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## Social Determinants of Health and Dysmenorrhea: A Systematic Review

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### Abstract

Social determinants of health play a key role in health disparities. Dysmenorrhea is a highly prevalent and impactful public health problem affecting reproductive-age females. Systematically examining social determinants of health in dysmenorrhea is important for identifying gaps in the literature and informing research, policy, and clinical practice to reduce the public health burden associated with dysmenorrhea. The purpose of this systematic review was to synthesize the literature on social determinants of health and dysmenorrhea. The review protocol was prospectively registered. We searched *Medline*, *EMBASE*, *CINAHL*, *PsycINFO*, *Scopus*, and *Google Scholar* through February 2024 using search strategies informed by the literature. Screening of the articles, data extraction, and risk of bias assessment were conducted independently by at least two reviewers on the Covidence platform. Among 2594 unique records screened, 166 met eligibility criteria and were included for data extraction and risk of bias assessment. Evidence suggests traumatic experiences, toxic environmental exposures, female genital mutilation, job-related stress, lack of menstrual education, and low social support were associated with worse dysmenorrhea outcomes. However, evidence was equivocal regarding relationships between dysmenorrhea outcomes and social determinants of health factors, including socioeconomic status, geographical location, race/ethnicity, employment, and religion. Nearly

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all articles (99.4%) had a high or very high overall risk of bias. Relationships between social determinants of health and dysmenorrhea outcomes were often inconsistent and complicated by heterogeneous study populations and methodologies. More rigorous research examining social determinants of health in dysmenorrhea is needed to inform policy and clinical practice.

**Perspective:** This systematic review synthesizes evidence linking social determinants of health and dysmenorrhea. Relationships between SDoH and dysmenorrhea were often equivocal and complicated by heterogeneous study populations and methodologies. We identify directions for future research and SDoH factors that could be addressed clinically (e.g., trauma, menstrual education, occupational stress).

## Keywords

Dysmenorrhea; Social Determinants of Health; Health Disparities; Health Equity; Race Factors

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## Introduction

Dysmenorrhea is the most common gynecological pain condition in the world.<sup>1</sup> Clinically, there are two types of dysmenorrhea: primary and secondary.<sup>2</sup> Primary dysmenorrhea occurs without demonstrable anatomical or pathological abnormalities.<sup>2</sup> It is highly common among females of reproductive age with a reported prevalence of 45% to 95%.<sup>1,3</sup> Key elements of the pathogenesis of primary dysmenorrhea have been described.<sup>2</sup> Effective treatments based on modification of etiologic pathways largely support the validity of the tenets of its pathogenesis.<sup>2</sup> Dysmenorrhea can also be secondary to an underlying pathology such as endometriosis, uterine fibroids, and pelvic inflammatory disease (PID).<sup>2</sup> The estimated prevalence of endometriosis is about 11% among reproductive-age females;<sup>4</sup> the reported prevalence of uterine fibroids was 4.5%-68.6% among females;<sup>5</sup> and the prevalence of self-reported lifetime PID among sexually experienced females in the United States is 4.4%.<sup>6</sup> Not all people with these conditions experience dysmenorrhea symptoms, and the exact prevalence of dysmenorrhea secondary to these conditions has not been reported in population-based studies. The distinction of primary and secondary dysmenorrhea may not always occur, as the confirmatory diagnosis of secondary dysmenorrhea often requires diagnostic technology or surgical procedures that are unavailable in many settings.<sup>7</sup> Whatever its etiology, dysmenorrhea is a population health problem that contributes to educational, occupational, and health disparities of affected people. Over 20% of female students across the world reported absence from grade school or university due to dysmenorrhea.<sup>3</sup> Dysmenorrhea negatively interferes with physical activities, sleep, and quality of life.<sup>1</sup> It also significantly increases females' risk of developing both noncyclic pelvic pain and non-pelvic pain conditions.<sup>8,9</sup>

While it is clear that biological and psychological factors contribute to individual differences in dysmenorrhea outcomes,<sup>2,10-12</sup> the ubiquity of dysmenorrhea among people who menstruate belies the substantial variation in prevalence and severity despite reasonably well-established models of pathophysiology.<sup>2</sup> This suggests that dysmenorrhea may be differentially experienced across populations through the influence by factors that interact with underlying biological processes. These factors, known as "social determinants of health (SDoH)," include social, cultural, and environmental exposures during the life course that

affect health, functioning, and quality of life outcomes.<sup>13</sup> SDoH are now well-established drivers of health disparities, defined as differences in health outcomes linked with social, economic, or environmental conditions.<sup>14,15</sup> As examples suggesting the relevance of SDoH to dysmenorrhea, racial and socioeconomic disparities in chronic pain<sup>16</sup> and gynecological disorders (e.g., uterine fibroids)<sup>17</sup> have been reported. Given the large proportion of people with dysmenorrhea around the world, understanding SDoH in relation to dysmenorrhea could inform targets for intervention through research, policies, and clinical practice to lower the negative health impacts associated with dysmenorrhea.

To our knowledge, no reviews have systematically synthesized data related to risk and protective social determinants of dysmenorrhea. Therefore, the purpose of this systematic review was to synthesize the literature on SDoH and dysmenorrhea. Our goal was to create a thorough summary of SDoH associated with dysmenorrhea and describe the valence associated with dysmenorrhea (i.e., increased or decreased risk). Synthesis of existing research can guide health policy and public health efforts and direct clinical attention to issues that affect dysmenorrhea outcomes. Critical assessment of research evidence can further direct rigorous new research on issues not yet understood.

## Methods

### Protocol Registration.

A protocol was developed by the research team who had expertise in systematic reviews, health disparities, dysmenorrhea, and women's health. The authors registered the review protocol on the international prospective register of systematic reviews PROSPERO (Registration number: CRD42023391715)<sup>18</sup> prior to the full-text screening of the results from the initial literature searches. The conduct and reporting of this review followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines.<sup>19</sup>

### Eligibility Criteria.

Inclusion criteria were (1) English language, (2) full-length publications (including journal articles, book chapters, and dissertation theses), (3) examined at least one dysmenorrhea outcome, (4) reported at least one SDoH variable, (5) reported findings from the statistical analysis of the relationship between 1 SDoH and 1 dysmenorrhea outcome variables, and (6) were observational studies, baseline analysis of interventional studies, or mixed methods research with a quantitative component.

Dysmenorrhea outcomes included presence/prevalence, menstrual pain severity, menstrual pain frequency, symptom interference with daily life (e.g., absence from school or work), needs for dysmenorrhea treatments, use of or access to dysmenorrhea treatments, and the risk of other chronic pain conditions (e.g., irritable bowel syndrome, non-cyclic pelvic pain) among people with dysmenorrhea.

SDoH factors were identified a priori. The identification of SDoH factors was guided by a report from the WHO Commission on SDoH,<sup>13</sup> Healthy People 2030,<sup>20</sup> and the PROGRESS framework (a framework that specifies factors that contribute to health equity: Place of

residence, **R**ace/ethnicity/culture/language, **O**ccupation, **G**ender/sex, **R**eligion, **E**ducation, **S**ocioeconomic status, **S**ocial capital).<sup>21</sup> As specified in the protocol, SDoH factors we planned to include were socioeconomic status (including education, parent's education, and income), race/ethnicity, gender identity, sexual orientation, insurance, healthcare access, social support and social capital, social stress, traumatic experiences, religion, health literacy, cultural factors, discrimination, employment, occupational factors, geographical locations, rurality, and environmental exposures.

Excluded articles were editorials, letters, comments, preprints, erratum, news, case reports, review papers without primary data collection, inaccessible full-length articles, studies only focusing on measurement/scale development, qualitative research, and duplicated reports of findings from a given dataset.

### **Information Sources and Search Strategy.**

We conducted searches of the following databases with no publication date limits: *Medline (Ovid)*, *EMBASE (Elsevier)*, *CINAHL (EBSCO)*, *PsycINFO (EBSCO)*, *Scopus (Elsevier)*, and *Google Scholar*. The first 100 articles retrieved by Google Scholar were downloaded using the Publish or Perish tool.<sup>22</sup> Searches reflected articles published as of February 4, 2024.

The search strategies were developed by a health sciences librarian in collaboration with coauthors. The search terms incorporated subject headings and keywords associated with dysmenorrhea and SDoH. Example dysmenorrhea terms, which were informed by previous systematic reviews on dysmenorrhea,<sup>23</sup> included dysmenorrh\*, menstrual cramps, menstrual pain, and period pain. The SDoH search terms were informed by the list of SDoH factors identified a priori. In addition, the comprehensive health equity search strategy developed and validated by Prady and colleagues assisted us in identifying SDoH search terms to include in our search strategy.<sup>24</sup> When possible, articles indexed as editorials, preprints, erratum, news, letters, and case reports were excluded using the Boolean operator NOT. The search was limited to English-language articles. Appendix 1 outlines the full search strategies for all information sources.

### **Selection Process.**

Literature search results were imported into the Covidence systematic review management platform.<sup>25</sup> After deduplication, the literature was screened in two stages. First, two reviewers independently screened titles and abstracts. Then, full texts were pulled, if available. The university interlibrary loan service attempted to locate the missing full-text articles until all options were exhausted. At least two reviewers independently screened all available full texts to assess eligibility. For both stages of screening, two reviewers reviewed and discussed discrepancies and if they could not reach a consensus, then consulted with a third reviewer. Additionally, authors reviewed the reference lists of included studies as well as relevant review papers to identify potential additional studies, a strategy known as spooling.

### Data extraction.

We developed a standard data extraction form on the Covidence platform.<sup>25</sup> The form was tested and revised accordingly before use. The following data were extracted: author, publication year, study design, country and recruitment setting, participant characteristics, sample size, dysmenorrhea outcomes and measures, SDoH factors and measures, methods for statistical analysis, and strength and significance of the relationships of interest. Four reviewers participated in data extraction. At least two reviewers independently extracted data from each article. Disagreements were resolved by discussion and consensus between two reviewers or consultation with a third reviewer. Where missing information was detected, or clarification was needed, authors attempted to contact study authors via email.

### Risk of Bias (RoB) Assessment:

At least two out of four reviewers independently assessed RoB using the RoB in Non-randomized Studies - of Exposure (ROBINS-E) tool.<sup>26</sup> There is no existing RoB tool designed to specifically assess studies on social determinants of health. We chose to use the ROBINS-E tool, as it is broadly applicable to RoB assessment in non-randomized studies of environmental exposures. As different study designs were included in this review, using a design-specific tool would make it challenging to synthesize study results across studies.

For each included study, authors evaluated RoB arising from (1) confounding, (2) measurement of the exposure (i.e., SDoH), (3) selection of participants into the study, (4) post-exposure interventions, (5) missing data, (6) measurement of the dysmenorrhea outcome, and (7) selection of the reported result. RoB for each domain was judged as “low RoB,” “some RoB concerns,” “high RoB,” and “very high RoB” based on ROBINS-E tool instructions.<sup>26</sup> Disagreements were resolved through discussion and consensus with assistance from a third reviewer. After assessing all seven domains, an overall RoB rating (low, some concerns, high, very high overall RoB) was generated for each article based on the ROBINS-E algorithm. Specifically, “low overall RoB” meant the RoB for all domains was low except for concerns about confounding. “Some overall RoB concerns” meant at least one domain was at some concerns, but not all domains were at high or very high RoB. “High overall RoB” meant at least one domain was at high RoB, but no domains were at very high RoB, or several domains were at some concerns. “Very high RoB” meant at least one domain was at very high RoB, or several domains were at high RoB.<sup>26</sup>

### Data Synthesis.

Key study characteristics (e.g., sample characteristics, study design, SDoH factors examined, dysmenorrhea outcomes) were summarized. Relationships within articles were synthesized according to SDoH factors. Articles reporting relationships with more than one factor were included in more than one section of the results (e.g., race/ethnicity and income). Findings were synthesized narratively, focusing on associations between SDoH factors and dysmenorrhea outcomes. Lower dysmenorrhea presence/prevalence, lower severity, lower frequency, lower interference, lower needs for treatment, lower risk of other chronic pain conditions, and higher treatment use/access were considered positive outcomes. Conversely, higher dysmenorrhea presence, higher severity, higher frequency, higher interference, higher needs for treatment, higher risk of other chronic pain conditions, and lower treatment

use/access were considered negative outcomes. We further categorized SDoH factors into risk factors, protective factors, and equivocal relationships based on the dominant evidence pattern in association with dysmenorrhea. If an SDoH factor was associated with positive dysmenorrhea outcomes in >60% of articles reporting that factor and in at least 5 articles, it was considered a protective factor. If an SDoH factor was associated with negative outcomes in >60% articles reporting on that factor and in at least 5 articles was considered a risk factor. If an SDoH factor did not show a dominant pattern, it was classified as having an equivocal relationship with dysmenorrhea outcomes. A quantitative meta-analysis was not conducted due to the pronounced heterogeneity in study samples (recruitment settings, eligibility criteria, and sample characteristics), dysmenorrhea outcome measures, SDoH measures, design, and analytical approaches across studies. This was in alignment with our registered protocol. Consequently, our systematic review aimed to offer a comprehensive account of the current literature regarding SDoH and dysmenorrhea.

