GYNECOLOGY

Association between heavy menstrual bleeding and depression among women in South Asia: a cross-sectional study

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OBJECTIVE: Heavy menstrual bleeding—clinically defined as excessive menstrual blood loss that interferes with physical, emotional, social, or material quality of life —adversely affects health and functional outcomes among individuals who menstruate. However, the full extent of the relationships between heavy menstrual bleeding and health outcomes remains unknown, especially in low- and middle-income countries. To begin to fill this evidence gap, we investigated associations between heavy menstrual bleeding and depression symptomology among women in South Asia.

STUDY DESIGN: We carried out a secondary analysis of cross-sectional data from household surveys conducted with 3438 adult women between August 2021 and June 2022 in 5 cities: Meherpur and Saidpur, Bangladesh; and Narsapur, Tiruchirappalli, and Warangal, India. Heavy menstrual bleeding was measured using the clinically validated SAMANTA scale, and depression symptomology was measured using the Center for Epidemiological Studies Short Depression scale. Regression analyses examined associations between heavy menstrual bleeding and depression symptomology among our analytic sample of 2564 women who had experienced a menstrual period in the previous 12 months.

RESULTS: The prevalence of heavy menstrual bleeding was 45% across the pooled sample, with city-specific prevalences ranging from 41% to 46%. The median Center for Epidemiological Studies Short Depression scale score was 6 (range: 4—29, out of a possible 30), with

30% of women scoring above the screening threshold for depression. Pooled analyses revealed a significant association between heavy menstrual bleeding and increased Center for Epidemiological Studies Short Depression scale scores (β: 0.07; 95% confidence interval, 0.03, 0.12) and a 15% increased risk of a binary depression outcome (95% confidence interval, 1.03, 1.29) among women with heavy menstrual bleeding. City-level analyses showed variability in the strength and significance of these associations, with some cities demonstrating stronger associations than others.

CONCLUSION: The findings highlight the substantial burden of heavy menstrual bleeding on women's mental health in South Asia. Addressing heavy menstrual bleeding as part of comprehensive women's reproductive healthcare is crucial for improving overall well-being. The study underscores the need for further research to explore the mechanisms linking heavy menstrual bleeding and depression, and to develop effective interventions tailored to the specific needs of women in different contexts. Understanding these relationships can provide healthcare providers and policymakers with evidence to better support women's health and mental well-being.

Key words: Bangladesh, CES-D-10, gynecology, India, low- and middle-income countries, menorrhagia, menstrual disorders, mental health, women's health

Introduction

Menstrual health is a state of complete physical, mental, and social well-being in relation to the menstrual cycle.[1] Despite menstruation being a physiologic part of women's health, menstrual disorders are common and can affect women's overall health and quality of life.[2–5] Indeed, gynecological disorders are among the leading causes of years lived with disability for women of reproductive age, particularly in low- and middle-income countries (LMICs).[6]

Heavy menstrual bleeding (HMB), clinically defined as "excessive menstrual blood loss which interferes with a woman's physical, emotional, social, or material quality of life," can have potentially profound consequences for women's well-being.[7–11] In the largest study to date on the global prevalence of HMB, Sinharoy et al[11] found that between 38% and 77% of women in major cities across the Global South were classified as experiencing HMB. Given that even managing a typical menstrual period can be challenging in LMIC settings,[12,13] HMB could pose an additional burden, potentially impacting women's mental well-being.

