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Latent profile analysis and influencing factors of sleep quality in community perimenopausal women: a cross-sectional study

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Abstract

Background Perimenopause is a critical turning point in women's life cycle, and the issue of sleep disturbance during perimenopause not only affects individual health, but also has profound implications for family functioning, socioeconomic status, and public health policies. Therefore, this study aims to explore different potential profiles of sleep quality in perimenopausal women in the community and analyze the influencing factors of different profiles.

Methods A cross-sectional study was conducted from July 2024 to December 2024, and a total of 281 perimenopausal women in the community were recruited from 4 communities in Bengbu by convenience sampling. The participants completed the pittsburgh sleep quality index (PSQI), and self-rating anxiety scale (SAS), self-rating depression scale (SDS) and simplified coping style questionnaire (SCSQ). Latent profile analysis(LPA) was employed to identify latent profiles of sleep quality of perimenopausal women in the community. The predictors of sleep quality in different latent profiles were assessed via multinomial logistic regression analysis. One-way ANOVA, chi-square test or Fisher exact test, and the Kruskal-Wallis test were used to compare the PSQI scores of perimenopausal women in the community under different latent profile characteristics.

Results The mean age of 281 perimenopausal women was 50.09 ± 5.08 years, and the prevalence of sleep disorders was 31.3%. The sleep quality of perimenopausal women in community could be divided into three different latent profiles: good sleep quality group (68.7%), falling sleep and maintenance difficulty group (24.2%), and poor sleep quality with sleep disorder group (7.1%). Taking the good sleep quality group as the reference group, drinking history (OR=2.061), chronic disease history (OR=2.154), spouse's health status (OR=1.871) and anxiety (OR=4.390) were the risk factors to predict the difficulty in falling asleep and maintaining sleep in community perimenopausal women ($P < 0.05$). Spouse's health status (OR=2.139) and anxiety (OR=19.029) were the risk factors for poor sleep quality and sleep disorders in community perimenopausal women ($P < 0.05$).

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Conclusions There are three qualitatively different potential profile categories of sleep quality in perimenopausal women in the community, and drinking history, chronic disease, poor spouse health and anxiety have predictive effects on their profile categories. In the future, community nursing staff can take targeted interventions according to different categories of sleep quality in perimenopausal women to improve sleep quality and level of health promotion.

Keywords Perimenopause, Sleep quality, Latent profile analysis, Influencing factors

Introduction

Perimenopause is the period of transition from a woman's reproductive period to menopause, from the onset of ovarian function decline to 1 year after the last menstrual period [1]. Perimenopause is an inevitable stage for women. At present, there are about 167 million perimenopausal women in China, accounting for about one quarter of the world [2]. Due to the decline of female reproductive function in this special period, a series of changes in physical and psychological care are triggered, and sleep disorders are one of the more serious complications [3]. According to surveys, the prevalence of sleep disorders in premenopausal women is 16%~42%, and that in perimenopausal women can reach 39%~47% [4]. The prevalence of sleep disorders in perimenopausal women is even as high as 42%~60%. mainly manifested as difficulty in falling asleep, waking up early from multiple dreams, poor sleep quality, easy to wake up in the middle, and other symptoms [5]. Studies by Chinese scholars have shown that perimenopausal related sleep disorders are common in women aged 40 to 55, with a prevalence of 13.2% ~65.1% [6, 7]. Good sleep can eliminate fatigue, repair body damage, start new nerve excitatory activities, and also help to improve the body's immunity and enhance the body's ability to resist diseases [8].

In addition, the sleep quality of perimenopausal women is also affected by many factors, such as physiological, psychological and social aspects [9, 10]. Studies have shown that chronic diseases are risk factors for the decline of sleep quality in menopausal women [10]. Women with chronic diseases had a 1.39-fold increased risk of sleep disorders [9]. Perimenopausal women with a history of diabetes have a higher incidence of sleep disorders [11]. Studies at home and abroad have shown that there is a correlation between the prevalence of diabetes and poor sleep quality. The hyperglycemic state of the body is unfavorable to the central nervous system, which may cause neurobehavioral abnormalities, neurotransmitter and autonomic dysfunction, thereby causing sleep disorders [12, 13]. Persistent chronic diseases may adversely affect the physical and mental health of perimenopausal women [14]. Poor sleep quality is a risk factor for cardiovascular disease, diabetes and obesity [15]. In addition, there is a certain correlation between the poor health of the husband and abnormal sleep in

perimenopausal women [16]. Spouses share the same living environment, share resources, eat together, and share social networks; The sharing of small and big things in life contributes to behavioral convergence, the daily life activities of spouses are intertwined, and the personal attributes of each spouse, such as emotions, attitudes, behaviors, health, stress, and lifestyle, affect both partners [17]. When the spouse is in poor health, the wife bears more responsibility for caring for her husband, which makes perimenopausal women bear greater mental and physical stress, which is prone to sleep problems. A healthy lifestyle plays an important role in physical and mental health [18], and study have shown that social activities affect the sleep quality of perimenopausal women [19]. Leisure physical activity can relieve anxiety, depression and other emotions, and reduce the risk of depression. Improve cognitive function and sleep status; Improve happiness, life satisfaction and quality of life [20]. Leisure and recreational activities are effective pressure regulating valves, which can shift perimenopausal women's excessive attention to discomfort, enhance their sense of control over life, and relieve anxiety before sleep. Studies have shown that insomnia disorder in perimenopausal period can not only cause inattention, mood disorders and other problems, but also increase the risk of anxiety and depression in this population; Both of them have a high degree of comorbidity, which seriously affects their physical and mental health and reduces their quality of life [21, 22].

Perimenopause is a critical turning point in the life cycle of women. The problem of sleep disorders in perimenopause is not only related to individual health, but also has a profound impact on family function, social economy and public health policy. Physiologically, insufficient sleep can increase the risk of chronic diseases such as cardiovascular disease and cognitive decline through hormonal fluctuations and neurotransmitter disorders, forming a vicious cycle of poor sleep and worse health. In the family dimension, in China's family-oriented culture, perimenopausal women often assume multiple care roles. Emotional fluctuations caused by sleep disorders may lead to family conflict, reduce marital satisfaction, and even exacerbate the vulnerability of left-behind families. From a socio-economic perspective, the direct medical costs and indirect productivity losses of sleep-related diseases may exacerbate the pressure on primary

care resources and the problem of population aging. It is of great significance to pay attention to the sleep quality of perimenopausal women in community. Poor sleep can weaken their immunity, increase the risk of cardiovascular disease, diabetes and other chronic diseases, and affect their health. Sleep disorders can aggravate psychological problems such as anxiety and depression, forming a vicious circle and reducing the quality of life [9–14]. Lack of sleep can lead to fatigue and slow reaction times, affecting the efficiency and safety of daily life [21, 22]. In addition, perimenopausal women are an important part of the community, and good sleep quality can better fulfill their responsibilities and create a good family and community atmosphere, otherwise it will lead to family conflict and interpersonal tension. Paying attention to their sleep quality is related to individual health and social harmony and stability [23].

However, individual sleep characteristics are often complex, diverse and highly heterogeneous [24], and most of the existing studies only classify the presence or absence of sleep disorders by the critical value of the scale, which makes it difficult to identify the characteristic differences of groups. Identification of the class of their change profiles and the establishment of predictors are conducive to the identification of people with moderate and high risk of sleep disorders, and the implementation of dynamic management. Different from traditional variance-centered statistical analysis methods, latent profile analysis (LPA) emphasizes human-centered, and accurately and objectively identifies subgroups with heterogeneous characteristics by constructing latent profile models [25]. At present, researches using potential profile to analyze phenomena related to nursing field have gradually emerged [26]. Through the potential profile analysis of the study group, its needs and risks can be more accurately identified and personalized nursing services can be provided for it [27, 28]. Therefore, LPA was used in this study to more accurately identify the heterogeneous group of sleep quality in community perimenopausal women, so that community nurses can provide personalized nursing services to improve their sleep quality according to their needs.