## Results

### Study Selection

Figure 1 provides a flow diagram of the articles identified, screened, included, and excluded. There were 4702 records identified – 4577 through database searching and 125 through citation searching, of which 2108 were excluded as duplicates, resulting in 2594 unique records screened. Three articles reported results from one study;<sup>27–29</sup> the one that reported the most comprehensive and non-duplicated results was retained and the other two were excluded.<sup>27</sup> Another pair of articles from the same study reported different SDoH factors, and both were retained.<sup>30,31</sup> A total of 166 articles were included in the review (See Supplementary Table 1).

### Characteristics of Included Articles

Table 1 summarizes the characteristics of the included articles. Articles included participants from 47 countries or territories, with half of the studies conducted in Asia. Most articles did not clearly indicate the type of dysmenorrhea examined, included samples of more than 100 participants, did not include participants under the age of 18, did not report the race/ethnicity of participants, recruited via communities rather than clinics, and were cross-sectional. Among SDoH factors, the top three most studied were income, participant education/literacy level, and geographical location. No articles examined relationships between dysmenorrhea outcomes and the following SDoH factors: gender identity, sexual orientation, healthcare access, insurance, or discrimination. For a detailed description of study characteristics, please see Supplementary Table 1.

For dysmenorrhea outcomes, the two most frequently studied were dysmenorrhea presence/prevalence (75.3%) and severity (24.1%). Menstrual pain frequency (3.6%), symptom interference with daily life (6.6%), treatment access/use (5.4%), and needs for treatment (0.6%) were studied much less often. None of the articles examined the risk of chronic pain conditions among people with dysmenorrhea as an outcome. For a study-by-study accounting of dysmenorrhea outcomes, see Supplementary Table 1.

## Risk of Bias (RoB)

Figure 2 summarizes RoB findings. Most articles had high or very high RoB related to confounding, missing data, measurement of the dysmenorrhea outcome, and/or selective reporting of results. For overall RoB, none of the identified articles were classified as low RoB, one was classified as some concerns, 128 were classified as high RoB, and 37 were classified as very high Rob. As almost all articles (99.4%) had an overall high or very high RoB, RoB was not further summarized within the results pertaining to each SDoH.

## SDoH as Risk Factors Associated with Worse Dysmenorrhea Outcomes

**Traumatic Experiences (n = 21)**—Across 21 articles, a large majority (n = 19, 90.5%) reported statistically significant relationships between traumatic experiences and worse dysmenorrhea outcomes, including higher dysmenorrhea presence,<sup>31–43</sup> severity,<sup>44–47</sup> and frequency.<sup>38–41,48,49</sup> Specifically, risk factors for higher dysmenorrhea presence, severity, or frequency were sexual assault/abuse/harassment,<sup>31,35,36,39–41,44–46,49</sup> sexual coercion,<sup>40</sup> gender-based harassment,<sup>40</sup> domestic violence by a partner or other family member,<sup>33</sup> maternal abuse,<sup>37</sup> cumulative childhood trauma, including general, emotional, physical, and sexual trauma,<sup>41</sup> war-related concussion,<sup>42</sup> and post-traumatic stress disorders.<sup>38,46,47</sup>

Analyses that combined or separated types of abuse showed important differences. In 5 articles that combined different types of abuse (sexual, physical, or emotional) in analyses, 4 identified combined abuse as a risk factor.<sup>33,34,43,50</sup> In contrast, physical violence alone (domestic or non-domestic) was not associated with dysmenorrhea presence or frequency.<sup>39,49</sup>

In the 2 articles that separated a history of childhood and adult sexual abuse,<sup>31,48</sup> one found childhood but not adult abuse was a risk factor for dysmenorrhea presence,<sup>31</sup> and the other showed childhood abuse was a more salient risk factor than adult abuse, though both were significant predictors for higher dysmenorrhea presence.<sup>48</sup>

**Environmental Exposures (n = 13)**—Across 13 articles, a majority (n = 8, 61.5%) showed that exposures to environmental toxicants were associated with worse dysmenorrhea outcomes, including higher presence,<sup>51–57</sup> severity,<sup>51</sup> and frequency.<sup>51</sup> Risk factors for worse dysmenorrhea outcomes included exposures to (1) passive smoking (linked to higher presence),<sup>27,52,54,57</sup> (2) toluene vapor (linked to higher dysmenorrhea presence and severity)<sup>51,55</sup> or handling military fuel (high toluene levels, linked to high dysmenorrhea presence),<sup>57</sup> (3) mercury vapor (linked to higher dysmenorrhea presence),<sup>56</sup> and (4) air pollutants (NO, NO<sub>2</sub>, NO<sub>x</sub>, CO, and PM<sub>2.5</sub>, linked to high presence).<sup>53</sup> However, 5 studies did not find statistically significant relationships between dysmenorrhea outcomes and environmental exposures, including passive smoking,<sup>58,59</sup> styrene in plastics through contact or ambient air,<sup>60</sup> phthalate metabolites (in urine and follicular fluid),<sup>61</sup> or cooking oil contaminated with polychlorinated biphenyls and dibenzofurans.<sup>62</sup>

**Female Genital Mutilation (n = 8)**—Across 8 articles, 5 (62.5%) reported statically significant relationships between female genital mutilation and worse dysmenorrhea

outcomes, including higher dysmenorrhea presence<sup>63–66</sup> and severity.<sup>67</sup> The remaining articles (n = 3, 37.5%) showed no association.<sup>68–70</sup>

**Job-related Stress (n=7)**—Out of 7 articles on job-related stress, 6 (85.7%) suggested high job-related stress was associated with worse dysmenorrhea outcomes (See Table 2). Specifically, low job control was consistently linked to worse dysmenorrhea outcomes, including higher severity<sup>71</sup> and higher interference.<sup>72</sup> Low job security was consistently linked to worse dysmenorrhea outcomes, including higher frequency<sup>73</sup> and higher interference.<sup>72</sup> Except for one study where no significant relationship was reported,<sup>57</sup> high job strain was linked to worse dysmenorrhea outcomes, including higher presence,<sup>74–76</sup> higher interference,<sup>76</sup> and higher frequency.<sup>73</sup>

### SDoH as Protective Factors Associated with Better Dysmenorrhea Outcomes

**Social Support (n = 11)**—In the 11 articles exploring the relationship between social support and dysmenorrhea outcomes, 7 (63.6%) reported that better social support was associated with better dysmenorrhea outcomes.<sup>77–83</sup> Specifically, better social support was linked to lower dysmenorrhea presence<sup>79,81,83</sup> and severity,<sup>78</sup> and disruptions in or absence of social support were related to higher dysmenorrhea presence<sup>77,80</sup> or severity.<sup>82</sup> The remaining articles (n = 4, 36.4%) showed no relationship.<sup>45,84–86</sup>

**Prior Menstrual Education or Menstrual Literacy (n = 8)**—Among the 8 articles that examined the relationship between prior menstrual education and dysmenorrhea outcomes,<sup>87–92</sup> 5 (62.5%) linked prior menstrual education or menstrual literacy to better dysmenorrhea outcomes, including lower presence<sup>88,90,93</sup> and severity.<sup>89,92</sup> The remaining 3 articles either showed an opposite relationship<sup>94</sup> or did not find statistically significant associations.<sup>87,91</sup>

### Equivocal Relationships Between SDoH and Dysmenorrhea Outcomes

#### Socioeconomic Status

**Income (n = 35):** About half of the articles (n = 18, 51.4%) showed significant relationships.<sup>30,44,80,83,93,95–107</sup> However, the direction of the relationships was inconsistent. Across 14 articles, lower income was associated with worse dysmenorrhea outcomes, including higher presence,<sup>30,44,80,93,96,97,102,104,105</sup> higher severity,<sup>95,108</sup> greater needs for treatment,<sup>99</sup> and lower likelihood to take pain medications<sup>98</sup> and oral contraceptive pills<sup>107</sup> for dysmenorrhea. In contrast, across 4 articles, higher income was associated with higher dysmenorrhea prevalence.<sup>83,103,106,109</sup> The rest of the studies (n = 17, 48.6%) showed no relationships between income and dysmenorrhea outcomes.

**Education/Literacy (n = 34):** Over half of the articles (n = 20, 58.8%) showed no relationships, and the rest (n = 14, 41.2%) showed significant relationships. Of the 14 showing significant relationships, the direction of the relationships was inconsistent. Across 6 articles, lower education/literacy was associated with worse dysmenorrhea outcomes, including higher presence,<sup>39,110,111</sup> higher severity,<sup>108</sup> higher interference,<sup>72</sup> and lower oral contraceptive use for dysmenorrhea.<sup>107</sup> In contrast, across 7 articles, lower education/literacy was associated with better dysmenorrhea outcomes, including lower

presence<sup>87,96,112,113</sup> and severity.<sup>114–116</sup> In the remaining article, education was significantly correlated with analgesics use for dysmenorrhea, but the direction of the relationship was unclear.<sup>117</sup>

**Parent Education (n = 19):** Over half showed no relationships (n = 10, 52.6%).<sup>70,76,94,97,104,118–122</sup> The rest (n = 9, 47.4%) showed significant relationships, but the direction of the relationships was inconsistent. In 6 articles, lower parent education was associated with worse dysmenorrhea outcomes, including higher dysmenorrhea presence<sup>83,123–125</sup> and severity.<sup>44,124,126</sup> However, in 2 other articles, lower parent education was associated with lower dysmenorrhea presence.<sup>91,127</sup> In the remaining article, the direction of the relationship was unclear.<sup>128</sup>

**Other Socioeconomic Status Factors (n = 16):** In 16 articles, miscellaneous socioeconomic status (SES) factors were examined using undefined/unspecified measures (n = 10),<sup>79,81,86,114,115,129–133</sup> a one-factor proxy measure (n = 3, e.g., housing ownership,<sup>39</sup> managing to make ends meet,<sup>39</sup> access to tap water/clean toilet facility/ hygienic menstrual products,<sup>110</sup> possession of costly goods<sup>134</sup>), or by combining multiple factors to derive a composite score (n = 3, e.g., mother's education and employment situation,<sup>90</sup> parent education, house type, and possession of costly goods,<sup>135</sup> place of residence, parent education, and number of siblings<sup>127</sup>). Across these 16 articles, the relationship between SES and dysmenorrhea outcomes was equivocal. Slightly more than half (n = 9, 56%) did not show significant relationships.<sup>79,81,86,90,130,131,133–135</sup> In 6 articles, lower SES was associated with worse dysmenorrhea outcomes including higher presence,<sup>39,110,127,129,132</sup> and severity.<sup>115</sup> in univariable or multivariable<sup>110</sup> analyses. In the remaining article, higher SES was associated with higher dysmenorrhea severity.<sup>114</sup>

**Geographic Location (n = 30, rurality: n = 29)**—Nine articles (30.0%) showed significant relationships.<sup>87,105,110,120,129,136–140</sup> However, the direction of the relationships was inconsistent. In 7 articles, rural living was associated with worse dysmenorrhea outcomes including higher dysmenorrhea presence<sup>87,105,110,129,136,139</sup> and severity.<sup>138</sup> In 2 articles, urban girls had higher dysmenorrhea presence<sup>136,141</sup> and severity;<sup>141</sup> however, in these two articles, rural girls were more likely to miss school due to dysmenorrhea<sup>136</sup> and less likely to take medications than urban girls.<sup>141</sup> The remaining 21 articles comparing rural and urban locations did not find any statistically significant associations with dysmenorrhea outcomes.<sup>70,118,120,121,124,126,127,142–155</sup> In one study, high altitude was associated with higher dysmenorrhea presence.<sup>137</sup>

**Other Occupational Factors (i.e., factors other than job-related stress, n =19)**—Table 2 summarizes results on other occupational factors (e.g., occupational exposures, types of occupations, work schedule, and physical aspects of the job). Across 19 articles, relationships between occupational factors and dysmenorrhea outcomes were equivocal.

In terms of occupational exposures, evidence was scarce, null, or equivocal. A small number of studies linked occupational chemical exposures (including hair products,<sup>156</sup> chemicals used in the semiconductor industry,<sup>157</sup> disinfectants,<sup>75</sup> or anti-cancer agents<sup>75</sup>) to higher dysmenorrhea presence or severity. Neither exposure to vibration<sup>27</sup> nor

exposure to noise<sup>27,75,157</sup> was associated with dysmenorrhea presence. Among 3 studies on occupational exposure to low temperatures, 2 reported associations with higher dysmenorrhea presence.<sup>158,159</sup>

Regarding job types/settings, the evidence was inconclusive (n=12). In 8 articles, job types/settings were associated with dysmenorrhea outcomes, including presence<sup>39,75,158,160–164</sup> and severity.<sup>165</sup> However, the relationships were not significant in the rest of the 4 studies.<sup>71,73,157,166</sup> While most articles (n=8, 66.7%) show significant relationship, the job types/settings studied were too heterogeneous to make a meaningful conclusion.