Globally, an estimated 6% of adult women experience depression, and depression is approximately 50% more common among women.[14,15] There is research suggesting that individuals with HMB are at a heightened risk of depression and other mental health conditions.[16–21] However, the majority of this evidence comes from studies conducted in high-income settings with specific sub-populations, limiting their generalizability.[9,19–21] For example, in their study of HMB and health-related quality of life among women ages 40 to 45 in Sweden, Karlsson et al (2014) found that women with HMB scored well below those who reported normal menstrual bleeding on scales of mental and emotional health. Similar research from larger populations across other regions is lacking.

| AJOG at a Glance |
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| **Why was this study conducted?** |
| The study was conducted to investigate the association between heavy menstrual bleeding (HMB) and depression among women in South Asia. |
| **Key findings** |
| This study found a significant association between HMB and depression scores (β: 0.07; 95% CI: 0.03, 0.12) and a 15% increased risk of a binary depression outcome among women with HMB. |
| **What does this study add to what is already known?** |
| This is the largest, most comprehensive study to date on the associations between HMB and women's depression. |
| More research is necessary to understand the mechanisms through which HMB may be associated with depression, but these findings underscore the importance of addressing menstrual health and mental health concurrently as critical components of women's overall well-being. |

Evidence is also lacking on the mechanisms through which HMB may cause or contribute to depression. Many causes of HMB, including uterine fibroids, endometriosis, polycystic ovarian syndrome, and hypothyroidism,[21–24] have themselves been associated with depression.[25–30] HMB has also been linked to nutritional deficiencies, both as a symptom and a cause.[31] There is evidence that many of these micronutrient deficiencies—namely, iron,[32–34] thiamine,[35,36] Vitamin A,[37–39] and Vitamin D[40–42]—may also be linked to depressive symptoms and mood disorders. Anemia is a diagnosis of particular concern to this relationship, given the associations between anemia and both HMB and depression.[10,34,43,44] Therefore, HMB may be associated with depression as a mediator, comorbidity, and a direct cause, as shown in Figure 1.

Evidence also shows indirect links between symptoms and experiences of HMB and risk factors for depression. Women and girls experiencing HMB may be at higher risk for pain during their menstrual cycle,[9,45,46] which may be both a cause and symptom of depression (Figure 1).[47–49] Additionally, shame and stigma associated with

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FIGURE 1
Hypothetical pathways through which HMB may be associated with depression
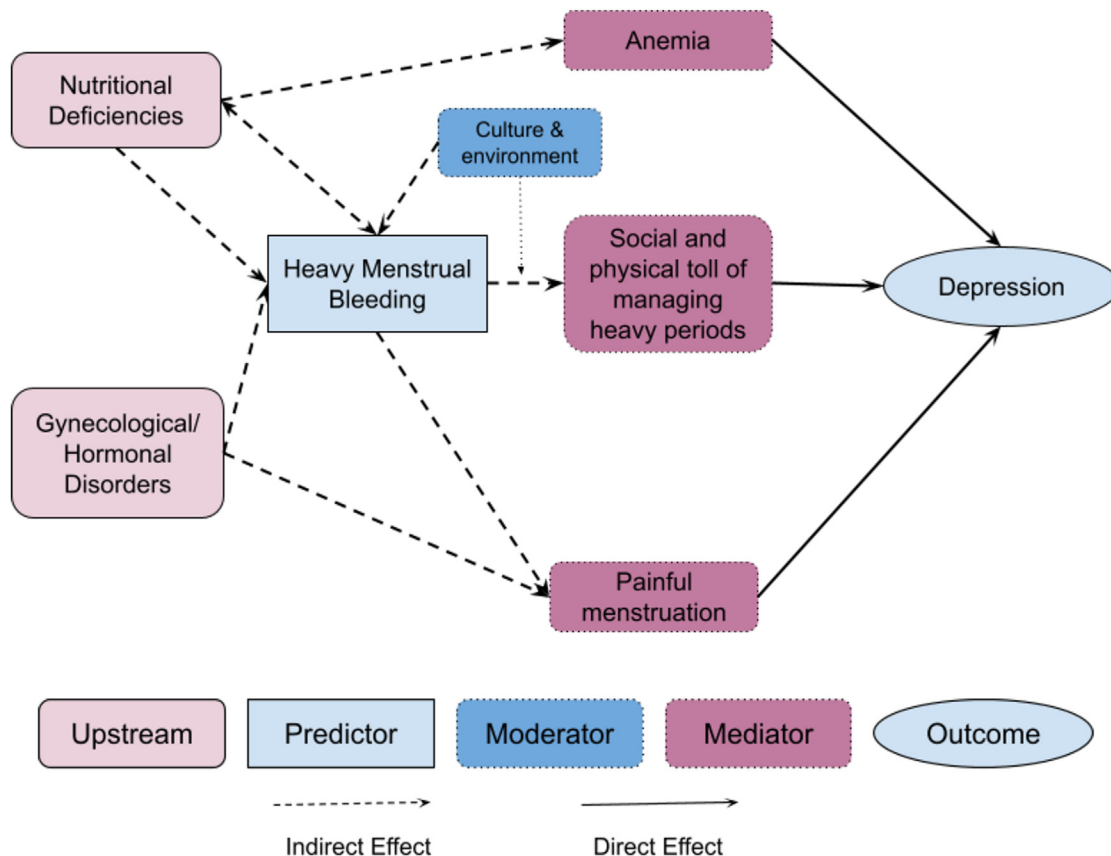
HMB, heavy menstrual bleeding.

