potential risks associated with puberty and menstruation:

'They (men) see that, as in, they see your breasts are enlarging, (laughter) pimples appear on your face, and hair also grows on pubic area, hips broadening, and so you are mature to marry.'

'There are some [fathers] if you tell them will say you are now mature and they can even rape you if you don't have your mother around.' (Kenya) (Mason, Nyothach et al. 2013)

This idea of menstruation and puberty as a time of increased vulnerability is also expressed through myths and taboos imposed upon girls to restrict their behaviours during menstruation. Girls' diets, movements, and behaviours may be vulnerable to cultural beliefs and practices not rooted in evidence. A study in India reported that 17% of girls asked researchers questions about menstruation that researchers later classified as myths and taboos (Chothe, Khubchandani et al. 2014). Girls questioned sociocultural restrictions (e.g. restrictions on touching anything; restrictions on visiting temples; restrictions on eating hot spicy foods, pickles, onions, and potatoes) and the reasoning behind them.

In a context where menstruating girls perceive themselves at increased risk of marriage, sexual abuse, and restrictions, it comes as no surprise that many girls fear menstruation and seek to conceal it. Whilst girls sought to conceal their menstrual status from males and even their mothers, secrecy around menstruation was of utmost importance for schoolgirls. The potential for leaks that could stain clothing and thus 'out' a menstruating girl in front of her classmates and teachers was a risk some schoolgirls were unwilling to take. As reported by a parent in Kenya, the fear and shame associated with menstruation results in school absenteeism:

'Most of the girls do not go to school during their monthly periods, because as Luo's we still cling to the past. We cannot buy our children proper materials for managing their menses even a cotton wool. We tell them to wear old pieces of clothes instead. They then become fearful and feel that when they get up the clothes might come out and so her classmates or the teachers might laugh at her, so much embarrassments make them not to go to school during their periods.' (P1 Parent FGD 1)' (Mason, Nyothach et al. 2013)

The only studies to directly measure girls' attitudes towards menstruation occurred in Bangladesh and Mexico. Upon reaching menarche in Bangladesh, adolescent girls felt mainly scared (64%), surprised (9%), good (2%), confused (2%), and shameful (4%); 19% of girls did not remember how they felt (Bosch, Hutter et al. 2008). Using the Adolescent Menstrual Attitude Questionnaire to measure girls' attitudes towards menstruation, Márvan et al. found that Mexican schoolgirls were significantly ($p < 0.0001$) more likely to have negative feelings (mean score = 2.77, S.D. = 0.73) or feelings of secrecy (mean score = 2.69, S.D. = 0.87) about menstruation than they were to have positive feelings (mean score = 1.97, S.D. = 0.76) (Marván and Molina-Abolnik 2012). Girls who were more knowledgeable and felt prepared for menstruation felt less negative and secretive about menstruation; increased feelings of preparedness were also directly associated with increased positive feelings about menstruation. Additionally, positive feelings about menstruation were associated with late maturers (i.e. girls who experienced menarche later than the norm) (Marván and Alcalá-Herrera 2014).

Outcome 4: Findings from relevant studies

Relevant studies complemented many of the themes discussed among included studies, such as fear, shame, secrecy, and sexual maturity. Puberty and menstruation mark girls' transition into womanhood. Qualitative findings from Tanzania indicate that some girls may view these changes positively:

'[Rural in-school Girl#1] I am happy and I'm worried because sometimes when I'm menstruating, I might have a lot of blood coming out, so I'm worried, and sometimes I'm happy because the young ones respect me.'
'[Rural in-school Girl#2] I feel happy/good when I see my body is changing, for example, I see myself I have become attractive.' (Sommer 2010)

At the same time, this transition to womanhood can cause shame, as indicated by qualitative evidence from Brazil:

'Menstruation was important, but I was ashamed. The day that it came for me, was strange, as I was talking to my mother, she had never talked to me about it. It came in the morning, and I was talking to my mother only at night, but just because I could not stand it, it was hard! I knew because I would read the books, only it was different, whatever! Wow! I was dying of shame, it is only my mother and I have no women at home. As I have no contact with my mother it is very difficult, I think if I had more freedom, talking with her more would be easier. My father was just looking at me and said, 'my daughter is growing.' At home, it is my father and three brothers. It gives me a lot of shame (S11, 16).'' (da Silva Bretas, Tadini et al. 2012)

For other girls, menarche is viewed as a fearful event, since menarche is perceived to indicate a girl's new sexual status (McMahon, Winch et al. 2011). If menarche comes at an age perceived as 'too early' or if menstrual cycles are irregular, the consequences can cause greater distress. Menstruating girls may be accused of premarital sex, as some parents incorrectly believe that menarche or irregular menstruation is a sign/consequence of sexual activity (Sommer 2009, Sommer, Ackatia-Armah et al. 2015).

Examining girls' perceptions about menstruation reveals significant knowledge gaps. Among 550 Nigerian girls in secondary school, only 39.3% perceived menstruation to be a normal physiological process; the rest perceived menstruation as assured fertility (36.4%), the release of bad blood (28.4%), cleansing of the womb (26.9%), and washing off of an undeveloped baby (17.8%) (Adinma and Adinma 2008). While more girls in Ethiopia and India correctly perceived menstruation to be a physiological process, 9.7% of Ethiopian girls and 6.25% of Indian girls perceived it to be a curse from god (Dasgupta and Sarkar 2008, Upashe, Tekelab et al. 2015). The Indian secondary school girls in this study also perceived menstruation as a disease (5%) and the result of some sin (5%) (Dasgupta and Sarkar 2008).

One possible reason for these knowledge gaps is that discussing menstruation with mothers and teachers is taboo in certain settings (Sommer 2009, Sommer, Ackatia-Armah et al. 2015). For girls and mothers able to overcome that taboo on discussing menstruation, new taboos may arise:

'I had no knowledge about menstruation and when I first saw it, I thought it was sickness. I was very shy and kept it to myself. My mother got to know about it later and

was annoyed because she says according to our culture if I cook while menstruating I will die. She taught me to use cloth but warned me not to be telling people about my menses and to be wary of boys.' (Ghana) (Dolan, Ryus et al. 2014)

4.7 Outcome 5: Experiences of menstruation/puberty

Experiences of menstruation and puberty warrant consideration in this RER because they shed light on how un/under/prepared adolescents were before experiencing menarche and puberty. Adolescents' experiences also tell us about their needs for knowledge of menstruation and puberty. The majority of included studies (11/15) and about half of relevant studies (23/44) included at least one outcome measure related to the experience of menstruation/puberty. Studies (included and relevant studies combined) included a wide range of 16 outcome measures on experiences of menstruation/puberty, many of them negative:

1. age at menarche
2. flow duration
3. experience of dysmenorrhoea/menstrual pain/premenstrual syndrome (PMS)
4. cycle length
5. remedies for menstrual pain/pain management strategies
6. school absenteeism/impact at school
7. limitations to daily activities/practice of restrictions (eating, sleeping, resting, religious, visiting others, participation in household activities)
8. dysmenorrhoeic Knowledge Scale
9. dysmenorrhoeic Self-Care Behaviours Scale
10. garment soiling
11. psychological experiences and emotions (anxiety, fear, shame, stigma, confusion)
12. self-reported changes at menarche
13. feelings at menarche
14. discussion (with others) about menstrual-related problems
15. menarche: knew what was happening/knew what to do/preparation for menarche
16. issues related to privacy (or lack).

Many studies included self-reports of the timing/age at menarche and physiologic factors such as flow duration, cycle length, etc., but only presented these data descriptively (for example, Adinma and Adinma 2009).

Dependent upon the socio-cultural context, some surveys asked questions about what girls can and cannot do whilst menstruating. A study from Nepal, for instance, found that 70.7% of girls reported that girls cannot go to school and that 100% reported that girls cannot cook during their period (Adhikari, Kadel et al. 2007). Generating evidence about socio-cultural norms, including restriction, relating to menstruation is critical to inform the design and content of appropriate interventions (House, Mahon et al. 2012).

Studies revealed a wide range of socio-cultural practices related to menstruation, reflecting their context. What these studies reveal in Table 3 are the pervasive ways in which – in some contexts – the experience of menstruation impacts on girls' daily lives.

Outcome 5: Findings from included studies

Affective aspects of menarche and menstruation were reported by many studies. A study from Mexico that grouped girls according to their age at menarche into 'early/average/late maturers' found significant differences in the reporting of emotional responses to menarche with late maturers significantly less likely to report being scared, sad, worried compared to early maturers, and significantly more likely to report being excited or happy (Marván and Alcalá-Herrera 2014). Late maturers were significantly less likely to report that they would have to keep their first period a secret. The early maturers group had the greatest percentage of participants who felt badly prepared [for menarche] and the lowest percentage of girls who felt well prepared. The authors describe the earlier maturers as experiencing a 'truncated preparation time to develop the resources and skills needed to cope [with menarche]' (Marván and Alcalá-Herrera 2014).

Many of the negative emotions related to menstruation were linked to issues of menstrual management, particularly linked to school:

'Even if I come to school I am embarrassed because at times I don't have what to use, or if I have cloths maybe I've not worn them properly or I've only worn my underwear so when I get up my dress is already soiled.' (Kenya) (Mason, Nyothach et al. 2013).

The need for secrecy was reported in many studies, both in terms of experiencing menarche and subsequent menstruation as well as its management. In some contexts, this need for secrecy is linked to socio-cultural norms to do with menstrual blood. For example, in a study from Kenya it was reported, 'Blood is something so

Table 4: Summary table of included studies

Country	Reported socio-cultural practice(s)
Nepal	Not sleeping in one's own house during first period (92.7%); spraying water if mistakenly touch someone whilst menstruating (91.3%); bathing on the third day of bleeding (96.0%); and eating outside the kitchen whilst menstruating (100%) (Adhikari, Kadel et al. 2007)
India	Restrictions on: any religious occasion (70.59%); marriage (10.29%); school (16.18%); playing (42.65%); household work (33.82%); and certain foods (50%)* (Dasgupta and Sarkar 2008) Dietary restrictions (20.7%) (Dongre, Deshmukh et al. 2007) Restrictions on entering religious sites, cooking, drawing potable water, and leaving home (Kothari 2010) 'Most girls reported that they abstain from going to holy places or touching things related to puja (worship)' (Kumar and Srivastava 2011)
Ethiopia	Activities restricted during menstruation (64.4%) (Gultie, Hailu et al. 2014)
Cambodia	Food restrictions (Sommer, Ackatia-Armah et al. 2015)
Brazil	<i>'The first period brought much fear. They say that virgin girls cannot eat certain foods, especially during menstruation, because menstruation can be delayed and sometimes rises to the head or many bad things happen. Sometimes I eat and I am afraid, because I met a girl that had it rise to her head, and when menstruation came, she was hospitalized. My mother always says that, during the period, we should not eat certain foods, the blood can rise to the head, for example, you cannot eat pineapple or suck lemon. I ate pineapple and sucked lemon and I ended up having a lot of cramping, then it was delayed, did not flow for me and I was frightened, very scared. I was very scared of having it go to my head. Nor can you walk barefoot on the cold ground. Now I'm being treated, I'm taking a medicine, because it gave me a shivering body, I feel a lot of cramping, I get nervous and lose my appetite.'</i> (da Silva Bretas, Tadini et al. 2012)

* Multiple responses permitted

secret that it is not recommended anyone to see,' (Mason, Nyothach et al. 2013).

In some studies, the socio-cultural context and norms relating to menstruation formed part of the intervention. For example, a menstrual education programme in Bangladesh included a component on 'hot or cold food affecting the menstrual cycle.' The post-test found the proportion of girls reporting that food temperature did not affect menses increased significantly from 65.5% to 86.1% ($p=0.001$) (Haque, Rahman et al. 2014). Another intervention on menstrual education in Iran found significant differences in the reporting of emotions (confusing/scared/uncomfortable/good) about menarche between the control and intervention groups (Djalalinia, Tehrani et al. 2012).

Outcome 5: Findings from relevant studies

Among a slightly older population in relevant studies, we see a subset of studies focused on issues related to dysmenorrhoea and descriptive physical problems (Kothari 2010, Ogunfowokan and Babatunde 2010, Nair, Leena et al. 2013, Sharanya 2014, Rani, Sharma et al. 2016). An intervention study from Taiwan evaluated the effects of health education on adolescents' dysmenorrhoea-related self-care, and found a significant increase in self-care behaviours in the intervention group (Chiou,

Wang et al. 2007). A study from Nigeria considered the relationship between receipt of pre-menarcheal education and reported experience of dysmenorrhoea (Adefuye, Oduşoga et al. 2010). The authors identified a significant relationship between pre-menarcheal education and 'better appreciation' of dysmenorrhoea ($p=0.00$), with girls with pre-menarcheal education reporting that they perceived dysmenorrhoea to be either a 'non-issue or at worse mild discomfort'. Studies also described reported remedies for dysmenorrhoea and/or menstrual pain (e.g. analgesics, non-pharmacologic remedies) (Adinma and Adinma 2008).

Many studies tended to focus only on the negative emotions associated with menarche. This focus may well reflect the way in which research instruments were designed. A study from India that recorded girls' self-reported reactions to menarche found that whilst over half (54.5%) reported that they were frightened and cried, a third reported 'feeling normal' (Kumar and Srivastava 2011). The sorts of language and words used by adolescents in relation to the experience of menstruation underscore the fraught nature of many adolescents' experiences, and include: shame, fear, embarrassment, terror, foreboding, insecurity, and confusion. Similarly, work from Tanzania and Brazil reveals the conflicting, but simultaneous positive

and negative feelings reported by adolescent girls about puberty and menstruation:

'I am happy and I'm worried because sometimes when I'm menstruating, I might have a lot of blood coming out, so I'm worried, and sometimes I'm happy because the young ones respect me.'

'I feel happy/good when I see my body is changing, for example, I see myself I have become attractive.'

'I am happy but also worried because [men] are disturbing me.' (Tanzania) (Sommer 2010)

'The day I started to get my menstruation, I truly felt bad and I was not happy at all. The first time I thought it was a disease and I couldn't tell anyone. It was my secret because I didn't understand what it was. And I felt so lonely to the extent that I wasn't happy. Truly, I didn't tell anyone.' (Tanzania) (Sommer 2009)

'When I had my first period, I was 11. I did not know what it was, I thought I was injured, I asked my grandmother what was happening, she did not answer.'

'Even my first menstruation was normal, my mother was there with me and gave me a pad and everything else I needed. I thought normal, a normal occurrence' (Brazil) (da Silva Bretas, Tadini et al. 2012).

Reflecting the preponderance of studies based on samples drawn from in-school adolescent girls, a dominant theme in many studies was the multiple ways in which experience of menstruation, and its management, was linked to school. A study from Ethiopia showed that 69.3% of adolescent girls reported that they did not 'feel comfortable' in school while menstruating and that menstruation interferes with school performance (40.9%) (Gultie, Hailu et al. 2014). A study from Ghana found that 95.2% of rural girls reported that menstruation meant ever having missed school compared to 20.2% of girls from peri-urban settings (Dolan, Ryus et al. 2014). Beyond school, studies from a wide range of settings included girls' reports of impacts on a wide range of daily activities. In Ghana, girls reported: being unable to play with other children (33.3%); remaining indoors (22.2%); and avoiding being around boys or men (35.4%) (Dolan, Ryus et al. 2014).

To minimise the impact of menstruation on school performance and self-confidence, an intervention study in Ghana used a combination of interventions (pads and/or education) (Dolan, Ryus et al. 2014). It found that subjective measures of shame, self-confidence and insecurity, had significantly greater changes in intervention sites with pads (as opposed to education only). School attendance in the pads and education intervention groups rose by 9%,

approximately six days per term out of a possible 65 days, or 18 out of 196 days per year compared to the control group that showed no significant difference in attendance between baseline and follow-up. The authors conclude that 'that the provision of sanitary care may mitigate menstruation-related anxiety' in school, and suggest that this might be associated with greater capacity of girls to engage in the classroom (as they are less worried about menstrual blood) (Dolan, Ryus et al. 2014). The intervention effects were consistent across rural and peri-urban sites, and the authors conclude that this might reflect low household spending priorities on sanitary products, irrespective of household wealth differences between rural and peri-urban sites (Dolan, Ryus et al. 2014).

4.8 Outcome 6: Sources of information about menstruation/puberty

Quality sources and information about menstruation and puberty can result in knowledgeable adolescents who are prepared for menarche and puberty. When the quality of sources and information is poor, it can lead to the reverse, leaving adolescents uninformed and even scared of the changes they are experiencing. This outcome is particularly relevant for this RER, as many of the included interventions incorporate MHM software interventions that rely on addressing deficits in knowledge of menstruation and management. Studies (10 included and 26 relevant) included nine outcome measures on sources of information about menstruation/puberty:

1. education/counselling prior to menarche
2. source of pre-menarchal counselling/education
3. preferred source of info/who 'should' be providing info
4. person with who menstruation most discussed (before and after menarche)
5. first source of knowledge about menstruation/ menstrual hygiene
6. media/adverts as sources of information
7. quality of teaching about menstruation
8. source of info about menstrual hygiene
9. gender of person providing info about menstruation.

In some studies, it is unclear on what basis the adolescent participants are making judgements about the quality of information about menstruation that they received. A study from Nepal that asked schoolgirls (n=150) whether they felt that they had been properly taught about menstruation reported that 98.0% of girls felt that they were not properly taught, although it is unclear how 'properly' was defined

by the researchers and understood by the respondents (Adhikari, Kadel et al. 2007).

Outcome 6: Findings from included studies

Most studies revealed that girls obtained information about menstruation and/or puberty directly from their mothers (Marván and Molina-Abolnik 2012, Shah, Nair et al. 2013, Isguven, Yoruk et al. 2015, Sharma, Negi et al. 2015). Mothers, however, were not girls' preferred source for learning about these topics. In Bangladesh, girls tended to avoid the taboo of discussing menstruation with their mothers (Bosch, Hutter et al. 2008). Some studies asked adolescents whom they thought should be teaching them. In Nepal, girls said they preferred learning from a course book (65.3%), teachers (10.7%), parents (6.6%), and all three sources (17.4%) (Adhikari, Kadel et al. 2007). In Turkey, when Isguven et al. asked students who should provide education about puberty, students reported: health professionals (54.4%), families (30.0%), teachers (5.9%), and don't know (9.7%) (2013). Students who had attained menarche were more likely to express a preference for receiving puberty education from health professionals compared to premenarcheal students (Isguven, Yoruk et al. 2015).

Whilst girls most often received information from females (e.g. mothers, sisters, friends, and female teachers), a few reported receiving information about menstruation and/or puberty from males (e.g. fathers, uncles, male teachers). Among schoolgirls in Kenya (n=120), one girl learned about menstruation from her uncle with whom she lived and others reported learning from male teachers in science class (Mason, Nyothach et al. 2013). Whilst Kenyan girls felt strongly about keeping menstruation secret from boys and men, girls who learned about menstruation from a male teacher did not perceive the experience negatively. In Turkey, only 0.8% of schoolgirls learned about puberty from their fathers, and most girls preferred to learn about puberty in female-only classes (Isguven, Yoruk et al. 2015).

Outcome 6: Findings from relevant studies

In a wide range of settings, from studies reporting quantitative survey responses, mothers were reported to be the main source of information about menstruation, including: Saudi Arabia (60.2%-56.7% of respondents) (Fetohy 2007); India (Dasgupta and Sarkar 2008) (Sharanya 2014, Rani, Sharma et al. 2016); Turkey (Cakir,

Mungan et al. 2007); Nigeria (Umeora and Egwuatu 2008); Iran (Fakhri, Hamzehgardeshi et al. 2012). In studies about problems related to menstruation, mothers were also cited as the main person with whom such problems were discussed in Nigeria (Adinma and Adinma 2008, Ogunfowokan and Babatunde 2010) and Malaysia (Wong and Khoo 2011). Some studies gave a response category of 'parents' making it impossible to separate out mother/father (Unni 2010, Ramathuba 2015).

Socio-cultural context appears to be important, however, with a study from Ghana reporting that 'most girls in our study had little or no knowledge of menstruation or the biological processes of maturation prior to the onset of menarche. They claimed that their families rarely discussed puberty and reproductive concerns with them, as social norms inhibited communication about and disclosure of menstrual status' (Dolan, Ryus et al. 2014). Girls in this study who had been told about menstruation prior to menarche 'reported being told little other than to notify a woman in their family (usually a mother, aunt or grandmother)'. A study conducted among schoolgirls in Ethiopia reported that 43.1% had received information about menstrual hygiene from a teacher (Mother: 22.96%; friend: 14.8%; media: 11.58%) (Gultie, Hailu et al. 2014). In the same study, when asked with whom they had discussed menstrual hygiene, 38.4% reported a friend compared to 8.7% with their mother. In another study of schoolgirls from Ethiopia, friends were reported by 67.8% of the sample as the source of information about menstruation (57% mass media; 50.3% teacher; 35.1% mother; 17.9% books; 6.2% other) (Upashe, Tekelab et al. 2015).

In some studies, when girls were asked about sources of pre-menarcheal information, substantial proportions reported no source of information, including: Nigeria (47.6%) (Adefuye, Odusoga et al. 2010); India (Dasgupta and Sarkar 2008). Sommer's qualitative work from Tanzania revealed 'the significant gap in girls' understandings of the bodily changes of puberty' and highlighted the need for 'credible and pragmatic information' (Sommer 2009).

A study from northern Nigeria reported girls' preferred source of information about menstruation and bodily changes separately, and found that whilst a parent was the preferred source of information about menstruation, parents and friends were preferred sources of information about bodily changes (Adeokun, Ricketts et al. 2009). In Nigeria, girls preferred to discuss menstruation and puberty with their mothers, followed by friends/classmates and lady doctors; girls found it less acceptable to receive

SRH education from health centre staff and teachers (Shaikh and Rahim 2006).

In some studies, classmates and friends were the most frequently reported source of information for menstrual advice (Kothari 2010, Ray, Ghosh et al. 2011). In a study from India 45% of girls reported that friends provided information to them about menstruation, compared to just 17% reporting their mothers (Dongre, Deshmukh et al. 2007). A comparative study from India revealed that sources of information were reported to be different dependent on place of residence, between residential and slum areas, with 80.4% reporting mother and 69.7% reporting friend/relative, respectively (Kumar and Srivastava 2011). Similarly in a study from Nigeria, 33.2% of girls reported that their friends/peers were the source of pre-menarcheal information (although 47.6% reported no information) (Adefuye, Odusoga et al. 2010).

Two studies focused explicitly on information about puberty (as opposed to menstruation and/puberty) (Ray, Ghosh et al. 2011, Mosavi, Babazadeh et al. 2014). A study from Iran explored the views and experiences of adolescent girls and selected adults about the provision of SRH (including puberty) information, and found that mothers and close relatives were the major source of information about puberty (whereas friends were the source of information about sex) (Mosavi, Babazadeh et al. 2014).

4.9 Included studies that evaluate interventions across any outcomes

Less than half of included studies (n=6) involved interventions addressing adolescent girls' knowledge of menstruation and/or puberty. Four intervention studies incorporated girl's knowledge of menstruation as a primary aim (Djalalinia, Tehrani et al. 2012, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Sharma, Negi et al. 2015). Two studies incorporated girls' knowledge of puberty as primary (Moodi, Zamanipour et al. 2013) and secondary (Djalalinia, Tehrani et al. 2012) aims. One intervention in India did not incorporate girls' knowledge of menstruation or puberty as aims; however, it met the RER inclusion

criteria and generated outcome data on menstrual hygiene practices (Kapadia-Kundu, Storey et al. 2014).

As evident in Table 4, all included intervention studies were published after 2011 and were conducted in Asia: India (n=3), Iran (n=2) and Bangladesh (n=1). Adolescent girls were the intervention recipients in all studies; however, Djalalinia et al.'s study in Iran also included household/family members and teachers as additional intervention recipients (2012). Two studies from India and Iran examined multiple interventions rather than single interventions (Djalalinia, Tehrani et al. 2012, Shah, Nair et al. 2013). Most intervention studies used a pre-post test design (n=4) (Moodi, Zamanipour et al. 2013, Shah, Nair et al. 2013, Haque, Rahman et al. 2014, Sharma, Negi et al. 2015). One used a cluster RCT design in India (Kapadia-Kundu, Storey et al. 2014), and one used a RCT-like design in Iran though it did not specify the particular design type (Djalalinia, Tehrani et al. 2012).

Regarding the nature of interventions, one study examined hardware interventions. This study in India introduced falalin cloths, followed by sanitary napkins, to girls who were using old cloth (Shah, Nair et al. 2013). The other five studies examined software interventions that introduced/changed girls' education as part of the intervention. The software intervention in Djalalinia et al.'s study in Iran also trained parents and teachers (2012).

To evaluate the interventions, all included studies collected quantitative intervention data; Shah et al. collected both quantitative and qualitative intervention data (2013). Based on this data, all intervention studies reported positive claims for the effects of their interventions on the outcomes relevant to girls' knowledge of puberty/menstruation (Table 4). Two studies noted enabling factors that benefited their studies. An educational intervention among adolescent girls in Bangladesh reported that recruiting female research assistants (RAs) helped participants feel more comfortable discussing menstruation (Haque, Rahman et al. 2014). In Iran, a community-based educational intervention benefited from mobilizing both parents and teachers as well as key stakeholders (Djalalinia, Tehrani et al. 2012).