In a previous study that examined the relationship between sleep trajectory and the prevalence of cardiovascular events in middle-aged women, more than 30% of women had insomnia symptoms; The results showed that nearly a quarter of women had persistent insomnia symptoms during midlife, and 14% had persistent sleep deprivation during midlife, about 7% of women develop a pattern of persistent insomnia symptoms and short sleep duration during midlife [29]. Chinese scholars explored three potential profile categories of sleep disorders in 120 perimenopausal women visiting the gynecological clinic of Maternal and Child Health Hospital, namely, mild

sleep disorder group (21.67%), moderate sleep disorder group (37.50%), and severe sleep disorder group (65.83%), the predictive effects of social interaction, hormone level and psychological state on the trajectory category were also explored [30]. However, to the best of our knowledge, there are few domestic studies involving potential profile analysis of sleep quality in community perimenopausal women in China. Therefore, the latent profile analysis method was used to analyze the sleep quality of perimenopausal women in the community, and the predictors of different sleep quality latent profile class were constructed to understand the influencing factors of different sleep quality latent profile class, so that community nurses could take targeted interventions to improve sleep quality and health promotion according to the sleep quality categories and risk factors of perimenopausal women.

Methods

Participants

The convenience continuous selection method was used to collect perimenopausal women from four communities in Bangshan District, Yuhui District, Huaishang District and Longzihu District of Bengbu City, Anhui Province, China, and a questionnaire survey was conducted from July to December 2024.

Inclusion criteria: (1) Perimenopausal women aged 40 ~60 years old, according to the diagnostic criteria of perimenopausal women in the tenth edition of Chinese Obstetrics and Gynecology: a period of transition from reproductive period to menopause, from the beginning of ovarian function decline to 1 year after the last menstrual period [1]; (2) clear consciousness, normal communication and understanding ability, have basic reading and writing ability, and can independently complete the text questions in the questionnaire without the assistance of others.; (3) Informed consent. Exclusion criteria: (1) severe heart, lung, liver and kidney function diseases; (2) Estrogen replacement therapy or sedatives in the past 3 months; (3) Subjects with a history of mental illness, such as: People with a previous or current diagnosis of schizophrenia, bipolar disorder, personality disorder, cognitive impairment or who are receiving psychiatric medication without stable control of their symptoms.

Sample

For descriptive cross-sectional studies of quantitative variables, the sample size was calculated as follows

[31]: $N = \frac{Z_{\alpha/2}^2 p(1-p)}{\delta^2}$. At the 95% confidence interval, $Z_{\alpha/2}=1.96$, δ represents the absolute error or precision, which was 0.05 in this study, and p is the prevalence rate of sleep disorders in perimenopausal women that can be based on the data from previous research [4, 7], which was 13.2%~65.1%. According to the formula,

the theoretical sample size was 176~349. Considering an invalid response rate of 15% during the study, it was concluded that 207~411 community perimenopausal women need to be investigated.

Data collection

Researchers should be trained in professional knowledge, investigation skills and ethical norms. After the training, researchers should be able to use unified questionnaire interpretation and interrogation skills, master professional communication methods for perimenopausal women's sleep problems, strictly abide by ethical norms, and protect subjects' privacy and right to know.

First, the investigators contacted community staff in four communities in Bengbu city, Bengshan District, Yuhui District, Huaishang District, and Longzihu District, to get to know registered perimenopausal women aged 40 to 60 years, and to hand out questionnaires at home. Those who met all three criteria were asked to complete a questionnaire, and those who met any one of the exclusion criteria were excluded. Investigators used uniform instructions and conducted the survey by distributing paper questionnaires offline. The researchers had obtained the ethical review permission from the school ethics committee before the investigation began. The investigators of this study included nursing teachers and undergraduate students. All investigators received unified training and were responsible for recruiting participants who met the inclusion criteria, while explaining the purpose, significance and content of the study to the participants. The research process remains anonymous. During the collection process, after obtaining the informed consent of the participants, the researchers introduced the requirements for filling out the questionnaires to them. Each questionnaire took approximately 15 to 20 min to complete and was filled out by the research subjects themselves. The questionnaires were distributed on the spot and collected immediately after completion. The data were checked by two researchers, and the questionnaires that were illogical, regularly answered, and missing more than 10% of the key indicators of the study were excluded.

Measures

Participants' general characteristics

The self-designed general information questionnaire was adopted, and the contents included: age, marital status, occupation, educational level, monthly income, current menstrual status, smoking history (It was defined as past/current smoking history, and never smoking was classified as no smoking history.), drinking history (It was defined as past/current drinking history, and never drinking was classified as no drinking history.), physical exercise situation (It was conducted at a moderate

intensity defined as a heart rate of 95~130 beats/min (or perceived fatigue, sweaty, but comfortable) for at least 30 min three to four times per week, using self-reported information from community perimenopausal women about whether they participated in activities that promote physical and mental health.), chronic disease history (It was defined as the subjects were officially diagnosed with the following diseases by medical institutions, and the course of disease was ≥ 3 months: hypertension, diabetes, coronary heart disease, chronic obstructive pulmonary disease, etc.), entertainment leisure activities (referring to outdoor entertainment leisure activities with relatives or friends, etc.), and the health status of the spouse (participant's subjective assessment of their spouse's psychosocial and physiological health: general/poor, good, and very good.).

Psychological condition

The anxiety status of perimenopausal women in the community can be evaluated through the Self-rating Anxiety Scale (SAS). This scale was developed by Zung and is used to assess the subjective feelings of anxiety of the research subjects [32]. The scale consists of 20 items covering multiple dimensions of anxiety symptoms, including mental anxiety and somatic anxiety. Each item is scored on a scale of 1 to 4, with "1" having no or little time, "2" having a little time, and "3" having a lot of time. "4" most or all of the time, and some items were reverse scored. To calculate the total score, the crude score obtained by adding the scores of 20 items was multiplied by 1.25 and rounded to the whole part to obtain the standard score, which was < 50 for no anxiety, ≥ 50 for mild anxiety, ≥ 60 for moderate anxiety, and ≥ 70 for severe anxiety. A higher score indicates a more severe anxiety condition of the evaluated person. In this study, a score of SAS ≥ 50 indicates the presence of anxiety symptoms [33]. The Cronbach's α coefficient of the scale was 0.77, which had good reliability and validity.

The depression status of perimenopausal women in the community can be evaluated through the Self-rating Depression Scale (SDS). This scale was developed by Zung and can be used to assess the subjective feelings of depression in the research subjects [34]. The scale covers four categories and four dimensions, including emotional symptoms (such as low mood and despair), physical symptoms (such as sleep problems and fatigue), psychomotor symptoms (such as slow movement) and cognitive symptoms (such as decreased attention), and consists of a total of 20 items. Each item was scored on a scale of 1 to 4, with "1" no or little time, "2" some time, "3" a lot of time, and "4" most or all time. When calculating the total score, the crude score obtained by adding the scores of 20 items was multiplied by 1.25, and the whole part was rounded to obtain the standard score. The

cut-off value was 53 points, 53~62 points were marked as mild depression, 63~72 points were marked as moderate depression, and > 72 points were marked as severe depression. A higher score indicates a more depressed condition of the assessed person. In this study, the Chinese version of the SDS standard score ≥ 50 points used to indicate the presence of depressive symptoms [33], so as to improve the sensitivity of this population. The Cronbach's α coefficient of the scale was 0.78, which had good reliability and validity.