menstruation may lead to further isolation and lack of social support,[12,13,19] which are risk factors for depression among women and girls (Figure 1).[50–52] Research has found that women and girls with HMB report anxiety around managing menstruation.[17,19] The additional challenges of managing menstruation in LMIC settings could exacerbate feelings of isolation, embarrassment, and feelings of tension at menstrual onset.[13,53]

Given the high burden of depression in women and girls and the high prevalence of HMB identified in previous research, it is important to better understand the relationship between HMB and women's depression in LMIC settings. South Asia is a region of particular concern due to taboos regarding menstrual health[54] coupled with underdiagnosis, stigma, and lack of access to mental healthcare.[55] The objective of this study was to investigate the association between HMB and depression in women in South Asia. We hypothesized that experiencing HMB would be associated with a higher likelihood of experiencing depressive symptoms, as well a higher risk of having depression.

Materials and methods
Study design, population, and data collection
This study is a secondary analysis of cross-sectional survey data from the Measuring Urban Sanitation and Empowerment (MUSE) project. Between August 2021 and June 2022, trained female enumerators conducted household-level data collection with adult women in Meherpur (N=720) and Saidpur (N=730), Bangladesh and Warangal (N=704), Narsapur (N=721), and Tiruchirappalli (N=735), India.[56] In the 2 cities in Bangladesh, neighborhoods were randomly selected from a sampling frame of all neighborhoods in the city. In the 3 cities in India, neighborhoods were purposively selected in collaboration with local partners to ensure diversity in terms of wealth and other demographic characteristics. Specifically, partners provided lists of neighborhoods in each city and identified priority areas for data collection. Within the neighborhoods, enumerators

used a random walk technique to select households, and an adult woman was targeted from each selected household. Women were included in the survey if they were at least 18 years of age and spoke the primary local language. Additional details on study design, participant selection, and survey protocols are described elsewhere.[57]

Within the survey, all women were asked if they had experienced a menstrual period in the past 12 months. If the answer to that question was "yes," the respondent was asked additional questions related to menstruation, as described below. The analytic sample for our study was restricted to women who had experienced a menstrual cycle in the past 12 months and who answered all items in the SAMANTA scale (N=2564).

Variables
Heavy menstrual bleeding
HMB was measured using the SAMANTA scale, a nonlaboratory based measure of HMB that was previously validated in Bangladesh and India, among the same population included in this survey.[11,58] The SAMANTA scale comprises 6 questions with binary (yes or no) response options, including whether the respondent experiences menstrual bleeding for more than 7 days per month, spots their clothes at night, or avoids activities due to the need to change menstrual materials. Guidance for scoring the SAMANTA scale specifies that affirmative responses to 2 specific questions ("Do you experience menstrual bleeding for more than 7 days per month?" and "In general, does menstruation bother you due to its abundance?") should each receive 3 points, while affirmative responses to all other items receive 1 point.[58] These values are summed, resulting in a potential range of values for the HMB score from 0 to 10. Respondents are categorized as having HMB if they score ≥3 out of 10 on the scale.[58] Additional details on the questions and scoring can be found in the supplemental materials.