Table 5: Included studies that evaluated an intervention

<p>Author, Year: (Djalalinia, Tehrani et al. 2012)</p> <p>Article Title: Parents or School Health Trainers, which of them is Appropriate for Menstrual Health Education?</p> <p>Country: Iran</p>			
Aim/ Objective	To compare different training sources for adolescents' menstrual health education		
Population	1,823 female middle school students aged 11-15 years from 15 middle schools in Tehran		
Age (Range/ Group/ Mean)	<p>Participants' ages ranged from 11-15 years</p> <p>Mean age of control group = 11.8 + 1.3 years</p> <p>Mean age of group trained by school health trainers = 11.65 + 0.51 years</p> <p>Mean age of group trained by parents = 11.62 + 0.59 years</p>		
Intervention	<p>The intervention involved menstrual health education (of which the content, duration and format are unclear).</p> <p>Students were allocated randomly to three groups: trained by parents, trained by schools' health trainers, and control (no training).</p>		
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • bath during menstruation • usual washing after toilet • use of sanitary pad or cotton as menstrual absorbent 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • feeling at first menstruation (confusing, scared, uncomfortable feeling, good feeling) • emotional change • appetite change • digestive disorders • headache, dizziness, and vomiting • menstrual pain 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • recommended source for information about menstruation
Literature/ Study Type	<p>Comparison of control and randomly allocated intervention groups</p> <p>Outcome assessment 2 years post-intervention</p>		
Evaluation (Yes/No)	<p>Yes. Researchers first conducted a survey on the menstrual health of participants. Participants were then randomized into three groups.</p> <p>Following a two-year training program, the adolescents' knowledge of puberty and menstrual health was assessed.</p>		
Summary of Main Findings	<p>Authors reported that negative psychological effects of menarche were lower in the groups that received the intervention. However, insufficient data were reported to calculate an effect size, and findings should be interpreted with caution in light of unclear attrition and analyses.</p> <p>The trained groups were more likely to take appropriate actions at menarche than controls, but this finding was not significant.</p>		
Intervention Claims	<p>Positive claims for the effects of the intervention on the outcomes.</p> <p>Menstrual health training from parents and teachers leads to better experiences of menarche and higher use of sanitary pads or cotton; however, based on their experience, the authors conclude that adolescents' health promotion is best addressed in school-based interventional programmes.</p>		
Reported Limitations	<p>Missing data values, particularly for questions that rely upon experience of menarche</p> <p>The 9-month school calendar used in this intervention is less than the 12-month minimum recommended by the mentoring field.</p>		

Author, Year: (Haque, Rahman et al. 2014) Article Title: The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh Country: Bangladesh			
Aim/ Objective	The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh		
Population	416 adolescent female students aged 11–16 years who were from three high schools (grades 6–8) and lived with their parents		
Age (Range/ Group/ Mean)	Participants' ages ranged from 11–16 years; of those, 52.4% of respondents were aged 11-13 years 15.4% were aged 11-12 years, 37.0% were aged 13 years, and 47.6% were aged 14+ years		
Intervention	Trained RAs delivered a 6-month menstrual hygiene educational intervention among schoolgirls. The training was delivered using a field manual in the Bangla language. Menstrual education focused on menstrual hygiene knowledge, beliefs and behaviours, menstrual disorders, and restrictions on menstruating adolescents. The educational materials were developed by an obstetrician/ gynaecologist and were culturally acceptable to the girls. RAs delivered twelve 45-min lessons once every 15 days. The RAs also used clean cloths and pads for demonstrations. Furthermore, 12 focus group discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other.		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • normal monthly duration of menstruation • poor menstrual hygiene predisposing to infection • hygienic practices preventing menstrual pain • menstrual blood being considered impure • proper sanitary products • cause of menstruation • origin of menstrual blood • age of normal cessation of menstruation • hot or cold food affecting the menstrual cycle • menstruation as indicating fertility (fecundity) • overall knowledge and beliefs (poor, medium, high) 	Menstrual hygiene practices <ul style="list-style-type: none"> • the absorbent used during menstruation • frequency of changing the absorbent each day • drying of the used absorbent • storing of washed clothes • methods of disposal of the used absorbent • cleaning of external genitalia • material used for cleaning of external genitalia 	Experiences of menstruation <ul style="list-style-type: none"> • regarding menstrual disorders experienced, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications • restrictions during menstruation, including: (1) visits to holy places; (2) visits to relatives, friends and neighbours; (3) participation in household activities; and (4) school attendance during menses • adolescent depression using the Children's Depression Inventory
Literature/ Study Type	Pre-post test		
Evaluation (Yes/No)	Yes. FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After 6 months of intervention, follow-up data were collected in the schools using the same questionnaire as at baseline regarding menstrual hygiene knowledge, beliefs and practices, types of complications, and restrictions on menstruating adolescents. RAs visited the homes of any students who were not available at school during the follow-up data collection..		
Summary of Main Findings	After health education, participants reported a significant improvement in 'high knowledge and beliefs' scores compared to baseline. Significant improvement was also observed in overall good menstrual practices, including improvements in using sanitary pads, frequency of changing pads/cloths per day, drying the used absorbent, methods of disposing of the used absorbent, and cleaning of genitalia. During the follow-up, the participants reported significant improvements in the regularity of their menstrual cycle and fewer complications during menstruation.		

<p>Author, Year: (Haque, Rahman et al. 2014)</p> <p>Article Title: The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh</p> <p>Country: Bangladesh</p>	
Intervention Claims	<p>Positive claims for the effects of the intervention on the outcomes.</p> <p>A school-based health education programme produced significant changes in girls' knowledge of menstruation, beliefs and practices of menstrual hygiene; however, the intervention did not lead to significant improvements in menstrual restrictions (e.g. visiting holy sites, doing household work), indicating the widespread nature of menstrual taboos and socio-cultural beliefs.</p>
Reported Limitations	<p>Data are based on self-reported outcomes that may differ from actual behaviour.</p> <p>Obtaining data on menstrual complications from participants rather than medical records might lead to bias.</p> <p>Dysmenorrhea was not assessed with a pain scale but rather with the report of any menstrual pain in the abdomen, groin, and lumbar regions.</p> <p>Despite attempts to standardise the intervention, environmental factors (e.g. abilities of RAs) may have affected the outcomes.</p>

<p>Author, Year: (Kapadia-Kundu, Storey et al. 2014)</p> <p>Article Title: Seeds of prevention: the impact on health behaviours of young adolescent girls in Uttar Pradesh, India, a cluster randomized control trial</p> <p>Country: India</p>	
Aim/ Objective	To describe the results of a school-based, randomized control cluster trial of the gateway moment concept in India, the Saloni pilot intervention, on the nutritional and hygiene practices and health outcomes of girls 11-14 years in Uttar Pradesh, India
Population	<p>1,200 adolescent girls aged 11-14 years in 30 rural government schools in Hardoi district, rural Uttar Pradesh</p> <p>At baseline, n = 595; at end-line, n = 601</p>
Age (Range/ Group/ Mean)	Specific age data not reported. Participants are aged 11-14 years.
Intervention	<p>The Saloni pilot intervention, implemented for one year, was designed as an addition to the existing government school health programme for adolescent girls (Saloni Swasth Kishori Yojna; SSKY). A prevention model that includes Sadharanikaran, an ancient Indian theory of communication, guided the development of the intervention, including the design of the teacher's manual and the Saloni diary. The 10 one-hour sessions were conducted monthly and promoted 19 behaviours: 5 health seeking behaviours, 6 nutrition behaviours, 3 reproductive health (RH) behaviours and 5 hygiene behaviours. Teachers were trained to encourage the girls to share what they learned with their parents after every session. Role-plays were used to demonstrate how to initiate Saloni discussions with parents. The intervention also used diaries to engage adolescent girls, articulate new social and behavioural norms and reinforce the daily practice of protective nutrition and hygiene behaviours.</p> <p>The intervention group = SSKY + pilot Saloni curriculum. The control group = SSKY only.</p>
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> changing cloth 3 times a day during menses
Literature/ Study Type	Cluster RCT
Evaluation (Yes/No)	Yes. The trial is a two-level, nested RCT with the unit of randomization being the block with 15 schools in the intervention arm and 15 schools in the control arm.

<p>Author, Year: (Kapadia-Kundu, Storey et al. 2014)</p> <p>Article Title: Seeds of prevention: the impact on health behaviours of young adolescent girls in Uttar Pradesh, India, a cluster randomized control trial</p> <p>Country: India</p>	
Summary of Main Findings	<p>The study provides evidence that school-based programs can produce concurrent changes in more than a dozen interrelated health behaviours. Girls in rural Uttar Pradesh primarily use 'cloth pieces' during menstruation rather than sanitary napkins. Girls should change their cloth pieces at least three times a day during menstruation, but constraints such as no toilets at school and lack of privacy at home often prevent them from doing so. Pre-intervention, 29.1% of girls in the intervention and 28.8% of girls in the control groups changed their cloth three times per day. Post-intervention, 35.1% of girls in the intervention and 18.1% of girls in the control groups changed their cloth three times per day ($p < .05$).</p>
Intervention Claims	<p>Positive claims for the effects of the intervention on the outcomes.</p> <p>School-based education programmes can produce change across multiple health issues.</p>
Reported Limitations	<p>The study's short timeframe did not permit measurement of long-term impact.</p> <p>Researchers could not measure the extent to which participants sustained behaviours beyond the intervention period.</p>

<p>Author, Year: (Moodi, Zamanipour et al. 2013)</p> <p>Article Title: Evaluating puberty health program effect on knowledge increase among female intermediate and high school students in Birjand, Iran</p> <p>Country: Iran</p>	
Aim/ Objective	To evaluate the effect of educational program for puberty health on improving intermediate and high school female students' knowledge in Birjand, Iran
Population	302 female intermediate ($n = 151$) and high school ($n = 151$) students were selected through randomized cluster sampling
Age (Range/ Group/ Mean)	Mean age = 12.9 ± 1.1 years
Intervention	Trained instructors taught all students identical educational content. The time of training in each class was designed in two 45-minute sessions. Students also received educational pamphlets about the required subject.
Outcomes	<p>Knowledge about puberty</p> <ul style="list-style-type: none"> mean score of knowledge about puberty health (with no specifics beyond that)
Literature/ Study Type	Quasi-experimental study using a questionnaire
Evaluation (Yes/No)	<p>Yes. Researchers evaluated the intervention using a pre-test and post-test. Data collection was conducted through a researcher-made questionnaire designed based on course objectives and included 20 one-score multi-choice questions for assessment of knowledge.</p> <p>A month after the intervention in each school, the questionnaires were distributed once again among the students and then collected for analysis.</p>
Summary of Main Findings	<p>The mean [undefined] knowledge level among intermediate students was 5.03 ± 3.7 before intervention and 10.8 ± 4.8 after intervention. Among high school students, the mean [undefined] knowledge scores were 4.1 ± 2.3 pre-intervention and 8.7 ± 3.8 post-intervention. Both groups experienced a significant difference between pre- and post-intervention results ($p < 0.001$).</p>
Intervention Claims	<p>Positive claims for the effects of the intervention on the outcomes.</p> <p>The intervention resulted in increased mean scores of knowledge about puberty.</p>
Reported Limitations	Unreported.

<p>Author, Year: (Shah, Nair et al. 2013)</p> <p>Article Title: Improving quality of life with new menstrual hygiene practices among adolescent tribal girls in rural Gujarat, India</p> <p>Country: India</p>				
Aim/ Objective	To study adolescent girls' knowledge regarding menstruation and menstrual practices; their quality of life; experience and satisfaction with three different kinds of menstrual pads (old cloths, a new soft cloth (falalin), and subsidized sanitary pads); and any differences in symptoms of reproductive tract infection using these three kinds of pads			
Population	164 unmarried post-menarchal adolescent girls (school-going and non-school-going) living in an under-privileged area in all eight project villages			
Age (Range/ Group/ Mean)	Mean age = 13.7 years			
Intervention	The intervention consisted of introducing falalin cloths, followed by sanitary napkins, among girls who were using old cloth at baseline. First, new falalin cloths (reused for three cycles) were offered to all girls for three months at a subsidized price through village-based accredited social health activists (ASHAs). Subsequently, sanitary pads were offered for another three months a subsidized price, also through the ASHAs. Programme supervisors visited the study villages monthly to ensure the intervention was being implemented as planned.			
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> knowledge related to menstruation (cause of pubertal changes, knowledge about menstruation before first menses, source of menstrual blood, path of urine and menstruation) 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> prevalence and quality of life issues among girls using old cloth at baseline and then using falalin cloths and sanitary pads each for three months (e.g. absent from school/work, skin abrasions, feel unclean, stains visible to others on absorbent pad while drying, spoils dress, feels comfortable, smells, drying problem) changes in use of three kinds of absorbent cloths/pads during the course of the study 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> menstrual restrictions response to lack of privacy 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> source of information about menstruation
Literature/ Study Type	Pre-post design			
Evaluation (Yes/No)	Yes. Survey data were collected at baseline and again three months after introducing each of the two kinds of absorbent pads.			
Summary of Main Findings	Both falalin cloths and sanitary pads were quickly shown to be acceptable to a large proportion of girls. Their use resulted in clear improvements in quality of life issues related to menstruation. Falalin cloth is preferable to sanitary pads because it is easily washable, reusable, soft, and has good absorbing capacity. Most importantly, falalin cloth is easily available at the community level at low cost and is environmentally friendly as it is disposed of easily by burning.			
Intervention Claims	<p>Positive claims for the effects of the intervention on the outcomes.</p> <p>Whilst falalin cloths and sanitary pads are both acceptable to adolescent girls, falalin cloths are preferable. Access to sanitary pads and falalin cloths should be scaled up and promoted in rural India.</p> <p>Falalin cloths provide an opportunity to improve menstrual hygiene, though additional research is required to assess its effectiveness.</p>			
Reported Limitations	Unreported.			

<p>Author, Year: (Sharma, Negi et al. 2015)</p> <p>Article Title: Menstrual hygiene among adolescent girls</p> <p>Country: India</p>				
Aim/ Objective	To assess knowledge and practice regarding menstrual hygiene before and after teaching program among adolescent girls			
Population	50 adolescent secondary school girls (n = 25 intervention; n = 25 control) studying in selected high school of Bhaniyawala Post, Dehradun District			
Age (Range/ Group/ Mean)	Mean age of participants = 13.88 + 1.5 years			
Intervention	The experimental group underwent an educational training programme on menstrual hygiene. The structured educational content was prepared after a thorough review and with the help of experts from nursing and medical professions			
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> • level of knowledge (test score) 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • frequency of changing sanitary pads • reusing cloth after washing • proper cleanliness of genitalia during menstruation • level of practice (score) 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • age at menarche • length of period (in days) • complaints during menstruation (dysmenorrhea, breast tenderness, both, none) 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • from whom girls received information about menstruation
Literature/ Study Type	'A true experimental study' that used a pre- and post-test questionnaire			
Evaluation (Yes/No)	Yes. Researchers administered a questionnaire on day one to collect pre-test data from both groups. They collected post-test from both groups 15 days after the intervention ended.			
Summary of Main Findings	Researchers note that the level of knowledge and practice regarding menstrual hygiene of subjects who participated in the educational program was significantly better than that of the control group.			
Intervention Claims	<p>Positive claims for the effects of the intervention on the outcomes.</p> <p>The menstrual hygiene educational programme effectively enhanced menstrual health and produced better knowledge and practice regarding menstrual hygiene.</p>			
Reported Limitations	Unreported.			

4.10 Relevant studies that evaluate interventions across any outcomes

We found 12 relevant intervention studies, all published since 2006, of which nine were school-based interventions (Table 5). Just one relevant intervention study was found for Africa (Dolan, Ryus et al. 2014), with a further four studies from India (Dongre, Deshmukh et al. 2007, Malleshappa, Krishna et al. 2011, Ravishankar 2011, Nair, Leena et al. 2013), two from Bangladesh (Tasnim, Rahman et al. 2009, Kabir, Saha et al. 2015), and studies from Turkey (Altundag and Calbayram 2016), Iran (Fakhri, Hamzehgardeshi et al. 2012), Saudi Arabia (Fetohy 2007), Taiwan (Chiou, Wang et al. 2007) and Nepal (Pokharel, Kulczycki et al. 2006).

One relevant intervention from Ghana incorporated both hardware (pads, underwear) and software (education) components and assessed the impact on a range of outcomes, including knowledge, school attendance and girls' subjective well-being (Dolan, Ryus et al. 2014). The experimental study design used three different treatments: hardware and software ('Pads and Ed'); software only ('Ed'); and no intervention. The five-month intervention found that school attendance rose in the two sites with 'pads and ed' by 9%, equivalent to 6 days per term. The study found no significant improvements in girls' feelings of shame, but did find significant ($p < 0.001$) improvements in girls' self-confidence and feelings of insecurity in sites with 'Pads and Ed', in both rural and peri-urban sites. This was the only relevant intervention study that used a treatment vs. control design. Seven studies used a pre-post design with no control, two used a post-only design with control,

and two were descriptive. Three studies incorporated qualitative formative evidence in the design of the intervention from a range of stakeholders (adolescent girls, parents, teachers, government officials) (Dongre, Deshmukh et al. 2007, Malleshappa, Krishna et al. 2011, Dolan, Ryus et al. 2014).

One school-based study from Turkey focused on girls with disabilities, and evaluated an intervention to improve menstrual hygiene practices using skills-based training on how to use and dispose of sanitary pads (Altundag and Calbayram 2016). One descriptive study from Nepal considered the extent to which standard school-based curricula and materials on sex education are covered (Pokharel, Kulczycki et al. 2006). The authors supplemented a survey of male and female students aged 12-19 with qualitative interviews with teachers, and concluded that standard sex education dealing with knowledge of reproductive biology and menstrual practices was poorly implemented.

The relevant intervention studies tended to focus on knowledge about menstruation rather than puberty. A quarter of relevant intervention studies included elements dealing with knowledge about puberty, with one study from Bangladesh (Tasnim, Rahman et al. 2009) and two from India (Malleshappa, Krishna et al. 2011, Ravishankar 2011). The majority of interventions focused solely on menstruation; knowledge about menstruation and/or menstrual hygiene practices (Chiou, Wang et al. 2007, Dongre, Deshmukh et al. 2007, Fetohy 2007, Fakhri, Hamzehgardeshi et al. 2012, Kabir, Saha et al. 2015, Altundag and Calbayram 2016).

Table 6: Relevant studies that evaluated an intervention

Author, Year: (Altundag and Calbayram 2016) Article Title: Teaching menstrual care skills to intellectually disabled female students Country: Turkey	
Aim/ Objective	To teach menstrual care skills, including pad replacement, to intellectually disabled adolescent female students who reached their age of menstruation
Population	77 female students at a special education high school, of which training given to 54 students with no attendance issues that agreed to take part in the study
Age (Range/ Group/ Mean)	Mean age was 15.14 + 0.90 years (range 13-17 years)
Intervention	Training in groups of 4-5 students. Training on: information on puberty and menstruation; how to use pads; cleaning habits specific to menstruation. Skills development: students observed pad replacement skills on a dummy (doll) and practised under observation.
Outcomes	Menstrual hygiene practices Pad replacement skills (e.g. puts wrapped sanitary napkin in plastic bag, places the sticky face of the sanitary napkin on the doll's underwear, washes the doll's hands)
Literature/ Study Type	One group pretest and post-test model. At pre-test stage, researchers observed students' pad replacement skills. Students then participated in a training and skill development stage. One month after the training (after waiting for the first menstrual cycle following baseline), researchers administered the pad replacement skills analysis to students.
Evaluation (Yes/No)	Yes
Summary of Main Findings	Pre- and post-training differences in following the steps of pad replacement were statistically significant ($p < 0.001$). Mean scores increased from 26.18 at pre-training to 35.09 at post-training.
Intervention Claims	Training significantly changed the scores of mentally disabled adolescents before and after training. The population improved their skills at all stages of skill building.
Reported Limitations	Unreported

Author, Year: (Chiou, Wang et al. 2007) Article Title: Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior Country: Taiwan	
Aim/ Objective	To evaluate the effects of systematic health education on female adolescents' knowledge of dysmenorrhea, menstrual attitudes, and dysmenorrhea-related self-care behaviours
Population	Female students at vocational nursing schools who had experienced dysmenorrheic cramps two or more times during the last 6 months
Age (Range/ Group/ Mean)	Whole sample ($15.73y \pm 0.39$) Experimental group ($n=218$; $15.74y \pm 0.36$). Control group ($n=237$; $15.72y \pm 0.42$)
Intervention	A three-session health education program. Each session lasted 50 minutes. Group education with 40–50 participants. Multiple teaching methods (lecture, discussion, experience sharing). A 'dysmenorrhea self-care pamphlet' was designed and distributed to participants. Intervention contents: knowledge of dysmenorrhea, menstrual attitudes, self-care skills for dysmenorrhea. Control group did not receive intervention; they received a pamphlet at the end of the study.

<p>Author, Year: (Chiou, Wang et al. 2007)</p> <p>Article Title: Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior</p> <p>Country: Taiwan</p>			
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> Dysmenorrheic knowledge scale (DKS) developed by the authors: 20 questions with yes/no answers 	<p>Attitudes, myths and/or perceptions about menstruation</p> <ul style="list-style-type: none"> Menstrual attitudes scale (MAS): 32 items with five dimensions, including menstruation as a debilitating event, menstruation as a bothersome event, menstruation as a natural event, anticipation and prediction of the onset of menstruation, and denial of any effect of menstruation. Scored on a 7-point Likert scale 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> Dysmenorrheic self-care behaviour scale (DSCBS): developed by the authors with 22 items. Each item scored on a 4-point Likert scale
Literature/ Study Type	Quasi-experimental intervention with a non-equivalent control group. Three vocational nursing schools: one intervention and two controls. group. Data collected before, 2 weeks post and 4 months post intervention		
Evaluation (Yes/No)	Yes		
Summary of Main Findings	A significant ($p < .001$) increase in the experimental group's DKS and DSCBS between pre- and 4 month tests. No significant increase in MAS for the experimental group.		
Intervention Claims	Health education could improve female adolescents' dysmenorrheic knowledge, but not attitudes (MAS).		
Reported Limitations	<p>Authors suggest that 'In future studies, the intervention design could provide the subjects with more time to share their experiences or discuss between the subjects and the researcher to enhance positive menstrual attitudes.'</p> <p>Authors acknowledge that during the pre-test, the menstrual attitudes of both the experiment and control group had been influenced by the questionnaire's content.</p>		

<p>Author, Year: (Dolan, Ryus et al. 2014)</p> <p>Article title: A blind spot in girls' education: menarche and its webs of exclusion in Ghana</p> <p>Country: Ghana</p>		
Aim/ Objective	To assess the impact of sanitary pads and puberty education on the school attendance and subjective well-being of post-pubertal girls.	
Population	Schoolgirls aged 12 years and older, irrespective of menstrual status ($n=120$) in 4 purposively selected sites (3 peri-urban; 1 rural). Rural site had no experience with sanitary pads prior to intervention. Peri-urban sites had some experience of sanitary pads.	
Age (Range/ Group/ Mean)	Girls aged 12 and above	
Intervention	<p>3 different treatments: 2 pads-with-puberty education (Pads+ Ed) villages and 1 puberty education-only (Ed-only) village, 1 control village.</p> <p>Puberty education based on Ghana Education Service curriculum + UNICEF 'Gender and Relationships' Programme (http://www.unicef.org/lifeskills/index_14927.html)</p> <p>Materials provided for pad element of intervention: sanitary pads, underwear, calendar, pencil, sharpener.</p>	
Outcomes	<p>Experiences of menstruation / puberty</p> <ul style="list-style-type: none"> School attendance (% of school days attended per term) 	<p>Attitudes, myths and/or perception about menstruation</p> <ul style="list-style-type: none"> Subjective measures of girl's shame, self-confidence, insecurity, and difficulty in concentrating at school

<p>Author, Year: (Dolan, Ryus et al. 2014)</p> <p>Article title: A blind spot in girls' education: menarche and its webs of exclusion in Ghana</p> <p>Country: Ghana</p>	
Literature/ Study Type	<p>Intervention preceded by formative evidence generation.</p> <p>Stage One: qualitative evidence generation of understandings of attitudes & practices surrounding girls' education, poverty and reproductive health</p> <p>Stage two: 5 month nonrandomised trial.</p>
Evaluation (Yes/No)	Yes
Summary of Main Findings	<p>School attendance rose in the Pads +Ed groups by 9% over the 5 month intervention. Attendance effects were consistent across pad sites. Control group showed no significant difference in attendance between baseline and follow-up.</p> <p>No significant improvement in feelings of shame. Significant improvement in self-confidence only for girls who received pads ($p<0.001$). Feeling insecure during period significantly decreased only in sites with pads ($p<0.001$).</p>
Intervention Claims	<p>Provisions for menstrual sanitary care (eg: privacy for changing, access to water and hygienic materials to manage menstruation) and exposure to puberty education has a positive effect on girls' school attendance and subjective well-being.</p> <p>The benefits of reliable sanitary care and puberty education were present in both rural and peri-urban sites, indicating that neither geography (distance to school), infrastructural (access to water) and/or socioeconomic (poverty) factors mitigate the positive effects of sanitary care.</p>
Reported Limitations	<p>No reported limitations.</p> <p>Article provides limited detail on the content of interventions: pad provision (type of pad eg: disposable; number of pads; pad-distribution mechanism. Underwear is also listed as one of the materials distributed, but no detailed info provided on this element. No info on the mode and frequency of the education component; limited info. on the education content.</p>

<p>Author, Year: (Dongre, Deshmukh et al. 2007)</p> <p>Article Title: The effect of community-based health education intervention on management of menstrual hygiene among rural Indian adolescent girls</p> <p>Country: India</p>			
Aim/ Objective	To study the effect of a community-based health education intervention on awareness and behaviour change of rural adolescent girls for management of menstrual hygiene.		
Population	Unmarried rural girls (2003: n=381; 2007 n=383) aged 12-19 years across 23 villages.		
Age (Range/ Group/ Mean)	12-19 years		
Intervention	Menstrual hygiene messages delivered at monthly meetings of village-based groups (Kishori Panchayat) of adolescent girls. Groups of n=12- 20 adolescent girls. Monthly health messages delivered by a female social worker or ANM. Number of monthly meetings not specified. At a later unspecified date girls who had received these monthly messages delivered the messaging themselves to other girls during quarterly meetings (number and frequency unspecified).		
Outcomes	<table border="0"> <tr> <td> <p>Knowledge of menstruation</p> <ul style="list-style-type: none"> Awareness of menstruation before onset </td><td> <p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> Type of absorbent (cloth / readymade); Following dietary restrictions; Cloth washing/ drying; wash reused cloth with soap/ powder/ Dettol; sun/ shade dry cloth </td></tr> </table>	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> Awareness of menstruation before onset 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> Type of absorbent (cloth / readymade); Following dietary restrictions; Cloth washing/ drying; wash reused cloth with soap/ powder/ Dettol; sun/ shade dry cloth
<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> Awareness of menstruation before onset 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> Type of absorbent (cloth / readymade); Following dietary restrictions; Cloth washing/ drying; wash reused cloth with soap/ powder/ Dettol; sun/ shade dry cloth 		

Author, Year: (Dongre, Deshmukh et al. 2007) Article Title: The effect of community-based health education intervention on management of menstrual hygiene among rural Indian adolescent girls Country: India		
Literature/ Study Type	Intervention preceded by a formative phase including development of health education material (pre-tested handmade flip book). Pre- and post- test survey of girls (after 3 years) survey. Qualitative data on perceptions of change generated from a subset of intervention participants. Selection criteria / refusal rates for post-test participants not given. Post-test subgroup asked for retrospective perceptions of change in practices (perceptions prior to intervention and current [3 years later] perceptions) by drawing a trend of perceived behaviour change.	
Evaluation (Yes/No)	Yes	
Summary of Main Findings	Significant changes in self-care behaviour and some knowledge items, but not in attitudes. Significant ($p<0.5$) increase in the proportion of girls: aware of menstruation prior to onset; and, proportion reporting use of readymade pads post-intervention. Significant ($p<0.5$) decrease in the proportion of girls reporting use of cloth for menstruation. No significant impact on dietary restrictions.	
Intervention Claims	Community-based participatory health education strategy could bring significant changes in awareness and behaviours of rural adolescent girls regarding hygienic management of menstrual periods	
Reported Limitations	'This was a small-scale study in one Primary Health Centre area. It needs to be tested at a larger scale to confirm the findings. In the present study, there may have been reporting biases, as the study focused on key behaviours that are difficult to verify objectively.'	

