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A communicative model of premenstrual syndrome with social determinants of health: a path analysis

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Abstract

Introduction Premenstrual syndrome (PMS) is characterized by the periodic emergence of physical, psychological, or behavioral symptoms that manifest following ovulation and subside with the commencement of menstruation. These symptoms may be intense enough to interfere with personal relationships, social engagements, or work performance. This study was undertaken to examine the relationship between social determinants of health (SDH) and premenstrual syndrome, taking into account the influence of social factors on health and disease, as well as the existing gap in knowledge regarding the impact of SDH on PMS, following the World Health Organization (WHO) model.

Method A cross-sectional study was carried out involving 600 women who visited health centers in Tehran in 2024. The questionnaires utilized comprised demographic and obstetric forms, Perceived Social Support, Physical Activity, Socioeconomic Status, Intimate Partner Violence, and the Premenstrual Symptoms Screening Tool. Data analysis employed SPSS-27, while the relationship model was assessed through path analysis in LISREL-8.8.

Results Path analysis revealed the direct impact of two intermediate factors on PMS: social support (B=-0.29) and physical activity (B=-0.35). Among the structural variables, socioeconomic status (B=-0.22) and age (B = 0.07) indirectly affected PMS. The model fit indices indicated a good fit (Chi-Square = 22.53, GFI = 0.99, RMSEA = 0.045, NFI = 0.95, NNFI = 0.94, CFI = 0.97, IFI = 0.97).

Conclusion According to the path analysis PMS is prevalent in Iranian women which indicates the necessity of screening for this disorder. In order to alleviate PMS, healthcare providers should pay attention to this condition's risk and protective factors.

Keywords Premenstrual syndrome, Path analysis, Structural determinants of health, Intermediate determinants of health

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Introduction

Premenstrual syndrome (PMS) is a common condition affecting women during their reproductive years, characterized by the presence of at least one symptom that is physical, emotional, or behavioral. These symptoms typically emerge during the luteal phase of the menstrual cycle and usually diminish shortly after the onset of menstruation [1]. PMS can present a variety of symptoms, which may encompass alterations in appetite, weight gain, abdominal discomfort, pain in the back and lower back, headaches, breast swelling and tenderness, nausea, constipation, anxiety, irritability, anger, fatigue, restlessness, mood fluctuations, and episodes of crying [2]. The estimated global prevalence of PMS among women of reproductive age is approximately 47.8% [3]. A recent systematic review revealed that the lowest prevalence occurs in France (12%), while the highest is reported in Iran (98%) [4].

Moderate to severe PMS can significantly detract from an individual's quality of life and result in increased societal costs due to diminished work productivity, elevated absenteeism, and a higher frequency of healthcare service utilization [5, 6]. Furthermore, PMS may elevate the risk of hypertension, adversely affect athletic performance and daily activities, and is notably linked to reduced academic achievement [7].

The precise causes of PMS remain unclear, largely due to a limited understanding of the underlying mechanisms [8]. In 2010, the World Health Organization's Commission for Social Determinants of Health (CSDH) proposed a framework to elucidate the social factors influencing health. This framework categorizes social determinants into two primary groups: (1) Structural determinants, and (2) Intermediate social determinants. These factors interact and ultimately influence health outcomes. Structural social determinants affecting social class include age, education, income, gender, and ethnicity (or race) [9]. The WHO model underscores the importance of socioeconomic and political contexts, along with the structural determinants that shape health. Intermediate social determinants cover several categories: material conditions such as employment; behavioral and biological factors like physical activity; psychosocial factors including domestic violence and social support; and the healthcare system [10].

Given the significant prevalence of PMS and PMMD among Iranian women [4], it is crucial to identify the factors that influence PMS within the context of Iran. Although some related factors have been investigated through various models in prior research conducted in other countries [11, 12], no specific studies have been conducted in Iran. The social determinants of health (SDH) model is recognized as one of the most comprehensive frameworks available. According to the World Health Organization's guidelines, which a panel of experts has endorsed, these models are designed to be relevant across various nations. Consequently, this research aims to explore the relationship between SDH and PMS as delineated by the WHO's 2010 Social Determinants of Health model. The study posits the following hypotheses: [1] There is a correlation between structural social determinants of health and PMS, and [2] There is a correlation between intermediate social determinants of health and PMS.