Depression
Depression symptomology was measured using the Center for Epidemiological

Studies Short Depression scale (CES-D-10).[59] The CES-D-10 is a 10-question survey module in which respondents rate how often in the past week they experienced depressive symptoms, scored between 0 (rarely or none of the time) and 3 (almost all of the time). The CES-D-10 score is a sum of the 10 questions, with a possible range of 0 to 30. While not a clinical diagnostic tool, respondents who scored above 10 are characterized as having a depressed mood,[59] which for the purpose of this paper will be referred to as depression. Additional details on the questions and scoring can be found in the supplemental materials. For this study, we examined both the continuous CES-D-10 score (experience of symptoms) and a binary depression outcome (depressed or not depressed). Notably, the CES-D-10 has not been broadly validated in South Asia to the authors' knowledge but has been used previously in research in both India and Bangladesh.[60–63] Cultural validity is further discussed in the comment section.

Covariates
A priori covariates were education and life stage.[53] These covariates were selected based on the review of prior literature on women's depression and menstrual health[16,18] and theoretical understanding of depression pathways.[53,64–70] Life stage is a derived variable with 4 categories, based on marital status and age: unmarried, age 49 or younger; married 3 years or less; married over 3 years and age 49 or younger; and over 49 years of age of any marital status.[53] These categories were informed by previous literature. Specifically, 49 years was designated as a cutoff given many nationally representative surveys (eg, Demographic and Health Surveys) only include women between the ages of 15 to 49[71], leading older women to be underrepresented in health research. Marital status and length of marriage have been shown to influence mobility, social status, and control of resources[72–74], all which impact the experience of menstruation[12,75] and may in turn impact mental health.

Poverty increases women's risk of depression.[76] While the survey did not collect data on wealth, we included

educational attainment and a variable representing the neighborhood as proxies.

Statistical analysis

We calculated descriptive statistics and analyzed the association between HMB and depression for the full analytic sample and by city.

First, we examined the association between HMB and CES-D-10 scores using a generalized linear mixed-effects model fit to a zero-inflated negative binomial distribution to account for overdispersion and excess of zeros in CES-D-10 scores. To account for clustering, the pooled (five-city) adjusted models included 2 random effects: a random intercept to control for clustering within cities and an additional random intercept to capture within-city neighborhood clustering. Adjusted city-level (single-city) models included a random intercept for neighborhood clustering only.

Second, we estimated the relative risk of the binary depression outcome among women with HMB using a Poisson regression model with cluster-robust standard errors.[77,78] In pooled models, standard errors were clustered at the city level while including neighborhood as a covariate. In city-level analyses, standard errors were clustered at the neighborhood level.

We ran both unadjusted and adjusted models for both analyses. All analyses were conducted in R Studio Version 2023.09.1.

Ethics

Study protocols were reviewed and approved by ethics review committees in each site: Emory University in Atlanta, USA (IRB00110271), International Institute of Health Management Research in New Delhi, India (IRB/2020−2021/001), and International Training Network-Bangladesh University of Engineering and Technology in Dhaka, Bangladesh (1.003/2022/02). Participants in all cities received compensation (either cash or in-kind) per local policies and ethical requirements. All women provided

informed consent before participation in the study. The funder (Bill & Melinda Gates Foundation) was involved in discussions related to the purposive selection of cities for data collection in the MUSE project. The funder had no role in data collection, data analysis, data interpretation, or writing of the manuscript.