Coping style

The coping styles of perimenopausal women in the community were evaluated through the simplified coping style questionnaire (SCSQ) [35]. This scale is a simplification and modification of the ways of coping questionnaire (WCQ) developed by Folkman and Lararus [36] by Chinese scholars in combination with the characteristics of Chinese culture. This questionnaire consists of two dimensions, namely the positive coping (PC) dimension and the negative coping (NC) dimension, with a total of 20 items. The score is calculated by a multi-level scoring method. If it is not adopted, it is scored as 0 points. If it is adopted occasionally, it is scored as 1 point. If it is adopted sometimes, it is scored as 2 points. If it is adopted frequently, it is scored as 3 points. The positive coping dimension contains 12 items, and the calculation result is the average score of the positive coping items. The negative coping dimension contains 8 items, and the calculation result is the average score of the negative coping items. When the score of negative coping is high, the score of psychological problems or symptoms is also high. When the positive coping score is high, the psychological problem or symptom score is low [35]. The Cronbach's α coefficient of the entire scale in this study was 0.90. The Cronbach's α coefficient of the Positive Coping Scale was 0.89. The Cronbach's α coefficient of the Negative Coping Scale was 0.78.

Quality of sleep

The sleep quality of perimenopausal women in the community was evaluated by the pittsburgh sleep quality index (PSQI) scale, which reflected the subjective sleep quality of the subjects in the last month [37]. The PSQI scale included 7 domains: subjective sleep quality, sleep onset duration, sleep time, sleep efficiency, sleep disturbance, hypnotic medication, and daytime dysfunction. Each domain was scored from 0 to 3. In this study, the Chinese version of PSQI score greater than 7 points was defined as having sleep disorders [38]. The Cronbach's α coefficient of the scale was 0.84.

Ethical considerations

In accordance with the Declaration of Helsinki, this research was approved by the Ethics Committee of Bengbu Medical University, Anhui Province, China (Approval No. 2025–262). All participants were informed of the purpose of the study before recruitment, and all participants were asked to voluntarily sign a written consent form. To protect the participants' privacy, all collected data were preserved anonymously and confidentially.

Statistical analysis

Mplus version 7.4 was used to explore the latent profiles of sleep status in perimenopausal women in the community, and latent profile analysis was used to classify participants into different types. The data of the seven dimensions of PSQI were entered into the LPA model, starting with the simplest "1 type", and gradually testing the possibility of 1–5 types to finally determine the most reasonable grouping scheme. The smaller the values of model test indexes Akaike information criterion (AIC), Bayesian information criterion (BIC) and sample size-adjust BIC (aBIC), the better the model fit [39]. The Entropy index ranges from 0 to 1, and the closer its value is to 1, the more accurate the model classification is [40]. The Lo-Mendel-Rubin Test (LMR) and bootstrap likelihood ratio test (BLRT) were used to assess the P values in the comparisons among models with different numbers of classes. A low P value indicated that the k -class model fit better than the $k-1$ -class model [41].

To explore the differences in data such as the characteristics of the participants for the subtypes based on LPA, IBM SPSS Statistics version 25.0 was used (IBM Corp., Armonk, NY, USA). Continuous data that conformed to a normal distribution were expressed as mean $\pm$ standard deviation ($\bar{X} \pm S$) and analyzed using analysis of variance for intergroup comparisons. Categorical data were described by frequency (n) and percentage (%) and analyzed using the *Chi*-square test or Fisher's exact probability test for intergroup comparisons. Continuous data that did not conform to a normal distribution were expressed as $M (P_{25} \sim P_{75})$ and analyzed using the non-parametric Kruskal-Wallis H test. Multivariate logistic regression analysis was used to analyze the influencing factors of potential profile of sleep quality, and a P value < 0.05 was considered statistically significant.

Results

Characteristics of participants

A total of 338 perimenopausal women in the community participated in the study. (Bangshan District 70 cases, Yuhui district 63 cases, Huaishang District 69 cases, Longzihu district 80 cases). 57 unqualified questionnaires were eliminated (7 questionnaires had the same answer

to all questions: for all questions of the survey scale, the first option was selected, and more than 10% of the items in the 50 questionnaires were not completed: missing items involved the key indicators of the study: SAS, SDS and PSQI, and refused to fill in the vacant questionnaires on the spot), a total of 281 valid questionnaires were analyzed, and the recovery rate was 83.1%. The age of the participants was between 40 and 60 years old, 90.0% of the participants were married, 49.5% of the participants had junior high school education or below, 45.6% of the participants were employed, and most of the participants had a monthly income less than 4000 RMB. More details can be found in Table 1.

Results of latent profile analysis of sleep quality perimenopausal women in the community

The scores of 7 dimensions of PSQI were used as the observation indicators to fit 1 to 5 profiles models. With the increase of the number of profiles, the values of AIC, BIC and aBIC decreased, and the Entropy values were all > 0.8 , and the Entropy reached the highest when the latent profiles was 2, but the LMR test value did not reach the significant level ($P > 0.05$). LMR and BLRT were significant in profiles 3 and 4 ($P < 0.05$), but in the 4-category model, the sample sizes divided into various categories were significantly different, which were 192, 60, 4, and 25 cases, respectively. In the 3-category model, the sample sizes divided into various categories were 193 cases, 68 cases and 20 cases, respectively. Therefore, considering the model division and the representativeness and interpretability of the research results, model 3 was selected as the best fitting model, as detailed in Table 2. The average attribution probability of sleep status of perimenopausal women in community to the three potential profiles was 96.5%, 92.2% and 100%, respectively, indicating that the results of the three potential profiles were reliable. More details can be found in Table 3.

PSQI scores and nomenclature of three potential profile of sleep quality in perimenopausal women in the community

According to Table 4; Fig. 1, the differences in the scores of the seven dimensions of PSQI among the three latent profile were statistically significant ($P < 0.01$). There were 193 cases (68.7%) in Class 1, and the scores of 7 dimensions were generally low, and the PSQI total score of this group was 5(3~7) low, so the Class 1 was named “good sleep quality group”. There were 68 cases (24.2%) in Class 2, and the scores of 7 dimensions were at a medium level. The total PSQI score of this group was 10(8~12), there were significant increases in the scores of Y2 (sleep onset duration) and Y5 (sleep disturbance), while the scores of other domains (Y3 sleep duration and Y7 daytime dysfunction) increased but were relatively flat, so the Class 2 was named as “falling sleep and maintenance difficulty

group”. There were 20 participants in Class 3 (7.1%), and the scores of 7 dimensions were higher than those in Class 1 and Class 2. The total PSQI score of this group was 15(15~17), this category scored very high on all seven dimensions (Y1-Y7), with Y3 (sleep time) and Y7 (daytime dysfunction) being particularly prominent, so Class 3 was named as “poor sleep quality with sleep disorder group”.

Univariable analysis of potential profile of sleep quality perimenopausal women in the community

Univariate analysis showed that there was no significant difference ($P > 0.05$) in age ($\chi^2=5.503$), marital status ($\chi^2=0.592$), education level ($\chi^2=6.347$), occupation ($\chi^2=4.917$), monthly income ($\chi^2=0.733$), smoking history ($\chi^2=1.466$), entertainment consumption ($\chi^2=0.469$), positive coping styles ($F=2.783$) and negative coping styles ($F=1.126$) among perimenopausal women with different sleep quality class. There were significant differences ($P < 0.05$) in drinking history ($\chi^2=14.068$), current menstrual status ($\chi^2=18.811$), physical exercise ($\chi^2=9.950$), chronic disease history ($\chi^2=16.117$), spouse's health status ($\chi^2=36.339$), depression ($\chi^2=19.071$) and anxiety ($\chi^2=58.718$) among community perimenopausal women with different sleep quality class. More details can be found in Table 1.