Author, Year: (Fakhri, Hamzehgardeshi et al. 2012) Article Title: Promoting menstrual health among Persian adolescent girls from low socioeconomic backgrounds: a quasi-experimental study Country: Iran		
Aim/ Objective	Effectiveness of a health promotion project on improving menstrual health in adolescent schoolgirls	
Population	N=698 high school post-menarchal students in urban and rural public high schools with low socio-economic status in Mazandarabn Province aged 14-18y (total); intervention n=349; control n=349)	
Age (Range/ Group/ Mean)	Range 14-18y; average age 15.7y, SD1.08y.	
Intervention	10 two-hour educational sessions on: the significance of adolescence, physical and emotional changes during adolescence, pubertal and menstruation health and premenstrual syndrome.	
Outcomes	Behaviours during menstruation • pad material used, daily use of a clean pad, number of pad replacements in 24 hours; pad changing at night / in school; remaining at home / not exercising during menstruation; school absence during menstruation; negative impact of menstruation on studying	Sources of information about menstruation
Literature/ Study Type	Quasi-experimental. Survey conducted post-intervention. No pre-test.	
Evaluation (Yes/No)	Yes	
Summary of Main Findings	'Menstrual health' (categories based on responses to a range of questions) significantly ($p=0.013$) better among intervention participants; intervention group significantly ($p=0.002$) more like to practise 'usual bathing' during menstruation. No intervention/ control data reported on sources of information about menstruation.	

<p>Author, Year: (Fakhri, Hamzehgardeshi et al. 2012)</p> <p>Article Title: Promoting menstrual health among Persian adolescent girls from low socioeconomic backgrounds: a quasi-experimental study</p> <p>Country: Iran</p>	
Intervention Claims	'The results showed a statistically significant difference between menstrual health of the experimental group compared with the control group, providing support for participation in adolescent health care programs'
Reported Limitations	None reported by authors

<p>Author, Year: (Fetohy 2007)</p> <p>Article Title: Impact of a health education program for secondary school Saudi girls about menstruation at Riyadh city</p> <p>Country: Saudi Arabia</p>			
Aim/ Objective	To assess the impact and suitability of menstrual education program (MEP) for 1st and 2nd graders		
Population	Students (n=248) at a girls' secondary school in Riyadh City		
Age (Range/ Group/ Mean)	60.5% aged 14-17; 39.5% aged 17+		
Intervention	One MEP session (120 minutes) delivered by school nurse, social workers and research using a lecture and discussion supported with posters, handouts and pamphlets*		
Outcomes	<p>Menstrual knowledge</p> <ul style="list-style-type: none"> Definition of menstruation, duration of menstruation, age of menarche, menopause, problems and pains associated with menses, causes of pain, methods of pain relieving. Abnormal menses, bathing during menses, perineal hygiene, types of pads, frequency of their changes, underwear and methods of cleaning. 	<p>Menstrual attitude scale</p> <ul style="list-style-type: none"> 22 statements measuring the latent construct of the children's attitude toward healthy and unhealthy practices during menstruation. Responses were designed as three points Likert- 	<p>Menstrual behaviours</p> <ul style="list-style-type: none"> 32 multiple choices items designed as (never, rarely, sometimes, always) assessing behaviours that are practiced by the students during menstruation (bathing and care of perineal pads and methods for managing any menstrual problems and type of food and drink used or avoided).
Literature/ Study Type	Post-test experimental-control study. School of intervention (and control) selected randomly from Riyadh government girls secondary schools. 6 classes randomly selected from 1st grade (3 intervention; 3 control) 4 classes selected randomly from 2nd grade (2 intervention; 2 control). Post-test conducted same day as intervention.		
Evaluation (Yes/No)	Yes		
Summary of Main Findings	No significant difference in sources of information about menstruation between control and intervention. Mean knowledge scores of intervention group significantly ($p < 0.001$) higher than control group. Menstrual attitudes and practices significantly ($p < 0.001$) higher for intervention than control.		
Intervention Claims	MEP can have positive effects on the menstrual knowledge, attitudes and practice of secondary school students.		
Reported Limitations	<p>Authors report no limitations.</p> <p>Unclear how claims about impact of the MEP on menstrual practice can be substantiated as post-test conducted same day as the intervention, leaving no time for menstrual practices to be enacted. Reader must assume that it is 'proposed' or 'planned' future menstrual practice.</p>		

* Covering: definition of menstruation, its source, age of menarche, menopause, duration of menstruation, problems and pain of menstruation, causes of pain, abnormal menstruation, what to do to relieve pain, washing during menses, type of pads, frequency of change, perineal hygiene, time of ovulation, life span of ovum, type of soap, normal secretion, underwear and methods of cleaning. Normal changes, herbal use, cold drink and ice-cream. Exercise during menses, dangerous behaviours during menses, salty food and methods used for hair removal. Pain relievers, aspirin use, when to contact doctor, healthy practice to relieve pain. Bad effect of stress, coffee, fatty and sugary diet. Benefit of vegetables and coconut. Types of food that should be given and that should be avoided during menses. Methods of treatment of complications.

Author, Year: (Kabir, Saha et al. 2015) Article Title: Female unmarried adolescents' knowledge on selected reproductive health issues in two low performing areas of Bangladesh: an evaluation study Country: Bangladesh	
Aim/ Objective	To evaluate the changes in knowledge of female unmarried adolescents on selected reproductive health issues
Population	Intervention delivered at the community level in two 'low performing' areas, one urban and one rural.
Age (Range/ Group/ Mean)	Evaluation participants currently unmarried females aged 12-19y
Intervention	Training of government service providers; dissemination of behaviour change materials; employment of community-based health promoters; community dramas; video shows
Outcomes	Menstrual hygiene practices Absorbent use (old cloths / clean and dry cloth / sanitary pad); cleaning (antiseptic liquid / hot water); abstain from eating meat/fish outside home; abstain from religious activities; take nutritious/good food.
Literature/ Study Type	Pre-post design; survey sample of female unmarried adolescents aged 12-19y selected independently at household level (max. 1 per household) for pre- and post-surveys.
Evaluation (Yes/No)	Yes
Summary of Main Findings	Significantly less inclined to use old cloths during menstruation at end-line compared to baseline [urban (77 vs. 49 %; $p < 0.001$) and rural (60 vs. 54 %; $p < 0.01$)]. Knowledge about use clean dry cloth during menstruation improved [urban (24 vs. 49 %; $p < 0.001$, rural (33 vs. 47 %; $p < 0.001$)]. Knowledge improved about use antiseptic liquid/hot water for washing during menstruation [rural (14 vs. 30 %; $p < 0.001$), insignificant in urban].
Intervention Claims	Community-level intervention can increase adolescent knowledge about some aspects of menstrual behaviour.
Reported Limitations	From authors: No control group. Generalizability of findings to the wider population in Bangladesh or the region is unclear. Only quantitative analysis; use of both quantitative and qualitative methods would have enriched understanding of the context of issues, knowledge and perceptions.

Author, Year: (Malleshappa, Krishna et al. 2011) Article Title: Knowledge and attitude about reproductive health among rural adolescent girls in Kuppam mandal: An intervention study Country: India	
Aim/ Objective	To determine the effectiveness of a reproductive health education intervention programme in improving the knowledge of adolescent girls aged 14-19y
Population	656 girls in the age group of 14-19 years were randomly selected from 3 high schools (class X) & 3 intermediate colleges(class XI & XII)
Age (Range/ Group/ Mean)	15-19 years; mean 16.68y.
Intervention	Education package* developed in consultation with parents, teachers & adolescents was used to educate the girls. A health education programme was organized in 6 daily 2hr sessions, on consecutive days. Included a didactic lecture followed by interactive sessions. Audio visual aids.

Author, Year: (Malleshappa, Krishna et al. 2011) Article Title: Knowledge and attitude about reproductive health among rural adolescent girls in Kuppam mandal: An intervention study Country: India			
Outcomes	Knowledge about menstruation Usual age of first menses; usual interval between two menstrual cycles.	Knowledge on menstrual hygiene Sanitary napkin/clean cloth should be used during menses and also changed regularly.	Knowledge of puberty Breasts enlarge in puberty; hips broaden in puberty; pubic hair grows in puberty.
Literature/ Study Type	Pre-post test using a 50 item structured questionnaire. Post-test immediately after intervention. Stratified cluster sampling; students stratified on the basis of the year (class X, XI, XII). Each division in a stratum was taken as a cluster. A cluster of 40 to 50 students was found to be feasible for intervention. Of the 22 clusters, 15 clusters were randomly selected and a total of 656 students were included in the study.		
Evaluation (Yes/No)	Yes		
Summary of Main Findings	Knowledge about puberty improved significantly post-intervention ($p<0.005$). Knowledge about ovulation improved (49.5% vs. 96.1%, $p<0.001$). Knowledge on menstruation & menstrual hygiene improved significantly (78.3% vs 96.4% and 92.5% vs. 98.9%, respectively, $p<0.005$)		
Intervention Claims	'Remarkable improvement was seen with relation to knowledge of participants about puberty, menstrual cycle...This study suggest that reproductive health education by health professionals can improve the knowledge and perceptions of adolescent girls especially in rural areas.'		
Reported Limitations	From authors: Sample size		

* The contents included anatomy and physiology of male and female reproductive system, physical and psychological changes during puberty, adolescence, conception and contraception, STDs including HIV/AIDS, using a simple language and culture sensitive terms.

Author, Year: (Nair, Leena et al. 2013) Article Title: ARSH 8: Family Life Education and Counseling: A School Based Model Country: India	
Aim/ Objective	To provide class-based family life education
Population	Secondary school students
Age (Range/ Group/ Mean)	Total sample n=2781, of which 64% were girls and 77.6% aged 16 and above
Intervention	To design a guidebook '101 questions' based on frequently asked questions by adolescents
Outcomes	Numbers of children who have received family life education and counselling classes
Literature/ Study Type	Descriptive
Evaluation (Yes/No)	No
Summary of Main Findings	'It is easier to target girl students in the school because both teachers and students take reproductive health issue particularly, menstruation and problems associated with it as an immediate felt need.'

Author, Year: (Nair, Leena et al. 2013)	
Article Title: ARSH 8: Family Life Education and Counseling: A School Based Model	
Country: India	
Intervention Claims	'the service component could be modified and implemented in a manner acceptable to the students and their teachers and the same could be a model for other parts of India.'
Reported Limitations	None reported by authors.

Author, Year: (Pokharel, Kulozycki et al. 2006)	
Article Title: School-Based Sex Education in Western Nepal: Uncomfortable for Both Teachers and Students	
Country: Nepal	
Aim/ Objective	To identify the extent to which sex education material (from the textbook Health, Population and Environment) is covered in classes in private or government schools in urban or rural areas
Population	N=451 8th and 9th grade students (174 female, 277 male) aged 12-19
Age (Range/ Group/ Mean)	12-19
Intervention	Standard school sex and reproductive health education
Outcomes	<div>Knowledge of reproductive biology No detail provided</div> <div>Knowledge of menstrual practices (girls only) No detail provided</div>
Literature/ Study Type	Mixed methods, descriptive. Qualitative interviews (n=8) with teacher responsible for implementing sex education in each of 8 schools. Survey questionnaire of 8th and 9th grade school students selected from 8 schools using systematic random sampling. Schools sampled using stratified random sampling by electoral constituency.
Evaluation (Yes/No)	Yes
Summary of Main Findings	'Sex education is being poorly implemented in all eight secondary schools sampled. The quality of sex and reproductive health education was found to be poor because of inadequate preparation of teachers, lack of adequate teaching materials and lack of school and community support for teachers to provide this instruction. Emphasis only given to presenting anatomical facts, while other issues are dealt with in a rapid and cursory manner, if at all. Findings revealed a judgmental attitude among teachers, which posed a critical barrier'
Intervention Claims	'the recent introduction of school-based sex education has contributed little thus far to improving reproductive and sexual health knowledge among youth'
Reported Limitations	None reported by authors.

Author, Year: (Ravishankar 2011)	
Article Title: Development and Evaluation of an Intervention to Meet the Reproductive Health Needs of Adolescents in India: A Randomized Controlled Trial	
Country: India	
Aim/ Objective	To improve the knowledge on sexual and reproductive health issues among adolescents and to strengthen adolescents' capacity to become an active player in advocating for open discussion on adolescent sexuality.

Author, Year: (Ravishankar 2011) Article Title: Development and Evaluation of an Intervention to Meet the Reproductive Health Needs of Adolescents in India: A Randomized Controlled Trial Country: India			
Population	Rural unmarried female adolescents		
Age (Range/ Group/ Mean)	Median age 17.6y		
Intervention	<ul style="list-style-type: none"> 4 day training programme for 20 volunteers on adolescent issues and problems, including reproductive health, and mediation skills. village-level team intervention provided SRH info*, services and referrals at 2-day weekend community sessions to adolescents. 2 health camps for adolescents, including: advice on menstrual cleanliness, including identification of cloth users, who were given 'special attention' with regards to menstrual hygiene practices. Sanitary napkins were distributed free of cost (no info on the scale and sustainability of this distribution) 		
Outcomes	Knowledge on puberty <ul style="list-style-type: none"> If a girl does not attain puberty at the age 14, she may be having biological problems / The excessive bleeding during menstruation is an indication of poor reproductive health of a woman / the ovum is usually released around 14th day from menstruation / Puberty start between 10-15 years in boys 	Knowledge on menstruation <ul style="list-style-type: none"> Views on menstruation / knowledge on age at start menstruation / knowledge on length of menstruation cycle / knowledge on duration of menstrual cycle 	Menstrual hygiene practices <ul style="list-style-type: none"> Hygienic measures usually taken during menstruation period (wash the secret parts) / Action taken when feel discomfort during periods / number of times take bathing during menstruation / currently practising of pads / frequency of pad changing / reuse of pad next cycle / number of times pad re-use / method of cloth cleaning
Literature/ Study Type	Pre-post test. Two villages purposively selected. Simple random sample of n=279 unmarried female adolescents drawn from two villages. Evaluation done after 6 months of interventions with a sample of n=120 adolescents		
Evaluation (Yes/No)	Yes		
Summary of Main Findings	No significant levels provided. Descriptive pre-post percentage distribution across a range of knowledge (puberty and menstruation) and practice (menstruation) measures		
Intervention Claims	'these programs have changed the adolescent girls' perception, attitude and behaviour on puberty and menstrual issues. A significant positive shift in all aspects with particular improvement in the areas of menstrual cleanliness'		
Reported Limitations	None reported by authors.		

* SRH info included: body changes, puberty, menstruation, secondary sex characteristics, masturbation, night emissions, sexual intercourse, assertiveness, decision-making and negotiation skills, value clarification, and inter-personal communication

Author, Year: (Tasnim, Rahman et al. 2009) Article Title: Talking about sexuality at secondary schools of periurban area of Dhaka city Country: Bangladesh		
Aim/ Objective	To determine the effect of introducing an education booklet on reproductive health knowledge among the adolescents and its acceptability to them	
Population	1,490 students of grades IX and X in eight secondary schools (both boys and girls schools) of periurban location of Dhaka city 862 students were in the pre-test group (45.9% boys and 54.2% girls), and 628 students were in the post-test group (50.6% boys and 49.4% girls)	
Age (Range/ Group/ Mean)	Unreported	
Intervention	Researchers developed a reproductive health information booklet in consultation with health professionals, parents, teachers, representatives of organisations working with adolescents, and adolescents. Researchers conducted a participatory health education session using the booklet for 1.5-2 hours. Booklets were then distributed to students to read at home.	
Outcomes	Knowledge on puberty <ul style="list-style-type: none"> • knowledge of puberty changes in boys (e.g. change of voice, night emission) • knowledge of puberty changes in girls (e.g. change in body curve, increase in breast size) 	Knowledge on menstruation <ul style="list-style-type: none"> • knowledge of menstruation (e.g. duration of menstrual cycle)
Literature/ Study Type	Quasi-experimental pre-post test Following the pre-test, students participated in a 1-2 hour health education session and received a health information booklet. Two months later, students who received the booklet completed the post-test using a structured questionnaire.	
Evaluation (Yes/No)	Yes	
Summary of Main Findings	A greater proportion of adolescents could correctly narrate the physiological changes of adolescence, duration of menstrual cycle, fertile period, leucorrhoea, masturbation, and night emission in the post test. Though the pre-test revealed that girls were more ignorant than boys of physical changes during adolescence, the post-test revealed significant improvements. Despite these improvements, the mean knowledge score at post-test was under 70%.	
Intervention Claims	'Providing reproductive health information to adolescents can be sustained through inclusion in school curriculum and has the potential to produce health benefits in future. The majority of students found the language of the booklets to be easy and the illustrations to be meaningful'	
Reported Limitations	'Personal communication with the students was very short, as the training session lasted only 1-2 hours. Students then took the booklets home, where there is a possibility they did not read it or could not seek clarification. It is possible that students answered the post-test questions based on pre-existing knowledge or information they remembered from the training session rather than the booklet's content.'	

4.11 Relevant systematic reviews

The search identified three relevant systematic reviews (Table 6), all of which were published since 2012, reflecting the relatively recent interest in menstruation as a research and/or intervention topic in LMICs. Across all three systematic reviews, included studies were heterogeneous with associated risks of bias, and the overall low quality of the majority of included studies was notable. Two reviews included menstruating females of all ages (Hennegan and Montgomery 2016) (Sumpter and Torondel 2013) and one focused on adolescent girls in India (van Eijk, Sivakami et al. 2016).

A systematic review of whether MHM interventions (both hardware and software) improve a range of outcomes (education, employment, psychosocial) for women and girls in LMICs found insufficient evidence to determine MHM intervention effectiveness, although the authors note 'some positive indicators' (Hennegan and Montgomery 2016). A moderate but non-significant standardised mean difference was found for two studies (Montgomery, Ryus et al. 2012, Wilson, Reeve et al. 2014) assessing the impact of sanitary pad provision on school attendance: 0.49 (95%CI -0.13, 1.11). Software interventions were generally found to improve knowledge of menstruation, with trials of education interventions reporting positive impacts on menstrual knowledge and practices.

A systematic review of the effects of MHM on health and psycho-social outcomes concluded that the effect of poor MHM remains unclear (Sumpter and Torondel 2013). Meta-analysis of a subset of studies found no association between confirmed bacterial vaginosis and MHM (OR: 1.07, 95% CI: 0.52–2.24). The authors concluded that although there was good evidence that educational interventions can improve MHM practices and reduce social restrictions there was no quantitative evidence that improvements in management methods reduce school absenteeism. They conclude that 'it appears likely that education programs have some effect on preparation for menstruation and can improve menstrual practices in at least some groups of girls: most likely those already in education.' Further, that the reviewed studies 'do not currently allow us to understand

the ways in which existing methods of MHM impact on women and girl's health or freedoms or the extent to which improving menstrual management would improve lives'.

A systematic review focused on adolescent girls in India described the status of MHM, and provides a detailed descriptive overview of a range of outcomes, including: awareness of menarche; source of information on MHM; MHM absorbents used; restrictions during menstruation; and school absenteeism (van Eijk, Sivakami et al. 2016). As the authors conclude, the value of this review is the collation of evidence that might be relevant for future MHM intervention design in India.

