

## OPEN

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## Menstrual Hygiene Management in Resource-Poor Countries

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**Importance:** Adequate management of menstrual hygiene is taken for granted in affluent countries; however, inadequate menstrual hygiene is a major problem for girls and women in resource-poor countries, which adversely affects the health and development of adolescent girls.

**Objective:** The aim of this article is to review the current evidence concerning menstrual hygiene management in these settings.

**Evidence Acquisition:** A PubMed search using MeSH terms was conducted in English, supplemented by hand searching for additional references. Retrieved articles were reviewed, synthesized, and summarized.

**Results:** Most research to date has described menstrual hygiene knowledge, attitudes, and practices, mainly in sub-Saharan Africa and South Asia. Many school-based studies indicate poorer menstrual hygiene among girls in rural areas and those attending public schools. The few studies that have tried to improve or change menstrual hygiene practices provide moderate to strong evidence that targeted interventions do improve menstrual hygiene knowledge and awareness.

**Conclusion and Relevance:** Challenges to improving menstrual hygiene management include lack of support from teachers (who are frequently male); teasing by peers when accidental menstrual soiling of clothes occurs; poor familial support; lack of cultural acceptance of alternative menstrual products; limited economic resources to purchase supplies; inadequate water and sanitation facilities at school; menstrual cramps, pain, and discomfort; and lengthy travel to and from school, which increases the likelihood of leaks/stains. Areas for future research include the relationship between menarche and school dropout, the relationship between menstrual hygiene management and other health outcomes, and how to increase awareness of menstrual hygiene management among household decision makers including husbands/fathers and in-laws.

**Target Audience:** Obstetricians and gynecologists, family physicians.

**Learning Objectives:** After completion of this educational activity, the obstetrician/gynecologist should be able to define what is meant by "adequate menstrual hygiene management," identify the challenges to adequate menstrual hygiene management that exist in resource-poor countries, and describe some of the intervention strategies that have been proposed to improve menstrual hygiene management for girls and women in those countries.

Menstruation is a normal biological process experienced by millions of women and girls around the world each month. Menarche signifies the start of a female's

reproductive years and often marks her transition to full adult female status within a society. Age at menarche tends to be slightly later in resource-poor countries than

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in higher-income countries,<sup>1</sup> yet an apparent decline in age at menarche has been documented in both developed<sup>2,3</sup> and developing countries<sup>4</sup> over the past few decades. One challenge of menstruation that is taken for granted in affluent countries is the simple question of how to manage or contain the menstrual flow and what happens to a girl or woman who is not able to do this successfully. The United Nations defines adequate menstrual hygiene management as “women and adolescent girls using a clean menstrual management material to absorb or collect blood that can be changed in privacy as often as necessary for the duration of the menstruation period, using soap and water for washing the body as required, and having access to facilities to dispose of used menstrual management materials.”<sup>5</sup> Particularly in poor countries, girls and women face substantial barriers to achieving adequate menstrual management.

Gender equity in education has long been heralded as a cornerstone for social and economic development. The education of girls and women holds a prominent position in both the United Nations’ Millennium Development Goals and in the recently adopted Sustainable Development Goals.<sup>6</sup> Although much progress has been made since 2000, in many countries (especially in South Asia and sub-Saharan Africa) a large number of girls either never attend school or attend only a few years of primary school before dropping out.<sup>7</sup> Furthermore, the number of out-of-school girls is rising again after years of improvement.<sup>7</sup>

Earlier menarche and a greater emphasis on education mean that many adolescent girls are in school while menstruating. With a typical menstrual cycle lasting 25 to 30 days within which bleeding occurs for 4 to 6 days,<sup>8</sup> postmenarcheal girls will experience menstrual bleeding on at least some school days every month. Menstrual hygiene management is therefore an increasingly important (yet often unrecognized) issue that is heavily intertwined with girls’ education, empowerment, and social development.

### EVIDENCE ACQUISITION AND EXTRACTION

As part of an ongoing program of menstrual hygiene management research and intervention in Ethiopia ([www.dignityperiod.org](http://www.dignityperiod.org)), we carried out a systematic review of the published literature on menstrual hygiene management to understand the current state of knowledge and gaps in evidence surrounding these practices in resource-poor countries. We searched PubMed with the help of a reference librarian for English-language articles published through December 2015 using the MeSH search terms *hygiene* or *menstrual hygiene*

*products* and *menstruation*. The PubMed search included the following: (“Hygiene”[MeSH] OR “Menstrual Hygiene Products”[MeSH]) AND English[lang]) AND (“Menstruation”[MeSH] AND English[lang]) AND (Journal Article[ptyp] AND English[lang]).

Our electronic search identified 199 unique citations that we then screened for relevance based on title and abstract (Fig. 1). Full-text screening was conducted of 58 articles, of which 27 were retained for inclusion and data extraction. We hand searched the reference lists of these articles plus key background articles to identify an additional 58 citations for screening. From the combined electronic and hand search, we identified 67 articles for inclusion that met the dual criteria of focusing on menstrual hygiene management in the setting of a low- or middle-income country.<sup>9</sup> These 67 articles include 43 descriptive studies, 11 intervention evaluation studies, 11 commentaries/editorials, and 2 review articles. For each included article, we extracted essential information into a spreadsheet to facilitate analysis. Extracted information for all articles included bibliographic information, research question or purpose, and information on the setting or location in which it was carried out. For descriptive studies, intervention evaluations, and review articles, we also extracted information on study design, sample characteristics, results, and limitations. We also extracted a description of the intervention that was used in those evaluation studies.

### THE CURRENT STATUS OF MENSTRUAL HYGIENE MANAGEMENT IN RESOURCE-POOR COUNTRIES

Most of the existing literature is descriptive in nature, explaining menstrual hygiene practices, knowledge, and attitudes—including beliefs and cultural taboos—and where girls get their information about menstruation. There are also observational studies that look at the associations between menstrual hygiene management practices and various sociodemographic and contextual characteristics (eg, lack of privacy, water, and/or proper sanitary disposal at school). Many of these studies are school based and often compare urban versus rural schools and/or private versus public schools. These articles frequently conclude that menstrual hygiene management is worse for girls in rural areas and for those who attend public schools (which tend to serve families of lower socioeconomic status). Studies are heavily concentrated in a handful of sub-Saharan African countries and the South Asia region. Very little is published in English from Latin America, North Africa and the Middle East, or Central Asia. The academic literature