Method

A cross-sectional study was performed on 600 married reproductive-aged women referred to community health centers in Tehran from July 10, 2024, to November 3, 2024.

Inclusion and exclusion criteria

The inclusion criteria were Iranian nationality, marriage, not being pregnant, reading and writing literacy, not having experienced a stressful event in the past 6 months, no history of hysterectomy or oophorectomy, a health record in the health center, no history of mental illness, and willingness to participate in the study. The exclusion criteria were reluctance to participate in the research and inappropriate completion of questionnaires.

Sample size and sampling method

To ensure sufficient statistical power for path analysis, it is recommended to have between 5 and 10 samples for every parameter [13]. Path analysis was used to explore the variables' connections, multiplying the number of questionnaire items for the independent variables (58 parameters) by 9. To enhance accuracy by 15% and account for possible sample attrition, the total sample size was raised to 600. Three health centers were randomly selected from each of the three universities of medical sciences, including Shahid Beheshti, Tehran, and Iran (a total of 9 health centers). Participants were selected from these centers in person by convenience method and based on eligibility. Women who were eligible and had regular menstrual cycles were asked to participate. If they were in the luteal phase of their menstrual cycle, they could fill out the questionnaire at that time, and if they were in the follicular phase, ovulation, or menstrual bleeding, the questionnaires were given to these people and the researchers wrote down their mobile phone numbers and menstrual cycle characteristics and asked them to complete the questionnaires at the appropriate time with the researchers' reminder.

Data collection

Data were collected using a demographic and obstetric questionnaire, the socioeconomic status questionnaire by

Ghodratnama et al., the Intimate Partner Violence by the World Health Organization, and the Multidimensional Scale of Perceived Social Support (MSPSS) by Zimnet et al., and Sharkey's Physical activity questionnaire to examine the variables related to the social determinants of health. The premenstrual symptoms screening tool was used to measure the premenstrual syndrome among participants.

Demographic and obstetric questionnaire

This questionnaire included items about the age, husband's age, ethnicity, husband's education level, gravidity, number of children, number of abortions, and history of cesarean section.

Premenstrual symptoms screening tool

This 19-item, two-part tool was created by Steiner et al. in 2003 [14]. Five questions in the second section gauge how much a person's life is affected by their PMS symptoms, while the first section consists of 14 questions about mood, physical, and behavioral symptoms. The four-point Likert scale—Not at all, Mild, Moderate, and Severe—is used to grade each issue. The content Validity Ratio (CVR) and Content Validity Index (CVI) of the Persian version of the questionnaire were reported to be 0.70 and 0.80, respectively. Moreover, the reliability of this tool was confirmed with an acceptable Cronbach's alpha value of 0.90 [15].

Socioeconomic status questionnaire

Socioeconomic status was measured using the questionnaire developed by Ghodratnama et al. [16]. The socioeconomic status questionnaire contained twelve questions, five of which asked demographic questions and seven about economic class, income, parental and individual educational attainment, and housing status. Higher scores indicated a higher socioeconomic position. One study found that Cronbach's alpha in this questionnaire was 0.82 [17].

World health organization violence against women (WHO-VAW) instrument

The screening tool developed by the World Health Organization is effective for identifying domestic violence across three domains: physical, psychological, and sexual [18]. It evaluates physical violence through 9 questions, sexual violence through 8 questions, and emotional violence through 15 questions. A positive response to any question related to physical, emotional, or sexual violence indicates the presence of violence. The number of cases of domestic violence is measured based on the five-point Likert scale. The internal reliability of this tool using Cronbach's alpha in three domains was 92%, 89%, and 88% for physical, psychological, and sexual violence, respectively [19]. Its validity has been assessed in various Iranian studies and has been appropriate [20].