Results
Descriptive analysis

The majority (83.9%) of the women in the data set were younger than 49 years old and married, and this trend was similar across cities. The median age was 31 (interquartile range, 13). Most women had completed at least some secondary education, though the proportion of women who completed higher levels of education varied across cities.

Across the region, the median CES-D-10 score was 6 (interquartile range, 6), ranging across cities from 4 (Saidpur) to 9 (Warangal). Approximately 30% of the overall sample had a CES-D-10 score of 10 or higher. This ranged from 22% (Saidpur) to 44% (Warangal). Forty-five percent of the population in the pooled sample was categorized as experiencing HMB, indicated by a SAMANTA score of 3 or higher, ranging from 41% (Tiruchirappalli) to 46% (Narsapur). Table 1 provides an overview of the variables of interest in the pooled sample and by city.

Associations between heavy menstrual bleeding and Center for Epidemiological Studies Short Depression scale score

Table 2 outlines the results from the unadjusted and adjusted models examining the association between depression symptoms (CES-D-10 score) and HMB, both pooled and by city. In the pooled adjusted model, HMB had a statistically significant association (β: 0.07, 95% CI, 0.03−0.12, P<.01) with CES-D-10 scores, indicating that women with HMB had more experiences and frequency of depressive symptoms. The findings were less precise at the city levels, with wide confidence intervals and large P values, except for Saidpur and Tiruchirappalli, where we observed positive

and statistically significant associations (0.19, 95% CI: 0.07, 0.31; 0.11, 95% CI: 0.02, 0.19, respectively). Narsapur had a negative association, but with wide confidence intervals and a large P value.

Associations between heavy menstrual bleeding and depression risk

Table 3 outlines the results from the unadjusted and adjusted models examining the association between the binary depression outcome and HMB, both pooled and by city. The pooled model estimated a 17% increased risk (adjusted risk ratio 1.17; 95% CI, 0.98, 1.41) for the depression outcome among women with HMB, and the trend was similar across most cities, ranging from 26% for Meherpur (95% CI, 0.96, 1.65) to 65% for Saidpur (95% CI, 1.20, 2.26). Narsapur showed a nonsignificant reduction in risk (9%).

Comment
Principal findings

Our pooled analyses across 5 South Asian cities demonstrated HMB is associated with depression, as measured by CES-D-10 score and as a binary depression outcome. The city-level analyses demonstrated variability in the strength and significance of these associations. This may be due to the smaller sample size in these analyses, leading to less precise estimates. There are also contextual factors to be considered. For example, the relationships between HMB and depression were weaker and/or insignificant in Warangal and Narsapur. Warangal is an important trading hub with higher levels of education and income and Narsapur has well-established and proactive menstrual health initiatives through the state government. Both cities have well-established public toilet facilities that are managed through private sector participation. These factors—adequate sanitation infrastructure, higher education and income levels, and proactive menstrual health initiatives—may play a role in mitigating depression outcomes related to menstrual health. Regardless, these findings underline how women's experiences

TABLE 1
Descriptive characteristics of the population, pooled sample, and by cities