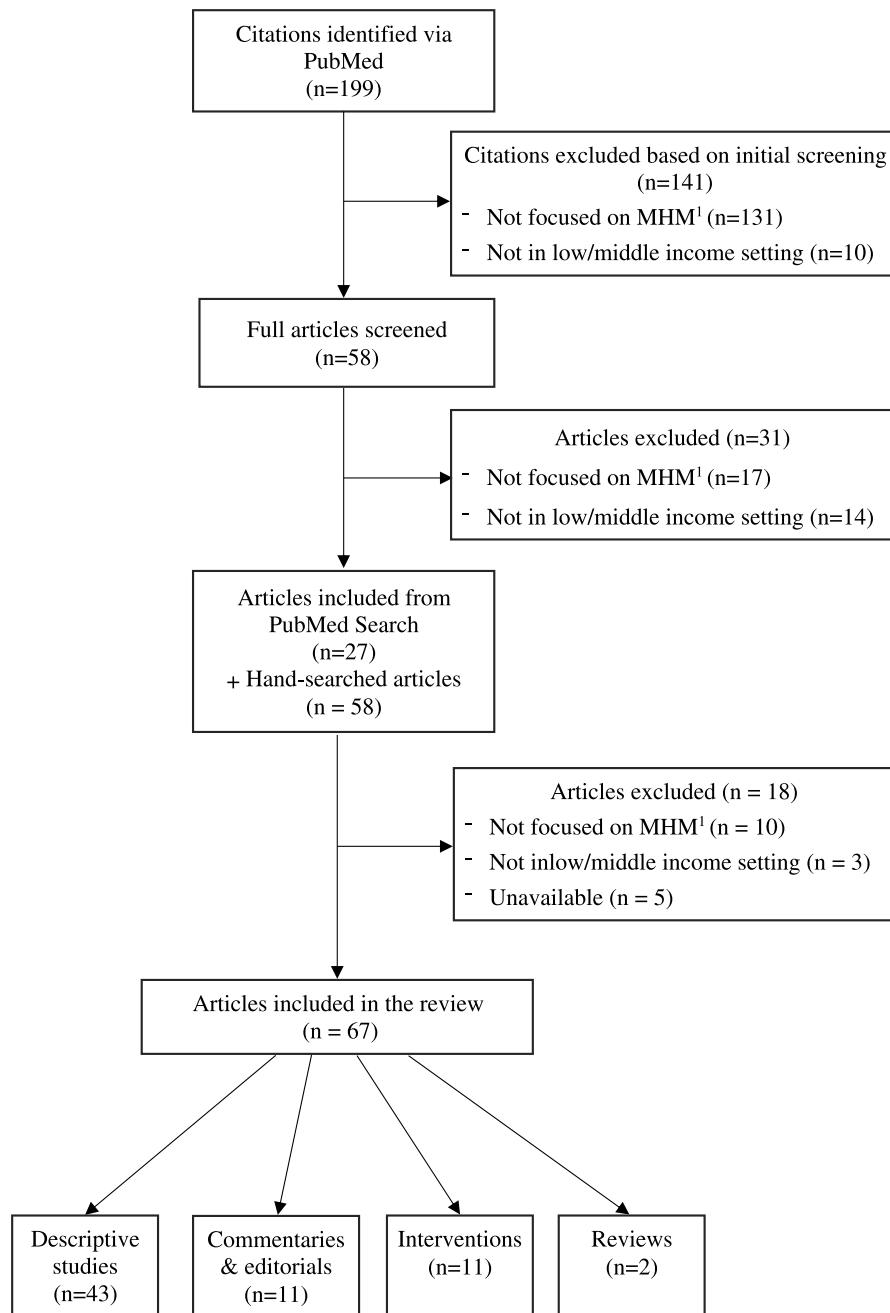


FIG. 1. Article identification flowchart. MHM, menstrual hygiene management.

has recently been paying more attention to issues surrounding menstrual hygiene management. Only 10 of the 67 articles included in this review were published prior to 2000.

Girls in resource-poor countries around the world tend to use old cloths, tissue paper, cotton or wool pieces, or some combination of these items to manage their menstrual bleeding<sup>10-31</sup> (Table 1). Egypt appears to be an exception to this pattern, where a large majority of girls report using commercially produced sanitary

pads or napkins instead of homemade menstrual hygiene devices.<sup>48,52</sup> Qualitative studies indicate that girls who know about commercial sanitary products may prefer these products because they are seen as more comfortable and less likely to leak, but for many girls such products are usually unavailable and/or unaffordable.<sup>13,19,24,40,44</sup>

Use of commercially produced sanitary pads is reported more commonly among girls in private schools, which typically serve wealthier families<sup>43</sup>; among those

TABLE 1  
Summary Results of Descriptive Articles Included in the Review

Year (Reference)	Setting	Purpose	Study Design and Sample	Results
2015 <sup>32</sup>	India  Gynecology, outpatient, and family welfare department of Odisha medical centers	To determine the association of MHM practices with urogenital infections in women, and to determine the influence of any other contextual factors	Case-control study 18- to 45-y-old women  (N = 486)	<ul style="list-style-type: none"> <li>• Women using reusable cloths were 2 times more likely to have a urogenital infection vs women who used disposable pads</li> <li>• Lab-positive cases of urogenital infection were more likely than negative to change their absorbents outdoors and to change these absorbents less often.</li> <li>• Girls who do not use sanitary napkins were 5.37 times more likely to be absent from school.</li> <li>• Students living in urban areas were 2.32 times more likely to use sanitary pads</li> <li>• 85.49% did not change menstrual materials at school</li> </ul>
2014 <sup>33</sup>	Ethiopia  Schools in Amhara state	To examine knowledge about menstruation, determinants of menstrual management and its influence on school attendance	Cross-sectional 10- to 19-y-old adolescent girls  (n = 574 surveys, n = 9 interviews)	<ul style="list-style-type: none"> <li>• 61.7% of the respondents miss school at least once per month due to menstruation</li> <li>• Main reasons for menstrual related absenteeism was lack of private changing/washing place at school (63.8%), fear of staining clothes (59.4%), discomfort from bloating/tiredness (55.1%), and pain (51.4%)</li> </ul>
2014 <sup>34</sup>	Uganda  6 rural government primary schools in Rukungiri district	To examine the menstrual hygiene practices and knowledge of girls, and assess the extent to which poor MHM affects their education	Cross-sectional 13- to 16-y-old girls  (N = 140)	<ul style="list-style-type: none"> <li>• Girls asked few questions on sanitary pad usage, but those asked indicated girls were unsure about usage and disposal.</li> <li>• Girls avoided school, dance classes, outdoor games, visiting temples, and doing daily chores during menstruation</li> </ul>
2014 <sup>35</sup>	India  3 girls' only schools in Pune	To document existing perceptions and misconceptions girls may have regarding menstruation, menarche, and various menstrual restrictions.	Cross-sectional 9- to 13-y-old girls  (N = 381) (Qualitative results only)	

(Continued on next page)

TABLE 1. (Continued)