In terms of work schedule, both long work hours and shift work were examined in relationship to dysmenorrhea outcomes. Except in one study where long work hours were associated with higher dysmenorrhea presence,<sup>158</sup> associations were not found in the other 5 studies.<sup>73,75,112,167,168</sup> Similarly, except in one study where shift work was associated with higher dysmenorrhea presence,<sup>75</sup> shift work was not associated with dysmenorrhea outcomes in the other 4 studies.<sup>27,58,73,169</sup>

For physical aspects of the job, both sedentary work and physical demands of the job were examined. The evidence was limited or equivocal. Sedentary work was not linked to dysmenorrhea presence in the one study on this relationship.<sup>170</sup> High physical demand was associated with higher dysmenorrhea presence in one study,<sup>75</sup> but not with dysmenorrhea presence in other studies.<sup>27,158,161</sup>

**Race/Ethnicity (n = 21)**—Across 21 articles, the direction of associations between race/ethnicity and dysmenorrhea outcomes was equivocal. Nine articles (42.9%) showed no relationship between racial/ethnic groups and dysmenorrhea outcomes.<sup>30,57,102,107,154,171–174</sup>

Seven articles (33.3%) suggested minoritized race/ethnicity was significantly associated with worse dysmenorrhea outcomes, including higher presence,<sup>39,104,123,175</sup> higher severity,<sup>123,176,177</sup> and higher interference.<sup>91</sup> These articles suggested worse dysmenorrhea outcomes in racially/ethnically minoritized groups including African/Black Americans,<sup>91,175,178,179</sup> Hispanic/Latino Americans,<sup>179</sup> Ethnic Minority Chinese in China,<sup>104</sup> Migrant Indians in India,<sup>39</sup> and girls of Asian/African ethnic origin living in Israel.<sup>123</sup>

Three articles (14.3%) showed that minoritized race/ethnicity was associated with better dysmenorrhea outcomes including lower presence,<sup>100</sup> severity,<sup>108,180</sup> and interference.<sup>100</sup> These articles showed lower dysmenorrhea severity in Black American women compared with White,<sup>108</sup> lower dysmenorrhea severity in Afro-Caribbean individuals compared with Caucasian individuals in England,<sup>181</sup> and lower dysmenorrhea presence and interference among non-Malay adolescent girls than Malay adolescent girls in Malaysia.<sup>100</sup>

The remaining 2 articles (22.2%) showed minoritized race/ethnicity as both risk and protective factor for dysmenorrhea depending on the racial group and outcome variable.<sup>182,183</sup> A study conducted in Canada showed that South Asian Canadians had a higher prevalence of dysmenorrhea, while East Asian Canadians had lower dysmenorrhea

prevalence, both in comparison to Caucasians.<sup>183</sup> A US-based study on female soldiers suggested African American soldiers had better dysmenorrhea outcomes than Caucasian American soldiers.<sup>182</sup> In the same study, Asian American soldiers with severe dysmenorrhea sought healthcare and treatment at a significantly lower rate than American soldiers in other racial/ethnic groups with severe dysmenorrhea.<sup>182</sup>

**Employment Status (n = 12)**—In 12 articles, the relationship between employment status and dysmenorrhea outcomes was equivocal; 7 showed no relationship,<sup>60,93,108,120,151,174,184</sup> and 5 showed statistically significant but inconsistent findings. Among these 5 articles, one suggested unemployment was associated with higher dysmenorrhea severity,<sup>185</sup> 3 showed employment was associated with higher dysmenorrhea presence,<sup>149,159,186</sup> and one reported higher dysmenorrhea presence among both employed and unemployed women compared to homemakers.<sup>187</sup>

**Religion (n = 11)**—Seven (63.6%) did not show any significant relationships.<sup>87,92,94,103,123,146,188</sup> Among 4 articles (36.4%) reporting significant results, 3 suggested Muslim girls in India had higher dysmenorrhea presence<sup>39,110</sup> and severity<sup>134</sup> compared to Indian girls with other religious affiliations, and the remaining article reported a higher presence of dysmenorrhea among religious Vietnamese women than their counterparts who practiced no religion.<sup>113</sup>

**Students' Living Situation (n = 8)**—Across 8 articles that examined students' living situations (e.g., living in dorms versus at home with family), 5 showed no relationship,<sup>94,97,119,122,124</sup> and 3 showed statistically significant relationships with dysmenorrhea outcomes. However, the direction of the association was inconsistent. Two articles suggested worse dysmenorrhea outcomes (i.e., higher dysmenorrhea presence) among those living in dorms or living away from parents,<sup>189,190</sup> while the other article suggested better outcomes (i.e., lower dysmenorrhea severity) among those living in dorms.<sup>126</sup>

**Miscellaneous Factors (n = 10)**—There was limited evidence for a number of factors. Four articles examined family culture and dysmenorrhea outcomes,<sup>39,83,96,191</sup> but the results were equivocal. Family conflicts were positively associated with dysmenorrhea severity in one study,<sup>191</sup> but was not associated with dysmenorrhea presence in another study.<sup>96</sup> Low family autonomy in decision-making was associated with high dysmenorrhea presence.<sup>39</sup> Family psychosocial coherence was not associated with dysmenorrhea presence.<sup>83</sup>

Two articles examined birthplace, though neither study analyzed the data by race/ethnicity.<sup>192,193</sup> The articles had conflicting findings. An older Australia-based study suggested dysmenorrhea presence differed based on birth country,<sup>187</sup> while a Canada-based study suggested dysmenorrhea presence did not differ based on being foreign-born or not.<sup>192</sup>

Two studies examined relationships between country of residence and dysmenorrhea outcomes.<sup>113,194</sup> In the two studies, higher dysmenorrhea prevalence was seen in Vietnamese immigrants in Korea versus native Vietnamese,<sup>113</sup> and higher dysmenorrhea severity was seen in people living in Australia versus China.<sup>194</sup>

One study examined registered city residency status.<sup>73</sup> A China-based study showed that registered residents of a large city were less likely to have dysmenorrhea than non-registered residents working in the city.<sup>73</sup>

One study examined the relationship between menarche initiation rites and dysmenorrhea outcomes and reported that women completing the rites (e.g., followed a prescribed diet, spent time in isolation, cared for during the ceremony, and emesis) were less likely to report dysmenorrhea.<sup>195</sup>

One study examining stress related to life events found that it was significantly associated with dysmenorrhea presence.<sup>57</sup>

Lastly, one study examined the relationship between e-health literacy and dysmenorrhea severity and reported a significant negative relationship (i.e., high e-health literacy, lower severity).<sup>196</sup>

## Discussion

This systematic review synthesizes literature on relationships between a comprehensive list of SDoH factors and dysmenorrhea outcomes. Despite limitations in the existing evidence, we identified SDoH variables as risk and protective factors for dysmenorrhea outcomes. SDoH factors associated with worse dysmenorrhea outcomes included traumatic experiences, harmful environmental exposures (especially passive smoking), female genital mutilation, and job-related stress. SDoH factors associated with better dysmenorrhea outcomes were prior menstrual education and social support. The mechanisms behind these associations are largely unknown but can be inferred. Chronic stress from trauma, jobs, or environmental exposures may induce epigenetic, hormonal, and neuroimmune changes (e.g., central sensitization, allostatic load, HPA activation), which increase vulnerability to pain.<sup>197,198</sup> Genital mutilation may result in injury, infection, and psychosocial consequences,<sup>199</sup> increasing the risk for chronic pain. Menstrual health education may provide people with knowledge, skills, and resources to manage dysmenorrhea.<sup>200</sup> Social support has been shown to decrease the adverse influence of pain-related stress and facilitate coping with pain.<sup>201</sup>

Some of the identified risk factors are consistent with existing literature. First, a systematic review focusing on childhood adversity linked sexual abuse and post-traumatic stress disorders with dysmenorrhea.<sup>202</sup> A meta-analysis pooling 4 studies showed that sexual assault increased the risk for dysmenorrhea with a pooled odds ratio of 1.6.<sup>203</sup> Additionally, lifetime traumatic events and chronic stress have been shown to increase the risk for chronic pain.<sup>204,205</sup> Second, environmental exposures have also been linked to the risks of uterine fibroids,<sup>206</sup> a condition that can cause menstrual pain. Third, among our included articles on female genital mutilation, a majority showed its associations with higher dysmenorrhea presence or severity, providing updated evidence on previously inconsistent associations between female genital mutilation and dysmenorrhea.<sup>202,207</sup> Compared to previous reviews, we comprehensively examined diverse SDoH factors, included broader and more updated articles, and incorporated a rigorous RoB assessment.

Our systematic review highlighted equivocal findings regarding the associations of SES and race/ethnicity with dysmenorrhea outcomes. The inconsistent findings may be due to several factors. First, there were significant heterogeneities across studies in terms of study populations, settings, designs, and SDoH and dysmenorrhea outcome measures. Second, some smaller studies might have been under-powered to detect significant associations. Third, inconsistent findings might also indicate that the influence of race/ethnicity and SES on dysmenorrhea is context-specific, intertwined, or intersected with other SDoH. On a global level, race and ethnicity are not uniformly defined or applied, and depending on the comparison group, dysmenorrhea outcomes could be better or worse. It will be important to focus on underlying mechanisms (e.g., discrimination, racial bias, access to care) that contribute to dysmenorrhea disparities when conceptualizing future research questions and hypotheses.

One overarching finding of this review was the lack of comprehensive, rigorous investigations of SDoH in relation to dysmenorrhea outcomes. The quality of evidence was limited for all SDoH factors as evident in the high and very high RoB for most included studies. There is a complete lack of evidence for SDoH factors including healthcare access, insurance, gender identity, sexual orientation, and discrimination. Additionally, how SDoH factors may be related to long-term dysmenorrhea outcomes, such as risk of other chronic pain conditions, remains unknown. Although the biopsychosocial model<sup>208</sup> is the long-standing accepted model for studying pain,<sup>209,210</sup> relatively little is known about how social and environmental factors affect dysmenorrhea.

High and very high RoB stemmed from several significant methodological issues in the reviewed articles. First, there was RoB arising from issues in measuring dysmenorrhea outcomes. Over 80% of articles had a high or very high RoB related to outcome measurement. Researchers often used poorly developed and/or unvalidated tools, threatening the validity of their findings. Moreover, important outcomes such as symptom severity and interference were infrequently assessed. Second, there was high RoB for over 80% of articles from confounders not being considered in study design and analyses. Dysmenorrhea risk factors such as age, family history, and parity, along with confounders for specific SDoH factors should be considered in study design and analyses. Third, there was RoB because studies were often poorly reported. Descriptions were insufficient on sampling approaches, sample characteristics (e.g., race/ethnicity), handling of missing data, SDoH and dysmenorrhea measurement, and analytic approaches. The case definition of dysmenorrhea and the types of dysmenorrhea studies were often unclear, making it challenging to compare studies and generalize findings. While it is often infeasible to confirmatively differentiate primary and secondary dysmenorrhea, researchers should thoughtfully determine eligibility criteria, be transparent about screening approaches, collect and report information on gynecological conditions, and follow established guidelines to ensure studies are clearly reported.

### Implications for Research

This review has important implications for future research. First, more attention to social and environmental factors is needed in dysmenorrhea research. The lack of systematic

examination of SDoH in dysmenorrhea creates barriers to developing public health strategies to improve dysmenorrhea outcomes and reduce health inequities. Future research needs to consider a broad range of SDoH since people with dysmenorrhea are heterogeneous with diverse lived experiences, backgrounds, and socioenvironmental contexts.<sup>211</sup> Second, to facilitate large-scale research on SDoH and dysmenorrhea outcomes, dysmenorrhea outcomes need to be included in large epidemiologic studies, which already collect a wealth of SDoH information. Despite its high prevalence and impact, dysmenorrhea outcomes have been historically excluded in large population-based or clinical studies.<sup>212</sup> Third, in examining the relationship between SDoH and dysmenorrhea, researchers need to rigorously design studies that can investigate the effects of SDoH on dysmenorrhea, account for confounders in study design and analysis, enhance the size and representation of study samples, use validated dysmenorrhea outcome and SDoH measures, apply sound approaches for missing data, and allow examination of longitudinal relationships between SDoH and longer-term dysmenorrhea outcomes (e.g., risk for future chronic pain). Fourth, studies on SDoH and dysmenorrhea should include a wide developmental range. Less than one-quarter of included studies enrolled adolescents younger than 18 years, the age group that undergoes significant biopsychosocial changes. A better understanding of the impact of SDoH on dysmenorrhea across the reproductive lifespan is needed to develop developmentally tailored interventions.<sup>213</sup> Fifth, future research needs to examine potential social and environmental barriers and facilitators to effective dysmenorrhea management.