Multivariate analysis of potential profile of sleep quality perimenopausal women in the community

Taking the sleep quality of perimenopausal women in the community as the dependent variable, and the good sleep quality group as the reference group, the statistically significant indicators in the above Table 1 were included as independent variables, including drinking history, current menstrual status, physical exercise, chronic medical history, spouse's health status, depression and anxiety status, for multinomial Logistic regression analysis. Falling sleep and maintenance difficulty group = 2, poor sleep quality with sleep disorder group = 3, set reference group: good sleep quality group = 1; The specific assignment can be found in Table 5.

The results of multinomial Logistic regression analysis showed that: Taking the good sleep quality group as the reference group, drinking history ($OR=2.087$), chronic disease history ($OR=2.221$), spouse health status ($OR=1.880$) and anxiety ($OR=4.358$) were risk factors for predicting the falling sleep and maintenance difficulty of perimenopausal women in community ($P < 0.05$). Taking the good sleep quality group as the reference group, spouse health status ($OR=2.130$) and anxiety ($OR=19.512$) were risk factors for poor sleep quality with sleep disorder in community perimenopausal women ($P < 0.05$). More details can be found in Table 6.

Table 1 Univariable analysis of general characteristics and their potential profiles of sleep quality perimenopausal women in the community [$n = 281$, ($\% / \bar{X} \pm S$)]

Variables	N= 281	Class 1	Class 2	Class 3	χ^2/F	P
Age (years)						
40~49	139(49.5)	97(50.3)	37(54.4)	5(25.0)	5.503	0.064
50~60	142(50.5)	96(49.7)	31(45.6)	15(75.0)		
	50.09 ± 5.08					
Marital status						
Married	253(90.0)	173(89.6)	61(89.7)	19(95.0)	0.592	0.744
Divorced/widowed	28(10.0)	20(10.4)	7(10.3)	1(5.0)		
Level of education						
Junior high school and below	139(49.5)	94(48.7)	30(44.1)	15(75.0)	6.347	0.175
Technical secondary school/High school	61(21.7)	44(22.8)	15(22.1)	2(10.0)		
Bachelor's degree or above	81(28.8)	55(28.5)	23(33.8)	3(15.0)		
Occupation						
Employed	128(45.6)	92(47.7)	24(35.3)	12(60.0)	4.917	0.086
Others	153(54.4)	101(52.3)	44(64.7)	8(40.0)		
Income(RMB)						
≤ 4000	163(58.0)	109(56.5)	41(60.3)	13(65.0)	0.733	0.693
> 4000	118(42.0)	84(43.5)	27(39.7)	7(35.0)		
Current menstrual status						
Rule	113(40.2)	90(46.6)	19(27.9)	4(20.0)	18.811	$P < 0.01$
Irregular	79(28.1)	43(22.3)	24(35.3)	12(60.0)		
Already menopausal	89(31.7)	60(31.1)	25(36.8)	4(20.0)		
Smoking history						
No	267(95.0)	185(95.8)	64(94.1)	18(90.0)	1.466	0.481
Yes	14(5.0)	8(4.2)	4(5.9)	2(10.0)		
Drinking history						
No	191(68.0)	138(71.5)	35(51.5)	18(90.0)	14.068	$P < 0.001$
Yes	90(32.0)	55(28.5)	33(48.5)	2(10.0)		
Physical exercise						
No	164(58.4)	124(64.2)	33(48.5)	7(35.0)	9.950	$P < 0.01$
Yes	117(41.6)	69(35.8)	35(51.5)	13(65.0)		
Chronic disease history						
No	225(80.1)	167(74.2)	45(20.0)	13(5.8)	16.117	$P < 0.001$
Yes	56(19.9)	26(46.4)	23(41.1)	7(12.5)		
Entertainment leisure activities						
No	99(35.2)	69(35.7)	22(32.3)	8(40.0)	0.469	0.791
Yes	182(64.3)	124(64.3)	46(67.7)	12(60.0)		
Spouse's health status						
Very good	145(51.6)	118(61.1)	25(36.8)	2(10.0)	36.339	$P < 0.001$
Good	95(33.8)	59(30.6)	23(33.8)	13(65.0)		
General/Poor	41(14.6)	16(8.3)	20(29.4)	5(25.0)		
Depression						
No	169(60.1)	132(68.4)	31(45.6)	6(30.0)	19.071	$P < 0.001$
Yes	112(39.9)	61(31.6)	37(54.4)	14(70.0)		
Anxiety						
No	213(75.8)	170(88.1)	38(55.9)	5(25.0)	58.718	$P < 0.001$
Yes	68(24.2)	23(11.9)	30(44.1)	15(75.0)		
Positive coping	-	1.69 ± 0.68	1.52 ± 0.63	1.86 ± 0.49	2.783	0.064
Negative coping	-	0.96 ± 0.53	1.05 ± 0.53	0.87 ± 0.42	1.126	0.326

RMB Renminbi, χ^2 Chi-square tes, F Analysis of variance

Table 2 The fitting results of the potential profile model for sleep quality of perimenopausal women in the community($n=281$)

Profiles	AIC	BIC	aBIC	LMR (P)	BLRT (P)	Entropy	Proportions(%)
1-Profiles	4854.820	4905.757	4861.363	-	-	-	1
2-Profiles	4195.232	4195.232	4205.514	0.0186	0.0000	0.999	0.929/0.071
3-Profiles	3942.079	4051.230	3956.101	0.0002	0.0000	0.903	0.687/0.242/0.071
4-Profiles	3613.603	3751.860	3631.364	0.0083	0.0000	0.932	0.683/0.214/0.032/0.071
5-Profiles	3583.739	3751.103	3605.239	0.2520	0.0000	0.898	0.107/0.032/0.641/0.149/0.071

AIC Akaike information criterion, BIC Bayesian information criterion, aBIC Adjusted Bayesian information criterion, LMR Lo-Mendell-Rubin test, BLRT Bootstrapped likelihood ratio test

Table 3 Average probability of belonging to the three potential categories of sleep quality perimenopausal women in the community

Class	1	2	3
1	0.965	0.035	0.000
2	0.078	0.922	0.000
3	0.000	0.000	1.000

Discussion

The trend and heterogeneity of sleep quality in community perimenopausal women

Perimenopause is a critical transitional period in the life cycle of women, during which women's sleep status changes significantly. This study identified three potential

profiles of sleep quality of perimenopausal women in the community through the latent profile analysis, namely, good sleep quality group, falling sleep and maintenance difficulty group, and poor sleep quality with sleep disorder group. The study results showed that there was heterogeneity in sleep quality of perimenopausal women in the community. This classification reflects the heterogeneity of sleep quality among perimenopausal women in the community within each latent trait. It complements previous studies that viewed community perimenopausal women as a homogenous whole and, to a certain extent, can provide guidance for the development of targeted interventions to improve sleep quality in community perimenopausal women. To the best of our knowledge,

Table 4 PSQI scores and three potential profiles of sleep quality in perimenopausal women in the community [$n=281$, ($P_{25} \sim P_{75}$)]