Year (Reference)	Setting	Purpose	Study Design and Sample	Results
2014 <sup>36</sup>	Ethiopia	To assess girls' knowledge and contextual factors related to MHM	Cross-sectional	<ul style="list-style-type: none"> <li>• 69.3% felt uncomfortable being in school during menstruation.</li> <li>• 51.2% were absent during menstruation.</li> <li>• Urban residents were 1.8 times more likely to be knowledgeable about MHM</li> </ul>
2014 <sup>19</sup>	Secondary and preparatory schools in Amhara province Kenya	To investigate the cultural and spatial limitations associated with menstruation and puberty	Cross-sectional Adolescent girls and schoolteachers (N = 53) (Qualitative results only)	<ul style="list-style-type: none"> <li>• Girls used cotton wool, plastic bags, mattresses, dried leaves, cow dung, and paper from school classrooms</li> <li>• These alternatives cause physical discomfort and frequently leak</li> </ul>
2013 <sup>37</sup>	Primary schools in Kisumu and surrounding rural areas India	To document the menstrual hygiene practices of rural women and assess their willingness to pay for sanitary napkins	Cross-sectional 15- to 45-y-old women (N = 995)	<ul style="list-style-type: none"> <li>• 28.8% of women used sanitary napkins and 58.5% used old cloths.</li> <li>• 25.3% of nonsanitary pad users were willing to buy napkins</li> </ul>
2013 <sup>38</sup>	9 villages in Haryana Malawi	To examine school and individual factors associated with menstrual-related absenteeism.	Cross-sectional Primary school girls (N = 717)	<ul style="list-style-type: none"> <li>• Students who thought that the school toilets lacked privacy had more than twice the odds of being absent during their last menstrual period.</li> <li>• Students travelling 30–60 min to school had 79% higher odds of menstrual-related absenteeism vs students who take less than 30 min</li> </ul>
2013 <sup>23</sup>	Primary school survey responses from Machinga and Balaka districts Kenya	To examine girls' attitudes, experiences, and concerns about menarche and menstruation	Cross-sectional 14- to 16-y-old girls (N = 120) (Qualitative results only)	<ul style="list-style-type: none"> <li>• The most common MHM items were old clothes, blankets, mattress pieces, underwear, socks, towels, and cotton wool/tissue.</li> <li>• If menses started unexpectedly, girls would pluck grass from the schoolyard</li> </ul>
	6 schools in Siaya County			

2012 <sup>39</sup>	Ghana  Urban and rural high schools and vocational centers in Accra	To explore girls' experiences of menstruation and schooling in rural and urban Ghana to adapt the Tanzania girl's book to Ghana	Cross-sectional 16- to 19-y-old girls  (n = 10–20 individuals in n = 8 focus groups) (Qualitative results only)	<ul style="list-style-type: none"> <li>• There were insufficient latrines in schools, poor water/sanitation facilities, limited privacy, and inadequate disposal mechanisms for girls managing menses</li> <li>• Girls purchase "pure water," plastic bags of clean drinking water, and carry this to school for use in the latrines</li> <li>• 33% of girls cited a lack of pads as the main reason for menstrual related absenteeism</li> <li>• 54% of students usually changed in latrines, 27% changed in dormitories/bedrooms, and 19% changed in bathing place</li> <li>• Low-cost products (Afripads and Makapads) were used most in poor schools</li> </ul>
2012 <sup>40</sup>	Uganda  18 secondary schools and low-cost sanitary pad facilities in Southern Uganda	To explore the difficulties schoolgirls face in managing menstrual hygiene and to investigate the extent to which low-cost sanitary pads may be part of the solution	Cross-sectional 13- to 20-y-old girls  (n = 134 girls, n = 9 sanitary pad leaders)	<ul style="list-style-type: none"> <li>• 65% of respondents had high knowledge of menstruation, while 35% of them had low knowledge</li> <li>• 37% of the girls used sanitary pads, 4% used toilet paper, 8% use new pieces of cloth, and 1% used old pieces of cloth</li> <li>• There was a statistically significant association between source of knowledge about menstrual hygiene and rural/urban status (<math>P &lt; 0.05</math>)</li> <li>• 60% of urban and 7% of rural girls used sanitary pads</li> <li>• 72% of rural girls attended school during menstruation vs 94% of urban girls</li> <li>• Knowledge scores were higher among girls who attained menarche, girls from BPL families and girls in older age groups</li> <li>• 34.7% used cloth, 44.1% used sanitary pad, and 21.2% used cloth with sanitary pads</li> </ul>
2012 <sup>26</sup>	Nigeria  4 schools in Sokoto	To assess the level of knowledge on menstruation and hygiene practices among adolescent schoolgirls	Cross-sectional 15- to 20-y-old girls  (N = 122)	
2012 <sup>41</sup>	India Rural and urban high schools	To assess the menstrual hygiene knowledge and practices of rural and urban adolescent girls	Cross-sectional 8th–10th Standard of high school (Standard)  (N = 321)	
2012 <sup>29</sup>	India  4 high schools in rural areas in Bangalore	To assess menstrual hygiene perceptions and practices in high schoolgirls	Cross-sectional 8th–10th Standard girls  (N = 506)	

(Continued on next page)

TABLE 1. (Continued)

Year (Reference)	Setting	Purpose	Study Design and Sample	Results
2011 <sup>30</sup>	India	To assess the knowledge and practices around menstrual hygiene in rural and urban school going adolescent girls	Cross-sectional 8th–9th Standard girls  (N = 387)	<ul style="list-style-type: none"> <li>• 49.35% of the sample used sanitary pads, 45.74% used old cloth, and 4.9% used new cloth</li> <li>• More urban girls used sanitary pads (60.58%) vs rural girls (30.83%)</li> <li>• 86.63% of girls did not change materials in school</li> <li>• Most girls from residential areas use sanitary napkins due to their economic status</li> <li>• Most girls from slum areas used cloth because of the cost of sanitary napkins</li> </ul>
2011 <sup>42</sup>	Girls' school in Nagpur district India	To identify the existing social and cultural practices related to menstruation in urban residential areas and slum areas of Ranchi	Cross-sectional 11- to 20-y-old girls and mothers (n = 117 girls, n = 41 mothers)	<ul style="list-style-type: none"> <li>• Girls used cloth from shirts/dresses, scraps of old towels/blankets, mattress cuttings, sanitary pads, and dried grass.</li> <li>• Bathing is a preferred practice for girls managing menses</li> <li>• Sanitary pads (43.2%), new cloth (10.8%), old cloth (30.7%), and others (15.4%)</li> <li>• 72.2% of girls thought sanitary pads should be ideally used during menstruation, 22% thought cloth pieces should be used, and 5.8% thought other absorbents should be used</li> <li>• Sanitary pads were highest in private schools (33.5%) vs government (16.4%) and community (13%)</li> <li>• Old cloth use was highest in community girls (70%) vs private schools (50%) and government school (62.6%)</li> </ul>
2011 <sup>24</sup>	Residential colonies and urban slums in Ranchi  Kenya	To examine the knowledge and practices surrounding menstruation and menstrual management among primary school girls	Cross-sectional 12- to 16-y-old girls  (n = 48 girls, n = 9 teachers) Cross-sectional 10- to 19-y-old girls  (N = 241)	<ul style="list-style-type: none"> <li>• To study knowledge about reproductive health and to assess treatment seeking behavior regarding reproductive health problems</li> </ul>
2012 <sup>28</sup>	Primary school in Nyanza Province India	To explore the menstrual practices among female adolescents of urban Karachi, Pakistan, by using interviews	Cross-sectional 13- to 19-y-old schoolgirls and community girls (N = 1275)	<ul style="list-style-type: none"> <li>• To explore the menstrual practices among female adolescents of urban Karachi, Pakistan, by using interviews</li> </ul>
2010 <sup>43</sup>	Pakistan  3 squatter settlements in Karachi			