### **Implications for Clinical Practice**

Our review also has important implications for clinical practice. Clinicians need to be aware of SDoH risk and protective factors related to dysmenorrhea outcomes. Multidisciplinary approaches are needed for holistic treatment. SDoH are often considered not addressable in clinical practice, and clinicians often feel helpless and frustrated when caring for patients faced with intertwined health and social challenges.<sup>214</sup> However, some SDoH factors are clinically addressable (e.g., trauma, menstrual education, and occupational stress), and recommendations are available for clinicians to influence SDoH factors at the patient, practice, and community levels.<sup>214</sup> For example, practical strategies include asking about social challenges sensitively, collecting history of trauma exposures, adopting trauma-informed care, evaluating potential environmental exposures and offering harm reduction resources, providing menstrual education (particularly for pediatric populations), and addressing barriers to care. These strategies may help acknowledge patients' psychosocial concerns, promote a holistic person-centered approach, and improve equity in dysmenorrhea care.

### **Limitations and Strengths**

This systematic review has some limitations. First, we only included English-language publications. Second, some studies containing relevant data might have been missed due to a lack of standard search terms on many SDoH factors and variations in how researchers referred to SDoH factors. Third, in this review, we treated higher treatment use/access as a positive outcome. However, we acknowledge that non-socioeconomic factors such as symptom severity and treatment preferences can affect treatment access and use.<sup>215</sup> Fourth, there is a lack of standardized tools to evaluate studies on SDoH. While the

ROBINS-E tool is broadly applicable to ROB assessment in non-randomized studies-of environmental exposure, its item concerning post-exposure intervention was not as relevant to some SDoH variables such as race/ethnicity. Fifth, because of the extensive scope of the review, the overall high RoB of the included studies, and the significant heterogeneities across studies in terms of study populations, SDoH measurement, dysmenorrhea outcome measurement, study design, and statistical tests, a meta-analysis was not conducted. Sixth, the relationship between SDoH and dysmenorrhea outcomes may be context dependent. Future research should assess how contextual factors affect the relationship between SDoH and dysmenorrhea outcomes.

This systematic review has several strengths. First, it offers a comprehensive picture of how various SDoH and dysmenorrhea outcomes are related. We included a wide range of SDoH factors and dysmenorrhea outcomes. Second, the review provides a global landscape of the social determinants of dysmenorrhea. Over 160 articles from over 40 countries were included. Third, we followed rigorous review methods including pre-registration of the protocol, multiple search engines, comprehensive search terms, and independent parallel screening/full-text review/data extraction.

## Conclusions

This systematic review identified SDoH factors likely associated with dysmenorrhea outcomes, thus helping to inform the assessment, prevention, and reduction of disparities related to dysmenorrhea. Studies had a high RoB due to methodological issues. This review suggests a lack of systematic examination of SDoH in dysmenorrhea and calls for more rigorous research to understand the impact of SDoH on dysmenorrhea and thereby inform clinical practice and health policy.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## References:

1. Iacovides S, Avidon I, Baker FC. What we know about primary dysmenorrhea today: a critical review. *Hum Reprod Update*. 2015;21(6):762–778. [PubMed: 26346058]
2. Dawood MY. Primary dysmenorrhea: advances in pathogenesis and management. *Obstet Gynecol*. 2006;108(2):428–441. [PubMed: 16880317]
3. Armour M, Parry K, Manohar N, et al. The Prevalence and Academic Impact of Dysmenorrhea in 21,573 Young Women: A Systematic Review and Meta-Analysis. *Journal of Women's Health*. 2019;28(8):1161–1171. doi:10.1089/jwh.2018.7615
4. Buck Louis GM, Hediger ML, Peterson CM, et al. Incidence of endometriosis by study population and diagnostic method: the ENDO study. *Fertil Steril*. 2011;96(2):360–365. [PubMed: 21719000]
5. Stewart EA, Cookson CL, Gandolfo RA, Schulze-Rath R. Epidemiology of uterine fibroids: a systematic review. *Bjog*. 2017;124(10):1501–1512. [PubMed: 28296146]

6. Kreisel K, Torrone E, Bernstein K, Hong J, Gorwitz R. Prevalence of Pelvic Inflammatory Disease in Sexually Experienced Women of Reproductive Age - United States, 2013–2014. *MMWR Morb Mortal Wkly Rep.* 2017;66(3):80–83. [PubMed: 28125569]
7. Missmer SA, Cramer DW. The epidemiology of endometriosis. *Obstetrics and Gynecology Clinics of North America.* 2003;30(1):1–19. [PubMed: 12699255]
8. Li R, Kreher DA, Jusko TA, Chapman BP, Bonham AD, Seplaki CL. Prospective Association between Dysmenorrhea and Chronic Pain Development in Community-Dwelling Women. *J Pain.* 2021;22(9):1084–1096. [PubMed: 33762206]
9. Li R, Li B, Kreher DA, Benjamin AR, Gubbels A, Smith SM. Association between dysmenorrhea and chronic pain: a systematic review and meta-analysis of population-based studies. *Am J Obstet Gynecol.* 2020;223(3):350–371. [PubMed: 32151612]
10. Ju H, Jones M, Mishra G. The prevalence and risk factors of dysmenorrhea. *Epidemiol Rev.* 2014;36:104–113. [PubMed: 24284871]
11. Oladosu FA, Tu FF, Hellman KM. Nonsteroidal antiinflammatory drug resistance in dysmenorrhea: epidemiology, causes, and treatment. *Am J Obstet Gynecol.* 2018;218(4):390–400. [PubMed: 28888592]
12. Rogers SK, Ahamadeen N, Chen CX, Mosher CE, Stewart JC, Rand KL. Dysmenorrhea and psychological distress: a meta-analysis. *Arch Womens Ment Health.* 2023;26(6):719–735. doi:10.1007/s00737-023-01365-6 [PubMed: 37632569]
13. World Health Organization. Closing the gap in a generation: health equity through action on the social determinants of health: Commission on Social Determinants of Health final report. Published 2008. Accessed March 1, 2024. [https://iris.who.int/bitstream/handle/10665/69832/WHO\\_IER\\_CSDH\\_08.1\\_eng.pdf?sequence=1](https://iris.who.int/bitstream/handle/10665/69832/WHO_IER_CSDH_08.1_eng.pdf?sequence=1)
14. Palmer RC, Ismond D, Rodriguez EJ, Kaufman JS. Social determinants of health: future directions for health disparities research. In. Vol 109: American Public Health Association; 2019:S70–S71.
15. Gómez CA, Kleinman DV, Pronk N, et al. Addressing Health Equity and Social Determinants of Health Through Healthy People 2030. *Journal of Public Health Management and Practice.* 2021;27(Supplement 6):S249–S257. [PubMed: 33729197]
16. Janevic MR, McLaughlin SJ, Heapy AA, Thacker C, Piette JD. Racial and Socioeconomic Disparities in Disabling Chronic Pain: Findings From the Health and Retirement Study. *J Pain.* 2017;18(12):1459–1467. [PubMed: 28760648]
17. Jacoby VL, Fujimoto VY, Giudice LC, Kuppermann M, Washington AE. Racial and ethnic disparities in benign gynecologic conditions and associated surgeries. *Am J Obstet Gynecol.* 2010;202(6):514–521. [PubMed: 20430357]
18. Chen C, Cromeens MG, Rogers S, Hinrichs R, Fortenberry JD, Carpenter J. Social Determinants of Health in Dysmenorrhea: A Systematic Review Protocol. PROSPERO 2023 CRD42023391715 [https://www.crd.york.ac.uk/prospero/display\\_record.php?ID=CRD42023391715](https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023391715). 2023.
19. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* 2021;372:n71. [PubMed: 33782057]
20. Pronk N, Kleinman DV, Goekler SF, Ochiai E, Blakey C, Brewer KH. Promoting Health and Well-being in Healthy People 2030. *J Public Health Manag Pract.* 2021;27(Suppl 6):S242–s248. [PubMed: 33278186]
21. O’Neill J, Tabish H, Welch V, et al. Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. *J Clin Epidemiol.* 2014;67(1):56–64. [PubMed: 24189091]
22. Harzing AW. Publish or Perish. Published 2007. Accessed June 30, 2023. <https://harzing.com/resources/publish-or-perish>.
23. Chen CX, Barrett B, Kwakkeboom KL. Efficacy of Oral Ginger (*Zingiber officinale*) for Dysmenorrhea: A Systematic Review and Meta-Analysis. *Evid Based Complement Alternat Med.* 2016;2016:6295737. doi:10.1155/2016/6295737 [PubMed: 27274753]
24. Prady SL, Uphoff EP, Power M, Golder S. Development and validation of a search filter to identify equity-focused studies: reducing the number needed to screen. *BMC Med Res Methodol.* 2018;18(1):106. [PubMed: 30314471]

25. Covidence Systematic Review Software. Covidence Systematic Review Software. Veritas Health Innovation. Published 2023. Accessed March 1, 2024. <https://www.covidence.org/>
26. Morgan RL, Thayer KA, Santesso N, et al. Evaluation of the risk of bias in non-randomized studies of interventions (ROBINS-I) and the 'target experiment' concept in studies of exposures: Rationale and preliminary instrument development. *Environ Int*. 2018;120:382–387. [PubMed: 30125855]
27. Lei L, Ye L, Liu H, et al. Passive smoking, cytochrome P450 gene polymorphisms and dysmenorrhea. *European journal of epidemiology*. 2008;23(7):475–481. [PubMed: 18437510]
28. Li N, Liu H, Chen C, et al. CYP1A1 gene polymorphisms in modifying the association between passive smoking and primary dysmenorrhea. *Annals of epidemiology*. 2007;17(11):882–888. [PubMed: 17728147]
29. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reproductive toxicology (Elmsford, NY)*. 2007;24(1):114–119.
30. Jamieson DJ, Steege JF. The prevalence of dysmenorrhea, dyspareunia, pelvic pain, and irritable bowel syndrome in primary care practices. *Obstet Gynecol*. 1996;87(1):55–58. [PubMed: 8532266]
31. Jamieson DJ, Steege JF. The association of sexual abuse with pelvic pain complaints in a primary care population. *American Journal of Obstetrics and Gynecology*. 1997;177(6):1408–1412. [PubMed: 9423743]
32. Golding JM, Wilsnack SC, Learman LA. Prevalence of sexual assault history among women with common gynecologic symptoms. *American Journal of Obstetrics & Gynecology*. 1998;179(4):1013–1019. [PubMed: 9790390]
33. John R, Johnson JK, Kukreja S, Found M, Lindow SW. Domestic violence: prevalence and association with gynaecological symptoms. *BJOG : an international journal of obstetrics and gynaecology*. 2004;111(10):1128–1132. [PubMed: 15383116]
34. Letourneau EJ, Holmes M, Chasedunn-Roark J. Gynecologic health consequences to victims of interpersonal violence. *Women's Health Issues*. 1999;9(2):115–120. [PubMed: 10189822]
35. Littleton H, Wright L, Dodd JC, Higgins M. Gynecological Health Complaints Among College Women With Sexual Victimization Histories: Examination of Depression and Anxiety as Potential Mediators. *Womens Health Issues*. 2023;33(1):105–112. doi:10.1016/j.whi.2022.06.001 [PubMed: 35787340]
36. Waigandt A, Wallace DL, Phelps L, Miller DA. The impact of sexual assault on physical health status. *Journal of Traumatic Stress*. 1990;3:93–102.
37. Xu K, Chen L, Fu L, et al. Stressful Parental-Bonding Exaggerates the Functional and Emotional Disturbances of Primary Dysmenorrhea. *International journal of behavioral medicine*. 2016;23(4):458–463. [PubMed: 26309099]
38. Cohen BE, Maguen S, Bertenthal D, Shi Y, Jacoby V, Seal KH. Reproductive and other health outcomes in Iraq and Afghanistan women veterans using VA health care: association with mental health diagnoses. *Women's health issues : official publication of the Jacobs Institute of Women's Health*. 2012;22(5):e461–471.
39. Patel V, Tanksale V, Sahasrabhojane M, Gupte S, Nevrekar P. The burden and determinants of dysmenorrhoea: a population-based survey of 2262 women in Goa, India. *Bjog*. 2006;113(4):453–463. [PubMed: 16489934]
40. Romito P, Cedolin C, Bastiani F, Beltramini L, Saurel-Cubizolles MJ. Sexual harassment and menstrual disorders among Italian university women: A cross-sectional observational study. *Scandinavian Journal of Public Health*. 2017;45(5):528–535. [PubMed: 28566013]
41. You DS, Albu S, Lisenbardt H, Meagher MW. Cumulative Childhood Adversity as a Risk Factor for Common Chronic Pain Conditions in Young Adults. *Pain Med*. 2019;20(3):486–494. [PubMed: 30011037]
42. Serbeniuk A, Kaminskiy V, Kumpanenko Y, Vash-Margita A, Malysheva I. The impact of the war in Ukraine on the reproductive health of female military personnel. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2023;163(2):409–415. [PubMed: 37458251]
43. Goeckenjan M, Veta-Darkowski J, Gabrys M, Mickan F, Wimberger P, Ehrenfeld-Lenkiewicz N. Life-time experience of violence as a risk factor for symptomatic endometriosis.