Group	N	Subjective sleep quality	Sleep Latency	Sleep Duration	Sleep efficiency	Sleep Disturbances	Use of Sleep Medication	Daytime dysfunction	Total score of the PSQI
Good sleep quality group	193	0(0 ~ 1)	0(0 ~ 1)	2(1 ~ 3)	1(0 ~ 2)	1(0 ~ 1)	0(0 ~ 0)	0(0 ~ 1)	5(3 ~ 7)
Falling sleep and maintenance difficulty group	68	1(1 ~ 2)	2(1 ~ 2)	3(2 ~ 3)	2(1 ~ 3)	1(1 ~ 2)	0(0 ~ 0)	2(1 ~ 2)	10(8 ~ 12)
Poor sleep quality with sleep disorder group	20	2(2 ~ 2)	2(2 ~ 2)	3(3 ~ 3)	3(2.3 ~ 3)	2(1 ~ 2)	2(2 ~ 2)	3(2 ~ 3)	15(15 ~ 17)
H		149.657	115.352	25.210	25.458	81.261	201.855	134.421	155.817
P		$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$

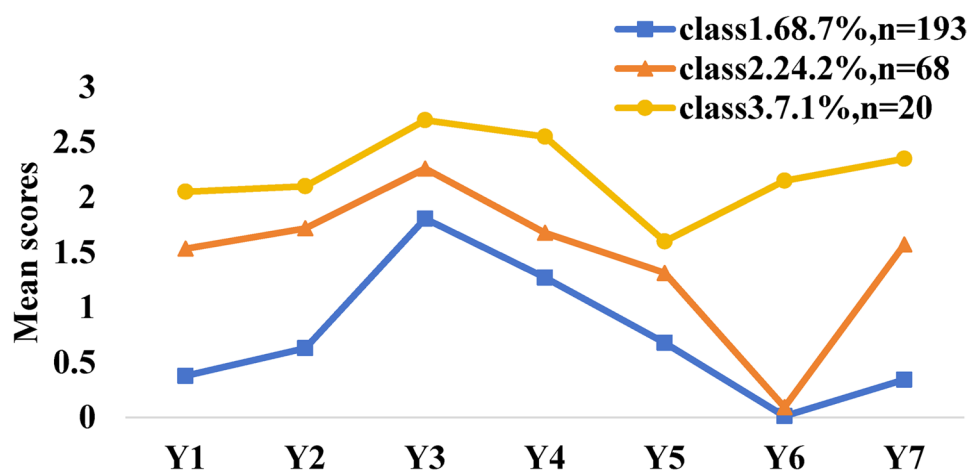
**Fig. 1** Trajectory diagram of the potential profile model of sleep quality perimenopausal women in the community

Table 5 Variable assignment

Variables	Categories	Variable assignment
Drinking history	X1	0=No, 1=Yes
Current menstrual status	X2	0=Rule, 1=Irregular, 2=Already menopausal
Chronic disease	X3	0=No, 1=Yes
Physical exercise	X4	0=No, 1=Yes
Spouse's health status	X5	0=Very good, 1=Good, 2=General/Poor
Depression	X6	0=No, 1=Yes
Anxiety	X7	0=No, 1=Yes
Quality of sleep	Y	Y1=Good Sleep quality Group, Y2=Falling sleep and maintenance difficulty group, Y3=Poor sleep quality with sleep disorder group

few studies have investigated the underlying profile characteristics of sleep quality and its influencing factors in community perimenopausal women.

Perimenopausal women generally face sleep problems such as difficulty falling asleep, frequent awakenings at night, and shortened sleep duration. This study found that there were 88 cases of perimenopausal women in the community with PSQI scores > 7 points, that is the probability of sleep disorders was 31.3%, which was very similar with the results of another study(33.2%) [42]. This means that the data obtained from the community survey can better represent the actual situation of sleep disorders in the whole population of perimenopausal women, provide reliable basic data for follow-up research, and enhance the universality of the conclusions drawn from the community research. However, the results of this study differ from those of other studies. This is lower than the results of a community-based survey in the

United States, which showed that 38% of menopausal transition women suffer from sleep disorders [43]. The results of this study were lower than those of a Russian study that showed that the incidence of sleep disorders in perimenopausal women was 61.2% [44]; Higher than the results of a cross-sectional survey of a nationally representative random sample of South Korea, 26% of the participants had poor sleep quality according to PSQI [10]. The prevalence of sleep disorders in perimenopausal women varies in different races, regions and populations, but the overall prevalence is high and shows an upward trend. The differences in the prevalence of sleep disorders in perimenopausal women in different countries and regions may be affected by factors such as the rhythm of life and social and cultural environment in different regions. This study conducted a field survey on the sleep status of perimenopausal women in the community. The high prevalence of sleep disorders in perimenopausal women may be related to the fact that in Chinese culture, perimenopausal women are regarded as a sign of natural aging, rather than a physiological stage that requires medical intervention. In addition, Bengbu, as a large labor export city, has a large number of young and middle-aged migrant workers, which leads to the prominent problem of “empty nest elderly” and “left-behind children”. Women need to bear more family responsibilities and pressure, which is prone to sleep fragmentation, difficulty falling asleep, waking up early and other sleep problems, and sleep disorders. This phenomenon suggests that it is necessary to strengthen the publicity and education of sleep health for perimenopausal women in the community to improve their cognition of sleep disorders and their awareness of seeking medical treatment.

Table 6 Multinomial logistic regression analysis of potential profile of sleep quality in community perimenopausal women ($n=281$)

Group	Variables	B	S.E.	Wald χ^2	P	OR	95%CI
Class 2 ^a							
	Current menstrual status	0.309	0.196	2.477	0.116	1.362	0.927 ~ 2.000
	Drinking history	0.736	0.325	5.138	0.023	2.087	1.105 ~ 3.944
	Physical exercise	0.487	0.343	2.010	0.156	1.627	0.830 ~ 3.188
	Chronic disease history	0.798	0.374	4.541	0.033	2.221	1.066 ~ 4.627
	Spouse's health status	0.631	0.222	8.093	0.004	1.880	1.217 ~ 2.903
	Depression	-0.086	0.392	0.048	0.827	0.918	0.425 ~ 1.979
	Anxiety	1.472	0.414	12.622	0.000	4.358	1.935 ~ 9.818
Class 3 ^a							
	Current menstrual status	0.222	0.347	0.410	0.522	1.248	0.633 ~ 2.463
	Drinking history	-1.458	0.807	3.264	0.071	0.233	0.048 ~ 1.132
	Physical exercise	0.536	0.629	0.727	0.394	1.710	0.498 ~ 5.866
	Chronic disease history	0.846	0.624	1.836	0.175	2.330	0.686 ~ 7.915
	Spouse's health status	0.756	0.378	4.001	0.045	2.130	1.015 ~ 4.469
	Depression	-0.323	0.741	0.190	0.663	0.724	0.169 ~ 3.094
	Anxiety	2.971	0.747	15.835	0.000	19.512	4.516 ~ 84.300

^aRefers to the good sleep quality group and serves as the reference group

For the community perimenopausal women in the good sleep quality group, there is a certain degree of sleep time disorder, but the total score of PSQI is 5(3~7), which does not exceed the range of sleep disorders defined by the Chinese version of PSQI (>7). They may be in a more comfortable sleep environment or have higher positive coping ability, and show better sleep quality. For this class of women, we should advocate and encourage them to maintain a good sleep status.