2010 <sup>22</sup>	Nigeria	To examine the knowledge and practices of adolescent schoolgirls in Kano, Nigeria, around menstruation and menstrual hygiene	Cross-sectional 10- to 19-y-old girls  (N = 400)	<ul style="list-style-type: none"> <li>• Girls' knowledge was significantly associated with their age group, but not with the type of school they attended</li> <li>• 88.7% of girls practiced good menstrual hygiene</li> <li>• 93.8% of girls started menstruation using sanitary pads</li> <li>• 6.2% used either specific pieces of cloth, or any available cloth they discarded after use</li> </ul>
2010 <sup>44</sup>	Coeducational, girls only, private, and government secondary schools in Kano Tanzania	To describe pubescent girls' experiences of menstruation and schooling.	Cross-sectional 16- to 19-y-old girls  (n = 16 interviews, n = 120 participatory activities) (Qualitative results only)	<ul style="list-style-type: none"> <li>• There were insufficient water/sanitation facilities at school and sanitary materials in the marketplace were unaffordable</li> <li>• These factors, or pressures from home to stop attending school, push girls who are already struggling with academics to leave school</li> <li>• 46.67% of girls use cloth and 15.67% of girls use sanitary napkins</li> </ul>
2010 <sup>45</sup>	India	To understand the perceptions, source of information, and status of menstrual hygiene	Cross-sectional 10- to 19-y-old girls (N = 300)	<ul style="list-style-type: none"> <li>• 65.70% of cloth users vs 12.3% of sanitary pad users were suffering from genital infections</li> <li>• 55.2% of the students received premenarcheal training</li> <li>• Sanitary pad use was higher among trained girls (75.1%) vs untrained girls (61.7%). Toilet paper and cloth use was higher among untrained girls (27.5% and 10.8%) vs trained girls (17.2% and 7.7%)</li> </ul>
2009 <sup>46</sup>	Sub-district school in Wardha district Nigeria  Secondary schools in Enugu State	To understand the prevalence of pre-menarcheal training among schoolgirls, and to determine whether this training affected girls' menstrual hygiene practices	Cross-sectional 10- to 19-y-old girls (N = 495)	<ul style="list-style-type: none"> <li>• Women managed menses with cotton wool (53.5%), rags/cloth/towel pieces (27.9%), pads (16.3%), and tissue (2.3%)</li> <li>• Women were willing to try Duet for menstrual management because of low cost (100%), ease of cleaning (100%), ease of drying/storage (97.7%), and ensured privacy (97.7%)</li> </ul>
2009 <sup>13</sup>	Zimbabwe  Public centers in Harare	To explore current menstrual practices, the effects of menses on daily life, unmet menstrual protection needs, and the acceptability of Duet as a menstrual management device	Cross-sectional  18- to 45-y-old women (N = 43)	

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TABLE 1. (Continued)

Year (Reference)	Setting	Purpose	Study Design and Sample	Results
2009 <sup>31</sup>	Ethiopia High school in Dabat and Kola Diba	To determine the age at menarche, patterns of menstruation among secondary school girls, and the magnitude of menstrual disorders	Cross-sectional 9th- to 10th-grade girls (N = 612)	<ul style="list-style-type: none"> <li>• 37.6% used sanitary pads, and 62.4% used pieces of cloth</li> <li>• Of the pad users, 57.9% were urban, and 42.1% were rural</li> </ul>
2008 <sup>12</sup>	Nigeria Private, public, girls' only, and coeducational schools in Onitsha	To investigate secondary school girls' perceptions of menstruation, medical problems associated with menstruation, and their key practices during menstruation	Cross-sectional Adolescent girls in JSS III and SSS III classes (N = 550)	<ul style="list-style-type: none"> <li>• Girls managed menses with tissue paper (41.3%), sanitary pads (32.7%), clothes (14.4%), multiple materials (10.7%), and tampons (0.9%)</li> <li>• The predominant medical problem associated with menstruation was abdominal pain/discomfort (66.2%)</li> <li>• 11.25% used sanitary pads, 6.25% used new cloth pieces, 42.5% used old cloth pieces, and 40% used all of the above</li> <li>• 98% used old clothes to make pads, and 2% used special pads</li> <li>• 88.7% of the sample reused pads</li> </ul>
2008 <sup>15</sup>	India Secondary school in West Bengal	To elicit the beliefs, sources of information about menstruation and the status of menstrual hygiene	Cross-sectional Adolescent girls in class 9 (N = 160)	
2007 <sup>11</sup>	Nepal Schools in the Chitwan district	To evaluate the knowledge and practices related to menstruation and menstrual hygiene	Cross-sectional 13- to 15-year-old girls (N = 150)	
2006 <sup>47</sup>	India 33 villages in 2 primary health centers areas	To determine the perceptions and experiences of women regarding menstruation and reproductive health	Cross-sectional 15- to 49-year-old women  (n = 1056 surveys, n = 16 key informants, n = 24 FGDs, n = 1205 interviews)	<ul style="list-style-type: none"> <li>• 0.4% of women used sanitary pads for MHM.</li> <li>• Women considered used cloths dirty and shunned the idea of reuse. They considered cloths to be abundant and easily available when needed</li> <li>• Reuse was considered an urban practice done only when there is a lack of space for disposal</li> </ul>

2005 <sup>48</sup>	Egypt Government rural, commercial, and nursing secondary schools in Mansoura	To determine the knowledge and practices of menstrual hygiene among adolescent secondary school girls	Cross-sectional 14- to 18-y-old girls (N = 664)	<ul style="list-style-type: none"> <li>• 66.8% of girls used sanitary pads, 15.9% used reusable cloths (after boiling/washing), 12% used old pieces of cloth and disposed after one use, and 5.3% used other materials (cotton, gauze, soft tissue, or nothing)</li> <li>• Presence of mass media at home (odds ratio [OR] = 12.7), high social class (OR = 5.98), middle social class (OR = 3.96), and urban residence (OR = 2.98) were major predictors of sanitary pad use</li> <li>• 75.6% of girls used old cloth (64.2% urban vs 89% rural girls and 62.2% school going vs 88.9% out-of-school girls)</li> <li>• School-going girls were 2.45 times more likely to adopt safe practices during menstruation compared with out-of-school girls</li> <li>• 60.2% of women used pads made from clothes, 11% used clothes with sanitary napkins, and 28% exclusively used sanitary pads</li> <li>• 73.4% of women in the 20- to 29-y age range used only sanitary napkins vs other age groups</li> <li>• 60.9% used sanitary pads (42.22% of secondary school girls vs 81.82% of undergraduates).</li> <li>• 32.86% used toilet paper (48.89% of secondary school girls vs 22.73% of undergraduates)</li> <li>• 77.1% used old cloth, 11.3% used old cloth with napkins, 6.5% used only undergarments, and 5.2% used commercial sanitary pads</li> <li>• Older girls and urban girls had better knowledge of menstruation</li> </ul>
2005 <sup>20</sup>	India 8 urban and 8 rural localities in Rajasthan	To deduce the important issues related to menstrual practices and its association with reproductive morbidity among girls	Cross-sectional 13- to 19-y-old girls (N = 730)	
2004 <sup>14</sup>	India A resettlement colony in New Delhi	To assess the knowledge, beliefs, and practices regarding menstruation by women	Cross-sectional 15- to 49-y-old women (N = 254)	
2003 <sup>49</sup>	Nigeria Undergraduate residence hall and secondary schools in Ife-Ife India Schools in a rural and urban town in Tamil Nadu State	To investigate students' knowledge, beliefs, attitudes, and practices during menstruation  To determine the "coming of age" celebrations, reproductive health issues and menstrual hygiene practices of urban and rural girls	Cross-sectional Freshman undergraduates and secondary school girls (N = 200)  Cross-sectional 12- to 17-y-old girls (n = 823 girls, n = 60 community members)	