- J Psychosom Obstet Gynaecol. 2023;44(1):2240007. doi:10.1080/0167482X.2023.2240007 [PubMed: 37493247]
44. Ambresin A-E, Belanger RE, Chamay C, Berchtold A, Narring F. Body dissatisfaction on top of depressive mood among adolescents with severe dysmenorrhea. *Journal of pediatric and adolescent gynecology*. 2012;25(1):19–22. [PubMed: 22217652]
  45. Okoro R, Malgwi H, Okoro G. Evaluation of Factors that Increase the Severity of Dysmenorrhoea among University Female Students in Maiduguri, North Eastern Nigeria. *Internet Journal of Allied Health Sciences and Practice*. 2013;11(4):7.
  46. Takeda T, Tadakawa M, Koga S, Nagase S, Yaegashi N. Relationship between Dysmenorrhea and Posttraumatic Stress Disorder in Japanese High School Students 9 Months after the Great East Japan Earthquake. *Journal of Pediatric and Adolescent Gynecology*. 2013;26(6):355–357. [PubMed: 24075088]
  47. Gammoh O, Durand H, Abu-Shaikh H, Alsous M. Post-traumatic stress disorder burden among female Syrian war refugees is associated with dysmenorrhea severity but not with the analgesics. *Electronic Journal of General Medicine*. 2023;20(4):em485.
  48. Golding JM. Sexual assault history and women's reproductive and sexual health. *Psychology of women quarterly*. 1996;20(7613934):101–121. [PubMed: 12296010]
  49. Mark H, Bitzker K, Klapp BF, Rauchfuss M. Gynaecological symptoms associated with physical and sexual violence. *Journal of Psychosomatic Obstetrics & Gynecology*. 2008;29(3):167–175.
  50. Ansari A, Urooj U, Waseem M. Gender Based Violence (GBV) data collection and gynaecologist's perspective in a tertiary care hospital. *Pakistan Journal of Medical and Health Sciences*. 2018;12(4):1587–1590.
  51. Ng TP, Foo SC, Yoong T. Menstrual function in workers exposed to toluene. *British journal of industrial medicine*. 1992;49(11):799–803. [PubMed: 1463681]
  52. Chen C, Cho SI, Damokosh AI, et al. Prospective study of exposure to environmental tobacco smoke and dysmenorrhea. *Environmental health perspectives*. 2000;108(11):1019–1022. [PubMed: 11102290]
  53. Lin S-Y, Yang Y-C, Lin C-C, et al. Increased Incidence of Dysmenorrhea in Women Exposed to Higher Concentrations of NO, NO<sub>2</sub>, NO<sub>x</sub>, CO, and PM<sub>2.5</sub>: A Nationwide Population-Based Study. *Frontiers in public health*. 2021;9(101616579):682341. [PubMed: 34222182]
  54. Xiao S-Q, Xing L-L, Wu Q-J, et al. Association Between Passive Smoking and Menstrual Discomfort: A Cross-Sectional Study of 2,571 Non-smoking Chinese Nurses. *Frontiers in public health*. 2022;10(101616579):889254. [PubMed: 35719676]
  55. Matsushita T, Arimatsu Y, Ueda A, Satoh K, Nomura S. Hematological and neuromuscular response of workers exposed to low concentration of toluene vapor. *Industrial Health*. 1975;13(3):115–121.
  56. Yang J-M, Chen Q-Y, Jiang X-Z. Effects of metallic mercury on the perimenstrual symptoms and menstrual outcomes of exposed workers. *American journal of industrial medicine*. 2002;42(5):403–409. [PubMed: 12382253]
  57. Gordley LB, Lemasters G, Simpson SR, Yiin JH. Menstrual disorders and occupational, stress, and racial factors among military personnel. *Journal of occupational and environmental medicine*. 2000;42(9):871–881. [PubMed: 10998762]
  58. Chung F-F, Yao C-CC, Wan G-H. The associations between menstrual function and life style/working conditions among nurses in Taiwan. *Journal of occupational health*. 2005;47(2):149–156. [PubMed: 15824480]
  59. Nloh AM, Ngadjui E, Vogue N, et al. Prevalence and factors associated with dysmenorrhea in women at child bearing age in the Dschang Health District, West-Cameroon. *The Pan African medical journal*. 2020;37(101517926):178. [PubMed: 33447333]
  60. Lemasters GK, Hagen A, Samuels SJ. Reproductive outcomes in women exposed to solvents in 36 reinforced plastics companies. I. Menstrual dysfunction. *Journal of occupational medicine : official publication of the Industrial Medical Association*. 1985;27(7):490–494.
  61. Li J, Deng T, Rao W, et al. Phthalate metabolites in urine and follicular fluid in relation to menstrual cycle characteristics in women seeking fertility assistance. *Environment international*. 2024;183(du1, 7807270):108362. [PubMed: 38064925]

62. Yang C-Y, Huang T-S, Lin K-C, Kuo P, Tsai P-C, Guo YL. Menstrual effects among women exposed to polychlorinated biphenyls and dibenzofurans. *Environmental research*. 2011;111(2):288–294. [PubMed: 21186023]
63. Mahmoud MIH. Effect of female genital mutilation on female sexual function, Alexandria, Egypt. *Alexandria Journal of Medicine*. 2016;52(1):55–59.
64. el-Defrawi MH, Lotfy G, Dandash KF, Refaat AH, Eyada M. Female genital mutilation and its psychosexual impact. *Journal of sex & marital therapy*. 2001;27(5):465–473. [PubMed: 11554208]
65. Kaplan A, Forbes M, Bonhoure I, et al. Female genital mutilation/cutting in The Gambia: long-term health consequences and complications during delivery and for the newborn. *International journal of women's health*. 2013;5(101531698):323–331.
66. Shiferaw MT, Wubshet M, Tegabu D. Menstrual problems and associated factors among students of Bahir Dar University, Amhara National Regional State, Ethiopia: A cross-sectional survey. *The Pan African medical journal*. 2014;17(101517926):246. [PubMed: 25309646]
67. Elnashar A, Abdelhady R. The impact of female genital cutting on health of newly married women. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2007;97(3):238–244. [PubMed: 17445819]
68. Ali HAAEW Arafa AE, El Fattah Abd Allah Shehata NA, Fahim AS. Prevalence of Female Circumcision among Young Women in Beni-Suef, Egypt: A Cross-Sectional Study. *Journal of pediatric and adolescent gynecology*. 2018;31(6):571–574. [PubMed: 30064003]
69. Arafa AE, Elbahrawe RS, Shawky SM, Abbas AM. Epidemiological and gynecological correlates with female genital mutilation among Beni-Suef University students; cross sectional study. *Middle East Fertility Society Journal*. 2018;23(3):184–188.
70. Shehata N, Arafa A, El Wahed H, Fahim AS, Hussein GK. Epidemiology of dysmenorrhea among university students in Egypt. *Int J Womens Health Wellness*. 2018;4(1):073.
71. Matsumura K, Tsuno K, Okamoto M, et al. The Association between the Severity of Dysmenorrhea and Psychological Distress of Women Working in Central Tokyo—A Preliminary Study. *Int J Environ Res Public Health*. 2023;20(21):7021. doi:10.3390/ijerph20217021 [PubMed: 37947577]
72. László KD, Gy rffy Z, Ádám S, Csoboth C, Kopp MS. Work-related stress factors and menstrual pain: A nation-wide representative study. *J Psychosom Obstet Gynaecol*. 2008;29(2):133–138. doi:10.1080/01674820701804423 [PubMed: 18484442]
73. Sznajder KK, Harlow SD, Burgard SA, Wang Y, Han C, Liu J. Gynecologic pain related to occupational stress among female factory workers in Tianjin, China. *International journal of occupational and environmental health*. 2014;20(1):33–45. [PubMed: 24804338]
74. Kordi M, Mohamadirizi S, Shakeri MT. The relationship between occupational stress and dysmenorrhea in midwives employed at public and private hospitals and health care centers in Iran (Mashhad) in the years 2010 and 2011. *Iranian journal of nursing and midwifery research*. 2013;18(4):316–322. [PubMed: 24403929]
75. Jiang Z, Wang J, Guo X, et al. Menstrual disorders and occupational exposures among female nurses: A nationwide cross-sectional study. *International Journal of Nursing Studies*. 2019;95:49–55. [PubMed: 31059897]
76. Laszlo KD, Kopp MS. Effort-reward imbalance and overcommitment at work are associated with painful menstruation: results from the Hungarostudy Epidemiological Panel 2006. *Journal of occupational and environmental medicine*. 2009;51(2):157–163. [PubMed: 19209036]
77. Alonso C, Coe CL. Disruptions of social relationships accentuate the association between emotional distress and menstrual pain in young women. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association*. 2001;20(6):411–416. [PubMed: 11714182]
78. Mashreghi M, Suhrabi Z, Soliemanifard P, Farzi S, Taheri S. The association between severity of dysmenorrhea and social support among female students of ilam university of medical sciences. *Shiraz E Medical Journal*. 2021;22(9):e108890.
79. Whittle GC, Slade P, Ronalds CM. Social support in women reporting dysmenorrhea. *Journal of psychosomatic research*. 1987;31(1):79–84. [PubMed: 3820148]

80. Hailemeskel S, Demissie A, Assefa N. Primary dysmenorrhea magnitude, associated risk factors, and its effect on academic performance: evidence from female university students in Ethiopia. *International journal of women's health*. 2016;8(101531698):489–496.
81. Faramarzi M, Salmalian H. Association of psychologic and nonpsychologic factors with primary dysmenorrhea. *Iranian Red Crescent medical journal*. 2014;16(8):e16307. [PubMed: 25389482]
82. Jordan J, Meckler JR. The relationship between life change events, social supports, and dysmenorrhea. *Research in nursing & health*. 1982;5(2):73–79. [PubMed: 6921820]
83. Makhlof EMM, AbdullHameed SM. Impact of psychological aspects of primary dysmenorrhea among employee female in university city, Assuit Governorate. *AAMJ*. 2010;8(3):61–78.
84. Evans S, Dowding C, Olive L, Payne LA. Pain catastrophizing, but not mental health or social support, is associated with menstrual pain severity in women with dysmenorrhea: A cross-sectional survey. *Psychology, Health & Medicine*. 2021;27(6):1410–1420.
85. Jandaghi G, Khalajinia Z. Comparing lifestyles, social support, body mass index and history of menses between mashhad university of medical sciences students with and without primary dysmenorrheal. *Scientific Research and Essays*. 2010;5(18):2752–2755.
86. Soja SL, Nayak BS, Lobo DJ. A Study to Evaluate the Effectiveness of Acupressure on Menstrual Discomforts Among Adolescent Girls. *International Journal of Nursing Education*. 2011;3(2):107–110.
87. Bhatia JC, Cleland J, Bhagavan L, Rao NSN. Levels and Determinants of Gynecological Morbidity in a District of South India. *Studies in Family Planning*. 1997;28(2):95–103. [PubMed: 9216030]
88. Prevalence Akta D. and factors affecting dysmenorrhea in female university students: effect on general comfort level. *Pain Management Nursing*. 2015;16(4):534–543. [PubMed: 26256218]
89. Adefuye PO, Odusoga OL, Adefuye BO, Akindele RA. Age at menarche and menstrual pattern in secondary schoolgirls in sagamu. *Nigerian Journal of Clinical Practice*. 2010;13(1):109–113.
90. Chiou M, Wang H. Predictors of dysmenorrhea and self-care behavior among vocational nursing school female students. *Journal of Nursing Research (Taiwan Nurses Association)*. 2008;16(1):17–25.
91. Klein JR, Litt IF. Epidemiology of adolescent dysmenorrhea. *Pediatrics*. 1981;68(5):661–664. [PubMed: 7312467]
92. Campbell MA, McGrath PJ. Use of medication by adolescents for the management of menstrual discomfort. *Archives of pediatrics & adolescent medicine*. 1997;151(9):905–913. [PubMed: 9308868]
93. Bakro RM, Farrukh MJ, Rajagopal MS, et al. Assessment of prevalence, knowledge and health-related practices of dysmenorrhea among Malaysian women in Kuala Lumpur: a cross-sectional survey. *Annals of medicine*. 2023;55(2):2281655. [PubMed: 38010360]
94. Sigdel D, Joshi A, Thapa T, Koirala P. Prevalence and predictors of dysmenorrhoea and its effects among adolescent girls in Chitwan, Nepal. *Journal of Chitwan Medical College*. 2023;13(1), 15–23.
95. Chen H-M, Chen C-H. Related factors and consequences of menstrual distress in adolescent girls with dysmenorrhea. *The Kaohsiung journal of medical sciences*. 2005;21(3):121–127. [PubMed: 15875437]
96. Gagua T, Tkeshelashvili B, Gagua D. Primary dysmenorrhea: prevalence in adolescent population of Tbilisi, Georgia and risk factors. *Journal of the Turkish German Gynecological Association*. 2012;13(3):162–168. [PubMed: 24592031]
97. Ibrahim NK, AlGhamdi MS, Al-Shaibani AN, et al. Dysmenorrhea among female medical students in King Abdulaziz University: Prevalence, Predictors and outcome. *Pakistan journal of medical sciences*. 2015;31(6):1312–1317. [PubMed: 26870088]
98. Mao L, Xi S, Bai W, et al. Menstrual patterns and disorders among Chinese women of reproductive age: A cross-sectional study based on mobile application data. *Medicine*. 2021;100(16):e25329. [PubMed: 33879662]
99. Nasrullah FD, Jalil R, Khan A. Frequency of pre-menstrual syndrome and menstrual irregularities in adolescents of different socioeconomic groups. *Medical Forum Monthly*. 2016;27(7):9–12.