In terms of future research, the systematic reviews highlighted a range of issues:

- Future trials must evaluate potential harms of interventions, particularly consequences of 'outing' menstruating girls in contexts with high levels of stigma associated with menstruation (Hennegan and Montgomery 2016).
- Mediators and moderators of effects need to be identified (eg: distribution of reusable absorbents may not be effective in the absence of improvements to WASH (Hennegan and Montgomery 2016).
- Absorbent sustainability, acceptability, comfort, and risk of reproductive tract infections must all be considered when selecting sanitary products appropriate for interventions (Hennegan and Montgomery 2016).
- Future trials should seek to use validated measures of psychosocial constructs and measures of women's wellbeing specific to, or which include, MHM – adapted to LMIC contexts. (Hennegan and Montgomery 2016)
- Studies are needed on the impact of MHM on adult women, and potential WASH interventions (Hennegan and Montgomery 2016)
- Need for combined – hardware and software – interventions with evaluation (Sumpter and Torondel 2013)
- Research that includes both in- and out- of school girls (Sumpter and Torondel 2013)

Table 7: Relevant systematic reviews identified by the search

<p>Author (Year): (Hennegan and Montgomery 2016)</p> <p>Article Title: Do Menstrual Hygiene Management Interventions Improve Education and Psychosocial Outcomes for Women and Girls in Low and Middle Income Countries? A Systematic Review</p> <p>Setting: LMICs</p>		
Inclusion criteria: study design	<ul style="list-style-type: none"> • Individually and cluster RCTs • Non-randomised controlled trials and controlled before-after studies 	
Inclusion criteria: population	Menstruating females from LMICs	
Intervention(s)	<p>Hardware interventions.</p> <ol style="list-style-type: none"> 1. The provision of clean absorbents/sanitary products (disposable or reusable), 2. Improved WASH or girl-friendly facilities. <p>Studies could include any number of these aspects where authors' hypothesised that the intervention was sufficient to improve MHM practices:</p> <ol style="list-style-type: none"> a. Improved clean water supply for menstruation management (e.g., access to water within latrine or private areas); b. Provision of soap or disinfectant for body and absorbent cleaning; c. Improved absorbent disposal facilities; d. Improvements to latrine privacy or safety. 	<p>Software interventions.</p> <p>Interventions that delivered sufficient education to provide an understanding of the biological process of menstruation (e.g., the cyclic nature of menses, origin of menstrual blood), and which authors hypothesised was sufficient to improve either MHM practices or misconceptions and confusion. Information could be provided in person or via printed or electronic resources.</p>
Outcomes	<p>Primary outcomes.</p> <p><i>Education.</i> School attendance (full or partial days) from school records or self-reported.</p> <p><i>Employment.</i> Self- or employer-reported attendance/absenteeism (full or partial days).</p> <p><i>Psychosocial Outcomes.</i> Outcomes were derived from qualitative literature identifying psycho-social consequences of poor MHM and included; anxiety, confusion, depression, embarrassment, emotional distress, fear, powerlessness, self-confidence, self-efficacy, shame, stigma, worry, and self-imposed withdrawal from activities such as playing sport. Externally enforced restrictions (e.g., not attending religious ceremonies) were not eligible outcomes as interventions were not hypothesised to impact such traditions.</p>	<p>Secondary outcomes.</p> <p><i>Education.</i> Academic achievement and school engagement.</p> <p><i>Employment.</i> Measures of productivity, engagement, and worker satisfaction.</p> <p><i>Psychosocial outcomes.</i> Other measures of attitudes related to menstruation.</p> <p><i>Menstrual knowledge and management.</i> Knowledge of menstruation and improved management practices.</p>
Countries included in systematic review items	Iran (3 studies), Saudi Arabia, Zimbabwe, Ghana, Nepal, and Kenya	
Summary of included studies	<p>Eight studies described in ten citations.</p> <p>Studies were highly heterogeneous in design and context.</p> <p>Six included assessment of education-only interventions, and three provided assessment of the provision of different types of sanitary products (menstrual cups, disposable sanitary pads, and reusable sanitary pads).</p>	

<p>Author (Year): (Sumpter and Torondel 2013)</p> <p>Article Title: A systematic review of the health and social effects of menstrual hygiene management</p> <p>Setting: LMICs</p>	
Inclusion criteria: study design	Experimental, observational and qualitative studies but excluding economic analyses, systematic reviews, project reports, policy analysis and other commentary. Purely descriptive studies, for example those focusing only on proportion of women using various management methods but not associating these with health or social outcomes, were excluded.
Inclusion criteria: population	Menstruating females from LMICs
Intervention(s)	Menstrual management interventions eg: washing or drying of reusable pads, use of disposable cloth rags or other absorbents. Interventions aimed at reducing social restrictions or poor menstrual practices included educational interventions and pre-menarcheal training.
Outcomes	The extent to which menstruation or menstrual management were associated with health or social outcomes. Health outcomes: reproductive tract infections (including bacterial vaginosis and vulvo-vaginal candidiasis); other reproductive infections (secondary infertility); urinary tract infections; anaemia. Social outcomes: social restrictions (eg: limiting diet, interactions during menstruation); school absenteeism.
Countries included in systematic review items	Indian subcontinent (7/14); sub-Saharan Africa (Tanzania, Gambia, Nigeria); North Africa/Middle East (Iran, Turkey, Egypt); and China (1/14)
Summary of included studies	14 studies included. 11 health outcome studies were cross-sectional, two were case-control and one was a cross-over intervention. The intervention study employed a cross-over design where each woman was followed for four menstrual cycles and received sanitary pads during 2 cycles and employed traditional methods for the other 2 cycles. Menstrual management was rarely the primary focus of the research however and this resulted in a number of included studies that are only relevant to specific populations such as HSV-2 positive women; those currently using birth control or ever having used birth control; and those currently experiencing symptoms of RTI.

<p>Author (Year): (Sumpter and Torondel 2013)</p> <p>Article Title: A systematic review of the health and social effects of menstrual hygiene management</p> <p>Setting: LMICs</p>	
Inclusion criteria: study design	To assess the status of MHM among adolescent girls in India to determine unmet needs
Inclusion criteria: population	Adolescent girls (aged 10-19 years)
Intervention(s)	Not an inclusion criteria
Outcomes	Information on menarche awareness, type of absorbent used, disposal, hygiene, restrictions and school absenteeism was extracted from eligible materials; a quality score was applied.
Countries included in systematic review items	India

Author (Year): (Sumpter and Torondel 2013)	
Article Title: A systematic review of the health and social effects of menstrual hygiene management	
Setting: LMICs	
Summary of included studies	Data from 138 studies involving 193 subpopulations. In 88 studies, half of the girls reported being informed prior to menarche (PP 48%, 95% CI 43% to 53%, I ² 98.6%). Commercial pad use was more common among urban (PP 67%, 57% to 76%, I ² 99.3%, n=38) than rural girls (PP 32%, 25% to 38%, I ² 98.6%, n=56, p<0.0001), with use increasing over time (p<0.0001). Inappropriate disposal was common (PP 23%, 16% to 31%, I ² 99.0%, n=34). Menstruating girls experienced many restrictions, especially for religious activities (PP 0.77, 0.71 to 0.83, I ² 99.1%, n=67). A quarter (PP 24%, 19% to 30%, I ² 98.5%, n=64) reported missing school during periods. A lower prevalence of absenteeism was associated with higher commercial pad use in univariate (p=0.023) but not in multivariate analysis when adjusted for region (p=0.232, n=53). Approximately a third of girls changed their absorbents in school facilities (PP 37%, 29% to 46%, I ² 97.8%, n=17). Half of the girls' homes had a toilet (PP 51%, 36% to 67%, I ² 99.4%, n=21).

5 Discussion

As a field, menstruation is inadequately researched and understood, in particular evidence relating to the experiences of young adolescents who are likely to be pre-menarcheal or experiencing menarche. Why is this the case? Menstruation as a topic of investigation and/or intervention has only recently begun to emerge in the literature. Of the three relevant systematic reviews that we found, they were all published from 2013-2016. The published research lags behind the rise in interest from practitioners in education and/or health (Adams, Bartram et al. 2009, House, Mahon et al. 2012, UNESCO 2014, Haver and Long 2015) as well as the development (and evaluation) of interventions dealing with puberty and menstruation and its management such as Growing Up Smart (Rwanda: IRH 2015a, IRH 2015b); CycleSmart (Guatemala and Rwanda: IRH 2013a, IRH 2013b) and Choices (Nepal: IRH 2011). It is a nascent field, and the volume of evidence is out of step with the scale of the issues associated with puberty, menstruation and its management. The effect of poor MHM on physical health outcomes is unclear; a meta-analysis found no association between confirmed bacterial vaginosis and MHM (OR: 1.07, 95% CI: 0.52–2.24) (Sumpter and Torondel 2013). However, there is little evidence relating to young adolescents in this meta-analysis, and we do not know if this group might have different health consequences of poor MHM.

The issues covered in this RER are tightly connected with the influence of gender norms, inequities and inequalities. Early adolescence represents a critical transitional period during which gender norms can act in multiple ways to impact on adolescents' lives (Igras, Macieira et al. 2014). Although our RER included evidence from a wide range of LMIC contexts (socio-cultural, economic, geographic), one over-arching theme emerges: young adolescent girls are under-prepared for puberty and menstruation. This theme underscores the importance of understanding how young adolescents understand, manage, challenge, subvert and internalise gender norms. Our RER focused on young adolescents, but experiences and impacts of menstruation for other age groups are also poorly understood, such as the impact of MHM among adult women on a range of outcomes. This impact is

perhaps most neatly highlighted in the problems reported by some female teachers in LMICs in managing their own menstrual hygiene whilst at work; the issues facing the menstruating girls that they teach notwithstanding.

Consistent, evidence-based standards needed for data collection

Our RER includes studies with a very wide range of definitions of 'good' or 'bad' MHM; in some studies any definition of 'good' or 'bad' was absent, the descriptive terms were used. Research would benefit from the use of consistent standards, grounded in evidence, of what is 'acceptable' or 'appropriate' menstrual knowledge and/or MHM. The ways in which some of the (particularly survey) questions and response categories were phrased raises many questions about the ways in which menstruation research is framed and understood by people conducting the research. For example, research from Ethiopia asked schoolgirls a question about whether they 'knew that there was a foul smell during menstruation' (Upashe, Tekelab et al. 2015). The basis of this question, and the evidence it generates, is unclear.

Data more widely available for older adolescents than young adolescents

Our findings reveal that nearly three times as many studies assess the knowledge of older adolescents than assess the knowledge of younger adolescents. The paucity of evidence focused on younger adolescents may reflect, in part, the difficulties associated with researching this age group. Whilst many nationally representative surveys (e.g. DHS) now include unmarried 15-19 year olds in their sample, research and evidence is much less routinely collected. The absence of evidence may also reflect socio-cultural contexts in which discussion of menstruation with a pre-menarcheal girl is highly constrained, especially across generations. Many of the studies included in our RER, particularly qualitative studies, underscore the proscribed nature of talking about menstruation, even amongst close relatives or friends. Of course, just because something is contextually-proscribed does not mean that it cannot be researched; but it does make that research more challenging.

A focus on in-school adolescents overlooks out-of-school adolescents

The challenging nature of this topic and this age group for research is reflected in the high proportion of studies that are school-based; in-school adolescents are a more ‘accessible’ population for research. It does mean, however, that with some notable exceptions, we know very little of the experiences of out-of-school young adolescents. This lacuna becomes even more important if we assume – on the basis of the limited evidence available – that girls might be out of school for menstruation-related reasons. Either, she no longer attends school as a result of menarche (e.g. the assumption of a more adult role post-menarche), or she is periodically absent as a result of issues related to MHM. In some studies, girls reported a preference for learning about puberty and menstruation from health professionals or educational materials, suggesting a demand for factual information; such interventions would likely exclude out-of-school adolescents unless they were community-based rather than school-based. It is clear that there is room for substantial innovation in the delivery of puberty and menstruation education – for both girls and boys – including the use of technology and/or specialist peripatetic teachers (as opposed to usual teachers with little or no specialist training).

Inadequate knowledge of menstruation and puberty among early adolescent girls

Across countries, levels of knowledge about menstruation prior to menarche are low among early adolescents; as a result, girls report reaching menarche in fear (Bosch, Hutter et al. 2008). Yet, relevant studies generally reveal higher levels of knowledge among older, often post-menarcheal adolescents. The fact that knowledge levels tend to increase with time suggests that knowledge may also come from one’s own menstrual experiences and from motivation to better understand one’s lived experiences.

Whilst few studies address knowledge of menstruation among early adolescent girls, far fewer address knowledge of puberty. No studies address early sexual feelings, sexual development, sexuality, or related topics. These findings may reflect an elision by researchers and/or respondents of puberty with menstruation for girls. However, puberty is a broad set of changes, of which menstruation is one – albeit an important – component. Given that physical signs of pubertal growth (e.g. breasts, hips, hair) are more clearly obvious than menstruation, it is surprising that so little work deals with this issue in LMICs. It is also possible that

puberty is implicitly included in broader – but not defined as puberty – research about adolescent girls’ lives not picked up by our search.

Girls’ seek accurate, comprehensive sources of information about menstruation and puberty

Among included and relevant studies from a wide range of settings, adolescent girls reported that their main source of information about menstruation came from their mothers. Yet, many mothers themselves lack sufficient, accurate knowledge of menstruation. Moreover, it is taboo in certain settings to discuss menstruation even with one’s own mother or family (Bosch, Hutter et al. 2008, Dolan, Ryus et al. 2014). Due to factors such as these, it is hardly unsurprising that adolescent girls’ knowledge of menstruation and puberty is so low. With the exception of Nigeria, where girls’ preferred to discuss menstruation with their mothers/parents (Shaikh and Rahim 2006, Adekun, Ricketts et al. 2009), girls elsewhere prefer to receive information from course books, teachers, and health professionals (Adhikari, Kadel et al. 2007, Isguven, Yoruk et al. 2015).

Girls constrained from implementing MHM practices

Adolescent girls around the world struggle to implement MHM practices. In LMICs, effective MHM may require girls to compete for scarce resources (e.g. soap, water, money for proper absorbents) (Mason, Nyothach et al. 2013, Shah, Nair et al. 2013) or exchange sex (Mason, Nyothach et al. 2013), for example. The resources required for MHM are more easily obtained by girls in higher economic classes (Kansal, Singh et al. 2016). In addition to obtaining resources, menstrual stigma also limits girls’ abilities to practice MHM at home, where girls seek to conceal their menstrual status by hiding their cloths in unsanitary environments and washing in secrecy. At school, MHM is an even greater challenge.

Interventions for early adolescents are primarily limited to Asia

Whilst included studies evaluating early adolescents’ knowledge of menstruation and puberty come from eight LMICs across three world regions, included studies examining interventions are clustered in three Asian countries. Evidence from other world regions is notably lacking and warrants attention. Among relevant

intervention studies, only one was found for Africa that focused on girls aged 12 years and older (Dolan, Ryus et al. 2014). The most common interventions by far are software interventions that introduce or change girls' education of menstruation and/or puberty. All the studies reviewed, including those implementing a hardware intervention, suggest that interventions to improve young female adolescents' knowledge about puberty and menstruation in LMICs have largely positive effects.

This RER did not set out to assess intervention effectiveness or quality, but the intervention studies display striking variation. Several studies fail to include sufficient detail around the study design, intervention, evaluation, and results. This lack of information hinders efforts to draw firm conclusions and replicate the interventions. It is also worth noting that no studies examined the impact of the intervention's duration or dosage. Future intervention studies would benefit from employing more robust designs and reporting on interventions in sufficient detail.

Roles exist for boys and men

A limited number of studies included evidence from people other than adolescent girls (e.g. teachers, mothers, fathers); adolescent boys were rarely included in comparative studies. The important roles (colleague, peer, brother, father) played by men and boys in supporting girls and women in their MHM includes:

- 'To provide support at home or school when a girl faces her first period or a woman has an embarrassing or difficult experience
- As the head of the household who controls the finances, to ensure female family members can afford appropriate sanitary protection materials
- As a community member who can challenge taboos, social norms and stigma, and influence the attitudes of others (both male and female).

- As teachers or employers, ensuring that the school or work environment makes it easy for girls and women to manage menstruation with dignity.
- As professional engineers, social development specialists, managers or medical professionals, supporting programmes for improving the menstrual hygiene context for girls and women' (House, Mahon et al. 2012).

It is notable in our RER that studies that also included adolescent boys usually did not ask them questions about menstruation; these questions were often only asked of girls.

5.1 Relevant systematic reviews

Method limitations may have resulted in missed relevant items. More specifically, we would have missed items published in languages other than English and published outside of our time period. Since the searches were limited to six online databases, it is highly probable that we missed relevant grey literature. In addition, the possibility is high that we missed some relevant in-service reports that were not intended or prepared for wider circulation. As an under-researched field, but one that is of growing interest to public health practitioners, it is very likely that substantial additional evidence relating to menstruation knowledge and practice among adolescents exists in the unpublished or grey literature (IRH 2011, IRH 2013a, IRH 2013b, IRH 2015). As Sumpter et al. note, 'there is a strong possibility that the best knowledge lies in the hands of those implementing programs' (Sumpter and Torondel 2013). Finally, despite attempts to obtain missing literature directly from its authors, we were unable to retrieve two items for screening that may have been eligible for inclusion.

6 References

- Adams, J., Bartram, J., Chartier, Y. and Sims, J. (2009) *Water, sanitation and hygiene standards for schools in low-cost settings*. Geneva: WHO
- Adefuye, P.O., Odusoga, O.L., Adefuye, B.O. and Akindele, R.A. (2010) 'Age at menarche and menstrual pattern in secondary schoolgirls in Sagamu' *Nigerian Journal of Clinical Practice* 13(1): 109–113
- Adeokun, L.A., Ricketts, O.L., Ajuwon, A.J. and Ladipo, O.A. (2009) 'Sexual and reproductive health knowledge, behaviour and education needs of in-school adolescents in northern Nigeria' *African Journal of Reproductive Health* 13(4): 37–50
- Adhikari, P., Kadel, B., Dhungel, S.I. and Mandal, A. (2007) 'Knowledge and practice regarding menstrual hygiene in rural adolescent girls of Nepal' *Kathmandu University Medical Journal* 5(3): 382–386
- Adinma, E.D. and Adinma, J.I. (2008) 'Perceptions and practices on menstruation amongst Nigerian secondary school girls' *African Journal of Reproductive Health* 12(1): 74–83
- Adinma, E.D. and Adinma, J.I. (2009) 'Menstrual characteristics amongst south-eastern Nigerian adolescent school girls' *West African Journal of Medicine* 28(2): 110–113
- Altundag, S. and Calbayram, N.C. (2016) 'Teaching menstrual care skills to intellectually disabled female students' *Journal of Clinical Nursing* 25(13–14): 1962–1968
- Boonstra, D. (2015) 'Advancing sexuality education in developing countries: evidence and implications' *Guttmacher Policy Review* 14(3): 17–23
- Bosch, A.M., Hutter, I. and van Ginneken, J.K. (2008) 'Perceptions of adolescents and their mothers on reproductive and sexual development in Matlab, Bangladesh' *International Journal of Adolescent Medicine and Health* 20(3): 329–342
- Brooks-Gunn, J. (1987) 'The impact of puberty and sexual activity upon the health and education of adolescent girls and boys' *Peabody Journal of Education* 64(4): 88–112
- Cakir, M., Mungan, I., Karakas, T., Giriskan, I. and Okten, A. (2007) 'Menstrual pattern and common menstrual disorders among university students in Turkey' *Pediatrics International* 49(6): 938–942
- Chang, S.F. and Chuang, M.H. (2012) 'Factors that affect self-care behaviour of female high school students with dysmenorrhoea: a cluster sampling study' *International Journal of Nursing Practice* 18(2): 117–124
- Chiou, M.H., Wang, H.H. and Yang, Y.H. (2007) 'Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior' *Kaohsiung Journal of Medical Sciences* 23(4): 183–190
- Chothe, V., Khubchandani, J., Seabert, D., Asalkar, M., Rakshe, S., Firke, A., Midha, I. and Simmons, R. (2014) 'Students' perceptions and doubts about menstruation in developing countries: a case study from India' *Health Promotion Practice* 15(3): 319–326
- Cicurel, I. and Sharaby, R. (2007) 'Women in the menstruation huts: variations in preserving purification customs among Ethiopian immigrants' *Journal of Feminist Studies in Religion* 23(2): 69–84
- Connolly, S. and Sommer, M. (2013) 'Cambodian girls' recommendations for facilitating menstrual hygiene management in school' *Journal of Water Sanitation and Hygiene for Development* 3(4): 612–622
- Da Silva Bretas, J.R., Tadini, A.C., Dias de Freitas, M.J. and Goellner, M.B. (2012) 'Meaning of menarche according to adolescents' *Acta Paulista De Enfermagem* 25(2): 249–255
- Dasgupta, A. and Sarkar, M. (2008) 'Menstrual hygiene: how hygienic is the adolescent girl?' *Indian Journal of Community Medicine* 33(2): 77–80
- Djalalinia, S., Tehrani, F.R., Afzali, H.M., Hejazi, F. and Peykari, N. (2012) 'Parents or school health trainers, which of them is appropriate for menstrual health education?' *International Journal of Preventive Medicine* 3(9): 622–627
- Dolan, C.S., Ryus, C.R., Dopson, S., Montgomery, P. and Scott, L. (2014) 'A blind spot in girls' education: menarche and its webs of exclusion in Ghana' *Journal of International Development* 26(5): 643–657
- Dongre, A.R., Deshmukh, P.R. and Garg, B.S. (2007) 'The effect of community-based health education intervention on management of menstrual hygiene among rural Indian adolescent girls' *World Health & Population* 9(3): 48–54
- Fakhri, M., Hamzehgardeshi, Z., Hajikhani Golchin, N.A. and Komili, A. (2012) 'Promoting menstrual health among persian adolescent girls from low socioeconomic backgrounds: a quasi-experimental study' *BMC Public Health* 12: 193
- Fetohy, E.M. (2007) 'Impact of a health education program for secondary school Saudi girls about menstruation at Riyadh city' *Journal of the Egyptian Public Health Association* 82(1–2): 105–126

- Gultie, T., Hailu, D. and Workineh, Y. (2014) 'Age of menarche and knowledge about menstrual hygiene management among adolescent school girls in Amhara province, Ethiopia: implication to health care workers & school teachers' *PLoS One* 9(9): e108644
- Haque, S.E., Rahman, M., Itsuko, K., Mutahara, M. and Sakisaka, K. (2014) 'The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh' *BMJ Open* 4(7): e004607
- Haver, J. and Long, J.L. (2015) *Menstrual hygiene management operational guidelines*. London: Save the Children
- Hennegan, J. and Montgomery, P. (2016) 'Do menstrual hygiene management interventions improve education and psychosocial outcomes for women and girls in low and middle income countries? A systematic review' *PLoS One* 11(2): e0146985
- House, S., Mahon, T. and Cavill, S. (2012) *Menstrual hygiene matters: a resource for improving menstrual hygiene around the world*. London: WaterAid
- Igras, S.M., Macieira, M., Murphy, E. and Lundgren, R. (2014) 'Investing in very young adolescents' sexual and reproductive health' *Global Public Health* 9(5): 555–569
- Iliyasu, Z., Aliyu, M.H., Abubakar, I.S. and Galadanci, H.S. (2012) 'Sexual and reproductive health communication between mothers and their adolescent daughters in northern Nigeria' *Health Care for Women International* 33(2): 138–152
- IRH – Institute for Reproductive Health (2011) 'Utilizing participatory data collection methods to evaluate programs for very young adolescents: an evaluation of Save the Children's Choices Curriculum in Siraha, Nepal'. Washington DC: IRH, Georgetown University, for USAID.
- IRH (2013a) 'Developing the CycleSmart™ kit: Guatemala country report exploring the use of CycleBeads® and an informational brochure to increase fertility awareness among youth'. Washington DC: IRH, Georgetown University, for USAID.
- IRH (2013b) 'Rwanda CycleSmart study'. Washington DC: IRH, Georgetown University, for USAID.
- IRH (2015a) 'Grow Up Smart endline study report'. Washington DC: IRH, Georgetown University for USAID.
- IRH (2015b) 'Grow Up Smart: baseline study report'. Washington DC: IRH, Georgetown University for USAID.
- Isguven, P., Yoruk, G. and Cizmecioglu, F.M. (2015) 'Educational needs of adolescents regarding normal puberty and menstrual patterns' *Journal of Clinical Research in Pediatric Endocrinology* 7(4): 312–322
- Kabir, H., Saha, N. and Gazi, R. (2015) 'Female unmarried adolescents' knowledge on selected reproductive health issues in two low performing areas of Bangladesh: an evaluation study' *BMC Public Health* 15: 1262
- Kansal, S., Singh, S. and Kumar, A. (2016) 'Menstrual hygiene practices in context of schooling: a community study among rural adolescent girls in Varanasi' *Indian Journal of Community Medicine* 41(1): 39–44
- Kapadia-Kundu, N., Storey, D., Safi, B., Trivedi, G., Tupe, R. and Narayana, G. (2014) 'Seeds of prevention: the impact on health behaviors of young adolescent girls in Uttar Pradesh, India, a cluster randomized control trial' *Social Science & Medicine* 120: 169–179
- Kirk, J. and Sommer, M. (2006) *Menstruation and body awareness: linking girls' health with girls' education*. Special on Gender and Health. Amsterdam: KIT
- Kothari, B. (2010) 'Perception about menstruation: a study of rural Jaipur, Rajasthan' *Indian Anthropologist* 40(1): 43–54
- Kumar, A. and Srivastava, K. (2011) 'Cultural and social practices regarding menstruation among adolescent girls' *Social Work in Public Health* 26(6): 594–604
- Malek, A., Shafiee-Kandjani, A.R., Safaiyan, A. and Abbasi-Shokoochi, H. (2012) 'Sexual knowledge among high school students in northwestern Iran' *ISRN Pediatrics*: 645103–645103
- Malleshappa, K., Krishna, S. and Nandini, C. (2011) 'Knowledge and attitude about reproductive health among rural adolescent girls in Kuppam mandal: an intervention study' *Biomedical Research-India* 22(3): 305–310
- Marván, M.L. and Alcalá-Herrera, V. (2014) 'Age at menarche, reactions to menarche and attitudes towards menstruation among Mexican adolescent girls' *Journal of Pediatric and Adolescent Gynecology* 27(2): 61–66
- Marván, M.L. and Molina-Abolnik, M. (2012) 'Mexican adolescents' experience of menarche and attitudes toward menstruation: role of communication between mothers and daughters' *Journal of Pediatric Adolescent Gynecology* 25(6): 358–363
- Mason, L., Nyothach, E., Alexander, K., Odhiambo, F.O., Eleveld, A., Vulule, J., Rheingans, R., Laserson, K.F., Mohammed, A. and Phillips-Howard, P.A. (2013) 'We keep it secret so no one should know' – a qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural western Kenya' *PLoS One* 8(11): e79132
- McMahon, S.A., Winch, P.J., Caruso, B.A., Obure, A.F., Ogutu, E.A., Ochari, I.A. and Rheingans, R.D. (2011) 'The girl with her period is the one to hang her head'. Reflections on menstrual management among schoolgirls in rural Kenya' *BMC International Health and Human Rights* 11(1): 7
- MDWS – Ministry of Drinking Water and Sanitation (2015) *Menstrual hygiene management national guidelines*. New Delhi: MDWS
- Mmari, K., Gibbs, S., Moreau, C., Narango-Rivera, G., De Meyer, S., El-Gibaly, O., Al-Attar, G., Kabiru, C., Maina, B., Bello, B., Xia-yun, Z. and Chahua, L. (2016) 'Yea, I've grown; I can't go out anymore': perceived risks for girls and boys entering adolescence' *Culture, Health & Sexuality* 20(7): 787–798