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TABLE 1. (Continued)

Year (Reference)	Setting	Purpose	Study Design and Sample	Results
2001 <sup>50</sup>	India Slum in central Delhi	To understand women's perceptions of menarche and menstruation in the sociocultural context of an urban slum, and whether menstrual behaviors and beliefs changed after moving from a rural to urban setting	Cross-sectional 15- to 45-y-old slum residents and health care leaders (n = 380 surveys, n = 52 in-depth interviews, n = 3 FGDs, n = 5 informant interviews)	<ul style="list-style-type: none"> <li>• 11.5% of the women interviewed used sanitary napkins and old cloth; 2.9% of the quantitative sample used sanitary napkins or new cotton</li> <li>• The remaining women (both qualitative and quantitative) were using either old or worn cloth</li> <li>• Washing cloths for reuse was practiced in the rural village but not in the urban slum due to a lack of space and privacy</li> <li>• 54% of the girls used tissue paper, 21.9% used sanitary pads, 12.3% used cloth, and 2.7% used tampons</li> </ul>
2000 <sup>10</sup>	Nigeria Secondary schools in Ile-Ife	To determine the menstrual knowledge and practices of secondary school girls	Cross-sectional 9- to 20-y-old adolescent girls (N = 352)	<ul style="list-style-type: none"> <li>• At menarche, 64% of professional women vs 52% of domestic workers were given pads/cotton wool</li> <li>• 36% professional vs 60% domestic workers were instructed on menstrual hygiene</li> </ul>
1997 <sup>51</sup>	Zimbabwe Offices and houses in Harare	To examine how women conceptualize their menstrual and premenstrual experiences	Cross-sectional Professional women and domestic workers (N = 50)	<ul style="list-style-type: none"> <li>• More than half of the girls used unsterilized cotton as pads or old cloth pieces and reused old cloth after washing</li> <li>• A majority of the girls changed their pad at fixed times during the day instead of whenever it was soaked</li> </ul>
1997 <sup>18</sup>	India Private and Government school in Punjab	To determine the knowledge and practices of adolescent schoolgirls regarding menstrual hygiene and its relationship with selected factors	Cross-sectional 9th- to 10th-grade girls (N = 150)	<ul style="list-style-type: none"> <li>• 98.5% used old cloth, and 1.5% used cotton</li> <li>• 78.5% of the sample used clean materials, and 15.4% used boiled and dried cloth</li> </ul>
1994 <sup>16</sup>	India Rural high school in Andhra Pradesh	To study the knowledge and practices of school going girls about menstruation	Cross-sectional 8th- to 10th-grade girls (N = 65)	<ul style="list-style-type: none"> <li>• 62.38% of students go to school on the first day of menstruation</li> <li>• 98.83% of students use sanitary pads during menstruation</li> </ul>
1990 <sup>52</sup>	Egypt Nursing secondary school in Alexandria	To investigate the knowledge and practices related to menstruation in a sample	Cross-sectional Nursing students (N = 513)	<ul style="list-style-type: none"> <li>• Girls predominantly used cloth (56.9%) and cotton (3.1%)</li> <li>• 70.8% of girls used clean materials, 9.2% used unclean materials, and 1.54% used any type of material</li> <li>• 53.85% of participants attended school during menses</li> </ul>
1988 <sup>21</sup>	India 4 schools in Dayalpur Centre	To understand the attitudes and practices of girls during menstruation	Cross-sectional 13- to 16-y-old girls (N = 65)	

1986 <sup>27</sup>	Nigeria	To ascertain the extent and magnitude of the physical, social and emotional problems associated with the onset of menarche and menstrual cycle in secondary school girls	Cross-sectional 12- to 17-year-old girls (N = 420)	<ul style="list-style-type: none"> <li>• 54.29% of urban vs 28.57% of rural girls used sanitary pads</li> <li>• 14.29% of urban vs 20.48% of rural girls used toilet tissue/cotton wool</li> <li>• 12.38% of urban vs 45.24% of rural girls used pieces of cloth</li> <li>• 19.04% of urban vs 5.71% of rural girls used tampons</li> </ul>
1970 <sup>17</sup>	10 rural, urban, girls only, and coeducational secondary schools in Rivers State Philippines Bay, Laguna	To present an ethnographic picture of MCH care among the Tagalogs to inform MCH service planners	Cross-sectional Community farmers and fishermen (N = NR) (Qualitative results only)	<ul style="list-style-type: none"> <li>• A limited number of women knew about commercial menstrual pads</li> <li>• Most women use old, clean cloths during menstruation, and natural remedies to combat menstrual symptoms</li> </ul>

BPL indicates below the poverty line; FGDs, focus group discussions; JSS III, junior secondary school; MCH, maternal and child health; MHM, menstrual hygiene management; NR, not reported; SSS III, senior secondary school.

in urban areas<sup>41</sup>; and among girls who have received explicit training in how to use commercial sanitary products.<sup>46</sup> The evidence is mixed, however, from urban slums where some studies report higher use of sanitary pads,<sup>28</sup> whereas others report higher use of old cloths.<sup>42</sup> Furthermore, knowledge about menstruation and menstrual hygiene tends to be higher in girls from urban areas compared with rural girls<sup>25,36,41</sup> and in older as compared with younger adolescent girls.<sup>22,25,29</sup>

Girls from resource-poor countries around the world attribute frequent school absences to difficulties managing their menses. In a Ugandan study of rural school-girls, nearly two-thirds said they miss school at least once per month because of menstruation.<sup>34</sup> In India, only 54% of girls reported attending school while menstruating.<sup>21</sup> In Egypt, more than one-third of girls in an urban secondary school reported staying home from school on the first day of menstruation.<sup>52</sup> Similarly, in Amhara province, Ethiopia, more than half of girls in secondary and preparatory schools reported being absent during menstruation,<sup>36</sup> and those who did not use sanitary pads were more than 5 times as likely to be absent.<sup>33</sup> Even if girls are not absent and manage to attend school during menstruation, they report being distracted, unable to concentrate, and less willing to participate because, for example, standing to answer questions is the custom in many schools, and writing on a blackboard in front of the class may expose them revealing menstrual stains, leakage, or odors.<sup>19,23,24,33,34</sup>

Absenteeism appears to be closely associated with lack of privacy and limited availability of water and sanitation facilities at schools. In Malawi, girls who reported that school toilets lacked privacy were more than twice as likely to be absent during their menstrual periods than girls at schools where more privacy was available.<sup>38</sup> In Uganda, girls cited a lack of privacy and washing space, fear of leakage and stains, discomfort, and a lack of pads as reasons for school absences during menstruation.<sup>34,40</sup> Given the opportunity to design their ideal toilet for school, girls emphasize the need for better lighting in latrines to be able to spot leaks and clean themselves<sup>34,40</sup>; more privacy including doors on latrines and functioning locks for the doors<sup>34,39,44</sup>; a water supply within the latrine in order to wash soiled hands, legs, or clothes<sup>34,39,44</sup>; lack of soap<sup>34,39,44</sup> and toilet paper<sup>34</sup>; and no disinfectant or cleaning supplies to clean latrines after use.<sup>39,44</sup>