Variable (N)	Pooled (N=2785)	Meherpur (N=552)	Narsapur (N=465)	Saidpur (N=599)	Tiruchirppalli (N=610)	Warangal (N=559)
Median CES-D-10 score, median (IQR)	6 (6)	6 (7)	6 (7)	4 (7)	7 (6)	9 (6)
Depression (CES-D-10 score>10)	775 (30.2%)	150 (28%)	121 (30.9%)	124 (22%)	167 (28.5%)	213 (43.9%)
Heavy menstrual bleeding (SAMANTA score>3)[a]	1145 (44.7%)	242 (45.2%)	181 (46.2%)	267 (47.3%)	239 (40.8%)	216 (44.5%)
Education[b]						
Less than primary	209 (8.2%)	44 (8.3%)	54 (13.8%)	50 (8.9%)	20 (3.4%)	41 (8.5%)
Primary	455 (17.8%)	70 (13.2%)	115 (29.4%)	89 (15.8%)	87 (14.9%)	94 (19.4%)
Secondary	1392 (54.4%)	358 (67.4%)	137 (35%)	361 (63.9%)	294 (50.3%)	242 (49.9%)
Beyond secondary	501 (19.6%)	64 (12%)	85 (21.7%)	65 (11.5%)	184 (31.4%)	108 (22.3%)
Life stage[c]						
Age, median (IQR)	31 (13)	32 (12)	30 (12)	28 (11)	32 (12)	34 (11)
Unmarried or living with partner, 49 and younger	287 (11.3%)	16 (3%)	75 (19%)	80 (14%)	70 (12%)	46 (9%)
Married under 3 y	112 (4.4%)	24 (4%)	16 (4%)	32 (6%)	32 (5%)	8 (2%)
Married 3 y and over, 49 and younger	2151 (83.9%)	489 (91%)	301 (77%)	451 (80%)	481 (82%)	429 (88%)
Over 49 y	14 (0.5%)	7 (1%)	0	2 (0.3%)	3 (5%)	2 (0.4%)

Values are median (IQR) or frequency (percentage) unless otherwise indicated.

CES-D-10, Center for Epidemiological Studies Short Depression scale; IQR, interquartile range.

[a] Three missing values from heavy menstrual bleeding (pooled); [b] Two hundred twenty-seven missing values from education (pooled); [c] One missing value from life stage (pooled).

of both HMB and depression may vary in direction and magnitude across contexts.

Results in the context of what is known

Our results align with previously published studies, which have shown that HMB may impact women's mental health and well-being.[16–21] The association between HMB and depression may be due to several factors, including the physical and emotional toll of managing heavy periods,[9,17,19] the social stigma surrounding menstruation,[12,13,19] and the potential biological links between menstrual disorders, nutritional deficiencies, and mood disturbances.[25–31] While evidence is generally aligned on the direction of the relationship between HMB and mental well-being, the magnitude and strength of this relationship is inconsistent across studies, with some reporting small but insignificant associations[10] and others finding clear and strong associations.[21] This may be in part due to the variation of population characteristics (ie, age or geography) across studies, further emphasizing the need for understanding contextual factors.

Clinical Implications

The findings of this study contribute to a more holistic understanding of how HMB could affect women's mental health. While more research is required to understand this relationship, clinicians should prioritize diagnosing and treating mental health conditions when evaluating patients with HMB.

Research Implications

Given the high burden of depression in women[15,50,66] and the importance of menstruation in women's health,[2] better understanding and addressing the multifaceted impacts of menstrual disorders such as HMB is critical for improving the well-being of women worldwide.[79] While there is research demonstrating the relationship between physical and mental health,[80] there continues to be a dearth of evidence on this topic as it relates to women's health concerns. This evidence gap underlines the continued lack of

TABLE 2

Associations between heavy menstrual bleeding and CES-D-10 score, pooled sample, and by city

City	Unadjusted beta (95% CI)	Adjusted beta (95% CI)	P value[a]	n
Pooled (all cities)	0.06 (0.01, 0.10)	0.07 (0.03−0.12)	.002	2556
Bangladesh				
Meherpur	0.09 (−0.03, 0.22)	0.08 (−0.05, 0.21)	.21	531
Saidpur	0.18 (0.06, 0.30)	0.19 (0.07, 0.31)	.002	565
India				
Narsapur	−0.03 (−0.11, 0.06)	−0.04 (−0.14, 0.05)	.37	390
Tiruchirappalli	0.11 (0.03, 0.20)	0.11 (0.02, 0.19)	.01	585
Warangal	−0.04 (−0.12, 0.05)	0.00 (−0.08, 0.09)	.91	485

Adjusted models include education and life stage as covariates. Pooled adjusted models control for clustering at the city and neighborhood level, and city-level adjusted models control for clustering at the neighborhood level.