- Montgomery, P., Ryus, C.R., Dolan, C.S., Dopson, S. and Scott, L.M. (2012) 'Sanitary pad interventions for girls' education in Ghana: a pilot study' *PLoS ONE* 7(10): e48274
- Moodi, M., Zamanipour, N., Sharifirad, G.-R. and Shahnazi, H. (2013) 'Evaluating puberty health program effect on knowledge increase among female intermediate and high school students in Birjand, Iran' *Journal of Education and Health Promotion* 2: 57
- Morabia, A., Costanza, M.C. and the World Health Organization Collaborative Study of Neoplasia and Steroid Contraceptives (1998) 'International variability in ages at menarche, first livebirth, and menopause' *American Journal of Epidemiology* 148(12): 1195–1205
- Moronkola, O.A. and Oyeibami, O. (2007) 'Age at menarche, menstrual patterns, sexual health knowledge, attitudes and premarital sexual partners of female athletes in Ibadan, Nigeria' *East African Journal of Public Health* 4(2): 51–54
- Mosavi, S.A., Babazadeh, R., Najmabadi, K.M. and Shariati, M. (2014) 'Assessing Iranian adolescent girls' needs for sexual and reproductive health information' *Journal of Adolescent Health* 55(1): 107–113
- Nair, M.K.C., Leena, M.L., Menon, P., George, B., Indira, M.S. and Russell, P.S.S. (2013) 'ARSH 8: family life education and counseling: a school based model' *Indian Journal of Pediatrics* 80: S234–S239
- Ogunfowokan, A.A. and Babatunde, O.A. (2010) 'Management of primary dysmenorrhea by school adolescents in ILE-IFE, Nigeria' *Journal of School Nursing* 26(2): 131–136
- Pokharel, S., Kulczycki, A. and Shakya, S. (2006) 'School-based sex education in western Nepal: uncomfortable for both teachers and students' *Reproductive Health Matters* 14(28): 156–161
- Ramathuba, D.U. (2015) 'Menstrual knowledge and practices of female adolescents in Vhembe district, Limpopo province, South Africa' *Curationis* 38(1): 1–6
- Rani, A., Sharma, M.K. and Singh, A. (2016) 'Practices and perceptions of adolescent girls regarding the impact of dysmenorrhea on their routine life: a comparative study in the urban, rural, and slum areas of Chandigarh' *International Journal of Adolescent Medicine and Health* 28(1): 3–9
- Ravishankar, A.K. (2011) 'Development and evaluation of an intervention to meet the reproductive health needs of adolescents in India: a randomized controlled trial' *Journal of Human Ecology* 34(3): 135–144
- Ray, S., Ghosh, T., Mondal, P.C., Basak, S., Alauddin, M., Choudhury, S.M. and Bisai, S. (2011) 'Knowledge and information on psychological, physiological and gynaecological problems among adolescent schoolgirls of eastern India' *Ethiopian Journal of Health Sciences* 21(3): 183–189
- Robinson, H. (2015) 'Chaupadi: the affliction of menses in Nepal' *International Journal of Women's Dermatology* 1(4): 193–194
- Seymour, K. (2012) *Bangladesh: tackling menstrual hygiene taboos. Sanitation and Hygiene Case Study 10*. New York: UNICEF
- Shah, S.P., Nair, R., Shah, P.P., Modi, D.K., Desai, S.A. and Desai, L. (2013) 'Improving quality of life with new menstrual hygiene practices among adolescent tribal girls in rural Gujarat, India' *Reproductive Health Matters* 21(41): 205–213
- Shaikh, B.T. and Rahim, S.T. (2006) 'Assessing knowledge, exploring needs: a reproductive health survey of adolescents and young adults in Pakistan' *European Journal of Contraception and Reproductive Health Care* 11(2): 132–137
- Sharanya, T. (2014) 'Reproductive health status and life skills of adolescent girls dwelling in slums in Chennai, India' *National Medical Journal of India* 27(6): 305–310
- Sharma, R., Negi, S., Kunj, D., Sharma, V. and Vardha (2015) 'Menstrual hygiene among adolescent girls' *Indian Journal of Community Health* 27(3): 376–380
- Sommer, M. (2009) 'Ideologies of sexuality, menstruation and risk: girls' experiences of puberty and schooling in northern Tanzania' *Culture, Health & Sexuality* 11(4): 383–398
- Sommer, M. (2010) 'Where the education system and women's bodies collide: the social and health impact of girls' experiences of menstruation and schooling in Tanzania' *Journal of Adolescence* 33(4): 521–529
- Sommer, M. (2013) 'Structural factors influencing menstruating school girls' health and well-being in Tanzania' *Compare: A Journal of Comparative and International Education* 43(3): 323–345
- Sommer, M., Ackatia-Armah, N., Connolly, S. and Smiles, D. (2015) 'A comparison of the menstruation and education experiences of girls in Tanzania, Ghana, Cambodia and Ethiopia' *Compare: A Journal of Comparative and International Education* 45(4): 589–609
- Sommer, M. and Sahin, M. (2013) 'Overcoming the taboo: advancing the global agenda for menstrual hygiene management for schoolgirls' *American Journal of Public Health* 103(9): 1556–1559
- Sommer, M., Vasquez, E., Worthington, N. and Sahin, M. (2013) *WASH in schools empowers girls' education*. Proceedings of the Menstrual Hygiene Management in Schools Virtual Conference 2012. New York: UNICEF and Columbia University
- Sumpter, C. and Torondel, B. (2013) 'A systematic review of the health and social effects of menstrual hygiene management' *PLoS One* 8(4): e62004
- Tasnim, S., Rahman, A. and Ara, I. (2009) 'Talking about sexuality at secondary schools of periurban area of Dhaka city' *International Journal of Adolescent Medical Health* 21(4): 601–608
- Thomas, F., Renaud, F., Benefice, E., de Meeüs, T. and Guégan, J. (2001) 'International variability of ages at menarche and menopause: patterns and main determinants' *Human Biology* 73(2): 271–290

- Um, L., Yusuf, N.W. and Musa, A.B. (2010) 'Menstruation and menstrual hygiene amongst adolescent school girls in Kano, northwestern Nigeria' *African Journal of Reproductive Health* 14(3): 201–207
- Umeora, O.U. and Egwuatu, V.E. (2008) 'Menstruation in rural Igbo women of south east Nigeria: attitudes, beliefs and practices' *African Journal of Reproductive Health* 12(1): 109–115
- UNAIDS – Joint United Nations Programme on HIV/AIDS (2004) *Seen but not heard: Very young adolescents aged 10-14 years*. Geneva: UNAIDS.
- UNESCO – United Nations Educational, Scientific and Cultural Organization (2014) *Puberty education & menstrual hygiene management. Good policy and practice in health education*. Paris: UNESCO.
- UNICEF – United Nations Children' Fund (2011) *The state of the world's children 2011: adolescence: an age of opportunity*. New York: UNICEF.
- Unni, J.C. (2010) 'Adolescent attitudes and relevance to family life education programs' *Indian Pediatrics* 47(2): 176–179
- Upashe, S.P., Tekelab, T. and Mekonnen, J. (2015) 'Assessment of knowledge and practice of menstrual hygiene among high school girls in Western Ethiopia' *BMC Women's Health* 15: 85
- Van Eijk, A.M., Sivakami, M., Thakkar, M.B., Bauman, A., Laserson, K.F., Coates, S. and Phillips-Howard, P.A. (2016) 'Menstrual hygiene management among adolescent girls in India: a systematic review and meta-analysis' *BMJ Open* 6(3)
- WHO – World Health Organization and UNICEF – United Nations Children's Fund (2013) *Progress on sanitation and drinking water – 2013 update*. Geneva: WHO.
- Wilson, E., Reeve, J. and Pitt, A. (2014) 'Education. Period. Developing an acceptable and replicable menstrual hygiene intervention' *Development in Practice* 24(1): 63–80
- Wong, L.P. and Khoo, E.M. (2011) 'Menstrual-related attitudes and symptoms among multi-racial Asian adolescent females' *International Journal of Behavioral Medicine* 18(3): 246–253
- Zegeye, D.T., Megabiaw, B. and Mulu, A. (2009) 'Age at menarche and the menstrual pattern of secondary school adolescents in northwest Ethiopia' *BMC Womens Health* 9: 29

7 Annexes

Appendix A: Search terms, their combinations and database application

All databases		All databases		All databases		All databases	
1. Adolescent Terms	AND	2. Puberty and Menstruation Terms	AND	3. Knowledge and Understanding Terms	AND	4. Intervention/ study type terms	
adolescen*		puberty		know*		arrangement*	
girl*		pubescen*		understand*		evaluat*	
teenage*		sexual maturity		manage*		initiative*	
youth*		catamenia		learn*		intervention*	
pre-adolescen*		menstrua*		apprehen*		model*	
		menarch*		comprehensi*		package*	
		mense*		educat*		pilot*	
				aware*		program*	
				familiar*		project*	
				proficien*		provision*	
						regime*	
						scheme*	
						strateg*	
						trial*	
						approach*	

* refers to truncated word roots in order to capture multiple derivations eg: adolescen* will capture adolescent, adolescents, adolescence, etc.

(adolescen* OR girl* OR teenage* OR youth* OR pre-adolescen*) AND (puberty OR pubescen* OR 'sexual maturity' OR menstrua* OR menarch* OR mense* OR catamenia) AND (know* OR understand* OR manage* OR learn* OR apprehen* OR comprehensi* OR educat* OR aware* OR familiar* OR proficien*) AND (arrangement* OR evaluat* OR initiative* OR intervention* OR model* OR package* OR pilot* OR program* OR project* OR provision* OR regime* OR scheme* OR strateg* OR trial* OR approach*)

Appendix B: Results of search term tests

We ran an expanded set of search term tests in order to develop the proposed final set of search terms. Below we summarise the findings of these test searches, including tests for words (period, maturity) subsequently excluded from our search terms as they returned high numbers of irrelevant items.

PubMed

Results for 1-3: 23,418 (limits = last 10 years, humans, English)

- * without the word 'period,: 2,943

- * without the words 'period' or 'maturity,: 2,503

Results for 1-4: 14,688 (limits = last 10 years, humans, English)

- * without the word 'period,: 1,610

- * without the words 'period' or 'maturity,: 1,356

ISI Web of Science

Results for 1-3: 60,546 (limits = last 10 years, English)

- * without the word 'period,: 10,528

- * without the words 'period' or 'maturity,: 8,655

Results for 1-4: 40,695 (limits = last 10 years, English)

- * without the word 'period,: 5,948

- * without the words 'period' or 'maturity,: 2,453

ScienceDirect

Results for 1-3: 43,815 (limits = last 10 years)

- * without the word 'period,: 18,191

- * without the words 'period' or 'maturity,: 8,655

Results for 1-4: 43,061 (limits = last 10 years)

- * without the word 'period,: 17,794

- * without the words 'period' or 'maturity,: 2,417

Appendix C: Data extraction tables for included studies (n=15)

Author, Year: (Adhikari, Kadel et al. 2007) Article Title: Knowledge and practice regarding menstrual hygiene in rural adolescent girls of Nepal Country: Nepal				
Aim/ Objective	To evaluate the knowledge and practice on different aspects of menstrual hygiene			
Population	150 adolescent girls aged 13-15 years from 3 schools in rural Chitwan district			
Age (Range/ Group/ Mean)	13-15 years			
Intervention	None			
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • normal age for menstruation to begin • length of normal flow • length of normal cycle • whether or not girls can go to school during menstruation • whether or not girls can cook during menstruation • what menstruation is (e.g. physiological, pathological, curse) • causes of menstruation • from where bleeding occurs 	Menstrual hygiene practices <ul style="list-style-type: none"> • use of cloth pads during menstruation • changing pads on a daily basis • pad material • disposal of pads • cleaning of genitalia 	Experiences of menstruation <ul style="list-style-type: none"> • where girls eat during menstruation • where girls sleep during menstruation • rest during period 	Sources of information about menstruation <ul style="list-style-type: none"> • who should be teaching girls about menstruation • who taught girls about menstrual hygiene • whether those teaching girls about menstruation taught it properly
Literature/ Study Type	Descriptive cross-sectional			
Evaluation (Yes/No)	No			
Summary of Main Findings	Although girls' knowledge of menstruation was better than their menstrual hygiene practice, neither was satisfactory. Girls were not properly maintaining menstrual hygiene, with only 29.3% changing their pad daily. Overall knowledge and practice were 40.6% and 12.9% respectively. The majority of girls (98.0%) believe that they were not properly taught about menstruation.			

Author, Year: (Bosch, Hutter et al. 2008) Article Title: Perceptions of adolescents and their mothers on reproductive and sexual development in Matlab, Bangladesh Country: Bangladesh	
Aim/ Objective	To investigate the perceptions of adolescents and their mothers on markers of reproductive and sexual development
Population	562 adolescents (307 boys and 255 girls) aged 12 to 16 years in three villages in Matlab In addition, 18 adolescents (of whom five were married) and five mothers were interviewed in depth
Age (Range/ Group/ Mean)	Mean age of girls = 14.1 years
Intervention	None

Author, Year: (Bosch, Hutter et al. 2008) Article Title: Perceptions of adolescents and their mothers on reproductive and sexual development in Matlab, Bangladesh Country: Bangladesh				
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> preparedness for the reaching of menarche (indicated by the awareness of menarche before its onset and perceived possibilities to discuss these events with others afterward) origins (function) of menarche 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> adolescents' first reaction on respectively reaching menarche 	Experience of menstruation <ul style="list-style-type: none"> self-reported changes due to reaching menarche 	Sources of information about menstruation <ul style="list-style-type: none"> distribution of adolescent girls who talked to someone after reaching menarche, and if so, to what person sources of information and discussions of menarche
Literature/ Study Type	Descriptive cross-sectional using a survey and in-depth interviews			
Evaluation (Yes/No)	No			
Summary of Main Findings	Adolescent girls are inadequately informed about menarche with 64% of girls reaching menarche in fear. Lack of knowledge about menstruation appears to be intergenerational, as mothers also lack information about menstruation. In the in-depth interviews, neither girls nor mothers could tell researchers biological facts about menstruation.			

Author, Year: (Chothe, Khubchandani et al. 2014) Article Title: Students' perceptions and doubts about menstruation in developing countries: a case study from India Country: India			
Aim/ Objective	To document perceptions regarding menstruation and various menstrual restrictions that have been underexplored		
Population	Students aged 9-13 years in grades 6-8 at three girls' schools in Pune, India 318 of 612 possible students submitted questions to the research team		
Age (Range/ Group/ Mean)	Participants' ages ranged from 9-13 year		
Intervention	None		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> participants' questions about menstruation, including anatomy and physiology, menstrual symptoms, menstrual myths and taboos, menstrual abnormalities, usage and disposal of sanitary pads 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> asking questions that researchers deemed to be menstrual myths and taboos 	Experience of menstruation <ul style="list-style-type: none"> asking questions about menstrual symptoms
Literature/ Study Type	Qualitative descriptive		
Evaluation (Yes/No)	No		
Summary of Main Findings	Students had substantial doubts about menstruation. Social myths and taboos influenced their menstrual practices. Students most frequently asked researchers questions about anatomy and physiology (25%). Of the 18% of participants who asked questions about menstrual symptoms, the most commonly questioned symptom was abdominal pain and backache.		

<p>Author, Year: (Djalalinia, Tehrani et al. 2012)</p> <p>Article Title: Parents or School Health Trainers, which of them is Appropriate for Menstrual Health Education?</p> <p>Country: Iran</p>			
Aim/ Objective	To compare different training sources for adolescents' menstrual health education		
Population	1,823 female middle school students aged 11-15 years from 15 middle schools in Tehran		
Age (Range/ Group/ Mean)	<p>Participants' ages ranged from 11-15 years</p> <p>Mean age of control group = 11.8 + 1.3 years</p> <p>Mean age of group trained by school health trainers = 11.65 + 0.51 years</p> <p>Mean age of group trained by parents = 11.62 + 0.59 years</p>		
Intervention	<p>Yes. The intervention involved menstrual health education (of which the content, duration and format are unclear).</p> <p>Students were allocated randomly to three groups: trained by parents, trained by schools' health trainers, and control (no training).</p>		
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • bath during menstruation • usual washing after toilet • use of sanitary pad or cotton as menstrual absorbent 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • feeling at first menstruation (confusing, scared, uncomfortable feeling, good feeling) • emotional change • appetite change • digestive disorders • headache, dizziness, and vomiting • menstrual pain 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • recommended source for information about menstruation
Literature/ Study Type	<p>Comparison of control and intervention groups</p> <p>Outcome assessment 2 years post-intervention</p>		
Evaluation (Yes/No)	<p>Yes. Researchers first conducted a survey on the menstrual health of participants. Participants were then randomly divided into three groups.</p> <p>Following a two-year training program, the adolescents' knowledge of puberty and menstrual health was assessed.</p>		
Summary of Main Findings	<p>Authors reported that negative psychological effects of menarche were lower in the groups that received the intervention. However, insufficient data were reported to calculate an effect size, and findings should be interpreted with caution in light of unclear attrition and analyses.</p> <p>The trained groups were more likely to take appropriate actions at menarche than controls, but this finding was not significant.</p>		

<p>Author, Year: (Haque, Rahman et al. 2014)</p> <p>Article Title: The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh</p> <p>Country: Bangladesh</p>	
Aim/ Objective	The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh
Population	416 adolescent female students aged 11–16 years who were from three high schools (grades 6–8) and lived with their parents
Age (Range/ Group/ Mean)	<p>Participants' ages ranged from 11–16 years; of those,</p> <p>52.4% of respondents were aged 11-13 years</p> <p>15.4% were aged 11-12 years, 37.0% were aged 13 years, and 47.6% were aged 14+ years</p>

Author, Year: (Haque, Rahman et al. 2014)			
Article Title: The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh			
Country: Bangladesh			
Intervention	Yes. Trained RAs delivered a 6-month menstrual hygiene educational intervention among schoolgirls. The training was delivered using a field manual in the Bangla language. Menstrual education focused on menstrual hygiene knowledge, beliefs and behaviours, menstrual disorders, and restrictions on menstruating adolescents. The educational materials were developed by an obstetrician/ gynaecologist and were culturally acceptable to the girls. RAs delivered twelve 45-min lessons once every 15 days. The RAs also used clean cloths and pads for demonstrations. Furthermore, 12 focus group discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other.		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none">• normal monthly duration of menstruation• poor menstrual hygiene predisposing to infection• hygienic practices preventing menstrual pain• menstrual blood being considered impure• proper sanitary products• cause of menstruation• origin of menstrual blood• age of normal cessation of menstruation• hot or cold food affecting the menstrual cycle• menstruation as indicating fertility (fecundity)• overall knowledge and beliefs (poor, medium, high)	Menstrual hygiene practices <ul style="list-style-type: none">• the absorbent used during menstruation• frequency of changing the absorbent each day• drying of the used absorbent• storing of washed clothes• methods of disposal of the used absorbent• cleaning of external genitalia• material used for cleaning of external genitalia	Experiences of menstruation <ul style="list-style-type: none">• regarding menstrual disorders experienced, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications• restrictions during menstruation, including: (1) visits to holy places; (2) visits to relatives, friends and neighbours; (3) participation in household activities; and (4) school attendance during menses• adolescent depression using the Children's Depression Inventory
Literature/ Study Type	Pre-post test		
Evaluation (Yes/No)	Yes. FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After 6 months of intervention, follow-up data were collected in the schools using the same questionnaire as at baseline regarding menstrual hygiene knowledge, beliefs and practices, types of complications, and restrictions on menstruating adolescents. RAs visited the homes of any students who were not available at school during the follow-up data collection.		
Summary of Main Findings	After health education, participants reported a significant improvement in 'high knowledge and beliefs' scores compared to baseline. Significant improvement was also observed in overall good menstrual practices, including improvements in using sanitary pads, frequency of changing pads/cloths per day, drying the used absorbent, methods of disposing of the used absorbent, and cleaning of genitalia. During the follow-up, the participants reported significant improvements in the regularity of their menstrual cycle and fewer complications during menstruation.		

Author, Year: (Iliyasu, Aliyu et al. 2012)	
Article Title: Sexual and reproductive health communication between mothers and their adolescent daughters in northern Nigeria	
Country: Nigeria	
Aim/ Objective	To determine the occurrence, content, and triggers of mother-to-daughter communication about SRH, and to compare menstrual hygiene practices between mothers and their teenage daughters in Ungogo town, a semi-urban community on the out-skirts of Kano city in northern Nigeria

Author, Year: (Iliyasu, Aliyu et al. 2012) Article Title: Sexual and reproductive health communication between mothers and their adolescent daughters in northern Nigeria Country: Nigeria				
Population	184 mothers and their unmarried daughters If more than one teenage daughter was present in the household, the oldest unmarried daughter was interviewed			
Age (Range/ Group/ Mean)	Daughters' ages ranged from 11-19 years (mean age = 14.7 + 1.65 years) Mothers' ages ranged from 26-54 years (mean age = 38.9 + 4.2 years)			
Intervention	None			
Outcomes	Knowledge of menstruation • SRH topics discussed by mother-daughter pairs with daughters reporting discussions about menstrual hygiene as well as menses	Menstrual hygiene practices • use of sanitary pads or cloth	Knowledge of puberty • SRH topics discussed by mother-daughter pairs with daughters reporting discussions about breast and body changes	Sources of information about menstruation/puberty • from whom/where girls received information
Literature/ Study Type	Descriptive cross-sectional using structured interviews and FGDs			
Evaluation (Yes/No)	No			
Summary of Main Findings	Most daughters (69%) obtained SRH education from their mothers. Daughters with formal education (13.6%) received this education at school. Daughters more often used sanitary pads during menstruation than mothers (81% vs. 39%); mothers most often re-used a piece of cloth (44%).			

Author, Year: (Isguven, Yoruk et al. 2015) Article Title: Educational Needs of Adolescents Regarding Normal Puberty and Menstrual Patterns Country: Turkey				
Aim/ Objective	To determine the level of knowledge and the sources of information about normal puberty and menstrual patterns in Turkish schoolgirls from İstanbul			
Population	922 randomly chosen schoolgirls			
Age (Range/ Group/ Mean)	Girls' ages ranged from 10-17 years (mean age = 14.7 + 2.0 years)			
Intervention	None			
Outcomes	Knowledge of menstruation • knowledge of normal menstrual patterns • mean time period between menses • normal age at menarche • mean menstrual flow length	Menstrual hygiene practices • number of pads used daily during menstruation	Knowledge of puberty • knowledge of normal pubertal development • first symptom of puberty • average time period between beginning of puberty and menarche • self-identification of being knowledgeable about puberty	Sources of information about menstruation/puberty • source of students' knowledge about puberty • who should provide education about puberty
Literature/ Study Type	Descriptive cross-sectional using a questionnaire survey			
Evaluation (Yes/No)	No			

<p>Author, Year: (Isguven, Yoruk et al. 2015)</p> <p>Article Title: Educational Needs of Adolescents Regarding Normal Puberty and Menstrual Patterns</p> <p>Country: Turkey</p>	
Summary of Main Findings	Girls who had attained menarche were more knowledgeable about puberty, largely through their own experiences. Mothers were the leading source of pubertal information. Half of the students did not know the time period between the beginning of puberty and menarche. Students who attained menarche preferred education about puberty to be given by health professionals and to both genders at the same setting.