100. Wong LP, Khoo EM. Dysmenorrhea in a multiethnic population of adolescent Asian girls. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2010;108(2):139–142. [PubMed: 19944416]
101. Wong LP. Premenstrual syndrome and dysmenorrhea: urban-rural and multiethnic differences in perception, impacts, and treatment seeking. *Journal of Pediatric and Adolescent Gynecology*. 2011;24(5):272–277. [PubMed: 21600811]
102. Kritz-Silverstein D, Wingard DL, Garland FC. The association of behavior and lifestyle factors with menstrual symptoms. *Journal of women's health & gender-based medicine*. 1999;8(9):1185–1193.
103. Hossain G, Sabiruzzaman, Islam S, Hisyam RZ, Lestrel E, Kamarul T. Influence of anthropometric measures and socio-demographic factors on menstrual pain and irregular menstrual cycles among university students in Bangladesh. *Anthropological Science*. 2011;119(3):239–246.
104. Hu Z, Tang L, Chen L, Kaminga AC, Xu H. Prevalence and Risk Factors Associated with Primary Dysmenorrhea among Chinese Female University Students: A Cross-sectional Study. *Journal of pediatric and adolescent gynecology*. 2020;33(1):15–22. [PubMed: 31539615]
105. Mukattash TL, Tahaine L, AlRawi N, Jarab A, Hammad H, Nuseir K. Behaviors and attitudes towards dysmenorrhea; A crosssectional survey of 2,000 Jordanian University students. *Jordan Medical Journal*. 2013;47(1):26–34.
106. Ozerdogan N, Sayiner D, Ayranci U, Unsal A, Giray S. Prevalence and predictors of dysmenorrhea among students at a university in Turkey. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2009;107(1):39–43. [PubMed: 19539288]
107. Choksey R, Mangal RK, Stead TS, Jones T, Flores R, Ganti L. Quantifying the Impact of Dysmenorrhea Symptoms on Quality-of-Life and Access to Oral Contraceptives by Income. *Health Psychol Res*. 2023;11:74120. doi:10.52965/001c.74120 [PubMed: 37405315]
108. Woods NF, Most A, Dery GK. Prevalence of perimenstrual symptoms. *Am J Public Health*. 1982;72(11):1257–1264. [PubMed: 6889817]
109. Wong LP. Attitudes towards dysmenorrhoea, impact and treatment seeking among adolescent girls: a rural school-based survey. *The Australian journal of rural health*. 2011;19(4):218–223. [PubMed: 21771164]
110. Anand E, Kumar P, Unisa S, Singh J. Neglect of Menstrual Disorders in Reproductive Health Care in India: A Population-Based Survey. *Women's Reproductive Health*. 2018;5(4):287–300.
111. Zannoni L, Giorgi M, Spagnolo E, Montanari G, Villa G, Seracchioli R. Dysmenorrhea, absenteeism from school, and symptoms suspicious for endometriosis in adolescents. *Journal of pediatric and adolescent gynecology*. 2014;27(5):258–265. [PubMed: 24746919]
112. Cho I-J, Kim H, Lim S, Oh S-S, Park S, Kang H-T. Emotional labor and dysmenorrhea in women working in sales and call centers. *Annals of occupational and environmental medicine*. 2014;26(101609244):45. [PubMed: 25699188]
113. Jang IA, Kim MY, Lee SR, Jeong KA, Chung HW. Factors related to dysmenorrhea among Vietnamese and Vietnamese marriage immigrant women in South Korea. *Obstetrics & gynecology science*. 2013;56(4):242–248. [PubMed: 24328009]
114. Boyacıoğlu NE, Gökdemir F, Keser Özcan N. Investigation of Factors Related to Menstrual and Premenstrual Symptoms. *Archives of Health Science and Research*. 2021;8(1):46–55.
115. Deekala RS, Akkapeddi SA, Rosivari PS. Prevalence of Dysmenorrhea and Determinants of Menstrual Distress in Adolescent Girls with Dysmenorrhoea, In Tirupati Town. *National Journal of Community Medicine*. 2022;13(4):229–234.
116. Jiang W, Hua X-G, Hu C-Y, Li F-L, Huang K, Zhang X-J. The prevalence and risk factors of menstrual pain of married women in Anhui Province, China. *European journal of obstetrics, gynecology, and reproductive biology*. 2018;229(e41, 0375672):190–194. [PubMed: 30216855]
117. Cetin A. Evaluation of Biological and Sociodemographic Factors Affecting Dysmenorrhea. *Cureus*. 2020;12(5):e7977. [PubMed: 32523834]

118. Nieczuja-Dwojicka J, Borowska B, Janiszewska A, Kozieł S. Socioeconomic factors and lifestyle affecting the variability of menstrual cycle characteristics in women from Central Poland. *Anthropological Review*. 2020;82(4):327–338.
119. Abu Helwa HA, Mitaeb AA, Al-Hamshri S, Sweileh WM. Prevalence of dysmenorrhea and predictors of its pain intensity among Palestinian female university students. *BMC Women's Health*. 2018;18:1-N.PAG. [PubMed: 29334974]
120. Arafa AE, Senosy SA, Helmy HK, Mohamed AA. Prevalence and patterns of dysmenorrhea and premenstrual syndrome among Egyptian girls (12–25years). *Middle East Fertility Society Journal*. 2018;23(4):486–490.
121. Teperi J, Rimpela M. Menstrual pain, health and behaviour in girls. *Social science & medicine* (1982). 1989;29(2):163–169. [PubMed: 2787534]
122. Nwankwo TO, Aniebue UU, Aniebue PN. Menstrual disorders in adolescent school girls in Enugu, Nigeria. *Journal of Pediatric and Adolescent Gynecology*. 2010;23(6):358–363. [PubMed: 21056354]
123. Shye D, Jaffe B. Prevalence and correlates of perimenstrual symptoms: a study of Israeli teenage girls. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*. 1991;12(3):217–224. [PubMed: 2054362]
124. Adib-Rad H, Kheirkhah F, Faramarzi M, Omidvar S, Basirat Z, Haji Ahmadi M. Primary Dysmenorrhea Associated with Psychological Distress in Medical Sciences Students in The North of Iran: A Cross-Sectional Study. *International journal of fertility & sterility*. 2022;16(3):224–229. [PubMed: 36029061]
125. Tadese M, Kassa A, Muluneh AA, Altaye G. Prevalence of dysmenorrhoea, associated risk factors and its relationship with academic performance among graduating female university students in Ethiopia: a cross-sectional study. *BMJ Open*. 2021;11(3):e043814.
126. Habibi N, Huang MSL, Gan WY, Zulida R, Safavi SM. Prevalence of Primary Dysmenorrhea and Factors Associated with Its Intensity Among Undergraduate Students: A Cross-Sectional Study. *Pain management nursing : official journal of the American Society of Pain Management Nurses*. 2015;16(6):855–861. [PubMed: 26328887]
127. Zurawiecka M, Wronka I. Association of primary dysmenorrhea with anthropometrical and socio-economic factors in Polish university students. *The journal of obstetrics and gynaecology research*. 2018;44(7):1259–1267. [PubMed: 29673014]
128. Al-Qazaz HK, Al-Dabbagh RO. Menstrual disorder: Cross-sectional study on prevalence and self-care practice among adolescents in Iraq. *Annals of Tropical Medicine and Public Health*. 2020;23(4):125–132.
129. El-Gilany AH, Badawi K, El-Fedawy S. Epidemiology of dysmenorrhoea among adolescent students in Mansoura, Egypt. *Eastern Mediterranean Health Journal*. 2005;11(1–2):155–163. [PubMed: 16532684]
130. Juniar D. Epidemiology of dysmenorrhea among female adolescents in Central Jakarta. *Makara Journal of Health Research*. 2015;19(1):21–26.
131. Rapkin AJ, Tsao JCI, Turk N, Anderson M, Zeltzer LK. Relationships among self-rated tanner staging, hormones, and psychosocial factors in healthy female adolescents. *Journal of pediatric and adolescent gynecology*. 2006;19(3):181–187. [PubMed: 16731411]
132. Vanitha D, Edward S, Varadharajan S, Rani MA. A community based study on menstrual disorders among the rural women of reproductive age. *International Journal of Women's Health and Reproduction Sciences*. 2017;5(4):270–276.
133. Zafar M, Sadeeqa S, Latif S, Afzal H. Pattern and prevalence of menstrual disorders in adolescents. *International Journal of Pharmaceutical Sciences and Research*. 2018;9(5):2088–2099.
134. Omidvar S, Bakouei F, Amiri FN. Primary dysmenorrhea and menstrual symptoms in Indian female students: prevalence, impact and management. *Global Journal of Health Sciences*. 2016;8(8):135–144.
135. Omidvar S, Begum K. Characteristics and determinants of primary dysmenorrhea in young adults. *American medical journal*. 2012;3(1):8–13.

136. Dambhare DG, Wagh SV, Dudhe JY. Age at menarche and menstrual cycle pattern among school adolescent girls in Central India. *Global journal of health science*. 2012;4(1):105–111. [PubMed: 22980118]
137. Gonzales GF, Carrillo CE. Low serum prolactin levels in native women at high altitude. *International Journal of Gynecology and Obstetrics*. 1993;43(2):169–175. [PubMed: 7905433]
138. Mathur CN, Jain P. A study of congestive and spasmodic dysmenorrhea in Indian rural and urban women. *Journal of Personality and Clinical Studies*. 1989;5(1):69–71.
139. Zegeye DT, Megabiaw B, Mulu A. Age at menarche and the menstrual pattern of secondary school adolescents in northwest Ethiopia. *BMC women's health*. 2009;9(101088690):29. [PubMed: 19804623]
140. Zhu X, Wong F, Bensoussan A, Lo SK, Zhou C, Yu J. Are there any cross-ethnic differences in menstrual profiles? A pilot comparative study on Australian and Chinese women with primary dysmenorrhea. *The journal of obstetrics and gynaecology research*. 2010;36(5):1093–1101. [PubMed: 20846252]
141. Defert C, Cousin I, Marchand IC, Burgazzi C, Pabic EL, Arnaud AP. Dysmenorrhea among 12-year-old teenagers from different socioeconomic backgrounds. *Arch Pediatr*. 2024;31(2):141–147. doi:10.1016/j.arcped.2023.09.018 [PubMed: 38267345]
142. Abdel-Salam DM, Alnuman RW, Alrwuaili RM. Epidemiological aspects of dysmenorrhea among female students at Jouf University, Saudi Arabia. *Middle East Fertility Society Journal*. 2018;23(4):435–439.
143. Avasarala AK, Panchangam S. Dysmenorrhoea in different settings: are the rural and urban adolescent girls perceiving and managing the dysmenorrhoea problem differently? *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine*. 2008;33(4):246–249. [PubMed: 19876499]
144. Chauhan M, Kala J. Relation between dysmenorrhea and body mass index in adolescents with rural versus urban variation. *Journal of obstetrics and gynaecology of India*. 2012;62(4):442–445. [PubMed: 23904707]
145. Fernandez-Martinez E, Onieva-Zafra MD, Parra-Fernandez ML. Lifestyle and prevalence of dysmenorrhea among Spanish female university students. *PloS one*. 2018;13(8):e0201894. [PubMed: 30096156]
146. Goldstein-Ferber S, Granot M. The association between somatization and perceived ability: roles in dysmenorrhea among Israeli Arab adolescents. *Psychosomatic medicine*. 2006;68(1):136–142. [PubMed: 16449424]
147. Juyal R, Kandpal SD, Semwal J. Menstrual hygiene and reproductive morbidity in adolescent girls in Dehradun, India. *Bangladesh Journal of Medical Science*. 2014;13(2):170–174.
148. Kagia A, Gichuhi JW, Karanja J. Prevalence of pain symptoms suggestive of endometriosis among adolescents in Kenya. *East African Medical Journal*. 2018;95(8):1818–1826.
149. Ohde S, Tokuda Y, Takahashi O, Yanai H, Hinohara S, Fukui T. Dysmenorrhea among Japanese women. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2008;100(1):13–17. [PubMed: 17888923]
150. Patel UV, Yadav S. Reproductive and general health problems among women in the reproductive age group in Jamnagar. *Health and Population: Perspectives and Issues*. 2006;29(4):212–223.
151. Pitts MK, Ferris JA, Smith AMA, Shelley JM, Richters J. Prevalence and correlates of three types of pelvic pain in a nationally representative sample of Australian women. *Medical Journal of Australia*. 2008;189(3):138–143. [PubMed: 18673099]
152. Sharma P, Kaur M, Kumar S, Khetarpal P. A cross-sectional study on prevalence of menstrual problems, lifestyle, mental health, and PCOS awareness among rural and urban population of Punjab, India. *J Psychosom Obstet Gynaecol*. 2022;43(3):349–358. doi:10.1080/0167482X.2021.1965983. [PubMed: 34448673]
153. Yaliwal RG, Biradar AM, Kori SS, Mudanur SR, Pujeri SU, Shannawaz M. Menstrual Morbidities, Menstrual Hygiene, Cultural Practices during Menstruation, and WASH Practices at Schools in Adolescent Girls of North Karnataka, India: A Cross-Sectional Prospective Study. *Obstetrics and gynecology international*. 2020;2020(101517078):6238193. [PubMed: 33133193]