While only a few studies have tested the relationship between infections and the type of material or product used to manage menstrual bleeding, those that have done so suggest that reusing old cloths may increase the risk of urogenital infections. In a case-control study from India, women with urogenital infections were

twice as likely to have been using reusable cloths instead of disposable sanitary pads.<sup>32</sup> In another study of schoolgirls in India, 65.7% of homemade menstrual cloth users reported urogenital infections compared with only 12.3% of those using sanitary pads.<sup>45</sup> Qualitatively, women and girls recognize that the way they manage their menstrual blood may be unhygienic, but they do not have better alternatives. For example, women in Zimbabwe expressed concerns about reusing old cloths and know that ironing or drying the cloths in the sun would be best, but they often avoid doing this because of embarrassment, a desire for secrecy, and/or a lack of electricity or coal to heat an iron.<sup>13</sup> Other girls feel they must store or hide cloths in places they know are unhygienic so that they are readily available when they need them.<sup>20</sup> Some women also insert newspaper or tissue paper into their vaginas to reduce the chance of menstrual leakage despite their concerns that this might not be safe and that the newspaper ink might cause cancer.<sup>13</sup>

The qualitative studies provide strikingly insightful information about women's and girls' perspectives on menstrual hygiene. These studies complement the evidence from quantitative studies. Girls realize that their menses may lead to school absences or even to their leaving school altogether.<sup>35,44</sup> Water and sanitation facilities at school are often so inadequate for menstrual hygiene management that some girls report carrying plastic bags of drinking water to use in the school latrines.<sup>39,44</sup> Nonetheless, girls are often highly resourceful at making sanitary "pads" out of whatever materials are available if menses start unexpectedly while they are at school, often resorting to the emergency use of leaves or grass.<sup>19,23</sup> These homemade options are often uncomfortable, leak frequently, and cause distress.<sup>19</sup> Especially in rural areas, women and girls may not even know about the existence of commercially manufactured sanitary products,<sup>17</sup> do not know how to use or dispose of them,<sup>35</sup> and/or perceive these products to be unaffordable.<sup>44</sup> In India, female residents of urban slums report particular challenges in dealing with their menses. They do not have the space to dispose of soiled cloths or other materials<sup>47</sup>; neither do they have sufficient privacy to wash and dry used cloths as they would be able to do in rural areas.<sup>50</sup> In some cases, girls even report exchanging sex for money so they can purchase commercial sanitary products.<sup>19,23</sup>

### INTERVENTIONS TO IMPROVE MENSTRUAL HYGIENE MANAGEMENT IN RESOURCE-POOR COUNTRIES

We found only 11 studies evaluating interventions that tried to improve menstrual hygiene management

or change menstrual hygiene practices. All of the interventions evaluated have been published since 2000. Seven of these studies were conducted in South Asia,<sup>53–59</sup> whereas the other studies were done in Ghana,<sup>60</sup> Tanzania,<sup>61</sup> Iran,<sup>62</sup> and Saudi Arabia<sup>63</sup> (Table 2).

Nearly all of the interventions were purely educational in nature, most of them taking place in or through the school setting. The 2 quasi-experimental educational interventions both reported better menstrual health<sup>62</sup> and hygiene practices<sup>63</sup> among the intervention groups. The studies that assessed menstrual hygiene knowledge and practice on a pretest-posttest basis within a single intervention group all reported some improvements, ranging from an increase in knowledge<sup>54,57,58</sup> and implementation of hygienic practices (such as drying cloths in the sun and washing with soap and water)<sup>53,55</sup> to an increased use of sanitary pads (either disposable or reusable) instead of old homemade cloths.<sup>53,54</sup> One study also reported that school absenteeism during menses decreased between the pretest and posttest evaluations.<sup>54</sup> Overall, there is moderate evidence that education-based interventions can improve menstrual hygiene knowledge and practices among schoolgirls in resource-poor countries.

The 3 interventions that distributed sanitary products—either pads of various materials<sup>59,60</sup> or menstrual cups<sup>56</sup>—to schoolgirls all evaluated these interventions using quasi-experimental designs. In Ghana, a 3-arm trial showed that both in the pad-with-underwear-distribution-plus-education arm and in the education-only arm attendance improved significantly over the control subjects who received neither pads nor education; however, attendance rose more quickly in the pad-plus-education arm than in the education-only arm of the study.<sup>60</sup> In India, an intervention provided schoolgirls with *falalin* cloth—a short, absorbent, woven cloth—for 3 months, followed by sanitary pads for 3 months. Absenteeism was highest when girls were using old traditional cloths. Absenteeism decreased when *falalin* cloth was available, but there were no absences among girls when using commercially produced sanitary pads.<sup>59</sup> Interestingly, however, a greater proportion of the girls preferred the *falalin* cloths to the commercial sanitary pads.<sup>59</sup> In Nepal, an intervention that distributed menstrual cups to schoolgirls and their mothers in the treatment group and education booklets to all girls failed to find an impact on school attendance. The majority of the girls did not report that the cups were convenient or easy to use.<sup>56</sup> There is limited (but mixed) evidence to suggest that distribution of sanitary products may reduce school absenteeism among girls.

The study from Nepal is the only one we found that evaluated outcomes beyond menstrual hygiene

TABLE 2  
Summary Results of Intervention Articles Included in the Review

Year (Reference)	Setting	Purpose	Study Design and Sample	Intervention Description	Results
2014 <sup>54</sup>	Bangladesh	To assess the impact of school-based menstrual education on menstrual knowledge, beliefs, and practices	Single group, pretest-posttest Grades 6–8 11- to 16-y-old girls (N = 416)	Menstrual health education was conducted in twelve 45-min lessons. The girls were shown demonstrations using clean cloths and pads	<ul style="list-style-type: none"> <li>Sanitary pad use among the sample increased from baseline to follow-up (16%–39%)</li> <li>School absence during menstruation decreased (7.7%–2.6%)</li> <li>Knowledge of poor menstrual hygiene predisposing to infection increased (68.3%–95.7%)</li> <li>At baseline, when using old cloths, 10.8% of the girls were absent from school</li> <li>When using <i>falalin</i> cloths for 3 mo, 3.8% of girls were absent from school</li> <li>When using sanitary pads for 3 mo, no girls were absent from school</li> <li>At the end of the study, 68% of the girls preferred <i>falalin</i> cloths, and 32% preferred sanitary pads</li> <li>Intervention participants had significantly better menstrual health vs control (<math>P = 0.013</math>).</li> <li>61.6% of the education group vs 49.3% of the control group engaged in regular bathing during menstruation</li> </ul>
2013 <sup>59</sup>	Government and semigovernment schools India Project villages in South Gujarat	To determine adolescent girls' menstrual practices and experiences using old cloth, a new cloth, and sanitary pads	Pretest-midtest-posttest Unmarried and school going adolescent girls (N = 164)	<i>Falalin</i> cloths were offered to girls for 3 mo at a subsidized cost through village-based Accredited Social Health Activists (ASHAs).  Sanitary pads were offered for another 3 mo at a subsidized cost through ASHAs	
2012 <sup>62</sup>	Iran  Urban and rural public high schools	To investigate the effectiveness of a health promotion project on improving menstrual health	Quasi-experiment, posttest only  14- to 18-y-old girls Low socioeconomic students (N = 689)	The experimental group engaged in ten 2-hour educational sessions  The control group received no education	