<p>Author, Year: (Kapadia-Kundu, Storey et al. 2014)</p> <p>Article Title: Seeds of prevention: the impact on health behaviors of young adolescent girls in Uttar Pradesh, India, a cluster randomized control trial</p> <p>Country: India</p>	
Aim/ Objective	To describe the results of a school-based, randomized control cluster trial of the gateway moment concept in India, the Saloni pilot intervention, on the nutritional and hygiene practices and health outcomes of girls 11-14 years in Uttar Pradesh, India
Population	1,200 adolescent girls aged 11-14 years in 30 rural government schools in Hardoi district, rural Uttar Pradesh At baseline, n = 595; at end-line, n = 601
Age (Range/ Group/ Mean)	Age data not reported
Intervention	<p>Yes. The Saloni pilot intervention, implemented for one year, was designed as an addition to the existing government school health programme for adolescent girls (Saloni Swasth Kishori Yojna; SSKY). A prevention model that includes Sadharanikaran, an ancient Indian theory of communication, guided the development of the intervention, including the design of the teacher's manual and the Saloni diary. The 10 one-hour sessions were conducted monthly and promoted 19 behaviours: 5 health seeking behaviours, 6 nutrition behaviours, 3 reproductive health (RH) behaviours and 5 hygiene behaviours. Teachers were trained to encourage the girls to share what they learned with their parents after every session. Role-plays were used to demonstrate how to initiate Saloni discussions with parents. The intervention also used diaries to engage adolescent girls, articulate new social and behavioural norms and reinforce the daily practice of protective nutrition and hygiene behaviours.</p> <p>Intervention group = SSKY + pilot Saloni curriculum Control group = SSKY only</p>
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> changing cloth (used during menstruation) 3 times a day
Literature/ Study Type	Randomized control cluster trial
Evaluation (Yes/No)	Yes. The trial is a two-level, nested RCT with the unit of randomization being the block with 15 schools in the intervention arm and 15 schools in the control arm.
Summary of Main Findings	<p>The study provides evidence that school-based programs can produce concurrent changes in more than a dozen interrelated health behaviours. Girls in rural Uttar Pradesh primarily use 'cloth pieces' during menstruation rather than sanitary napkins. Girls should change their cloth pieces at least three times a day during menstruation, but constraints such as no toilets at school and lack of privacy at home often prevent them from doing so. Pre-intervention, 29.1% of girls in the intervention and 28.8% of girls in the control groups changed their cloth three times per day. Post-intervention, 35.1% of girls in the intervention and 18.1% of girls in the control groups changed their cloth three times per day (p<.05).</p>

<p>Author, Year: (Marván and Alcalá-Herrera 2014)</p> <p>Article Title: Age at Menarche, Reactions to Menarche and Attitudes towards Menstruation among Mexican Adolescent Girls</p> <p>Country: Mexico</p>				
Aim/ Objective	To investigate the relationships between menarcheal timing and both menarcheal experience and attitudes toward menstruation in Mexican girls			
Population	405 postmenarcheal adolescents who were attending 3 different public middle schools (first or second grades) in Mexico City Participants had to have lived with their biological mothers around the time they experienced menarche, and they had to have reached menarche at least 3 months before they completed the survey.			
Age (Range/ Group/ Mean)	Participants' ages ranged from 11-16 years (mean age = 12.98 years)			
Intervention	None			
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> if girls had discussed menstruation with their mother prior to their first period, they were asked to complete a checklist indicating whether or not they had discussed 4 topics related to menses: hygiene, body function, how women feel physically during their periods (physical sensations), and emotional aspects of menstruation 	<p>Attitudes, myths and/or perceptions of menstruation</p> <ul style="list-style-type: none"> menstrual attitudes measured by the postmenarcheal form of the Adolescent Menstrual Attitude Questionnaire 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> menarcheal age (results not presented) whether or not participants knew what was happening whether or not participants knew what they should do whether or not participants felt prepared to start menstruating 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> sources of information from which girls first received information about menstruation
Literature/ Study Type	Descriptive cross-sectional using a survey			
Evaluation (Yes/No)	No			
Summary of Main Findings	Early maturers (those who attained menarche before 11 years) were more likely than average maturers (those who attained menarche at 11-12 years) or late maturers (those who attained menarche at 13+ years) to state they had not known what they should do at the moment they got their first period ($p < .01$), that they had not felt prepared to start menstruating ($p < .05$), and that they thought they must keep secret the fact of already having had their first period ($p < .05$). Early maturers were also the most likely to have felt scared ($p < .05$), worried ($p < .05$) and sad ($p < .05$). Late maturers showed more positive attitudes toward menstruation than their peers ($p < .01$).			

<p>Author, Year: (Marván and Molina-Abolnik 2012)</p> <p>Article Title: Mexican adolescents' experience of menarche and attitudes toward menstruation: role of communication between mothers and daughters</p> <p>Country: Mexico</p>	
Aim/ Objective	To investigate the relationships between menarcheal timing and (1) menarcheal experience and (2) attitudes toward menstruation in Mexican girls
Population	602 female students in 10 different public schools in Mexico City who were attending grades equivalent to grades 5-10 in North American schools Participants had to have lived with their biological mothers around the time they experienced menarche, and they had to have reached menarche at least 3 months before they completed the survey.
Age (Range/ Group/ Mean)	145 participants (24.1%) were aged 11-12 years 248 participants (41.2%) were aged 13-14 years 209 participants (34.7%) were aged 15-16 years

<p>Author, Year: (Marván and Molina-Abolnik 2012)</p> <p>Article Title: Mexican adolescents' experience of menarche and attitudes toward menstruation: role of communication between mothers and daughters</p> <p>Country: Mexico</p>			
Intervention	None		
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> if girls had known what was happening when they got their first period if girls had known what they should do when they got their first period 	<p>Attitudes, myths and/or perceptions of menstruation</p> <ul style="list-style-type: none"> menstrual attitudes measured by the postmenarcheal form of the Adolescent Menstrual Attitude Questionnaire 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> how prepared girls felt to start menstruating telling your mother the same day about menarche telling your best friend the same week about menarche whether or not girls experienced emotional reactions to menarche (e.g. excited, ashamed, mature, scared, happy, sad, worried, calm, and odd; participants also indicated whether or not they had had the following thoughts: 'I must keep secret that I have had my first period,' 'Now, I won't be able to do whatever I want when I want,' and 'Now, I'm a young woman') age at menarche
Literature/ Study Type	Descriptive cross-sectional using a survey		
Evaluation (Yes/No)	No		
Summary of Main Findings	<p>Most participants knew what they should do when they experienced their menarche, though only 39% stated they had felt prepared to start menstruating. Regarding menstrual attitudes, adolescents scored highest on Negative Feelings and Secrecy rather than on Positive Feelings. Participants who had previously discussed the emotional aspects of menses with their mothers were more likely to claim they had felt prepared to start menstruating when they got their first period (OR = 3.45). The fact that adolescents felt prepared to start menstruating predicted positive attitudes toward menstruation.</p>		

<p>Author, Year: (Mason, Nyothach et al. 2013)</p> <p>Article Title: 'We keep it secret so no one should know'--a qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural western Kenya</p> <p>Country: Kenya</p>	
Aim/ Objective	To examine girls' attitudes, experiences, and concerns around menarche and menstruation as part of a baseline evaluation for a randomised controlled pilot study examining the potential benefits of different menstrual solutions for adolescent primary schoolgirls in rural western Kenya
Population	120 schoolgirls aged 14–16 years who attended eligible MS Study (the bigger project under which this study is nested) schools
Age (Range/ Group/ Mean)	Participants' ages ranged from 14-16 years (mean age = 14.3 years)
Intervention	None

Author, Year: (Mason, Nyothach et al. 2013)

Article Title: 'We keep it secret so no one should know'--a qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural western Kenya

Country: Kenya

Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> • knowledge of (and preparation for) menstruation 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • menstrual practices, including coping with inadequate alternatives to pads, paying for pads, and struggles with menstrual hygiene 	<p>Attitudes, myths and/or perceptions of menstruation</p> <ul style="list-style-type: none"> • perceptions of menarche, maturation and sexual vulnerability • secrecy around menstruation • fear and shame of menstruation 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • experience of menstruation, schooling, and other experiences associated with menstruation 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • who gave girls information about menstruation • where girls were taught about menstruation • feedback about male vs. female teachers
Literature/ Study Type	Descriptive quantitative using FGDs				
Evaluation (Yes/No)	No				
Summary of Main Findings	Girls were unprepared for menstruation and demonstrated poor knowledge. They devised practical methods to cope with menstrual difficulties, often alone since parental and school support of menstrual needs is limited. Girls admitted 'other girls' were absent from school during menstruation, due to physical symptoms or inadequate sanitary protection. Sanitary pads were valued, but resource and time constraints result in prolonged use causing chafing. Alternatives included rags and grass. Girls reported that 'other girls' participated in transactional sex to buy pads and received pads from boyfriends.				

Author, Year: (Moodi, Zamanipour et al. 2013)

Article Title: Evaluating puberty health program effect on knowledge increase among female intermediate and high school students in Birjand, Iran

Country: Iran

Aim/ Objective	To evaluate the effect of educational program for puberty health on improving intermediate and high school female students' knowledge in Birjand, Iran
Population	302 female intermediate (n = 151) and high school (n = 151) students were selected through randomized cluster sampling
Age (Range/ Group/ Mean)	Mean age = 12.9 ± 1.1 years
Intervention	Yes. Trained instructors taught all students identical educational content. The time of training in each class was designed in two 45-minute sessions. Students also received educational pamphlets about the required subject.
Outcomes	<p>Knowledge about puberty</p> <ul style="list-style-type: none"> • mean score of knowledge about puberty health (with no specifics beyond that)
Literature/ Study Type	Quasi-experimental study using a questionnaire
Evaluation (Yes/No)	<p>Yes. Researchers evaluated the intervention using a pre-test and post-test. Data collection was conducted through a researcher-made questionnaire designed based on course objectives and included 20 one-score multi-choice questions for assessment of knowledge.</p> <p>A month after the intervention in each school, the questionnaires were distributed once again among the students and then collected for analysis.</p>

Author, Year: (Moodi, Zamanipour et al. 2013)				
Article Title: Evaluating puberty health program effect on knowledge increase among female intermediate and high school students in Birjand, Iran				
Country: Iran				
Summary of Main Findings	The mean [undefined] knowledge level among intermediate students was 5.03 ± 3.7 before intervention and 10.8 ± 4.8 after intervention. Among high school students, the mean [undefined] knowledge scores were 4.1 ± 2.3 pre-intervention and 8.7 ± 3.8 post-intervention. Both groups experienced a significant difference between pre- and post-intervention results (p<0.001).			

Author, Year: (Shah, Nair et al. 2013)				
Article Title: Improving quality of life with new menstrual hygiene practices among adolescent tribal girls in rural Gujarat, India				
Country: India				
Aim/ Objective	To study adolescent girls' knowledge regarding menstruation and menstrual practices; their quality of life; experience and satisfaction with three different kinds of menstrual pads (old cloths, a new soft cloth (falalin), and subsidized sanitary pads); and any differences in symptoms of reproductive tract infection using these three kinds of pads			
Population	164 unmarried post-menarchal adolescent girls (school-going and non-school-going) living in an under-privileged area in all eight project villages			
Age (Range/ Group/ Mean)	Mean age = 13.7 years			
Intervention	Yes. The intervention consisted of introducing falalin cloths, followed by sanitary napkins, among girls who were using old cloth at baseline. First, new falalin cloths (reused for three cycles) were offered to all girls for three months at a subsidized price through village-based accredited social health activists (ASHAs). Subsequently, sanitary pads were offered for another three months a subsidized price, also through the ASHAs. Programme supervisors visited the study villages monthly to ensure the intervention was being implemented as planned.			
Outcomes	Knowledge of menstruation <ul style="list-style-type: none">knowledge related to menstruation (cause of pubertal changes, knowledge about menstruation before first menses, source of menstrual blood, path of urine and menstruation)	Menstrual hygiene practices <ul style="list-style-type: none">prevalence and quality of life issues among girls using old cloth at baseline and then using falalin cloths and sanitary pads each for three months (e.g. absent from school/work, skin abrasions, feel unclean, stains visible to others on absorbent pad while drying, spoils dress, feels comfortable, smells, drying problem)changes in use of three kinds of absorbent cloths/pads during the course of the study	Experiences of menstruation <ul style="list-style-type: none">menstrual restrictionsresponse to lack of privacy	Sources of information about menstruation <ul style="list-style-type: none">source of information about menstruation
Literature/ Study Type	Pre-post design			
Evaluation (Yes/No)	Yes. Survey data were collected at baseline and again three months after introducing each of the two kinds of absorbent pads.			
Summary of Main Findings	Both falalin cloths and sanitary pads were quickly shown to be acceptable to a large proportion of girls. Their use resulted in clear improvements in quality of life issues related to menstruation. Falalin cloth is preferable to sanitary pads because it is easily washable, reusable, soft, and has good absorbing capacity. Most importantly, falalin cloth is easily available at the community level at low cost and is environmentally friendly as it is disposed of easily by burning.			

Author, Year: (Sharma, Negi et al. 2015) Article Title: Menstrual hygiene among adolescent girls Country: India				
Aim/ Objective	To assess knowledge and practice regarding menstrual hygiene before and after teaching program among adolescent girls			
Population	50 adolescent secondary school girls (n = 25 intervention; n = 25 control) studying in selected high school of Bhaniyawala Post, Dehradun District			
Age (Range/ Group/ Mean)	Mean age of participants = 13.88 + 1.5 years			
Intervention	Yes. The experimental group underwent an educational training programme on menstrual hygiene. The structured educational content was prepared after a thorough review and with the help of experts from nursing and medical professions.			
Outcomes	Knowledge of menstruation • level of knowledge (test score)	Menstrual hygiene practices • frequency of changing sanitary pads • reusing cloth after washing • proper cleanliness of genitalia during menstruation • level of practice (score)	Experiences of menstruation • age at menarche • length of period (in days) • complaints during menstruation (dysmenorrhea, breast tenderness, both, none)	Sources of information about menstruation • from whom girls received information about menstruation
Literature/ Study Type	'A true experimental study' that used a pre- and post-test questionnaire			
Evaluation (Yes/No)	Yes. Researchers administered a questionnaire on day one to collect pre-test data from both groups. They collected post-test from both groups 15 days after the intervention ended.			
Summary of Main Findings	Researchers note that the level of knowledge and practice regarding menstrual hygiene of subjects who participated in the educational program was significantly better than that of the control group.			

Author, Year: (Um, Yusuf et al. 2010) Article Title: Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria Country: Nigeria	
Aim/ Objective	To examine the knowledge and practices of adolescent school girls in Kano, Nigeria around menstruation and menstrual hygiene
Population	400 adolescent female secondary school students (10-19 years old)
Age (Range/ Group/ Mean)	Participants' ages ranged from 10-19 years (mean age = 14.4 + 1.2 years)
Intervention	None

<p>Author, Year: (Um, Yusuf et al. 2010)</p> <p>Article Title: Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria</p> <p>Country: Nigeria</p>				
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> assessed knowledge of menstruation and menstrual hygiene, specifically: knew correctly that menstruation in early adolescence is normal, aware of expected age range for starting menstruation, aware of the duration for a normal period, have heard of menstrual cycle, knew correct description of menstrual cycle, knew duration of a normal menstrual cycle, knew sanitary products exits for menstrual protection, awareness of sanitary products used for menstrual protection, aware of the best sanitary product for adolescent, aware that poor hygiene predispose to infection, knew that personal hygiene has a place in prevention of menstrual pain, aware of age of normal cessation of menstruation 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> use of sanitary pad or absorbent during last menstrual period number of times students changed menstrual protection dressings number of baths during menstruation why students did not use sanitary pads assessed menstrual hygiene good practice score 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> age at menarche 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> first source of information on menstruation and menstrual hygiene
Literature/ Study Type	Descriptive cross-sectional using a survey			
Evaluation (Yes/No)	No			
Summary of Main Findings	<p>The mean age at menarche was 12.9 ± 0.8 years. Most participants (87.5%) were graded as having fair knowledge of menstruation, although they were deficient in specific knowledge areas. Only 4.0% of participants received a 'good' grade on knowledge of menstruation. The majority (88.7%) the students examined had good practice of menstrual hygiene. Most of them used sanitary pads as absorbent during their last menses (93.8%) and increased the frequency of bathing (72.5%). Students reported changing their menstrual dressings from 1-5 times per day (mean = 2.6 ± 0.8).</p>			

Appendix D: Data extraction tables for relevant excluded studies (n=44)

Author, Year: (Adefuye, Odusoga et al. 2010) Article Title: Age at menarche and menstrual pattern in secondary schoolgirls in Sagamu Country: Nigeria		
Aim/ Objective	To determine the mean age at menarche and pattern of menstruation in the sub-urban district of Southwestern Nigeria To demonstrate the influence of pre-menarcheal education on the attitude of the respondents	
Population	1097 post-menarcheal school girls from seven middle grade schools in Sagamu, a sub-urban town in Remo division of Ogun State, south west of Nigeria A total of 1064 questionnaires were collected and analyzed, as 33 were excluded for insufficient data.	
Age (Range/ Group/ Mean)	Respondents' ages ranged from 13-21 years (mean 16.01 + 1.6 years)	
Intervention	None	
Outcomes	Experiences of menstruation <ul style="list-style-type: none"> • age at menarche • flow duration • experience of dysmenorrhoea • cycle length • relationship between pre-menarchal information and experience of dysmennoreha 	Sources of information about menstruation <ul style="list-style-type: none"> • whether students received pre-menarchal counseling/education prior to beginning menstruation • who provided the counseling/education
Literature/ Study Type	Descriptive using retrospective questionnaire	
Evaluation (Yes/No)	No	

Author, Year: (Adeokun, Ricketts et al. 2009) Article Title: Sexual and Reproductive Health Knowledge, Behaviour and Education Needs of In-School Adolescents in Northern Nigeria Country: Nigeria		
Aim/ Objective	To explore the RH knowledge, sexual behaviour and sexuality education needs of in-school adolescents in northern Nigeria	
Population	989 students from Junior Secondary School level 1 to Senior Secondary School level 2 were selected from 24 purposively-selected secondary schools in rural, semi-urban and urban areas in each of the four project states	
Age (Range/ Group/ Mean)	Age (in years) = Percent of students: <15 = 34.1%; 15-19 = 55.3%; >19 = 10.6% NB: includes male students (data not disaggregated by sex)	

<p>Author, Year: (Adeokun, Ricketts et al. 2009)</p> <p>Article Title: Sexual and Reproductive Health Knowledge, Behaviour and Education Needs of In-School Adolescents in Northern Nigeria</p> <p>Country: Nigeria</p>		
Intervention	None, though the descriptive study is intended to form the baseline of a future intervention	
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> • knowledge of the menstrual cycle • when in the menstrual cycle is an unsafe period • when ovulation occurs in the menstrual cycle 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • with whom students prefer to talk about issues such as menstruation and bodily changes
Literature/ Study Type	Exploratory cross-sectional using questionnaire	
Evaluation (Yes/No)	No	

<p>Author, Year: (Adinma and Adinma 2009)</p> <p>Article Title: Menstrual characteristics amongst south-eastern Nigerian adolescent school girls</p> <p>Country: Nigeria</p>		
Aim/ Objective	To examine the characteristics of menstruation amongst adolescent Igbo school girls with respect to the biosocial characteristics, the pattern of menstruation, associated complications, and the source of information on menstruation	
Population	550 female students recruited from a multi-sampling of 50 secondary schools in Onitsha, Anambra State, Nigeria	
Age (Range/ Group/ Mean)	<p>Students' ages ranged from 12-20 years</p> <p>Age (in years) = Percent of students:</p> <p>12-14 = 3.6%;</p> <p>15-17 = 75.6%;</p> <p>18-20 = 20.8%</p>	
Intervention	None	
Outcomes	<p>Experience of menstruation</p> <ul style="list-style-type: none"> • age at first menarche • duration of menstrual flow • problems associated with menstruation 	
Literature/ Study Type	Descriptive cross-sectional using pre-tested, semi-structured, and interviewer-administered questionnaire	
Evaluation (Yes/No)	No	

Author, Year: (Adinma and Adinma 2008) Article Title: Perceptions and practices on menstruation amongst Nigerian secondary school girls Country: Nigeria				
Aim/ Objective	To determine adolescent secondary school girls' perceptions, medical problems and key practices during menstruation with a view to identifying information and practice gaps, and misconception on menstruation			
Population	550 female students recruited from a multi-sampling of 50 secondary schools in Onitsha, Anambra State, Nigeria			
Age (Range/ Group/ Mean)	Students' ages ranged from 12-20 years Age (in years) = Percent of students: 12-14 = 3.6%; 15-17 = 75.6%; 18-20 = 20.8%			
Intervention	None			
Outcomes	Menstrual hygiene practices <ul style="list-style-type: none"> menstrual absorbents used 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> perceptions about menstruation as: a normal physiological process, assured fertility (fecundity), release of bad blood, cleansing of the womb, washing off of an undeveloped baby, due to evil forces/curse from gods 	Experience of menstruation <ul style="list-style-type: none"> age at first menarche duration of menstrual flow problems associated with menstruation 	Sources of information about menstruation <ul style="list-style-type: none"> persons with whom menstrual problems were most discussed
Literature/ Study Type	Descriptive cross-sectional using pre-tested, semi-structured, and interviewer-administered questionnaire			
Evaluation (Yes/No)	No			

Author, Year: (Altundag and Calbayram 2016) Article Title: Teaching menstrual care skills to intellectually disabled female students Country: Turkey				
Aim/ Objective	To teach pad replacement skills among other menstrual care skills with the help of a dummy to intellectually disabled adolescent female students who reached their age of menstruation			
Population	54 female students who attended the high school section of Denizli Camlik Special Education Occupational Training Center in the Aegean region			
Age (Range/ Group/ Mean)	Respondents' ages ranged from 13-17 years (mean 15.14 + 0.90 years)			
Intervention	Yes. Pre-test stage: Parents completed a form after watching the students' pre-training pad replacement skills. Training stage: In groups of 4-5, students received training on menstruation. Basic training included: information on the age of the onset of puberty and physical changes associated with that period; information on the onset of menstruation; how to use pads; and cleaning habits specific to the period. Skill development stage: Instructors showed pad replacement skills on a doll to each individual student using the pad replacement skills analysis. They allowed each student to experiment on the doll and then asked students to perform the routine and demonstrate the skills for an observer who analysed the skills. Post-test stage: One month after the skills and training course, instructors re-administered the pad replacement skills analysis to students.			

<p>Author, Year: (Altundag and Calbayram 2016)</p> <p>Article Title: Teaching menstrual care skills to intellectually disabled female students</p> <p>Country: Turkey</p>			
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • pad replacement skills (e.g. placing the pad on underwear with the sticky side of the pad against the underwear, washing and drying the doll's hands) 		
Literature/ Study Type	Quasi-experimental		
Evaluation (Yes/No)	<p>Yes. Researchers used the 'One Group Pretest and Posttest Model' to measure students' pad replacement skills pre-training and one month post-training. The intervention achieved positive results. Students gained menstrual hygiene skills. The difference between students' pad replacement skill scores pre- and post-intervention was statistically significant.</p>		

<p>Author, Year: (Cakir, Mungan et al. 2007)</p> <p>Article Title: Menstrual pattern and common menstrual disorders among university students in Turkey</p> <p>Country: Turkey</p>			
Aim/ Objective	<p>Patterns of menstrual cycles were analyzed for association with age of menarche, prevalence of menstrual irregularity, dysmenorrhea, prolonged menstrual bleeding, and effect of menstrual disorders, especially dysmenorrhea, on social activities and school attendance among the female students</p>		
Population	<p>480 female students from two faculties (Faculty of Medicine and Midwife School) of Karadeniz Technical University in Trabzon were asked to complete the questionnaire; of those, 391 subjects (81.4%) completed the questionnaire</p>		
Age (Range/ Group/ Mean)	<p>Students' ages ranged from 16.731-26.902 years (mean 20.745 + 1.823 years)</p>		
Intervention	None		
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • number of pads changed per day 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • age at menarche • menstrual pattern: duration between two periods, duration of menstrual flow, menstrual irregularity, prolonged menstrual flow (>10 days), dysmenorrhea • symptoms in dysmenorrheic subjects (e.g. abdominal pain, backache, chills, vomiting) • limitations on daily activities (e.g. missing social activities and sports) • school absenteeism • being admitted to a physician • pain management strategies (e.g. naproxen sodium, heat packs) 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • first source of knowledge about menarche and menstruation (e.g. mothers, friends, television)

Author, Year: (Cakir, Mungan et al. 2007)

Article Title: Menstrual pattern and common menstrual disorders among university students in Turkey

Country: Turkey

Literature/ Study Type	Descriptive cross-sectional
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Evaluation (Yes/No)	No
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Author, Year: (Chang and Chuang 2012)

Article Title: Factors that affect self-care behaviour of female high school students with dysmenorrhoea: A cluster sampling study

Country: Taiwan

Aim/ Objective	To investigate the relationship between knowledge about dysmenorrhoea, beliefs about dysmenorrhoea, cues to action associated with dysmenorrhoea and the self-care behaviour of those with dysmenorrhoea To identify factors that affect the self-care behaviour of female high school students with dysmenorrhoea
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Population	603 female high school students
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Age (Range/ Group/ Mean)	No data on age, only school year (1 st /2 nd /3 rd)
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Intervention	None
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Outcomes	Sources of information about menstruation • from whom/where students learned about dysmenorrhea
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Literature/ Study Type	Cross-sectional using purposive sampling and a questionnaire
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Evaluation (Yes/No)	No
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Author, Year: (Chiou, Wang et al. 2007)

Article Title: Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior

Country: Taiwan

Aim/ Objective	To evaluate the effects of systematic health education on female adolescents' knowledge of dysmenorrhea, menstrual attitudes, and dysmenorrhea-related self-care behaviors
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Population	455 female students at three vocational nursing schools (218 subjects randomly assigned to an experimental group, and 237 subjects randomly assigned to a control group) Female students who had experienced dysmenorrheic cramps two or more times during the last 6 months since the interview were recruited for the study.
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Age (Range/ Group/ Mean)	The mean age of all students was 15.73 + 0.39 years. The mean age of the experimental group was 17.74 + 0.36 years. The mean age of the control group was 15.72 + 0.42 years.
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Author, Year: (Chiou, Wang et al. 2007) Article Title: Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior Country: Taiwan			
Intervention	Yes. Researchers designed a dysmenorrheal self-care pamphlet for female adolescents and a systematic three-session health education intervention 'to use teaching strategies, counseling, and behavioral change to provide an opportunity for female adolescents to learn in planned purposes and to influence their health knowledge and behaviour.' Sessions lasted 50 minutes and used multiple teaching methods including lecture, discussion, and experience sharing. The contents of the intervention included knowledge of dysmenorrhea, menstrual attitudes, and self-care skills for dysmenorrhea. Participants in the control group received no intervention.		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> Dysmenorrheic Knowledge Scale (developed by the authors) 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> menstrual attitude scale (originally developed by others) 	Experiences of menstruation <ul style="list-style-type: none"> Dysmenorrheic Self-Care Behaviours Scale
Literature/ Study Type	A quasi-experimental intervention with a non-equivalent-control group design		
Evaluation (Yes/No)	Yes. Data were collected before, 2 weeks after, and 4 months after the intervention. Results revealed a significant increase in the experimental group members' dysmenorrhea-related knowledge and self-care behavior, but not in their attitudes.		