154. Nyirenda T, Nyagumbo E, Murewanhema G, et al. Prevalence of dysmenorrhea and associated risk factors among university students in Zimbabwe. *Women's health (London, England)*. 2023;19(101271249):17455057231189549.
155. Belayneh W, Kassaye Z, Arusi T, et al. Prevalence of dysmenorrhea and associated factors and its effect on daily academic activities among female undergraduate students of Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia. *Frontiers in Reproductive Health*. 2023;5:1244540. doi:10.3389/frph.2023.1244540 [PubMed: 38162010]
156. Blatter BM, Zielhuis GA. Menstrual disorders due to chemical exposure among hairdressers. *Occupational Medicine*. 1993;43(2):105–106. [PubMed: 8495000]
157. Chee HL, Rampal KG. Relationship between selected health problems and exposures among women semiconductor workers in Malaysia. *The Medical journal of Malaysia*. 2003;58(3):387–398. [PubMed: 14750379]
158. Messing K, Saurel-Cubizolles MJ, Bourguin M, Kaminski M. Factors associated with dysmenorrhea among workers in French poultry slaughterhouses and canneries. *Journal of occupational medicine : official publication of the Industrial Medical Association*. 1993;35(5):493–500. [PubMed: 8515321]
159. Mergler D, Vezina N. Dysmenorrhea and cold exposure. *The Journal of reproductive medicine*. 1985;30(2):106–111. [PubMed: 3872361]
160. Yang Y, Zhang W, Chan A, et al. An epidemiological study of reproductive health in female civil aviation employees. *Aviation, space, and environmental medicine*. 2013;84(6):625–629. [PubMed: 23745292]
161. Christiani Niu, Xu. Occupational Stress and Dysmenorrhea in Women Working in Cotton Textile Mills. *International journal of occupational and environmental health*. 1995;1(1):9–15. [PubMed: 9990151]
162. Johnson CY, Grajewski B, Lawson CC, MacDonald LA, Rocheleau CM, Whelan EA. Occupational physical demands and menstrual cycle irregularities in flight attendants and teachers. *Occup Environ Med*. Published online January 6, 2024. doi:10.1136/oemed-2023-109099
163. Koo M, Chen CH, Tsai KW, Lu MC, Lin SC. Ambulatory medical services utilization for menstrual disorders among female personnel of different medical professions in Taiwan: A nationwide retrospective cohort study. *BMC Women's Health*. 2015;15(1):66. doi:10.1186/s12905-015-0220-3 [PubMed: 26306618]
164. Smith DR, Choe M, Chae Y, An G, Jeong J, Jeon M. Subjective symptoms among female hospital nurses in Korea. *Asian Journal of Nursing*. 2006;9(2):78–83.
165. Achilles SL, Austin MN, Meyn LA, Mhlanga F, Chirenje ZM, Hillier SL. Impact of contraceptive initiation on vaginal microbiota. *Am J Obstet Gynecol*. 2018;218(6):622.e621–622.e610.
166. Pais M, Noronha JA. A correlative study on dysmenorrhea among rural village women of Udipi district, Karnataka. *International Journal of Nursing Education*. 2011;3(1):29–31.
167. Araki Y, Muto T, Asakura T. Psychosomatic symptoms of Japanese working women and their need for stress management. *Industrial health*. 1999;37(2):253–262. [PubMed: 10319574]
168. Nishikitani M, Nakao M, Tsurugano S, Inoue M, Yano E. Relationship between menstruation status and work conditions in Japan. *BioPsychoSocial medicine*. 2017;11(101286572):26. [PubMed: 29026436]
169. Albert-Sabater JA, Martinez JM, Baste V, Moen BE, Ronda-Perez E. Comparison of menstrual disorders in hospital nursing staff according to shift work pattern. *Journal of clinical nursing*. 2016;25(21–22):3291–3299. [PubMed: 27530371]
170. Pullon S, Reinken J, Sparrow M. Prevalance of dysmenorrhoea in Wellington women. *New Zealand Medical Journal*. 1988;101(839):52–54. [PubMed: 3380425]
171. Lee LK, Chen PCY, Lee KK, Kaur J. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore medical journal*. 2006;47(10):869. [PubMed: 16990962]
172. Ng TP, Tan NC, Wansaicheong GK. A prevalence study of dysmenorrhoea in female residents aged 15–54 years in Clementi Town, Singapore. *Annals of the Academy of Medicine, Singapore*. 1992;21(3):323–327. [PubMed: 1416778]

173. Tabachnik M, Sheiner E, Wainstock T. The association between second to fourth digit ratio, reproductive and general health among women: findings from an Israeli pregnancy cohort. *Scientific reports*. 2020;10(1):6341. [PubMed: 32286380]
174. Grace VM, Zondervan KR. Chronic pelvic pain in New Zealand: prevalence, pain severity, diagnoses and use of the health services. *Australian & New Zealand Journal of Public Health*. 2004;28(4):369–375. [PubMed: 15704703]
175. Tu FF, Datta A, Atashroo D, et al. Clinical profile of comorbid dysmenorrhea and bladder sensitivity: a cross-sectional analysis. *American Journal of Obstetrics and Gynecology*. 2020;222(6):594.e591–594.e511.
176. Chen CX, Carpenter JS, Ofner S, LaPradd M, Fortenberry JD. Dysmenorrhea Symptom-Based Phenotypes: A Replication and Extension Study. *Nurs Res*. 2021;70(1):24–33. doi:10.1097/NNR.000000000000477 [PubMed: 32956256]
177. Chen CX, Ofner S, Bakoyannis G, Kwekkeboom KL, Carpenter JS. Symptoms-Based Phenotypes Among Women With Dysmenorrhea: A Latent Class Analysis. *Western Journal of Nursing Research*. 2018;40(10):1452–1468. [PubMed: 28914180]
178. Chen CX, Carpenter JS, Ofner S, LaPradd M, Fortenberry JD. Dysmenorrhea symptom-based phenotypes: A replication and extension study. *Nurs Res*. 2021;70(1):24–33. [PubMed: 32956256]
179. Chen CX, Ofner S, Bakoyannis G, Kwekkeboom KL, Carpenter JS. Symptoms-based phenotypes among women with dysmenorrhea: A latent class analysis. *West J Nurs Res*. 2018;40(10):1452–1468. [PubMed: 28914180]
180. Van Den Akker OBA, Eves FF, Service S, Lennon B. Menstrual cycle symptom reporting in three British ethnic groups. *Social Science & Medicine*. 1995;40:1417–1423. [PubMed: 7638650]
181. van den Akker OB, Eves FF, Service S, Lennon B. Menstrual cycle symptom reporting in three British ethnic groups. *Soc Sci Med*. 1995;40(10):1417–1423. [PubMed: 7638650]
182. Deuster PA, Powell-Dunford N, Crago MS, Cuda AS. Menstrual and oral contraceptive use patterns among deployed military women by race and ethnicity. *Women & health*. 2011;51(1):41–54. [PubMed: 21391160]
183. Jarosz AC, Jamnik J, El-Sohemy A. Hormonal contraceptive use and prevalence of premenstrual symptoms in a multiethnic Canadian population. *BMC Womens Health*. 2017;17(1):87. [PubMed: 28950854]
184. Tufail A, Mustafa R, Munaver SA, Nawaz B. Frequency of psychological stress among women with new onset menstrual disorders amid corona pandemic lockdown. *Pakistan journal of medical sciences*. 2022;38(5):1159–1164. [PubMed: 35799741]
185. Facchin F, Buggio L, Ottolini F, Barbara G, Saita E, Vercellini P. Preliminary insights on the relation between endometriosis, pelvic pain, and employment. *Gynecologic and obstetric investigation*. 2019;84(2):190–195. [PubMed: 30380545]
186. Arafa AE, Khamis Y, Hassan HE, Saber NM, Abbas AM. Epidemiology of dysmenorrhea among workers in Upper Egypt; A cross sectional study. *Middle East Fertility Society Journal*. 2018;23(1):19–22.
187. Wood C, Larsen L, Williams R. Social and psychological factors in relation to premenstrual tension and menstrual pain. *The Australian & New Zealand journal of obstetrics & gynaecology*. 1979;19(2):111–115. [PubMed: 292427]
188. Santos LBD, Barbosa IR, Dantas THdM, et al. Prevalence of primary dysmenorrhea and associated factors in adult women. *Revista da Associacao Medica Brasileira* (1992). 2022;68(1):31–36. [PubMed: 35239934]
189. Acheampong K, Baffour-Awuah D, Ganu D. Prevalence and predictors of dysmenorrhea, its effect, and coping mechanisms among adolescents in Shai Osudoku District, Ghana. *Obstetrics and gynecology international*. 2019;2019:1–8.
190. Karout N, Hawai SM, Altuwaijri S. Prevalence and pattern of menstrual disorders among Lebanese nursing students. *Eastern Mediterranean Health Journal*. 2012;18(4):346–352. [PubMed: 22768696]
191. Abed N, Marzoug H, Boughambouz K. Primary dysmenorrhea among adolescents in the District of Constantine, Algeria. *Notulae Scientia ....*

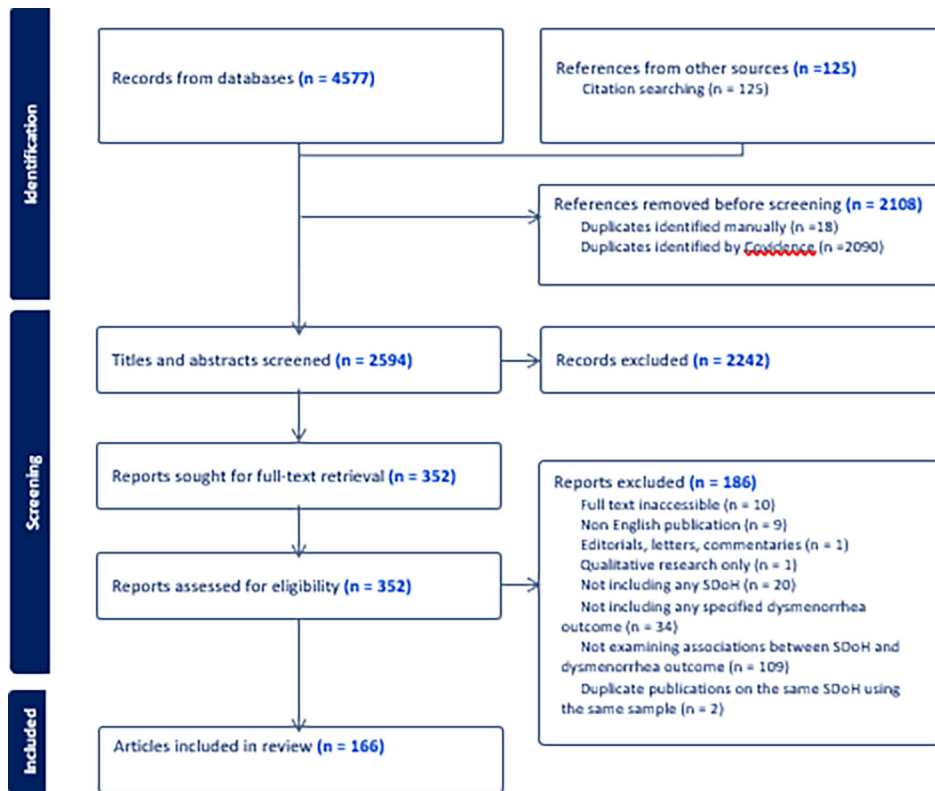
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192. Burnett MA, Antao V, Black A, et al. Prevalence of primary dysmenorrhea in Canada. *Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC*. 2005;27(8):765–770.
193. Chan WY, Dawood MY, Fuchs F. Relief of dysmenorrhea with the prostaglandin synthetase inhibitor ibuprofen: effect on prostaglandin levels in menstrual fluid. *Am J Obstet Gynecol*. 1979;135(1):102–108. [PubMed: 474640]
194. Zhu X, Bensoussan A, Zhu L, et al. Primary dysmenorrhoea: a comparative study on Australian and Chinese women. *Complement Ther Med*. 2009;17(3):155–160. [PubMed: 19398069]
195. Zuluaga G, Andersson N. Initiation rites at menarche and self-reported dysmenorrhoea among indigenous women of the Colombian Amazon: a cross-sectional study. *BMJ Open*. 2013;3(3):e002012. doi:10.1136/bmjopen-2012-002012
196. Chen J, Duan Y, Zhang Y, et al. Self-Care Behavior and Associated Factors of Nursing Students with Dysmenorrhea: A Structural Equation Model. *Journal of Nursing Management*. 2023:1–11. doi.org/10.1155/2023/8820772
197. Nelson SM, Cunningham NR, Kashikar-Zuck S. A Conceptual Framework for Understanding the Role of Adverse Childhood Experiences in Pediatric Chronic Pain. *The Clinical Journal of Pain*. 2017;33(3): 264–270. [PubMed: 27275737]
198. Melzack R. Chapter 3: Pain and Stress: Clues toward Understanding Chronic Pain. In: *Advances in Psychological Science, Biological and Cognitive Aspects*. Psychology Press. 2014 (2): 63–85.
199. Sarayloo K, Latifnejad Roudsari R, Elhadi A. Health Consequences of the Female Genital Mutilation: A Systematic Review. *Galen Med J*. 2019;8:e1336. [PubMed: 34466496]
200. Evans RL, Harris B, Onuegbu C, Griffiths F. Systematic review of educational interventions to improve the menstrual health of young adolescent girls. *BMJ Open*. 2022;12(6):e057204.
201. Che X, Cash R, Ng SK, Fitzgerald P, Fitzgibbon BM. A Systematic Review of the Processes Underlying the Main and the Buffering Effect of Social Support on the Experience of Pain. *The Clinical Journal of Pain*. 2018;34(11): 1061–1076. [PubMed: 29697476]
202. Moussaoui D, Grover SR. The association between childhood adversity and risk of dysmenorrhea, pelvic pain, and dyspareunia in adolescents and young adults: a systematic review. *Journal of Pediatric and Adolescent Gynecology*. 2022;35(5):567–574. [PubMed: 35569788]
203. Latthe P, Mignini L, Gray R, Hills R, Khan K. Factors predisposing women to chronic pelvic pain: systematic review. *Bmj*. 2006;332(7544):749–755. [PubMed: 16484239]
204. Groenewald CB, Murray CB, Palermo TM. Adverse childhood experiences and chronic pain among children and adolescents in the United States. *Pain Rep*. 2020;5(5):e839. doi:10.1097/PR9.0000000000000839 [PubMed: 32903388]
205. Nicol AL, Sieberg CB, Clauw DJ, Hassett AL, Moser SE, Brummett CM. The Association Between a History of Lifetime Traumatic Events and Pain Severity, Physical Function, and Affective Distress in Patients With Chronic Pain. *The Journal of Pain*. 2016;17(12):1334–1348. [PubMed: 27641311]
206. Shen Y, Xu Q, Xu J, Ren ML, Cai YL. Environmental exposure and risk of uterine leiomyoma: an epidemiologic survey. *Eur Rev Med Pharmacol Sci*. 2013;17(23):3249–3256. [PubMed: 24338469]
207. Lurie JM, Weidman A, Huynh S, Delgado D, Easthausen I, Kaur G. Painful gynecologic and obstetric complications of female genital mutilation/cutting: a systematic review and meta-analysis. *PLoS medicine*. 2020;17(3):e1003088. [PubMed: 32231359]
208. Engel GL. The need for a new medical model: a challenge for biomedicine. *Science*. 1977;196(4286):129–136. [PubMed: 847460]
209. Turk DC, Monarch ES. Biopsychosocial perspective on chronic pain. *Psychological approaches to pain management: A practitioner's handbook*. The Guilford Press. 1996.
210. Fillingim RB. Individual differences in pain: understanding the mosaic that makes pain personal. *Pain*. 2017;158 Suppl 1:S11–s18. [PubMed: 27902569]