(Continued on next page)

TABLE 2. (Continued)

Year (Reference)	Setting	Purpose	Study Design and Sample	Intervention Description	Results
2012 <sup>60</sup>	Ghana	To conduct a pilot-controlled study to determine the role of sanitary pads in girls' education	Experimental 3 arm study	<p>Pads with education groups received: one pair of underwear, 12 pads per month, a daily calendar, a pencil, and a sharpener</p> <p>Education-only group received information on puberty changes, the biological process of menstruation, menstrual hygiene, and demonstrations on use and disposal of pads</p> <p>The control group received neither intervention</p>	<ul style="list-style-type: none"> <li>• In the pads with education groups, attendance rose by 6 d per 65-d term</li> <li>• In the education-only group, attendance rose at 5 mo</li> <li>• No significant difference in attendance between the rural and periurban sites</li> </ul>
2011 <sup>56</sup>	Periurban and rural school sites in Accra Nepal	To estimate the impact of menstruation on school attendance and investigate the effect of menstrual cups on school attendance	Experimental 2 arm study	<p>25 girls from each school and their mothers were given a menstrual cup and instructions</p> <p>Official school records were used to obtain attendance records</p> <p>All girls received a booklet of time diaries for each month. At the end of the study, control group girls were given menstrual cups</p>	<ul style="list-style-type: none"> <li>• Treatment girls were not more likely to attend school on all days</li> <li>• No impact of the menstrual cup on period-specific symptoms or on self-esteem/empowerment</li> <li>• Treatment girls expressed that the cups were easy to use (31%), convenient for walking and cycling (14%), didn't require washing (19%), and convenient for managing menses (25%)</li> </ul>
	Schools in Chitwan district		7th- to 8th-grade girls and mothers (N = 198)		

2011<sup>61</sup>

Tanzania

To describe the Tanzania girl's puberty book project, which was developed through participatory research in 3 phases

Three phase book project  
Phase I: 16- to 19-y-old adolescent girls

Phase II: 11- to 12-y-old girls

Phase III: Standards 5-7 and form 1 girls (n = 136 phase I, n = NR phase II and III) (Qualitative results only)

Puberty book for girls to read and learn about menstruation and MHM, in English and Swahili

Phase I: Development of puberty book from participatory activities with girls

Phase II: Field testing of initial copies with girls, parents, and teachers

Phase III: Dissemination and book evaluation

• Girls responded positively to the book, and their suggestions were incorporated into edits made to the English and Swahili texts and illustration

• Girls found the book useful in helping to understand their body and supplement advice when there was no one else available

2009<sup>55</sup>

Local primary and secondary schools  
India

To assess the impact of health education on menstrual knowledge, misconceptions, and menstrual hygiene practices

Single group, pretest-posttest

Health education on menstruation and healthy menstrual practices was given to the girls through lectures and the use of audiovisual aids

• Girls reporting washing their genitalia with soap and water when changing cloths and sanitary pad use increased from pretest to follow-up (29.95%–94.93%)

• Knowledge of the uterus as the source organ for menstruation increased (33.64%–99.54%)

• Washing cloths with soap and water increased (48.72%–87.18%)

2007<sup>53</sup>

Two secondary schools in Kalamboli  
India  
23 rural primary health centers

To study the effect of a community-based health education intervention on MHM

Classes 9–10 Adolescent girls (N = 197)

Single group, pretest-posttest

12- to 19-y-old unmarried adolescent girls (N = 383)

Participatory and community-based health education

Girls and peer groups were mobilized to disseminate health education messages using prepared flipbooks

• Ready-made pad users increased (5.2%–24.9%) and cloth users declined (94.8%–72.7%)

• Reuse of cloth declined (84.8%–57.1%)

• If reusing cloth, sun-drying cloths increased (78.4%–90.0%)

(Continued on next page)



TABLE 2. (Continued)

Year (Reference)	Setting	Purpose	Study Design and Sample	Intervention Description	Results
2007 <sup>63</sup>	Saudi Arabia	To assess the impact and suitability of a menstrual health education program	Quasi-experiment, posttest only  1st and 2nd grade high schoolgirls (N = 248)	Health education lectures and group discussions were conducted using visual aids. Hygiene practices were assessed using a 32-item scale	<ul style="list-style-type: none"> <li>• The knowledge scores of the intervention classes were significantly higher than the control groups</li> <li>• The mean hygienic practice scores of the intervention classes were significantly higher than the controls</li> </ul>
2006 <sup>57</sup>	Government girls' secondary schools in Riyadh Bangladesh	To reveal the findings of a pilot study on reproductive health education	Single group, pretest-posttest  Adolescent males and females 16–24 y (N = 379)	Reproductive health, HIV/AIDS, and gender education were provided at 5 selected residential youth training centers.  The topics were delivered using stories, quizzes, riddles, debates, visuals, and discussions	<ul style="list-style-type: none"> <li>• Participants not considering menstruation a disease increased (57%–90%).</li> <li>• At pretest, around 30% of respondents agreed that menstrual cloth should be dried under the sun. At posttest, there was a 2-fold increase</li> </ul>
2000 <sup>58</sup>	Bangladesh  Community libraries and government secondary schools	To explore the effects of the Adolescent Reproductive Health Education (ARHE) program	Single group, posttest only Adolescent boys and girls 12 y and older (N = NR) (Qualitative results only)	The ARHE program curriculum included: education on physical and mental changes, reproduction, guidance on age for marriage and childbearing, STDs, family planning and disease prevention, substance abuse, and gender issues	<ul style="list-style-type: none"> <li>• Before the program, girls would leave their menstrual cloths in inappropriate places. Girls kept their cloths in a plastic packet or cloth wrapper, after washing and drying the material, once the program was completed</li> <li>• Girls discussed menstrual hygiene with other girls in the village based on their new knowledge on hygienic menstruation practices</li> </ul>

HIV indicates human immunodeficiency virus; MHM, menstrual hygiene management; NR, not reported; STDs, sexually transmitted diseases.

management practices and school attendance. This study did not find any effect of the menstrual cup intervention on test scores, cramps, premenstrual symptoms, or self-esteem/empowerment indicators; however, actual use of the menstrual cups within the intervention group was relatively low.<sup>56</sup>

### ADDITIONAL PERSPECTIVES

Eight of the 11 commentaries and editorials on menstrual hygiene management were penned in the last decade, demonstrating how this issue has started to gain prominence. One commentary summarizes a history of menstrual hygiene products,<sup>64</sup> and another focuses on differences in menstrual hygiene management between Western nations and other countries, mostly in sub-Saharan Africa.<sup>65</sup> Another commentary compares experiences across cultures, albeit between countries in different regions, noting that old cloths and naturally absorbent substances are the most common materials used in menstrual hygiene management, although a few cultures utilize menstrual huts or otherwise exclude women from their usual social interactions during menstruation.<sup>66</sup>

India and Kenya have received attention over the last few years as these countries have moved to subsidize commercial sanitary products for rural girls and to remove the value-added tax on menstrual hygiene products, respectively. In India, the subsidy plan faces potential pitfalls due to the lack of knowledge and awareness of family members, teachers, and health care providers; lack of water and sanitation facilities available in schools; and lack of sufficient solid-waste disposal in villages.<sup>50</sup> Other authors have called attention to the disconnect between focusing on menstrual hygiene management when there is still a serious lack of access to water and sanitation facilities in schools, especially in the South Asia region.<sup>67</sup>