Author, Year: (Connolly and Sommer 2013) Article Title: Cambodian girls' recommendations for facilitating menstrual hygiene management in school Country: Cambodia					
Aim/ Objective	To explore Cambodian adolescent girls' voiced experiences of menstruation and education and their suggestions to address the challenges they face managing menses in the school environment				
Population	146 in-school and out-of-school girls aged 16-19 years from an urban area in Dangkao District of Phnom Penh and a rural area in Rotanak Mondul District of Battambang Province Researchers also conducted key informant interviews with 15 adults				
Age (Range/ Group/ Mean)	Participants' ages ranged from 16-19 years				
Intervention	None				
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> gaps in menstrual knowledge challenges to learning (e.g. teachers lack confidence to teach material effectively) 	Menstrual hygiene practices <ul style="list-style-type: none"> ability to access water and sanitation facilities nature and availability of sanitary materials 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> constraints at the onset of menses (e.g. belief that girls should stay home during their first period to learn about womanhood and protect themselves from the outside world) 	Experiences of menstruation <ul style="list-style-type: none"> school absenteeism 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> preferred way of learning about menstruation (e.g. from a female teacher who could discuss issues from her own experience)
Literature/ Study Type	Comparative case study				
Evaluation (Yes/No)	No				

Author, Year: (da Silva Bretas, Tadini et al. 2012)	
Article Title: Meaning of menarche according to adolescents	
Country: Brazil	
Aim/ Objective	To understand the meaning of menarche for a group of teenagers
Population	17 female adolescents in school aged 14-18 years
Age (Range/ Group/ Mean)	Participants' ages ranged from 14-18 years
Intervention	None
Outcomes	Experiences of menstruation <ul style="list-style-type: none"> • FGDs using the guiding question 'how was (or is) the experience with your first menstrual period?'
Literature/ Study Type	Qualitative descriptive
Evaluation (Yes/No)	No

Author, Year: (Dasgupta and Sarkar 2008)					
Article Title: Menstrual Hygiene: How Hygienic is the Adolescent Girl?					
Country: India					
Aim/ Objective	<ul style="list-style-type: none"> • To elicit the beliefs, conception and source of information regarding menstruation among the study population • To find out the status of menstrual hygiene among adolescent girls 				
Population	160 adolescent girls from one class (IX) in a secondary school situated in the field practice area of Rural Health Unit and Training Center, Singur, West Bengal				
Age (Range/ Group/ Mean)	No data on age				
Intervention	None				
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • awareness of menstruation prior to attainment of menarche • awareness of the use of sanitary pads during menstruation • the source of menstrual bleeding 	Menstrual hygiene practices <ul style="list-style-type: none"> • use of sanitary pads, old cloth pieces, and new cloth pieces • disposal/reusal of used menstruation material 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • believing menstruation to be a physiological process, a curse of God, a disease, or the result of some sin 	Experiences of menstruation <ul style="list-style-type: none"> • age of menarche • practicing restrictions (not attending religious occasions, not eating certain foods, not playing, not performing household work, not attending school, and not attend any marriage ceremony during the menstrual period) 	Sources of information about menstruation <ul style="list-style-type: none"> • who was girls' first informant
Literature/ Study Type	Descriptive, cross-sectional using a questionnaire				
Evaluation (Yes/No)	No				

<p>Author, Year: (Dolan, Ryus et al. 2014)</p> <p>Article Title: A blind spot in girls' education: menarche and its webs of exclusion in Ghana</p> <p>Country: Ghana</p>					
Aim/ Objective	The study assessed the impact of sanitary pads and puberty education on the school attendance of post-pubertal girls, as well as the implications of menarche for their well-being.				
Population	120 schoolgirls, irrespective of menstrual status, participated in the intervention research. These schoolgirls attended primary and junior secondary schools in three peri-urban sites in the Central Region (Awutu-Effutu-Senya and Effutu Municipal Districts) and one rural site in the Ashanti Region (Sekyere West District). Researchers also conducted qualitative formative research with schoolgirls, parents, school drop-outs, and educators.				
Age (Range/ Group/ Mean)	Ages 12 and older				
Intervention	<p>Yes. The goal of the five-month intervention was to determine whether the provision of sanitary pads and puberty education would potentially mitigate some of the negative events associated with menarche by improving girls' attendance and retention at school.</p> <p>The intervention had one control group (peri-urban) and three intervention arms:</p> <p>i) peri-urban: pads + education</p> <p>ii) rural: pads + education</p> <p>iii) peri-urban: education only.</p>				
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> knowledge of menstruation or the biological processes of maturation prior to the onset of menarche content of menstruation discussions prior to menarche 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> access to and purchase of disposable pads lack of sanitary pads at schools despite Ministry of Education policy possibility of soiling or giving off a scent when wearing cloth 	<p>Attitudes, myths and/or perceptions of menstruation</p> <ul style="list-style-type: none"> misconceptions of menstruation (e.g. fear of the body; fear of boys; fear of participating in what were once 'typical' activities like cooking, praying, fetching water or serving guests) 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> 'Does menstruation ever cause you to': miss school; be unable to play with other children; miss work; avoid physical activities; remain indoors; avoid being around boys or men; be unable to carry out daily activities soiling garments (e.g. the possibility, the consequences) fear of being 'found out' in class - anxiety of starting their period during school where there was no water and/or private areas in which to change 	<p>Sources of information about menstruation/ puberty</p> <ul style="list-style-type: none"> discussing puberty and reproductive concerns with family
Literature/ Study Type	<p>Stage 1: Formative qualitative research comprised of FGDs with a range of stakeholders</p> <p>Stage 2: Non-randomised trial that examined the impact of the provision of sanitary pads and/or puberty education on girls' school attendance</p>				
Evaluation (Yes/No)	<p>Yes. In the intervention sites, researchers administered four surveys: a baseline assessment, two interim questionnaires and a final assessment. In the control site, they collected data at baseline and at the completion of the study.</p> <p>While attendance did not vary between groups pre-intervention, over the intervention, attendance rose in the pads + education groups by 9%.</p> <p>The control group showed no significant difference in attendance between baseline and follow-up. Although attendance rates were initially unchanged in the education-only group, by follow-up, this group achieved a similar high mean attendance rate as the pads + education sites. A longer-term trial is needed to confirm this effect.</p> <p>Finally, the data suggest improvements in subjective well-being are associated with an increased capacity to engage in the classroom.</p>				

<p>Author, Year: (Dongre, Deshmukh et al. 2007)</p> <p>Article Title: The effect of community-based health education intervention on management of menstrual hygiene among rural Indian adolescent girls</p> <p>Country: India</p>				
Aim/ Objective	The effect of community-based health education intervention on management of menstrual hygiene among rural Indian adolescent girls.			
Population	381 unmarried rural adolescent girls aged 12-19 years			
Age (Range/ Group/ Mean)	<p>Participants' ages ranged from 12-19 years (at baseline).</p> <p>Age (in years) = Percent of participants: 12=14.4%; 13=15.0%; 14=12.6%; 15=12.9%; 16=12.9%; 17=13.6%; 18=12.6%; 19=6.0%</p>			
Intervention	<p>Yes. Researchers implemented a community-based health education intervention on management of menstrual hygiene among rural Indian adolescent girls. They developed a pre-tested, handmade flip book containing needs-based key messages about the management of menstrual hygiene. Messages were delivered at monthly meetings of 23 village-based groups of adolescent girls, called Kishori Panchayat (KP).</p>			
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> • awareness of the menstrual cycle prior to its onset 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • use of cloth • use of ready-made pads • for girls reusing cloth: wash reused cloth with soap/ powder/ Dettol; sun dry cloth; shade dry cloth 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • dietary restrictions 	<p>Sources of information about puberty</p> <ul style="list-style-type: none"> • who informed girls of menstruation (mothers, KP members, female school teachers, friends)
Literature/ Study Type	Pre-post testing			
Evaluation (Yes/No)	<p>Yes. Researchers conducted a needs assessment for health messages with this target audience, using a survey and FGDs. After 3 years, the effect of the messages was assessed using quantitative (survey) and qualitative (trend analysis) methods.</p> <p>After 3 years, significantly more adolescent girls (55%) were aware of menstruation before its initiation compared with baseline (35%). Using ready-made pads increased significantly: 5% to 25%. Reuse of cloth declined 85% to 57%.</p> <p>Trend analysis showed that adolescent girls perceived a positive change in their behaviour and level of awareness.</p>			

<p>Author, Year: (Fakhri, Hamzehgardeshi et al. 2012)</p> <p>Article Title: Promoting menstrual health among Persian adolescent girls from low socioeconomic backgrounds: a quasi-experimental study</p> <p>Country: Iran</p>	
Aim/ Objective	The effectiveness of a health promotion project on improving menstrual health in adolescent girls in Iran.
Population	<p>698 high school girls (349 in the study group and 349 in the control group) aged 14-18 years in urban and rural public high schools with low socioeconomic status in Mazandaran province. In order to participate, students must have had parental consent and menstruated at least once.</p> <p>The control group comprised high school students in Mazandaran province who did not participate in the education.</p>
Age (Range/ Group/ Mean)	Average age of girls in study = 15.7 + 1.08 years
Intervention	<p>Yes. The intervention involved menstrual health education (10 two-hour sessions) provided by the Youth and School Health Department. Topics included the significance of adolescence, physical and emotional changes during adolescence, pubertal and menstruation health and PMS. Trainers used an educational manual developed by a team of adolescent health professionals.</p>

<p>Author, Year: (Fakhri, Hamzehgardeshi et al. 2012)</p> <p>Article Title: Promoting menstrual health among Persian adolescent girls from low socioeconomic backgrounds: a quasi-experimental study</p> <p>Country: Iran</p>				
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • genital hygiene • bathing • pad material used • daily use of clean pad • number of pad replacements during 24 hours • changing the pad at night or when in school 	<p>Attitudes, myths and/or perceptions of menstruation</p> <ul style="list-style-type: none"> • menstrual attitude, including viewing menstruation as positive troubling or both 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • behaviours during menstruation (e.g. tendency to stay at home or not exercise; ability to properly perform daily tasks; negative impact of menstruation on studying; frequency of school absences during menstruation) • noting the first day of the monthly menstruation • noticing typical period occurrence • paying attention to sudden changes in menstruation dietary changes during menstruation (e.g. eating more protein and less salt and sugar; reduced consumption of snacks, sweets or pickles and increased consumption of vegetables, fruits and grains; avoiding certain foods; taking iron supplements during menstruation) 	<p>Sources of information about menstruation/ puberty</p> <ul style="list-style-type: none"> • from whom/where students received information about menstruation and questions related to personal health
Literature/ Study Type	Cluster controlled pre-post			
Evaluation (Yes/No)	<p>Yes. Evaluation done immediately post-intervention with researchers administering questionnaire to all students (intervention and control). Results showed a statistically significant difference between menstrual health of the experimental group compared with the control group. However, the aggregated 'menstrual health' variable included a wide range of behaviours.</p>			

<p>Author, Year: (Fetohy 2007)</p> <p>Article Title: Impact of a health education program for secondary school Saudi girls about menstruation at Riyadh city</p> <p>Country: Saudi Arabia</p>	
Aim/ Objective	To assess the impact and suitability of menstrual education program for 1st and 2nd graders at a girls' secondary school in Riyadh city
Population	248 girls at a randomly selected governmental girls' secondary school in Riyadh. Six classes were chosen randomly from 1st grade, with three classes receiving a health education intervention and the others as controls. Four classes were chosen randomly from 2nd grade, with two classes receiving a health education intervention and the others as controls.
Age (Range/ Group/ Mean)	<p>Unclear.</p> <p>Data given for distribution of ages: 60.5% of the total sample was aged 14-17 years, and 39.5% of the sample was >17 years</p>
Intervention	<p>Yes. The intervention involved a 2-hour education session, run by a school nurse and two social workers, that aimed to increase menstrual knowledge and knowledge of healthy practices and promote healthy practices and positive behaviour change. The five topics included: general information and defining menstruation; causes of pain, abnormal menstruation and how to manage; normal changes and strategies for management of pain and menses; medical pain relief information; and types of food that should be consumed during menstruation.</p>

Author, Year: (Fetohy 2007) Article Title: Impact of a health education program for secondary school Saudi girls about menstruation at Riyadh city Country: Saudi Arabia				
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • knowledge of definition of menstruation • knowledge of duration of menstruation • knowledge of age at menarche • knowledge of menstrual pain – knowledge of methods for relieving pain • knowledge of menstrual hygiene 	Menstrual hygiene practices <ul style="list-style-type: none"> • management practices and hygiene (e.g. bathing) 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • menstrual attitude (attitude towards healthy and unhealthy practices) 	Sources of information about menstruation <ul style="list-style-type: none"> • from whom/where students receive information about menstruation
Literature/ Study Type	'randomized post-test only experimental-control groups design'			
Evaluation (Yes/No)	Yes. The questionnaire was distributed immediately post-intervention in both intervention and control classes.			

Author, Year: (Gultie, Hailu et al. 2014) Article Title: Age of menarche and knowledge about menstrual hygiene management among adolescent school girls in Amhara province, Ethiopia: implication to health care workers & school teachers Country: Ethiopia				
Aim/ Objective	To assess the age of menarche and knowledge of adolescents about MHM in Amhara province			
Population	492 female students in Mehalmeda high school (grades 9, 10, 11 and 12) during the 2012/13 academic year			
Age (Range/ Group/ Mean)	The mean age of the students was 16.85 ± 1.336 years. Age (in years) = Percent of participants: 13-15 = 17.3%; 16-18 = 75.0%; 19-21 = 7.3%; >21 = 0.4%			
Intervention	No			
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • knowledge of MHM (e.g. poor menstrual hygiene predisposes to an infection, use of sanitary pad and genital washing should be done frequently) 	Menstrual hygiene practices <ul style="list-style-type: none"> • main MHM materials (e.g. commercially made sanitary pads, underwear, and homemade pad) • reporting foul smelling during menstruation 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • perception of menstrual blood (e.g. as unhygienic) 	Sources of information <ul style="list-style-type: none"> • with whom students discussed menstrual hygiene • learning about menstrual hygiene in class
Literature/ Study Type	School-based cross sectional study			
Evaluation (Yes/No)	No			

<p>Author, Year: (Kabir, Saha et al. 2015)</p> <p>Article Title: Female unmarried adolescents' knowledge on selected reproductive health issues in two low performing areas of Bangladesh: an evaluation study</p> <p>Country: Bangladesh</p>		
Aim/ Objective	Evaluate changes in knowledge of female unmarried adolescents on selected RH issues in two low performing areas of Bangladesh	
Population	Female unmarried adolescents aged 12-19 years selected from households (oldest adolescent selected if >1 adolescents in the households)	
Age (Range/ Group/ Mean)	Participants' ages ranged from 12-19 years	
Intervention	Yes. The 12-month intervention included training of government service providers, disseminating behaviour change materials within the targeted communities, and employing community-based health promoters. Peer promoters organised group and 1:1 sessions at the community level to improve knowledge on RH and increase awareness about health services.	
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> • knowledge about use clean dry cloth during menstruation • knowledge about using sanitary pad/cotton • knowledge about use antiseptic liquid/hot water for washing during menstruation • knowledge about whether or not one must abstain from eating meat/fish/outside home during menstruation 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • MHM materials (e.g. old cloths, sanitary pad)
Literature/ Study Type	Pre-post	
Evaluation (Yes/No)	<p>Yes. Researchers conducted a baseline survey before the intervention and an end-line survey one year later.</p> <p>Female unmarried adolescent were significantly less inclined to use old cloths during menstruation at the end-line survey compared to baseline. Knowledge about using clean dry cloth during menstruation also improved significantly. In the rural area, knowledge improved significantly about use of antiseptic liquid/hot water for washing during menstruation by female unmarried adolescents at the end-line compared to baseline.</p>	

<p>Author, Year: (Kansal, Singh et al. 2016)</p> <p>Article Title: Menstrual Hygiene Practices in Context of Schooling: A Community Study Among Rural Adolescent Girls in Varanasi</p> <p>Country: India</p>	
Aim/ Objective	<p>To assess the awareness about menarche and their sources of information before its onset</p> <p>To find out the prevailing practices for menstrual hygiene among adolescent girls</p> <p>To ascertain the association of awareness of menstruation before menarche and practices for menstruation hygiene with educational status of respondents and their mothers</p> <p>To assess the relative contribution of educational status of respondents and their mothers on the likelihood of using unhygienic practices during menstruation</p>
Population	<p>Survey: 650 adolescent girls aged 15-19 years living in rural Varanasi were selected by lottery irrespective of education/marital status. Researchers selected up to 1 girl per household and excluded girls with disabilities.</p> <p>FGDs: 40 participants selected at random from those surveyed</p>
Age (Range/ Group/ Mean)	More than half of survey respondents belonged to the age group 15-17 years
Intervention	None

Author, Year: (Kansal, Singh et al. 2016) Article Title: Menstrual Hygiene Practices in Context of Schooling: A Community Study Among Rural Adolescent Girls in Varanasi Country: India			
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • awareness about menarche before its onset 	Menstrual hygiene practices <ul style="list-style-type: none"> • maintaining hygienic (e.g. sanitary napkin used during menstruation) or unhygienic (e.g. cloth used as absorbent) practices • materials used during menstruation (e.g. sanitary napkin, cloth) • method of cloth disposal 	Sources of information about menstruation <ul style="list-style-type: none"> • from whom girls received information about menarche before onset
Literature/ Study Type	Cross-sectional descriptive with quantitative and qualitative components		
Evaluation (Yes/No)	No		

Author, Year: (Kansal, Singh et al. 2016) Article Title: Menstrual Hygiene Practices in Context of Schooling: A Community Study Among Rural Adolescent Girls in Varanasi Country: India			
Aim/ Objective	To assess the awareness about menarche and their sources of information before its onset To find out the prevailing practices for menstrual hygiene among adolescent girls To ascertain the association of awareness of menstruation before menarche and practices for menstruation hygiene with educational status of respondents and their mothers To assess the relative contribution of educational status of respondents and their mothers on the likelihood of using unhygienic practices during menstruation		
Population	Survey: 650 adolescent girls aged 15-19 years living in rural Varanasi were selected by lottery irrespective of education/marital status. Researchers selected up to 1 girl per household and excluded girls with disabilities. FGDs: 40 participants selected at random from those surveyed		
Age (Range/ Group/ Mean)	More than half of survey respondents belonged to the age group 15-17 years		
Intervention	None		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • awareness about menarche before its onset 	Menstrual hygiene practices <ul style="list-style-type: none"> • maintaining hygienic (e.g. sanitary napkin used during menstruation) or unhygienic (e.g. cloth used as absorbent) practices • materials used during menstruation (e.g. sanitary napkin, cloth) • method of cloth disposal 	Sources of information about menstruation <ul style="list-style-type: none"> • from whom girls received information about menarche before onset
Literature/ Study Type	Cross-sectional descriptive with quantitative and qualitative components		
Evaluation (Yes/No)	No		

<p>Author, Year: (Kothari 2010)</p> <p>Article Title: Perception about Menstruation: A Study of Rural Jaipur, Rajasthan</p> <p>Country: India</p>					
Aim/ Objective	Knowledge about menstruation				
Population	<p>90 school-going adolescent girls in rural Rajasthan who were post-menarchal and unmarried (some girls who dropped out of school were subsequently included in the sample)</p> <p>Researchers also interviewed 45 married men</p>				
Age (Range/ Group/ Mean)	Girls' ages ranged from 12-18 years				
Intervention	None				
Outcomes	<p>Knowledge of menstruation</p> <ul style="list-style-type: none"> • knowledge about the biological attributes of menstruation, personal hygiene, menstruation-related health problems and social restrictions associated with menstruation • knowledge of menstruation at the time of menarche • understanding why menstruation occurs 	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • material used (e.g. sanitary napkins, homemade pads) • re-use of cloth 	<p>Attitudes, myths and/ or perceptions of menstruation</p> <ul style="list-style-type: none"> • menstruation as a normal phenomenon, extremely bad and disabling, dirty, disease 	<p>Experiences of menstruation</p> <ul style="list-style-type: none"> • self-reported symptoms associated with menstruation • psychological preparedness of girls at menarche • restrictions (religious, cooking, etc.) 	<p>Sources of information about menstruation</p> <ul style="list-style-type: none"> • seeing advertisements on TV • from whom girls received advice regarding menstruation • preferred education source to learn about menstruation
Literature/ Study Type	Descriptive semi-structured interviews				
Evaluation (Yes/No)	No				

<p>Author, Year: (Kumar and Srivastava 2011)</p> <p>Article Title: Cultural and social practices regarding menstruation among adolescent girls</p> <p>Country: India</p>	
Aim/ Objective	To find out the existing social and cultural practices regarding menstruation, awareness levels, and the behavioral changes that come about in adolescent girls during menstruation, their perception about menarche, how do they treat it, and the various taboos, norms, and cultural practices associated with menarche
Population	<p>117 adolescent girls aged 11-20 years in residential and slum areas</p> <p>Researchers also selected 41 mothers</p>
Age (Range/ Group/ Mean)	Girls' ages ranged from 11-20 years
Intervention	None

Author, Year: (Kumar and Srivastava 2011) Article Title: Cultural and social practices regarding menstruation among adolescent girls Country: India				
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • knowledge of menarche prior to experience 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • religious, social and cultural practices associated with menstruation • taboos 	Experiences of menstruation <ul style="list-style-type: none"> • psychological reaction to menarche • whether or not girls faced embarrassment due to menstruation 	Sources of information about menstruation <ul style="list-style-type: none"> • sources of information of menses and hygiene practices during menstruation
Literature/ Study Type	Cross-sectional descriptive using a questionnaire and FGDs			
Evaluation (Yes/No)	No			

Author, Year: (Malek, Shafiee-Kandjani et al. 2012) Article Title: Sexual Knowledge among High School Students in Northwestern Iran Country: Iran	
Aim/ Objective	To evaluate the sexual issues in high school girls and boys
Population	2,700 students (male and female) in the 1st-3rd grades of high school
Age (Range/ Group/ Mean)	No information on ages is provided
Intervention	None
Outcomes	Knowledge of puberty <ul style="list-style-type: none"> • questions about puberty physiology to measure knowledge
Literature/ Study Type	Cross-sectional descriptive using a questionnaire
Evaluation (Yes/No)	No

Author, Year: (Malleshappa, Krishna et al. 2011) Article Title: Knowledge and attitude about reproductive health among rural adolescent girls in Kuppam Mandal: An intervention study Country: India	
Aim/ Objective	To determine the effectiveness of a RH education intervention programme in improving the knowledge of adolescent girls aged between 14-19 years in Kuppam Mandal, Andhra Pradesh
Population	656 girls in the age group of 14-19 years were randomly selected from three high schools (class X) and three intermediate colleges (classes XI and XII) in Kuppam Mandal, Chittoor District, Andhra Pradesh
Age (Range/ Group/ Mean)	The mean age of girls was 16.68 years

Author, Year: (Malleshappa, Krishna et al. 2011) Article Title: Knowledge and attitude about reproductive health among rural adolescent girls in Kuppam Mandal: An intervention study Country: India		
Intervention	Yes. The eight-month intervention involved a RH education package developed in consultation with parents, teachers and adolescents. The programme was organized in 6 sessions with each session lasting for two hours on 6 consecutive days. The contents included anatomy and physiology of male and female reproductive systems, physical and psychological changes during puberty, adolescence, conception and contraception, and STDs including HIV/AIDS. Lectures were followed by interactive session with the students.	
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • usual age of first menses (9-16 years) • usual interval between two menstrual cycles (1 month) • ovulation • sanitary napkins/clean cloth should be used during menses and also changed regularly 	Knowledge of puberty <ul style="list-style-type: none"> • breasts enlarge in puberty • hips broaden in puberty • pubic hair grows in puberty
Literature/ Study Type	Pre-post test	
Evaluation (Yes/No)	Yes. A 50-item structured questionnaire was used to test participants' knowledge before and after the education session. Students' knowledge about puberty improved significantly after the intervention. Students had good knowledge regarding age at first menses and maintaining hygiene during menses at pre-test. Their knowledge about ovulation, menstruation, and menstrual hygiene improved significantly after the intervention.	