The general trend of sleep quality in the falling sleep and maintenance difficulty group was similar to that in the good sleep quality group, but the poor subjective sleep quality, sleep onset time and daytime dysfunction of perimenopausal women in the community were more obvious, which may be related to short sleep time, low sleep efficiency and serious sleep disorders. The sleep quality of perimenopausal women in the community has not been further deteriorated, and targeted non-drug intervention can be used. Improve the overall quality of sleep. A series of non-drug therapies such as appropriate exercise, diet and nutrition management, physical and psychological therapy are recommended. It is recommended to choose appropriate exercise methods according to your own interests, ability, and physical strength. It is recommended to give priority to aerobic exercise and resistance exercise, start from low intensity, and step by step, and perform a warmup-exercise-relaxation exercise cycle each time. The degree of exercise is fever and slight sweating, but attention should be paid to avoid strenuous exercise within 2 h before going to bed., and paid attention to balanced nutrition in diet with adequate intake of protein, probiotics and vitamins. Caffeinated substances should be avoided, and transcranial magnetic stimulation, light therapy, or hyperbaric oxygen therapy should be used to improve sleep if necessary [7].

The proportion of the poor sleep quality with sleep disorder group was the lowest, but the scores of the poor sleep quality group were higher than those of the other two groups, especially in the sleep duration dimension. Poor sleep quality and short sleep duration increase the risk of cardiovascular disease, all-cause mortality, and cancer-related mortality [45]. Therefore, in order to improve the attention of community perimenopausal women to sleep problems, community nursing staff should focus on strengthening propaganda and education, populating the core concept of sleep quality, encouraging women to accurately identify sleep problems through professional means, and adopting mindfulness behavior therapy. Targeted sleep hygiene education, behavioral therapy (sleep restriction and stimulus control), relaxation training (progressive muscle relaxation), cognitive therapy (cognitive reconstruction and paradoxical intention method), and medical intervention when necessary are provided to effectively improve

sleep quality and effective sleep duration and reduce related health risks [46]. Hypnotic drugs are an effective means of adjuvant treatment for insomnia, which can improve sleep problems in a short period of time under the condition of appropriate drug dosage and regular use. However, perimenopausal women may have concerns about drug resistance in taking drugs, and do not take drugs on time and in accordance with the doctor's advice, and there are mistakes, omissions or private withdrawal of drugs, which will produce adverse reactions of drug withdrawal and aggravate insomnia [10]. Medication management should be strengthened when using drug treatment, and the purpose and necessity of correct medication should be informed to perimenopausal women in the community, and the drug dose should be adjusted according to the dynamic effect, so as to achieve the best therapeutic effect with the lowest effective dose and reduce drug resistance and adverse reactions [11].

Predictors of latent profile of sleep quality in community perimenopausal women

This study found that the factors influencing the sleep quality profile of perimenopausal women in the community included drinking history, chronic diseases, spouse's health status, and anxiety. This study found that compared with the community perimenopausal women in the group with good sleep quality, the probability of drinking history in the group with falling sleep and maintenance difficulty was 2.087 times higher than that in the group with good sleep quality. A national cohort study in Korea showed that alcohol risk ($OR = 1.53$) was a risk factor for poor sleep quality in menopausal women [10]. Studies have shown that alcohol intake is a trigger for sleep fragmentation [47]. Relying on alcohol to promote sleep can also disrupt the structure of the sleep cycle, forming a vicious cycle. Community nursing staff can take cognitive behavioral therapy to correct the wrong idea of alcohol as a sleep aid in perimenopausal women, establish a positive feedback regulation system and gradually improve their sleep quality.

Perimenopausal women face not only gynecological problems, but also chronic diseases such as cardiovascular and cerebrovascular diseases and endocrine diseases. The results of this study showed that compared with the community perimenopausal women with good sleep quality, the probability of chronic diseases in the group with falling sleep and maintenance difficulty was 2.221 times higher than that in the group with good sleep quality. The results of a systematic review and meta-analysis on the influencing factors of sleep disorders in perimenopausal women showed that women with chronic diseases had a 1.39-fold increased risk of sleep disorders [9]. Similarly, a national survey study in Korea also showed that chronic diseases were risk factors for poor sleep quality

in menopausal women [10]. Perimenopausal women with a history of diabetes have a higher prevalence of sleep disorders [11]. Studies at home and abroad have shown that there is a correlation between the prevalence of diabetes and poor sleep quality of patients. The high blood glucose state of the body is unfavorable to the central nervous system, which may cause abnormal neurobehavior, neurotransmitter and autonomic nervous dysfunction, thus causing sleep disorders [12, 13]. Persistent chronic diseases may have adverse effects on the physical and mental health of perimenopausal women [14]. Therefore, multidisciplinary team collaboration and multi-level intervention may be the key strategy to implement comprehensive perimenopausal health management [48], so as to alleviate the negative impact of chronic diseases on perimenopausal women.

Our study also found that the spouses of community perimenopausal women in the falling sleep and maintenance difficulty and poor sleep quality with sleep disorder groups had worse health status than those in the good sleep group, with 1.880 times worse in the falling sleep and maintenance difficulty group and 2.130 times worse in the poor sleep quality with sleep disorder group. Studies have shown that there is a certain correlation between poor husband's health and abnormal sleep in perimenopausal women [16]. When the health status of their spouse deteriorated, the sleep quality of women also decreased synchronously, indicating a bidirectional association. When a spouse has chronic diseases (such as cardiovascular and cerebrovascular diseases), women need to provide frequent nighttime care, which leads to sleep fragmentation. In addition, spouse disease may increase family economic pressure and further induce anxiety insomnia. Couples who live together for a long time develop similar circadian rhythms. A UK Biobank study of 47,420 couples found significant sleep-wake synchrony, which reduced nighttime interference and improved sleep efficiency [47]. Therefore, community nursing staff need to encourage perimenopausal women and their spouses to actively participate in health management, seek nursing support from family, society or professional institutions, share the care pressure and reduce the psychological burden of both sides. Family members other than lovers should be considered in perimenopausal women's health education to encourage them to understand the experience of perimenopausal women, and to establish a higher quality social support system for perimenopausal women, so that they can be freed from the heavy burden of physical and mental pressure. Improve the family care of perimenopausal women by family members (especially their spouses), fully understand the various physical and mental changes they face, take targeted measures to improve the sleep quality of

perimenopausal women, promote the physical and mental health of perimenopausal women [49].

With the continuous decline of estrogen levels and the disorder of autonomic nervous function, perimenopausal women are often prone to mood fluctuations, such as irritability, suspicion, anxiety and depression. These psychological problems have gradually become the focus of public attention. Studies have pointed out that there is a close relationship between mental state and physical health, and long-term anxiety may lead to physical health problems [50]. Anxiety is one of the common psychological problems in perimenopausal women, which is mainly manifested as nervousness, fear, worry and irritability, etc. It is related to women's personal characteristics, life pressure, family relationship and social support [51]. The results of this study showed that compared with the good sleep quality group, the anxiety of the perimenopausal women in the falling sleep and maintenance difficulty group was 4.358 times higher than that of the good sleep quality group, and the anxiety of the Poor sleep quality with sleep disorder group was 19.512 times higher than that of the good sleep quality group. This finding is similar to that in a previous study [19]. In a sampling study conducted by Simbar et al. [52], the proportion of women with mild to severe anxiety in perimenopausal women was as high as 83.70%. In this study, the prevalence of anxiety in community perimenopausal women was 24.20%, which was higher than another study in China [53]. Anxiety may lead to sleep disorders in perimenopausal women, such as difficulty falling asleep, lack of sleep and poor sleep quality, and affect their daytime function [54]. As a result, perimenopausal women have cognitive dysfunction such as distraction, memory decline and slow thinking, which affects their work efficiency. Body discomfort such as palpitation, shortness of breath, dizziness and stomachache may affect their health.