Multidimensional scale of perceived social support (MSPSS)

The MSPSS consists of 12 items that assess perceived social support from various sources, including spouse, friends, and family, and is rated on a 5-point Likert scale ranging from "strongly disagree' to "strongly agree". In this scale, 'strongly disagree' signifies that the individual has never experienced the support mentioned in the statement. In contrast 'strongly agree' indicates that the individual has fully experienced that support [18]. Bagherian et al. found that Cronbach's alpha coefficients for the three dimensions of social support—support from friends, significant others, and family were 0.90, 0.93, and 0.85, respectively [21].

Sharkey's physical activity index

Sharkey's physical activity questionnaire assessed the level of physical activity. The questionnaire has five questions, and each question has five options. It was prepared and compiled based on the Likert scale. Each question is given a minimum score of 1 and a maximum score of 5, so the total score of each person is between 5 and 25, and the higher score obtained from this questionnaire indicates more physical activity in the individual [22]. The face and content validity of the questionnaire were confirmed by the experts in physical education in Iran. The reliability of the questionnaire was reported to be 0.85, based on Cronbach's alpha [23].

Ethical consideration

The Medical Ethics Committee of Shahid Beheshti University of Medical Sciences sanctioned the protocol for this study (ethics code: IR.SBMU.REC.1403.180). Following the acquisition of informed consent from the women and outlining the objectives of the study, the researcher gathered the necessary data by conducting interviews and completing questionnaires. The women were also informed that their information would be kept confidential, that their participation in the study was voluntary, and that they would not encounter any consequences or difficulties if they chose not to take part.

Data analysis

Analysis of the collected data was done with LISREL-8.8 and SPSS-27. The correlation between the variables under study was examined using the Pearson test. The path analysis approach looked at the links between the variables and added the "direct effect" and "total indirect effect" of each variable to find the overall impact of each variable on the others. In the current study, the model goodness of fit was assessed using the Root Mean Square Error of Approximation (RMSEA) < 0.08, Goodness of Fit

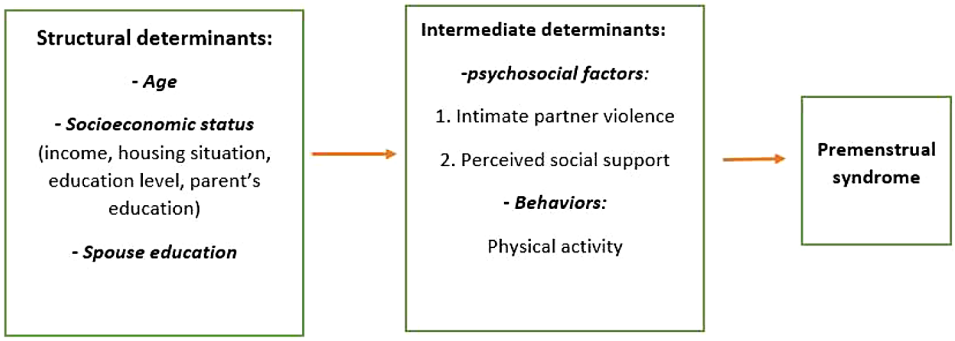

Fig. 1 Conceptual framework of the relationship between social determinants of health and premenstrual syndrome

Table 1 Demographic and obstetric characteristics of participants

Quantitative variables	Mean and standard deviation
women' age	27.82 ± 6.45
Husbands' (or partners') age	36.66 ± 5.38
Gravidity	1.82 ± 0.64
Socioeconomic status	14.23 ± 4.24
Perceived social support	31.46 ± 12.23
Intimate partner violence	50.62 ± 21.51
Physical activity	12.08 ± 5.72
Premenstrual syndrome	34.35 ± 11.46
Women's education level	
Diploma and lower	270 (%45)
Associate Degree	44 (%7.3)
Bachelor degree	226 (%37.6)
Master and above	60(%10)
Husbands (or partners') education level	
Diploma and lower	266 (%44.33)
Associate Degree	68 (%11.33)
Bachelor degree	201 (%33.5)
Master and above	65 (%10.83)
Ethnicity	
Fars	495 (%82.5)
Others	105 (%17.5)

Index (GFI) > 0.90, Normed Fit Index (NFI) > 0.90, and Comparative Fit Index (CFI) > 0.90 [24]. The conceptual model of the social determinants that affect premenstrual syndrome was designed based on the WHO conceptual framework of SDH [25] and a review of the literature [26–30] (Fig. 1).