Author, Year: (McMahon, Winch et al. 2011) Article Title: 'The girl with her period is the one to hang her head': Reflections on menstrual management among schoolgirls in rural Kenya Country: Kenya		
Aim/ Objective	To explore how menstruation is perceived and navigated by rural Kenyan schoolgirls	
Population	48 primary school girls aged 12-16 years who had started menstruating 9 teachers	
Age (Range/ Group/ Mean)	Girls ages ranged from 12-16 years	
Intervention	None.	
Outcomes	Menstrual hygiene practices <ul style="list-style-type: none"> • methods for managing periods, (e.g. folded, bunched up or sewed cloth, including cloth from shirts or dresses) • problems using cloth (e.g. frequent leaks, chafing) 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • feelings associated with menstruation (e.g. fear, shame, distraction, confusion) • concerns about being stigmatized by fellow students • perception that the onset of menstruation signals the advent of a girl's sexual status • attitudes and practices of girls toward menstruation, arranged into personal, environmental and behavioural factors
Literature/ Study Type	Descriptive cross-sectional using FGDs, in-depth interviews, and field notes from observations	
Evaluation (Yes/No)	No	

Author, Year: (Moronkola and Oyebami 2007) Article Title: Age at menarche, menstrual patterns, sexual health knowledge, attitudes and premarital sexual partners of female athletes in Ibadan, Nigeria Country: Nigeria		
Aim/ Objective	To find out age at menarche, menstrual patterns, attitudes and premarital sexual partners of female athletes in Ibadan Nigeria	
Population	250 female athletes	
Age (Range/ Group/ Mean)	Participants' ages ranged from 14-36 years (modal age = 21 years)	
Intervention	None.	
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> the average menstruation period (4-6 days) when ovulation occurs (13-15 days before a woman's next period) knowledge that 'young girls do experience irregular menstruation at initial stage' knowledge that 'the psychological state of lady may delay her menstruation' 	Experiences of menstruation <ul style="list-style-type: none"> age at menarche period regularity
Literature/ Study Type	Descriptive cross-sectional using a retrospective survey	
Evaluation (Yes/No)	No	

Author, Year: (Mosavi, Babazadeh et al. 2014) Article Title: Assessing Iranian Adolescent Girls' Needs for Sexual and Reproductive Health Information Country: Iran		
Aim/ Objective	To explore the views and experiences of adolescent girls and key adults regarding the necessity of providing SRH information and services for adolescent girls in Iran	
Population	247 adolescent girls (non-peer education = 230; peer education = 17) 71 adults (e.g. government representatives, representatives of non-governmental organisations, religious leaders, health service providers, mothers, teachers, sociologists)	
Age (Range/ Group/ Mean)	Girls' ages ranged from 14-19 years	
Intervention	None.	
Outcomes	Sources of information about puberty <ul style="list-style-type: none"> adolescents' major source of information about puberty 	
Literature/ Study Type	Descriptive qualitative (FGDs with adolescent girls and their mothers; semi-structured interviews with key informants)	
Evaluation (Yes/No)	No	

Author, Year: (Nair, Leena et al. 2013) Article Title: ARSH 8: Family Life Education and Counseling: A School Based Model Country: India			
Aim/ Objective	To understand the problems of school going adolescents in selected schools To provide class-based family life education		
Population	1,304 adolescent girls (who formed 64% of the 2,781 total adolescents surveyed)		
Age (Range/ Group/ Mean)	22.4% of the total sample (males and females) were less than 16-years-old; data is not disaggregated further		
Intervention	Yes. The intervention involved preparation of a guidebook '101 Questions' based on the most frequently asked questions among adolescents participating in a formative component of the research involving queries collected anonymously on a slip of paper.		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> whether or not girls received information about menstruation prior to menarche 	Menstrual hygiene practices <ul style="list-style-type: none"> how often girls changed pad/cloths what type of absorbent girls used (e.g. cloths, pad) difficulty in changing pads three or more times a day (e.g. due to lack of facility, financial status, ignorance) 	Experiences of menstruation <ul style="list-style-type: none"> psychological problems during menstruation (e.g. fear, anger, anxiety, low mood, irritability, tiredness)
Literature/ Study Type	Descriptive cross-sectional using a survey		
Evaluation (Yes/No)	Yes. No data on evaluation of the intervention was provided beyond the numbers of adolescents exposed to the 'family life education and counselling classes.'		

Author, Year: (Ogunfowokan and Babatunde 2010) Article Title: Management of primary dysmenorrhea by school adolescents in ILE-IFE, Nigeria Country: Nigeria			
Aim/ Objective	To determine knowledge of menstruation and primary dysmenorrhea, assess the severity of pain they experienced during an episode of primary dysmenorrhea, and determine the management strategies they adopted		
Population	150 adolescent students with dysmenorrhea attending a girls' senior secondary school in Ile-Ife, Nigeria.		
Age (Range/ Group/ Mean)	Girls' ages ranged from 10-20 years Age (in years) = Percent of participants: 10-13 = 5% 14-17 = 63% 18-20 = 33%		
Intervention	None		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> knowledge deficits regarding menstruation and dysmenorrhea source of menstrual blood 	Experiences of menstruation <ul style="list-style-type: none"> reported pain on the Faces Pain Scale methods to manage primary dysmenorrhea 	Sources of information about menstruation <ul style="list-style-type: none"> source of information about dysmenorrhea
Literature/ Study Type	Descriptive cross-sectional using a semi-structured questionnaire		

Author, Year: (Ogunfowokan and Babatunde 2010)	
Article Title: Management of primary dysmenorrhea by school adolescents in ILE-IFE, Nigeria	
Country: Nigeria	
Evaluation (Yes/No)	No

Author, Year: (Pokharel, Kulozycki et al. 2006)	
Article Title: School-Based Sex Education in Western Nepal: Uncomfortable for Both Teachers and Students	
Country: Nepal	
Aim/ Objective	To determine the extent to which material using a chapter on RH contained within the textbook Health, Population and Environment is covered in classes in private or government schools in urban or rural areas
Population	Students (male = 277; female = 174) in the 8th and 9th grades In-depth interviews with 8 teachers
Age (Range/ Group/ Mean)	Students ages ranged from 12-19 years
Intervention	Yes. Students are supposed to be taught basic sex education using a chapter in a textbook called Health, Population and Environment. Little is known about how or how well this material is covered.
Outcomes	Menstrual hygiene practices • questions about menstrual practices (no data provided in article)
Literature/ Study Type	Descriptive cross-sectional using a school-based survey and in-depth interviews with teachers
Evaluation (Yes/No)	Yes. Authors presented qualitative description of students' experiences of RH teaching.

Author, Year: (Rani, Sharma et al. 2016)	
Article Title: Practices and perceptions of adolescent girls regarding the impact of dysmenorrhea on their routine life: a comparative study in the urban, rural, and slum areas of Chandigarh	
Country: India	
Aim/ Objective	To estimate the prevalence, to compare the impact of dysmenorrhea on routine life among adolescent girls, and to compare the practices and perceptions regarding dysmenorrhea
Population	300 adolescent girls aged 11-18 years who had attained menarche were selected from households in urban (n=100), rural (n=100), and slum (n=100) areas in the Union Territory of Chandigarh
Age (Range/ Group/ Mean)	Participants' ages ranged from 11-18 years
Intervention	None.

Author, Year: (Rani, Sharma et al. 2016) Article Title: Practices and perceptions of adolescent girls regarding the impact of dysmenorrhea on their routine life: a comparative study in the urban, rural, and slum areas of Chandigarh Country: India					
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> having knowledge of menstruation before starting it 	Menstrual hygiene practices <ul style="list-style-type: none"> pad material used 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> beliefs about menstruation (e.g. menstrual blood as impure, menstruation as a natural process) 	Experiences of menstruation <ul style="list-style-type: none"> menstrual history (e.g. regular vs. irregular cycles, periodicity) symptoms of dysmenorrhea practices regarding dysmenorrhea (e.g. taking medicine, eating non-vegetarian food, drinking hot tea) effect of pain on daily activities grading of dysmenorrhea using the faces scale 	Sources of information about menstruation <ul style="list-style-type: none"> from whom/where girls received menstrual information
Literature/ Study Type	Descriptive cross-sectional using a survey questionnaire				
Evaluation (Yes/No)	No				

Author, Year: (Ravishankar 2011) Article Title: Development and Evaluation of an Intervention to Meet the Reproductive Health Needs of Adolescents in India: A Randomized Controlled Trial Country: India				
Aim/ Objective	To improve the knowledge on SRH issues among the adolescents and to strengthen their capacity to become an active player in advocating for open discussion on adolescent sexuality			
Population	200 rural unmarried female adolescents			
Age (Range/ Group/ Mean)	Participants' ages ranged from 17-19 years (median age = 17.6 years)			
Intervention	Yes. The intervention involved a six-month comprehensive package delivered through trained primary agents at the villages. Volunteers (n=20) received four days' training involving 14 sessions. Activities included weekend life skills education sessions/group discussions; special lectures and debates; and two gynaecological health camps for adolescent girls where doctors gave advice on RH matters. In order to get girls accustomed with use of sanitary napkins, sanitary napkins were distributed free of cost in villages.			
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> 'The excessive bleeding during menstruation is an indication of poor reproductive health of a woman' (true/false) 'The ovum is usually released around 14th day from menstruation' (true/false) typical age at menarche length of menstrual cycle 	Menstrual hygiene practices <ul style="list-style-type: none"> hygienic measures usually take during menstruation number of times bathing during menstruation use of pads, cloth *outcomes here are mentioned in the article, but results are not reported 	Knowledge of puberty <ul style="list-style-type: none"> 'If a girl does not attain puberty at the age 14, she may be having biological problems' (true/false) 'Puberty start between 10-15 years in boys' (true/false) 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> views on menstruation (e.g. common process, disease, curse of god)

Author, Year: (Ravishankar 2011)	
Article Title: Development and Evaluation of an Intervention to Meet the Reproductive Health Needs of Adolescents in India: A Randomized Controlled Trial	
Country: India	
Literature/ Study Type	Described by authors as a RCT, though it is unclear how the RCT was structured and which groups were intervention /control. The evaluation appears to be a pre-post intervention test design
Evaluation (Yes/No)	Yes. Immediately after 6 month intervention

Author, Year: (Ray, Ghosh et al. 2011)	
Article Title: Knowledge and information on psychological, physiological and gynaecological problems among adolescent schoolgirls of eastern India	
Country: India	
Aim/ Objective	To determine sex education knowledge level of school going adolescents in semi urban area of Midnapore, West Bengal, India
Population	521 students aged 10-19 years who were randomly selected from two premier secondary schools
Age (Range/ Group/ Mean)	Students' ages ranged from 10-19 years. Most (94.2%) were aged 13-16 years.
Intervention	None
Outcomes	<div>Knowledge of puberty</div> <ul style="list-style-type: none"> puberty-related problems and their prevention [undefined] <div>Sources of information about puberty</div> <ul style="list-style-type: none"> from whom/where students received information about puberty
Literature/ Study Type	Descriptive cross-sectional using a questionnaire
Evaluation (Yes/No)	No

Author, Year: (Shaikh and Rahim 2006)	
Article Title: Assessing knowledge, exploring needs: a reproductive health survey of adolescents and young adults in Pakistan	
Country: Pakistan	
Aim/ Objective	<div>To assess the baseline SRH knowledge and explore the needs with regards to SRH promotion</div> <div>To suggest interventions based on needs identified in the target population in order to upgrade the level of existing services</div>
Population	Female (n=208) and male (n=191) adolescents living in 20 villages near Lahore
Age (Range/ Group/ Mean)	The mean age of participants was 17 years
Intervention	None
Outcomes	<div>Knowledge of menstruation</div> <ul style="list-style-type: none"> whether participants had ever heard or discussed issues regarding menstruation, such as the onset of menstrual cycles and the importance of maintaining hygiene during menstruation <div>Knowledge of puberty</div> <ul style="list-style-type: none"> whether participants had ever heard or discussed issues regarding puberty, such as physical bodily changes <div>Sources of information about menstruation/puberty</div> <ul style="list-style-type: none"> from whom/where respondents received information on SRH preferred sources of information regarding SRH

Author, Year: (Shaikh and Rahim 2006)	
Article Title: Assessing knowledge, exploring needs: a reproductive health survey of adolescents and young adults in Pakistan	
Country: Pakistan	
Literature/ Study Type	Descriptive cross-sectional using a questionnaire
Evaluation (Yes/No)	No

Author, Year: (Sharanya 2014)			
Article Title: RH status and life skills of adolescent girls dwelling in slums in Chennai, India			
Country: India			
Aim/ Objective	To assess the reproductive and menstrual morbidity profile, and personal and environmental menstrual hygiene, in order to determine the RH-seeking behaviour and life skills of adolescent girls living in slums in Chennai, southern India		
Population	Slum-dwelling girls aged 13-19 years in Chennai		
Age (Range/ Group/ Mean)	Participants' ages ranged from 13-19 years with the majority (86%) aged 15-19 years		
Intervention	None		
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • awareness of the menstrual cycle before attaining menarche... • the significance of menstruation 	Experiences of menstruation <ul style="list-style-type: none"> • cultural restrictions during menstruation 	Sources of information about menstruation/puberty <ul style="list-style-type: none"> • the main source of information/teaching best menstrual practices
Literature/ Study Type	Cross-sectional using a questionnaire		
Evaluation (Yes/No)	No		

Author, Year: (Sommer 2009)	
Article Title: Ideologies of sexuality, menstruation and risk: girls' experiences of puberty and schooling in northern Tanzania	
Country: Tanzania	
Aim/ Objective	To examine girls' voiced experiences of menstruation, puberty and schooling in northern Tanzania To examine how the onset of menses and puberty may be impacting on girls' school participation, given societal implications of pubertal onset and potentially gender discriminatory school environments
Population	Post-pubescent girls aged 16-19 years living in urban and rural Kilimanjaro The urban girls came from an in-school secondary school (n=60) and a vocational training centre for school drop-outs (n=20). The rural girls came from a secondary school (n=20-40) [unclear why actual sample size not given] and a church-run centre for school drop-outs [unable to sample sufficient numbers].
Age (Range/ Group/ Mean)	Girls' ages ranged from 16-19 years
Intervention	None

Author, Year: (Sommer 2009) Article Title: Ideologies of sexuality, menstruation and risk: girls' experiences of puberty and schooling in northern Tanzania Country: Tanzania					
Outcomes	Menstrual hygiene management • challenges of managing menstruation in schools	Knowledge of puberty • gaps in knowledge of body changes, sexual health and HIV/AIDS	Attitudes, myths and/or perceptions of menstruation/puberty • understandings and perceptions about girls' bodies and development	Experiences of menstruation/puberty • first experiences of menses • the ways in which menses and puberty has impacted girls' lives in and out of school • potential linkages between menarche and the initiation of sexual behaviour (e.g. hiding perceived early onset of menses for fear of being accused of premarital sexual activity) • menstrual narratives	Sources of information about menstruation/puberty • from whom girls receive guidance
Literature/ Study Type	Comparative (urban/rural) case study using in-depth interviews and participatory research with young women				
Evaluation (Yes/No)	No				

Author, Year: (Sommer 2010) Article Title: Where the education system and women's bodies collide: The social and health impact of girls' experiences of menstruation and schooling in Tanzania Country: Tanzania			
Aim/ Objective	To describe the social context and lived experiences of menstruation and schooling for pubescent girls in northern Tanzania, highlighting girls' voiced recommendations for making school environments more girl-friendly and school curriculum more attuned to girls' needs		
Population	Post-pubescent girls aged 16-19 years living in urban and rural Kilimanjaro The urban girls came from an in-school secondary school (n=60) and a vocational training centre for school drop-outs (n=20). The rural girls came from a secondary school (n=20-40) [unclear why actual sample size not given] and a church-run centre for school drop-outs [unable to sample sufficient numbers].		
Age (Range/ Group/ Mean)	Girls' ages ranged from 16-19 years		
Intervention	None		
Outcomes	Menstrual hygiene management • challenges of managing menstruation in schools	Attitudes, myths and/or perceptions of menstruation/puberty • views of becoming a young woman	Experiences of menstruation/puberty • restrictions on girls' lives • participation in school during menstruation
Literature/ Study Type	Comparative (urban/rural) case study using in-depth interviews and participatory research with young women		
Evaluation (Yes/No)	No		

<p>Author, Year: (Sommer 2013)</p> <p>Article Title: Structural factors influencing menstruating school girls' health and well-being in Tanzania</p> <p>Country: Tanzania</p>			
Aim/ Objective	To understand girls' experiences of menstruation, puberty and schooling, with a specific focus on exploring the structural influences within and outside of the school environment that are currently shaping girls' transitions through puberty in a society undergoing significant demographic changes		
Population	Adolescent girls aged 16-19 years, in and out of school (n=8 per site, total sample size not given) Key informant interviews with adults		
Age (Range/ Group/ Mean)	Girls' ages ranged from 16-19 years		
Intervention	None		
Outcomes	<p>Menstrual hygiene practices</p> <ul style="list-style-type: none"> • themes of availability of services and sanitation systems, basic water, disposal paths, and cloth • water and sanitation preferences at school • type of absorbent for managing menses (e.g. tissue or toilet paper, sanitary towels, pads or kanga (cloth)) • disposal of menstrual waste 	<p>Attitudes, myths and/or perceptions of menstruation/ puberty</p> <ul style="list-style-type: none"> • themes regarding beliefs of menstruation 	<p>Experiences of menstruation/puberty</p> <ul style="list-style-type: none"> • experiences learning SRH curriculum in school • factors impacting girls' school-going experiences • navigating the onset of puberty within the school and home
Literature/ Study Type	Comparative (urban/rural) case study using in-depth interviews with purposively sampled respondents Also used participant observation, documentary review and in-depth interviews with adults involved in girls' lives (e.g. health workers, teachers, grandparents, village elders)		
Evaluation (Yes/No)	No		

<p>Author, Year: (Sommer, Ackatia-Armah et al. 2015)</p> <p>Article Title: A comparison of the menstruation and education experiences of girls in Tanzania, Ghana, Cambodia and Ethiopia</p> <p>Country: Tanzania, Ghana, Cambodia, Ethiopia</p>	
Aim/ Objective	<p>To examine how menarche impacts the lives of schoolgirls in three low-income countries (Ghana, Cambodia and Ethiopia)</p> <p>To identify similarities between the three countries that would enable the adaptation to each context of a previously developed training book on menstruation issues for girls</p>
Population	Girls aged 16-19 years from rural and urban areas in each country
Age (Range/ Group/ Mean)	Girls' ages ranged from 16-19 years
Intervention	None

Author, Year: (Sommer, Ackatia-Armah et al. 2015) Article Title: A comparison of the menstruation and education experiences of girls in Tanzania, Ghana, Cambodia and Ethiopia Country: Tanzania, Ghana, Cambodia, Ethiopia					
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • limited provision of health information • insufficient menstrual-related guidance • receiving any information about menstruation pre-menarche 	Menstrual hygiene practices <ul style="list-style-type: none"> • insufficient water and sanitation facilities within schools 	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • importance of culture in perpetuating negative attitudes towards menstruation • menstrual myths 	Experiences of menstruation <ul style="list-style-type: none"> • experience of first menstruation • punishment for early menarche 	Sources of information about menstruation <ul style="list-style-type: none"> • sources of guidance • student-teacher relations • types of information (incorrect or correct) provided
Literature/ Study Type	Comparative analyses across three countries and participatory activities with girls				
Evaluation (Yes/No)	No				

Author, Year: (Tasnim, Rahman et al. 2009) Article Title: Talking about sexuality at secondary schools of periurban area of Dhaka city Country: Bangladesh		
Aim/ Objective	To determine the effect of introducing an education booklet on RH knowledge among the adolescents and its acceptability to them	
Population	1,490 student respondents (862 during the pre-test and 628 during the post-test) from classes IX and X at purposively selected secondary high schools (4 boys schools and 4 girls schools) in a periurban location of Dhaka city Pre-test respondents were 54.2% female and 45.9% male. Post-test respondents were 49.4% female and 50.6% male.	
Age (Range/ Group/ Mean)	Age not reported	
Intervention	Yes. The intervention involved the distribution of an education booklet and a health education session in the respective classes. The education session usually took 1.5-2 hours. Students were encouraged to ask or write down questions, and feedback was given accordingly. Then, the booklet was distributed to students to read at home.	
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • correct definition of menstruation • correct definition of the fertile period 	Knowledge of puberty <ul style="list-style-type: none"> • awareness of physical changes during adolescence
Literature/ Study Type	Quasi-experimental pre-post test design	
Evaluation (Yes/No)	Yes. Researchers implemented tests pre and post-intervention to measure changes in knowledge. Girls were more ignorant than boys about physical changes during adolescence during the pre-test, but they made significant improvements during the post-test. The overall mean knowledge score of students was much improved during the post-test.	

Author, Year: (Umeora and Egwuatu 2008) Article Title: Menstruation in rural Igbo women of south east Nigeria: attitudes, beliefs and practices Country: Nigeria		
Aim/ Objective	To evaluate the beliefs, myths and traditional practices associated with menstruation within rural Igbo communities	
Population	Purposively sampled females aged 17-56 years	
Age (Range/ Group/ Mean)	Participants' ages ranged from 17-56 years (mean age = 32.2 years)	
Intervention	None	
Outcomes	Attitudes, myths and/or perceptions of menstruation <ul style="list-style-type: none"> • effect of pre-menarchal education on attitude to menstruation (e.g. menstruation is a disorder, a curse, evil, dirty) 	Sources of information about menstruation <ul style="list-style-type: none"> • source of pre-menarchal education
Literature/ Study Type	Descriptive cross-sectional using a questionnaire and collecting students' queries on chits of paper	
Evaluation (Yes/No)	No	

Author, Year: (Upashe, Tekelab et al. 2015) Article Title: Assessment of knowledge and practice of menstrual hygiene among high school girls in Western Ethiopia Country: Ethiopia		
Aim/ Objective	To assess the knowledge and practice of menstrual hygiene among high school girls at Nekemte town, Oromia region, Western Ethiopia	
Population	828 post-menarchal female high school students Girls with visual impairment, evening class students, and those who were critically ill and incapable to provide informed consent were excluded from the study.	
Age (Range/ Group/ Mean)	The majority of participants (65.1%) were less than 17-years-old; 34.9% of participants were aged 17 years or older.	
Intervention	None	
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • students' menstrual knowledge score • knowledge of menstruation (e.g. physiological process, pathological process, curse from god) • cause of menstruation (e.g. hormones, curse of god, disease) • source of menstrual blood • heard about menstruation before attaining menarche • knowledge of menstrual hygiene • knowledge of foul smells during menstruation [unclear what direction this question is going, or who is defining foul smelling] • knowledge of menstrual blood is unhygienic [again, who is defining unhygienic and how 	Sources of information about menstruation <ul style="list-style-type: none"> • from whom/where girls received information about menstruation
Literature/ Study Type	Descriptive cross-sectional using a questionnaire and collecting students' queries on chits of paper	
Evaluation (Yes/No)	No	

Author, Year: (Wong and Khoo 2011) Article Title: Menstrual-related attitudes and symptoms among multi-racial Asian adolescent females Country: Malaysia		
Aim/ Objective	To investigate the perceptions and attitudes related to menstruation, PMS and treatment-seeking behaviour among adolescent girls of different ethnocultural groups attending public secondary schools in Malaysia To provide insight into menstrual-related education information in order to help adolescent girls manage the physical and psychological changes associated with menstruation	
Population	1,092 adolescent females from 94 public secondary schools in Kuala Lumpur	
Age (Range/ Group/ Mean)	Participants' ages ranged from 13–19 years (mean age = 15.19 ± 1.39 years)	
Intervention	None	
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • whether participants had ever previously obtained information regarding PMS • information that girls wanted to know regarding PMS (e.g. prevention and treatment of PMS, physiology) 	Sources of information about menstruation <ul style="list-style-type: none"> • from whom/where girls acquired the information about PMS
Literature/ Study Type	Descriptive cross-sectional using a self-administered semistructured questionnaire	
Evaluation (Yes/No)	No	

Author, Year: (Zegeye, Megabiaw et al. 2009) Article Title: Age at menarche and the menstrual pattern of secondary school adolescents in northwest Ethiopia Country: Ethiopia		
Aim/ Objective	To determine the age at menarche and patterns of menstruation among secondary school girls, and to identify the magnitude of common menstrual disorders	
Population	612 secondary school girls	
Age (Range/ Group/ Mean)	Participants' ages ranged from 14.5-19.5 years (mean age = 17.4 ± 1 years)	
Intervention	None	
Outcomes	Knowledge of menstruation <ul style="list-style-type: none"> • whether or not girls had received information from someone 	Sources of information about menstruation <ul style="list-style-type: none"> • from whom girls received information about menstruation
Literature/ Study Type	Descriptive cross-sectional using a questionnaire survey	
Evaluation (Yes/No)	No	



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About GAGE

Gender and Adolescence: Global Evidence (GAGE) is a nine-year longitudinal research programme generating evidence on what works to transform the lives of adolescent girls in the Global South. Visit www.gage.odi.org.uk for more information.

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