In addition, anxiety not only aggravates the physical discomfort of perimenopausal women, affects their sleep quality and social function, but also reduces their self-esteem and self-confidence, and even leads to more serious psychological disorders such as depression [53]. A number of previous studies have shown that depression is an influencing factor for sleep disorders in perimenopausal women [9, 10, 30, 55]. However, in this study, it was not concluded that depression is a risk factor for poor sleep quality in community perimenopausal women. Due to the heterogeneity of the study population, some previous studies were based on outpatients or hospital patients [30, 55], who usually seek medical treatment actively due to prominent symptoms, have more severe depression, and are more likely to be associated with sleep disorders. However, the community sample included more participants with mild symptoms

or who did not seek medical treatment, and the degree of depression may be generally mild, leading to the dilution of the association. Future studies can refine the stratification and design of research subjects, include depression patients in the hospital to compare the differences in the community population, and dynamically monitor the association between depression and sleep quality.

Depression and anxiety are common mood disorders in perimenopausal women. At the same time, sleep disorders themselves are also typical symptoms of population with depression and anxiety. A multi-center study showed that there was a causal relationship between sleep quality and depression and anxiety in perimenopausal women, which influenced each other and formed a vicious circle [56]. Long-term poor sleep quality increases the risk of diabetes, cardiovascular disease, depression, anxiety, heart attack, obesity, and stroke [57]. Perimenopausal women are in an important stage of social role transformation, family and work pressure, and multiple objective negative factors are easy to lead to anxiety and depression. Therefore, during the perimenopausal period, women need to pay attention to their psychological status and actively seek social support, so as to better cope with the challenges brought by physiological changes and improve their sleep quality. At the same time, family members, friends and social organizations should also give more care and support to perimenopausal women in the community to help them go through this special physiological stage.

In this study, variables such as age, physical exercise, recreation and leisure activities, coping style and depression had no effect on the sleep quality trajectory of perimenopausal women in the community. However, other studies have shown that age, physical exercise, social activities and depression affect the sleep quality of perimenopausal women [19, 58]. This may be due to the heterogeneity of the study sample leading to differences in results, and the particularity of the community environment and cultural background, which makes the effect mechanism of related variables on sleep quality in this study different from that of the outpatient and inpatient population in other studies. The measurement methods of variables were different, and the evaluation criteria of indicators such as physical exercise, recreational leisure activities, coping style and depression status in this study were different from those in other studies. In the future, we can expand the sample size, refine the stratification, unify the variable measurement standards, and combine the longitudinal tracking design to further explore the mechanism of the variable's influence on the sleep quality of perimenopausal women in the community.

Limitations

However, this study still has some shortcomings. First of all, this study is mainly cross-sectional, with small sample size and limited coverage. In addition, the Pittsburgh Sleep Quality Index (PSQI) is self-reported by the respondents, and some subjective items and options may cause bias. To longitudinally analyze the potential characteristics of sleep disorders in perimenopausal women in the community at different time points, comprehensively analyze the various factors affecting the sleep quality of perimenopausal women in the community, and verify the scientific validity and feasibility of this study. Secondly, this study adopted a convenient sampling method of continuous selection, which improved the feasibility and efficiency of the study to a certain extent, but may limit the extrapolation of the study results. In addition, the measurement tool used in this study was insufficient to verify, and it is necessary to further verify and improve the tool in follow-up studies. In addition, in the process of data collection, although we have taken certain measures to ensure the integrity and accuracy of data, data missing inevitably occurred, which may have a certain impact on the accuracy and reliability of the research results. Follow-up studies should pay more attention to the integrity of data collection process and adopt pre-survey to optimize the questionnaire design to reduce missing. Finally, this study failed to fully consider and introduce appropriate moderator variables for analysis, resulting in relatively superficial interpretation of the relationship between variables and failure to fully tap the depth and breadth of the research question. Therefore, it is necessary for future studies to adopt a more rigorous design and more comprehensive data collection, and further conduct sensitivity analysis and moderator variable analysis to reveal the influencing factors of sleep quality in community perimenopausal women more comprehensively and deeply.

Conclusions

Although our study has some limitations, it is still innovative and valuable for practice. Some previous studies were based on outpatient or inpatient perimenopausal women, who usually seek medical treatment actively due to prominent symptoms, and sleep problems are more prominent. The innovation of our study is to focus on perimenopausal women who live in the community for a long time, and understand the potential profile of sleep quality in this special group. To the best of our knowledge, there are few studies on the potential profile analysis and influencing factors of sleep quality in community perimenopausal women in China. The prevalence of sleep disorders in perimenopausal women in the community is 31.3%, which is close to the prevalence of sleep disorders in the hospital outpatient department, which is

33.2%. This indicates that most perimenopausal women do not take the initiative to see a doctor for sleep problems, and it is necessary to strengthen the publicity and education for this group to improve their awareness and health seeking awareness. At the same time, community samples better reflect the real situation of the general population, which can provide reliable data for follow-up research and enhance the universality of conclusions. In addition, this study concluded that there were three different latent profiles of sleep quality in perimenopausal women in the community (good sleep quality group, falling sleep and maintenance difficulty group, poor sleep quality with sleep disorder group), and drinking history, chronic disease, poor spouse health, and anxiety had predictive effects on their latent profiles. In the future, community nurses can provide personalized nursing services for them, which is of great significance to improve the sleep quality and health of perimenopausal women in the community.

Abbreviations

PSQI	Pittsburgh sleep quality index
RMB	Renminbi
SAS	Self-ating anxietyscale
SCSQ	Simplified coping style questionnaire
PC	Positive coping
NC	Negative coping
AIC	Akaike information criterion
BIC	Bayesian information criterion
aBIC	Adjusted Bayesian information criterion
LMR	Lo-Mendel-Rubin Test
BLRT	Bootstrap likelihood ratio test

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Authors' contributions

S.D.H.—conception, design, drafting the article. **S.D.H.**—**Z.H.S.**—**J.J.L.**—**Z.Y.W.**—**G.J.M.**—data collection. **S.D.H.**—**X.T.S.**—**S.T.T.**—**J.Z.L.**—conception, design, data analysis and interpretation, drafting the article. **S.D.H.**—**S.T.T.**—**J.Z.L.**—conception, design, interpretation of data, critical revision of the draft. **S.D.H.**—**J.Z.L.**—design, data analysis and interpretation, drafting the article. 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 on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Declarations

Ethics approval and consent to participate

In accordance with the Declaration of Helsinki, this research was approved by the Ethics Committee of Bengbu Medical University, Anhui Province, China (approval no. 2025 – 262). All participants were informed of the purpose

of the study before recruitment, and all participants were asked to voluntarily sign a written consent form. To protect the participants' privacy, all collected data were preserved anonymously and confidentially.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