Results

Table 1 reports the statistical distribution of the demographic characteristics of the participants. According to the results, their mean age was 27.82 ± 6.45 years, and the mean score of premenstrual syndrome was 34.35 ± 11.46.

As per the results of Pearson's correlation test:

- Socioeconomic status (r = -0.166), social support (r = 0.165), and physical activity (r = -0.181) all show significant negative relationships with premenstrual syndrome (PMS).
- Intimate partner violence (r = 0.103) has a significant positive relationship with PMS (Table 2).

The final model in the present study is shown in Fig. 2. Not all relationships were significant (Table 3). Based on the results of the path analysis, the variables of age (B = -0.07) and socioeconomic status (B = -0.22) in the indirect path and perceived social support (B = -0.29) in the indirect path were associated with PMS. At the same time, physical activity (B=-0.35) had a significant negative

Table 2 Connection between social determinants of health and premenstrual syndrome in women

Variables	Premenstrual syndrome	Age	Socioeconomic status	Social support	Physical activity	Spouse Education	Intimate partner violence
Premenstrual syndrome	1						
Age	0.02	1					
Socioeconomic status	-0.166*	0.011	1				
Social support	-0.165*	-0.136	0.201	1			
Physical activity	-0.181*	-0.237*	0.068	0.262*	1		
Spouse/ partner Education	-0.024	-0.020	0.199*	0.032	0.018	1	
Intimate partner violence	0.103*		-0.515*	-0.156	-0.104	-0.288*	1