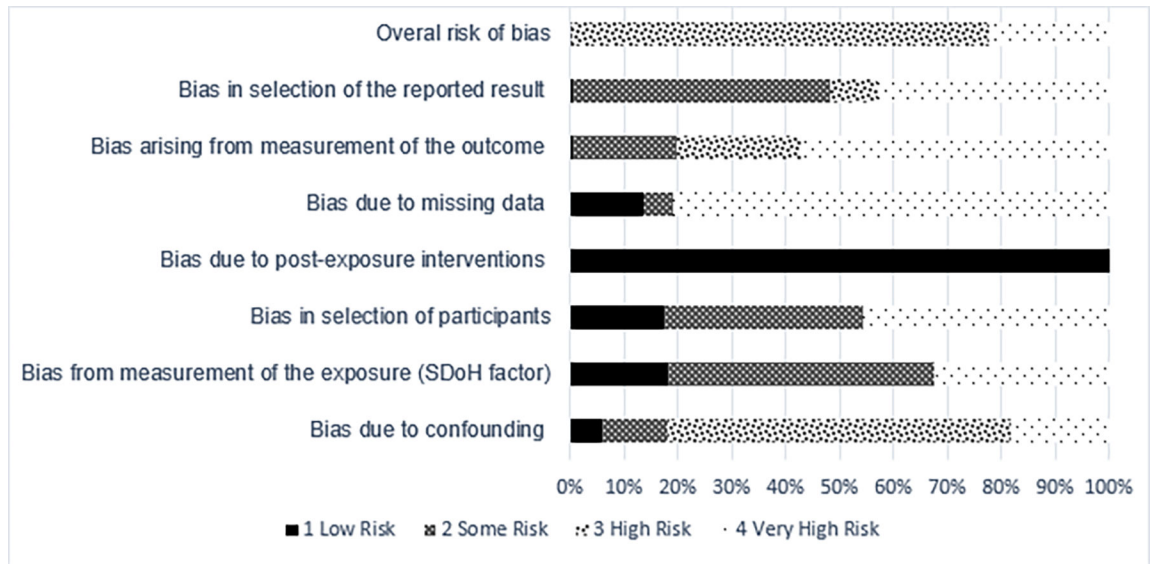
211. Chen CX, Draucker CB, Carpenter JS. What women say about their dysmenorrhea: a qualitative thematic analysis. *BMC Womens Health*. 2018;18(1):47. doi:10.1186/s12905-018-0538-8 [PubMed: 29499683]
212. Berkley KJ, McAllister SL. Don't dismiss dysmenorrhea! *Pain*. 2011;152(9):1940–1941. [PubMed: 21514053]
213. Gagnon MM, Moussaoui D, Gordon JL, Alberts NM, Grover SR. Dysmenorrhea across the lifespan: a biopsychosocial perspective to understanding the dysmenorrhea trajectory and association with comorbid pain experiences. *PAIN*. 2022;163(11):2069–2075. [PubMed: 35420567]
214. Andermann A Taking action on the social determinants of health in clinical practice: a framework for health professionals. *Cmaj*. 2016;188(17–18):E474–e483. [PubMed: 27503870]
215. Chen CX, Kwekkeboom KL, Ward SE. Beliefs about dysmenorrhea and their relationship to self-management. *Res Nurs Health*. 2016;39(4):263–276. doi:10.1002/nur.21726 [PubMed: 27177093]
216. Gallicchio L, Miller S, Greene T, Zacur H, Flaws JA. Menstrual cycle abnormalities among cosmetologists: the Reproductive Outcomes in Salon Employees (ROSE) study. *Reproductive sciences (Thousand Oaks, Calif)*. 2010;17(1):20–28. [PubMed: 19767543]
217. Amaza DS, Sambo N, Zirahei JV, Dalori MB, Japhet H, Toyin H. Menstrual pattern among female medical students in University of Maiduguri, Nigeria. *British journal of medicine and medical research*. 2012;2(3):327.
218. Bourdon M, Antoine V, Combes U, et al. Severe pelvic pain is associated with sexual abuse experienced during childhood and/or adolescence irrespective of the presence of endometriosis. *Human Reproduction*. 2023;38(8):1499–1508. [PubMed: 37308317]
219. Güngördü N, Kurtul S. Association between self-reported menstrual disorders and occupational exposures in female healthcare workers: a university hospital experience from Turkey. *The European Research Journal*. 2023(Query date: 2024–02-07 12:10:07).
220. Sagsoz N, Oguzturk O, Aktulum F. Attention-Deficit Hyperactivity disorder in adult primary dysmenorrhea patients. *Journal of Experimental and Clinical Medicine (Turkey)*. 2021;38(3):305–307.

### Highlights

- Trauma, environmental toxins, genital mutilation, and job stress worsen dysmenorrhea outcomes.
- Menstrual education and social support are linked to better dysmenorrhea outcomes.
- Impact of multiple social determinants of health on dysmenorrhea outcomes is unclear.
- The research on social factors affecting dysmenorrhea is limited but highly necessary.
- Thorough study of social determinants of dysmenorrhea can guide policies and clinical interventions.



**Figure 1.**  
PRISMA Flow Diagram



**Figure 2. Risk of Bias of Included Articles (N = 166).**  
SDoH: Social Determinants of Health.

**Table 1.**

Summary of Characteristics Across included Articles (N = 166)

	<b>n</b>	<b>%</b>
<b>Geographic Region</b>		
Asia		
Southern Asia	28	16.87
East Asia	28	16.87
Western Asia	17	10.24
Southeast Asia	8	4.82
Central Asia	1	0.60
Both Southeast Asia and East Asia	1	0.60
America		
North America	28	16.87
South America	3	1.81
Africa		
Sub-Saharan Africa	14	8.43
Northern Africa	11	6.62
Europe		
Western Europe	9	5.42
Southern Europe	4	2.41
Eastern Europe	4	2.41
Northern Europe	3	1.81
Central Europe	1	0.60
Oceania (i.e., Australia and New Zealand)	6	3.61
<b>Study Design to Examine the Relationship between SDoH and Dysmenorrhea Outcomes</b>		
Cross-sectional	152	91.57
Longitudinal		
Longitudinal Correlational	7	4.22
Prospective Cohort	1	0.60
Retrospective Cohort	4	2.41
Case Control	2	1.20
<b>Population Studied/Diagnosis</b>		
Primary Dysmenorrhea	30	18.07
Secondary Dysmenorrhea	2	1.20
Mixed Primary and Secondary	12	7.23
Not Stated/Unclear	122	73.49
<b>Sample Size</b>		
<99	3	1.81
100–499	73	43.98
500–999	44	26.51
>1000	44	26.51
Not Reported	2	1.20

	n	%
<b>Included Participants &lt; 18 Years Old</b>	35	21.08
<b>Recruitment Setting</b>		
Communities	127	76.51
Clinics	26	15.66
Both Communities and Clinics	4	2.41
Other (e.g., Military, Healthcare Workers)	7	4.22
Unclear	2	1.20
<b>Race/Ethnicity Reported</b>	47	28.31
<b>SDoH Studied</b>		
Socioeconomic Status - Income	35	21.08
Socioeconomic Status - Education/Literacy	34	20.48
Geographical Location	30	18.07
Occupational Factors	26	15.66
Race/Ethnicity	21	12.65
Traumatic Experiences	21	12.65
Socioeconomic Status - Parent Education	19	11.45
Other Socioeconomic Status Factors	16	9.64
Environmental Exposure	13	7.83
Employment	12	7.23
Social Support	11	6.63
Religion	11	6.63
Miscellaneous	10	6.02
Female Genital Mutilation	8	4.82
Students' Living Situation	8	4.82
Menstrual Education	8	4.82
Gender Identity	0	0
Sexual Orientation	0	0
Health Care Access	0	0
Insurance	0	0
Discrimination	0	0

**Table 2.**

Occupational Factors and Dysmenorrhea Outcomes

Category	Specific Factors	Dysmenorrhea Presence		Dysmenorrhea Severity		Dysmenorrhea Interference		Dysmenorrhea Frequency		Treatment Use	
		UV	MV	UV	MV	UV	MV	UV	MV	UV	MV
Job-related stress	Low Job Control			+71		+72	+72				
	Low Job Security					+72	+72	+73	+73		
	High Job Strain/Stress	+74 NS <sup>57</sup>	+75,76 NS <sup>57</sup>			+76		+73	+73		
	Chemical Hazards	+157	+75,156,157 NS <sup>216</sup>		+156 NS <sup>216</sup>					NS <sup>216</sup>	
	Vibration		NS <sup>27</sup>								
	Noise	NS <sup>157</sup>	NS <sup>27,75</sup>					+73	NS <sup>73</sup>		
	Low Temperature	+158 NS <sup>157</sup>	+158,159								
Types of Occupation	Types of Jobs or Settings	+39,75,158,160 NS <sup>157</sup>	+75,161-164	NS <sup>71,166</sup>	+165			NS <sup>73</sup>	NS <sup>73</sup>		
Work Schedule	Long Work Hours/Overtime/Few Breaks	+158 NS <sup>112,167</sup>	+158 NS <sup>75</sup>	NS <sup>71</sup>		NS <sup>168</sup>	NS <sup>168</sup>	NS <sup>73</sup>	NS <sup>73</sup>	NS <sup>168</sup>	
	Shift Work	NS <sup>169</sup>	+75 NS <sup>27,58,169</sup>					NS <sup>73</sup>	NS <sup>73</sup>		
Physical Aspects of Job	Sedentary Work	NS <sup>170</sup>									
	High Physical Demand	+158	+75 NS <sup>27,158,161</sup>								

UV: Univariable; MV: Multivariable; +: Positive significant relationship, -: Negative significant relationship; NS: Non-significant; Blank: Not applicable (relationship not examined)

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