CES-D-10, Center for Epidemiological Studies Short Depression scale.

[a] For adjusted models only.

research of female-specific health issues.[81] Further research should focus on deepening our understanding of this relationship. This can include longitudinal and cohort studies to better understand temporality in relationships and qualitative research to characterize women's experiences.

The variation in city-level findings underlines the importance of the socioeconomic, cultural, and political environment. Further research should seek to advance our understanding of how contextual factors can shape mental health outcomes as they relate to menstruation, such as through additional large-scale multigeography studies.

Strengths and Limitations

To our knowledge, this is the largest, most comprehensive study to date on the associations between HMB and women's depression. Specific strengths include the inclusion of women across South Asian cities and of a broad age range, compared to previous studies that used samples from only 1 setting and a narrower age group. In our analytic sample, 45% of women were classified as having HMB. Our study therefore draws attention to the challenges of menstrual health in LMICs, where women face limited access to safe spaces and materials for meeting menstruation-related needs, taboos and stigma surrounding

menstruation, and lack of appropriate healthcare,[12,13,19] which can be both causes of and contributors to the experience of HMB.

Our study is also, to our knowledge, the largest multicity study to publish data on CES-D-10 scores in the global South. Notably, women's depression estimates as categorized by the binary CES-D-10 variable ranged between 22% and 44% across cities, substantially higher than the global estimate of 6%.[15] While there are limits of the CES-D-10 in measuring depression, discussed below, these estimates contribute to the discussion on women's health and depression. This is

TABLE 3

Associations between heavy menstrual bleeding and depression, pooled sample, and by city

City	Unadjusted risk ratio (95% CI)	Adjusted risk ratio (95% CI)	P value[a]	n
Pooled	1.14 (1.02, 1.28)	1.17 (0.98, 1.41)	.09	2556
Bangladesh				
Meherpur	1.29 (0.99, 1.68)	1.26 (0.96, 1.65)	.09	531
Saidpur	1.46 (1.08, 1.98)	1.65 (1.20, 2.26)	.001	565
India				
Narsapur	0.80 (0.65, 1.15)	0.91 (0.66, 1.24)	.53	390
Tiruchirappalli	1.29 (1.01, 1.66)	1.27 (0.98, 1.64)	.06	585
Warangal	0.99 (0.83, 1.20)	1.00 (0.82, 1.23)	.97	485

Adjusted models include education and life stage as covariates. Pooled adjusted models control for clustering at the city and neighborhood level, and city-level adjusted models control for clustering at the neighborhood level.

[a] For adjusted models only.

important in the context of South Asia, where there is both underreporting of mental illness and lack of high-quality epidemiological data on mental health disorders.[55]

This study's limitations should be considered when interpreting the results. Given the relatively small magnitude of association and variation across cities, it is possible that other confounding socioeconomic or clinical variables may drive the observed relationship. Our survey did not collect information on gynecological or social conditions that may provide insights to the etiology of HMB, therefore limiting our mechanistic insight into the results. It also did not collect information on symptoms that may be associated with HMB (eg, endometriosis-related pain), which could influence or exacerbate depression. Furthermore, given the cross-sectional nature of the study, the temporal relationship between bleeding and depressive symptoms cannot be established. The survey also did not collect data on several variables that may be associated with depression in women, such as history of intimate partner violence,[82–84] limiting our ability to control for unobserved covariates. While we believe that accounting for neighborhood in the models should appropriately capture poverty, it is possible that there are within-neighborhood variations that are not fully captured.