*sign of significance

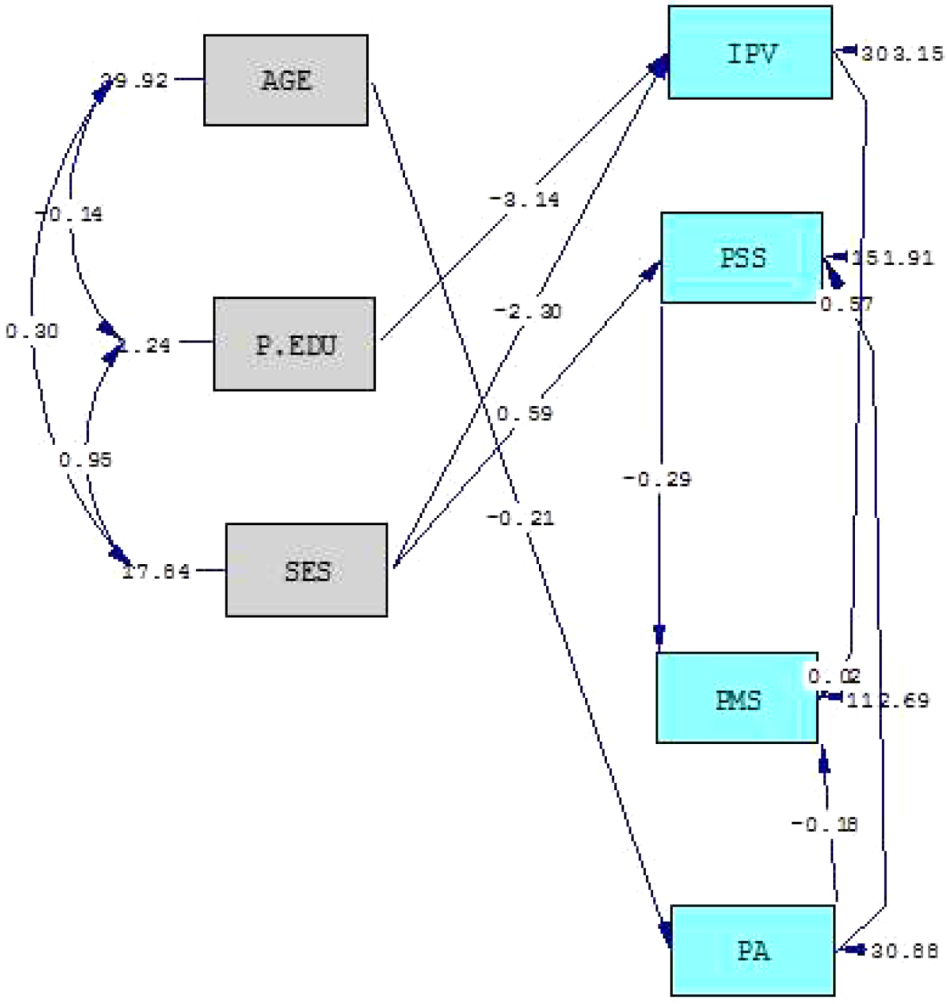

Fig. 2 Full Empirical Path Model between social determinants of health with premenstrual syndrome

Table 3 Path coefficients of social determinants affecting premenstrual syndrome in women participating in the study

Variable	Effect			*P*-value
	Direct B(SE)	Indirect B(SE)	Total B(SE)	
Age	0.0	-0.07(0.02)	-0.07(0.02)	< 0.001
Socioeconomic status	0.0	-0.22(0.06)	-0.22(0.06)	< 0.001
Spouse/partner Education	0.0	-0.07(0.07)	-0.07(0.07)	0.317
Intimate partner violence	0.02(0.02)	0.0	0.02(0.02)	0.305
Social support	-0.29(0.03)	0.0	-0.29(0.03)	< 0.001
Physical activity	-0.18(0.08)	-0.17(0.03)	-0.35(0.08)	< 0.001

causal relationship with PMS in both direct and indirect paths (Fig. 2).

Table 4 presents the indices assessing model fit. Given that the relative chi-square (chi-square/ degrees of freedom) is below 3, the Root Mean Square Error of Approximation (RMSEA) is under 0.08. The Goodness of Fit Index (GFI) and the Comparative Fit Index (CFI) exceed 0.90, indicating that the model demonstrates a satisfactory and suitable fit.

Discussion

The relationship between premenstrual syndrome and social determinants of health was examined in this study using path analysis. The participants in this study had a high average PMS score, which suggests that their PMS was significantly severe. This result is consistent with an earlier Iranian study [31]. In addition, the study of Ranjbaran et al. showed that PMS is prevalent among Iranian reproductive-aged women [32].

Table 4 Indices indicating the model's goodness of fit

Index	CFI	GFI	AGFI	NFI	NNFI	IFI	RFI	RMSEA	X2/df
	0.97	0.99	0.97	0.95	0.94	0.97	0.90	0.045	2.44

We discovered that, albeit indirectly, age was positively correlated with PMS. This conclusion contradicts findings from another Iranian study [34], but it is consistent with certain previous Iranian studies [31, 33], one study from Saudi Arabia [34], and one South Korean study [35] as well. It is important to note that this study's participant sample included a broader age range than previous research, which may help to explain these disparities. In addition, the study design and different methods of data analysis can be another reason for these disparities. On the other hand one possible explanation for the positive association between age and PMS is that as individuals age and take on more family responsibilities, they tend to experience a rise in stressors, which leads to a greater likelihood of developing PMS [36].

Consistent with findings from one study in Iran [37] and another from Thailand [38], the results of this investigation showed that socioeconomic level was negatively connected with premenstrual syndrome only through two indirect pathways. Similarly, a study conducted in Iceland on 11,973 women showed that women with lower educational levels and income were more likely to suffer from severe premenstrual syndrome [39]. Higher socioeconomic position women are more likely than lower socioeconomic status women to seek therapy for their PMS, according to a Japanese study [40]. The frequency and severity of PMS or PMDD can also be greatly impacted by the work environment and restricted access to healthcare treatments. Significant job-related stress and unpleasant working conditions may be experienced by women with lower earnings, which can worsen their psychological stress and PMS [41].