Sommer<sup>68</sup> has written 4 of these commentaries and has become a voice of advocacy for improved menstrual hygiene management for girls in low-resource environments. She has advocated for adding menstrual hygiene management to the agenda of access to clean water and improved sanitation in schools<sup>68</sup> and to including menstrual hygiene management as part of the response to humanitarian emergencies.<sup>69</sup> She and her colleagues have also argued that menstrual hygiene management should be part of any educational agenda for school-aged girls<sup>5</sup> and should be promoted more broadly as a general public health issue.<sup>70</sup>

The findings from our review are consistent with and expand upon the other review articles that we found on this topic. One review that focused on water and

sanitation in schools found that the availability of water and sanitation facilities in schools is a key determinant of girls' school attendance in general and that lack of such facilities increases the challenges girls face with respect to managing menstrual hygiene.<sup>71</sup> Studies included in this review reported that girls often experience discomfort at school during menstruation, have special concerns about privacy when handling menstrual issues, fear teasing from peers (both male and female), lack mechanisms for the proper disposal of menstrual products, and have insufficient water for cleaning themselves while menstruating.<sup>71</sup>

One other review focused more directly on menstrual hygiene management, but found it difficult to define this term given the variation in definitions used across the included articles.<sup>72</sup> Education interventions were found to improve knowledge, awareness, and some menstrual hygiene practices, but documenting the effect of menstrual hygiene management on school attendance and dropout rates is much more difficult, given how poorly records are often kept and the often-ambiguous reasons for school absences.<sup>72</sup>

We limited our search to peer-reviewed articles published in English. There may be additional interventions reported to improve menstrual hygiene management among adolescent girls in resource-poor countries that have not been published in the peer-reviewed English literature. This may account for the disproportionate number of articles originating from countries in sub-Saharan Africa and South Asia. In addition, the lack of consistency between studies in terms of how "good" menstrual hygiene management is defined and measured makes it challenging to compare studies and generate accurate summaries. Because menstrual hygiene management is a relatively new (but vitally important) topic for research and advocacy, we expect these definitions and measurements will become more standardized as the field evolves and our understanding of the issue improves.

### FUTURE RESEARCH AND ADVOCACY DIRECTIONS

The existing literature on menstrual hygiene management in resource-poor settings highlights common challenges experienced across different cultures. Major barriers to improved menstrual hygiene among girls include a lack of awareness and support from teachers, many of whom are male; lack of familial support; lack of cultural acceptance of certain menstrual hygiene products; limited economic resources to purchase commercially produced products; inadequate water and sanitation facilities at school with concurrent concerns

about washing, privacy, and menstrual pad disposal; cramps, pain, and discomfort associated with menstruation irrespective of the menstrual hygiene products used; and travel difficulties to/from school, which can extend time away from home and increase the likelihood of leaks/stains, embarrassment, and discomfort. Fear of embarrassment from menstrual accidents and teasing by peers is a common thread in many qualitative studies.

Our review identified several important gaps in the existing evidence base concerning menstrual hygiene management. First, there is a lack of knowledge around the household decision-making process for school enrollment. How is this decision made for postmenarcheal girls and by whom? What is the level of knowledge and awareness around menstrual hygiene management among those who are making these decisions? We found 1 intervention that targeted menstrual hygiene education at mothers in addition to schoolgirls,<sup>56</sup> but we did not find any that also targeted fathers, in-laws, and/or community leaders who might be influential in valuing (or hindering) girls' access to education. Considering how culturally and religiously embedded beliefs and practices about menstruation are, it is important to understand better the decision-making process for girls' school enrollment and to extend intervention efforts beyond female relatives only to include all of those involved in the decision-making process. Increasing male understanding of menstruation and the importance of menstrual hygiene management is likely to emerge as a key consideration in improving both school attendance and the availability of suitable water and sanitation facilities at schools in poor countries.

Second, most intervention studies have been school based and focused on the absenteeism of girls who are already enrolled in school. Few studies have looked at girls who are out of school and whether education and awareness efforts with these girls and their families before menarche might reduce the number of girls who drop out around the time menstruation begins. Postmenarcheal girls who are still enrolled in school are likely to be from families who are more supportive of girls' education. Once a girl drops out of school, getting her reenrolled may be difficult, even if the menstrual hygiene management situation improves.

Third, except for the trial from Nepal that reported low use of provided menstrual cups and few significant findings,<sup>56</sup> there are almost no studies looking at outcomes other than absenteeism in schoolgirls. No studies have looked at girls' school performance or their absenteeism rates with respect to absenteeism among boys. A few qualitative studies identify fear, embarrassment, and pain as important barriers to attending school during menstruation, but these are measured quantitatively

less frequently. Other outcomes such as school performance, self-confidence/self-esteem, empowerment, quality of life, and genitourinary infections are almost entirely absent from the reporting. While many of these are culturally constructed and can be difficult to measure, improvements in these areas have the potential to confer important benefits on girls.

Finally, the literature on water and sanitation regarding schools in resource-poor countries is currently disconnected from the literature on menstrual hygiene management. Much of the menstrual hygiene literature mentions the importance of having good access to water and sanitation in schools, but few menstrual hygiene interventions actually attempt to address these issues. Conversely, menstrual hygiene management does not appear to be a significant outcome measure in studies in the literature on water and sanitation. We did not identify a single intervention that tried to improve menstrual hygiene management by focusing on what seems to be the important triad of (1) improved education regarding menstrual hygiene for girls, teachers, parents, and other decision makers; (2) adequate menstrual hygiene supplies; and (3) clean water and improved sanitation in schools. The ability of girls and women to manage their menses hygienically and without disruption of their daily activities is taken for granted in affluent countries. In these countries, access to menstrual hygiene supplies is generally easy and affordable. This is not the case for women and girls in resource-poor countries. We suspect that this is also true in impoverished parts of the United States and other seemingly resource-rich nations. We are learning that poor menstrual hygiene management may have serious health and developmental consequences for adolescent girls. This seems to be an important factor in hindering the education and empowerment of women in the world's poor countries. Because these issues affect half of the world's people, they merit increased attention by educators, policy makers, and government officials. Improved menstrual hygiene management needs to be on the health agendas of all resource-poor countries, particularly as those countries strive to train large cadres of teachers and community-based/primary-care health workers.

In the United States and other high-income countries, we must also strive to increase the awareness of the importance of menstrual hygiene management among clinicians so that they can better serve their patients, particularly those who are recent immigrants from resource-poor countries where menstrual hygiene management may be a serious issue. Lack of adequate menstrual hygiene management may also be present in the poorest parts of affluent countries, where access

to menstrual supplies is taken for granted and where these problems may easily be overlooked. Clinicians everywhere should be active partners in promoting better access to menstrual hygiene products, better water and sanitation in schools, and better knowledge within local communities concerning the basic biology of menstruation and how to manage the problems that may arise with it. Finally, we seek to make clinical researchers aware of the existing knowledge gaps concerning menstrual hygiene management among the world's poor, especially gaps in our knowledge concerning the relationship between menstrual hygiene management and health outcomes such as genitourinary infections, healthy social development, and sound mental health.

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