We acknowledge that existing tools to measure depression symptoms are largely based on constructs created by Western medicine.[85,86] Responses to and interpretation of the questions in such tools may be impacted by translation to other languages and understanding of emotional terms, among other factors.[87,88] Culture may also shape the manifestation of depression symptoms.[89] We did not explore the local conceptualization of depression but instead relied on previous validations of the CES-D-10. It is possible that the estimates in this paper are inflated due to challenges with measurement validity, or, conversely, that current global estimates do not capture the depth of the burden of poor mental health in LMICs.[55,90] While the CES-D-10 has been validated in many high-income countries,[59,91–93] it has not been as broadly validated in the Global South.

Finally, it is not clear whether a less than 1 point change in CES-D-10 score is clinically meaningful. To the authors' knowledge there is no threshold or body of evidence establishing what is a meaningful change on the CES-D-10 score. Ohno et al[94] propose that a change within 10 points may fall within the threshold of measurement error for the long-form CES-D; however, it is difficult to assume how well this finding might translate to the CES-D-10, which is shorter and may focus on more clinically important symptoms.

Conclusions

Consistent with our hypothesis, our analysis found associations between HMB and both depressive symptoms and depression risk. These findings underscore the importance of addressing menstrual health and mental health concurrently as critical components of women's overall well-being. ∎

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Appendix
Supplemental Material 1. SAMANTA scale

Calaf J, Cancelo MJ, Andeyro M, Jiménez JM, Perelló J, Correa M, Parera N, Lete LI, Calvo A, Doval JL, Duarte R, García JL, Colomé C. Development and Psychometric Validation of a Screening Questionnaire to Detect Excessive Menstrual Blood Loss That Interferes in Quality of Life: The SAMANTA Questionnaire. J Womens Health (Larchmt). 2020 Jul; 29(7):1021-1031. doi: 10.1089/jwh.2018.7446. Epub 2020 Jun 22. PMID: 32580622.

Item number	Question
1	Do you experience menstrual bleeding during more than 7 d per month?
2	Do you experience 3 or more days of heavier menstrual bleeding during your menstrual period?
3	In general, does menstruation bother you due to its abundance?
4	During any of these heavier menstrual bleeding days do you spot your clothes at night; or would you spot them if you did not use double protection or did not change your clothes during the night?
5	During these heavier menstrual bleeding days, are you worried about staining the chair, sofa, etc.?
6	In general, during these heavier menstrual bleeding days, do you avoid, as far as possible, some activities, trips, or leisure-time plans because you frequently need to change your tampon or sanitary towel?

Scoring: Questions are yes or no questions. Affirmative responses to items 1 and 3 each receive three points. Affirmative responses to all other items receive 1 point. These values are summed, resulting in a potential range of values from 0 to 10. Respondents are categorized as having heavy menstrual bleeding if they score ≥3 out of 10 on the scale.

Supplemental Material 2. Center for Epidemiologic Studies Depression scale short form

Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). Am J Prev Med. 1994 Mar-Apr;10(2):77-84. PMID: 8037935.

	Rarely or none of the time (less than 1 d)	Some or a little of the time (1—2 d)	Occasionally or a moderate amount of time (3—4 d)	All of the time (5—7 d)
1. I was bothered by things that usually do not bother me.	☐	☐	☐	☐
2. I had trouble keeping my mind on what I was doing.	☐	☐	☐	☐
3. I felt depressed.	☐	☐	☐	☐
4. I felt that everything I did was an effort.	☐	☐	☐	☐
5. I felt hopeful about the future.	☐	☐	☐	☐
6. I felt fearful.	☐	☐	☐	☐
7. My sleep was restless.	☐	☐	☐	☐
8. I was happy.	☐	☐	☐	☐
9. I felt lonely.	☐	☐	☐	☐
10. I could not "get going."	☐	☐	☐	☐

Scoring: Response scale is from 0 (rarely or none of the time) to 3 (almost all of the time) for all items except for 5 and 8. Items 5 and 8 are reverse coded. The total score is calculated by totaling all items scored after reversing the positive mood items. Possible range for scores is 0 to 30 with higher scores representing greater degrees of depressed mood.