Social support was the only predictor in this study that showed a direct negative causal connection with PMS, which is in line with two Korean studies [11, 27] and one study from China [42]. Social support is about being aware of one's surroundings and having faith that help will be available when required. Social support is recognized as a way to reduce stress and has been linked to numerous elements of physical and mental health, general life satisfaction, and quality of life [43–45]. Moreover, the brain opioid theory of social attachment suggests that the connection of the neuropeptide β-endorphin to μ-opioid receptors in the central nervous system (CNS) is a crucial neurochemical process in forming social bonds [46].

Consistent with findings from previous studies from Iran, the United Kingdom, Turkey, India, and Egypt [47–51] our results showed a negative causal connection between physical activity and premenstrual syndrome through both direct and indirect pathways. Exercise has been shown to increase endorphins, control the synthesis of progesterone and estrogen, and promote the development of natural anti-inflammatory compounds [52]. In addition, there are many other advantages to physical activity, such as improved general health, social contact possibilities, and a decrease in depression symptoms, and the spectrum of PMS symptoms may be lessened with the use of these combined advantages [53].

Although a prior study reported a strong relationship between PMS and domestic violence [54], our study did not find a statistically significant correlation. Another Swedish did not indicate a significant relationship between violence and PMDD [55], which is in line with the results of the current study. This discrepancy can be due to different measurements of violence and differences in considering various types of violence in these studies.

There were various limitations to this investigation. The main limitation was that every questionnaire used in this study was based on self-evaluation. As a result, self-reporting bias based on personal opinions was inevitable. Therefore, it is recommended that future studies use medical examinations and para-clinical test results to increase the accuracy and precision of the results. Furthermore, the study did not account for unmeasured confounders such as dietary habits, genetic predispositions, and mental health history, all of which could influence the severity of PMS and mediate the effects of SDH.

The study's findings have significant ramifications for clinical treatment, research, teaching, and policy formulation. When treating PMS, medical professionals should consider the known risk and protective factors. This study lays the groundwork for future investigations into the social determinants of health and their impact on PMS. In terms of education, these results can aid in developing improved training curricula for medical professionals and increasing public awareness. Finally, policymakers should utilize this data to create public health initiatives aimed at reducing the incidence and impact of PMS in women. For instance, educational or interventional programs It is better to focus intervention or educational programs on women with risk factors for PMS, such as women with low income and education levels, older women, etc.

Conclusion

We presented an empirical model that illustrates the relationships between social determinants of health and premenstrual syndrome (PMS). Aging was found

to have a detrimental effect on PMS symptoms, while physical activity, perceived social support and high socio-economic status serve as protective factors for PMS. Considering the high average score of PMS in Iranian women, health policymakers should pay special attention to the risk factors and protective factors of this disorder. For instance, Health policymakers should encourage women to be more physically active through appropriate cultural development, increase the knowledge of men in society about premenstrual syndrome, and clarify the role of men in reducing women's mental health problems.

Abbreviations

IPV	Intimate partner violence
SES	Socioeconomic Status
PPS	Perceived Social Support
RMSEA	Root Mean Square Error of Approximation
NFI	Normed Fit Index
AGFI	Adjusted Goodness of Fit Index
NNFI	Non-Normed Fit Index
P. EDU	Partners' Education
PMS	Premenstrual Syndrome
PA	Physical Activity
GFI	Goodness of Fit Index
IFI	Incremental Fit Index
RFI	Relative Fit Index

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Author contributions
Alamolhoda. SH and Hamzehgardeshi. Z supervised the study. Hamzehgardeshi. Z prepared the proposal. Salehi. F and Hooshmand Fini. M conducted sampling. Nasiri. M and Jahanfar. Sh analyzed the data. Vakili. F and prepared the article text. All authors read and approved the final manuscript.

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Data availability
The data that support the findings of this study are available at a reasonable request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

Declarations

Ethics approval
This research was approved by the Ethics Committee of the Faculty of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences with ethics code IR.SBMU.REC.1403.180. All methods were carried out following relevant guidelines and regulations or declarations of Helsinki.

Consent to participate
Participants were fully informed and gave their permission to participate in this research by indicating their informed consent in the questionnaires.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

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