- Kong B, Ma Ding, Duan Tao. *Obstetrics and Gynecology* (The 10th Edition). Beijing: People's Medical Publishing House; 2024:391–2.
- Wang Xixi L, Jinzhi. Research progress on bio-psycho-social factors affecting the occurrence of perimenopausal syndrome. *J Bengbu Med Coll*. 2016;41(03):419–420. <https://doi.org/10.13898/j.cnki.Issn.1000-2200.2016.03.046>.
- Harrington YA, Parisi JM, Duan D, Rojo-Wissar DM, Holingue C, Spira AP. Sex Hormones, Sleep, and memory: interrelationships across the adult female lifespan. *Front Aging Neurosci*. 2022;14:800278. <https://doi.org/10.3389/fnagi.2022.800278>.
- Zhao M, Sun M, Zhao R, Chen P, Li S. Effects of exercise on sleep in perimenopausal women: A meta-analysis of randomized controlled trials. *Explore (NY)*. 2023;19(5):636–45. <https://doi.org/10.1016/j.explore.2023.02.001>.
- Salari N, Hasheminezhad R, Hosseini-Far A, Rasoulpoor S, Assefi M, Nankali S. Global prevalence of sleep disorders during menopause: a meta-analysis. *Sleep Breath*. 2023;27(5):1883–97. <https://doi.org/10.1007/s11325-023-02793-5>.
- Chen R. Interpretation on the 2023 Chinese menopause symptom management and menopausal hormone therapy guidelines. *Med J PUMCH*. 2023;24(3):514–9. <https://doi.org/10.12290/xhyzz.2023-0190>.
- Climacteric Health Care Branch of Chinese Preventive Medicine Association. Gynecologic endocrinology and fertility professional committees of China association for promotion of health science and Technology, professional committees of Beijing association of the integrating of traditional and Western Medicine. Chinese expert consensus on clinical management of menopause-related insomnia. *Chin Gen Pract*. 2023;26(24):2951–8. <https://doi.org/10.12114/j.issn.1007-9572.2023.0192>.
- Joffe H, Massler A, Sharkey KM. Evaluation and management of sleep disturbance during the menopause transition. *Semin Reprod Med*. 2010;28(5):404–21. <https://doi.org/10.1055/s-0030-1262900>.
- Zeng W, Xu J, Yang Y, Lv M, Chu X. Factors influencing sleep disorders in perimenopausal women: a systematic review and meta-analysis. *Front Neurol*. 2025;16:1460613. <https://doi.org/10.3389/fneur.2025.1460613>.
- Hwang JH, Lee K, Choi E, Cho HN, Park B, Rhee Y, et al. Sleep quality and associated factors in Premenopausal, Perimenopausal, and postmenopausal women in Korea: findings from the K-Stori 2016. *Nat Sci Sleep*. 2021;13:1137–45. <https://doi.org/10.2147/NSS.S298397>.
- Ren Hongfang J, Miaofang F. To study the status and influencing factors of sleep disorders in patients with perimenopausal syndrome. *Maternal Child Health Care China*. 2023;38(02):359–62. <https://doi.org/10.19829/j.zgfybj.issn.1001-4411.2023.02.045>.
- Li Y, Jingjing H, Minna C, Qingpin Y, Fei W, Chen F, et al. Relationship between both quality and duration of sleep and type 2 diabetes in middle-aged and elderly people in Shanghai. *Chin J Epidemiol*. 2020;41(8):1261–5.
- Andreozzi F, Van Overstraeten C, Ben Youssef S, Bold I, Carlier S, Gruwez A, et al. African ethnicity is associated with a higher prevalence of diabetes in obstructive sleep apnea patients: results of a retrospective analysis. *Sleep Breath*. 2020;24(3):857–64. <https://doi.org/10.1007/s11325-019-01912-5>.
- Mengmeng H, Huihui C, Deyun B. Analysis on the related influencing factors of perimenopausal syndrome in women and the effect of health management intervention. *Med Innov China*. 2020;17(16):026–30. <https://doi.org/10.3969/j.issn.1674-4985.2020.16.007>.

15. Weng Jing. The influence of perimenopausal sleep disorder on women's. *Phys Mental Health*. 2019;6(10):1483–4. 10.3969/j.issn.2095-7130.2019.10.070.
16. Kong Jing J, Xiaohong W, Jiangping. Effects of living conditions on the sleep pattern in the perimenopausal women. *Mod M Edical J*. 2014;42(11):1262–6. <https://doi.org/10.3969/j.issn.1671-7562.2014.11.002>.
17. Mechanic D. Social policy, technology, and the rationing of health care. *Med Care Rev*. 1989;46(2):113–20. <https://doi.org/10.1177/107755878904600202>.
18. Xianghua F, Chen M, Xianghong L, Xiaoguang W, Hongjun L, Lijun D et al. Study on the relationship between self-rated health situation and health status in the elderly-an 8-year follow-up study from multidimensional longitudinal study of aging in Beijing. *Chin J Epidemiol*, 2003;(03):19–23. doi:CNKI:SUN:ZHLX.0.2003-03-009.
19. Mao Xuefeng S, Lu Z, Xin L, Xiaoping Z, Qian Z, Jintang, et al. Sleep quality and influencing factors of Perimenopausal women in Ningbo region. *J Zhejiang University(Medical Sciences)*. 2011;40(01):85–9. doi:CNKI:SUN:ZJYB.0.2011-01-019.
20. Cui Degang Q, Fen Q, Fubing T, Xiuqi L, Jing Z, Xiaoxiao, et al. Mental Health, quality of life and Well-being of recreational physical activity for adults using ICF: A systematic review. *Chin J Rehabil Theory Pract*. 2021;27(09):1038–47. <https://doi.org/10.3969/j.issn.1006-9771.2021.09.007>.
21. Ping Y, Liang C, Fan X, Zhang L, Ying D, Wang Z. Can acupuncture improve sleep quality and anxiety among women during perimenopause? A protocol for systematic review and meta-analysis. *Med (Baltim)*. 2022;101(2):e28449. <https://doi.org/10.1097/MD.00000000000028449>.
22. Sander B, Muftah A, Sykes Tottenham L, Grummisch JA, Gordon JL. Testosterone and depressive symptoms during the late menopause transition. *Biol Sex Differ*. 2021;12(1):44. <https://doi.org/10.1186/s13293-021-00388-x>.
23. Committee for Promoting Healthy China Action. Healthy China Initiative (2019–2030) [Z/OL]. National Health Commission of the People's Republic of China. <https://www.nhc.gov.cn/guihuaxs/c100133/201907/2a6ed52fc264203b5351bdbbadd2da8.shtml>.
24. Li X, Hongqiong W, Ke S. The study advances in clinical heterogeneity of insomnia patients. *Chin J Diagnostics(Electronic Edition)*. 2019;7(3):159–63. 10.3877/cma.jissn.2095-655X.2019.03.005.
25. Zhao Jie L, Lu Z, Xiaona F, Xiangkan L, Xindan L. Use of cluster analysis in nursing research: a literature review. *Mod Clin Nurs*. 2021;20(9):75–80. <https://doi.org/10.3969/j.issn.1671-8283.2021.09.014>.
26. Zhang Shan L, Lu WY. Latent profile analysis based on visual analysis on research hotspots in nursing field and implications for nursing education. *Health Vocat Educ*. 2025;43(08):83–8. <https://doi.org/10.20037/j.issn.1671-1246.2025.08.23>.
27. Song L, Luo Q, Liu C, Zhou Y, Huang D, Ju C, et al. Quality of life and its association with predictors in lung transplant recipients: a latent profile analysis. *Front Public Health*. 2024;12:1355179. <https://doi.org/10.3389/fpubh.2024.1355179>.
28. Gu ZH, Wang JY, Yang CX, Wu H. Study on the profiles of sleep Disorders, associated Factors, and pathways among gynecological cancer Patients - A latent profile analysis. *Nat Sci Sleep*. 2024;16:599–611. <https://doi.org/10.2147/NSS.S457651>.
29. Thurston RC, Chang Y, Kline CE, Swanson LM, El Khoudary SR, Jackson EA, et al. Trajectories of sleep over midlife and incident cardiovascular disease events in the study of women's health across the Nation. *Circulation*. 2024;149(7):545–55. <https://doi.org/10.1161/CIRCULATIONAHA.123.066491>.
30. Jinli H, Lixiang Z, Jiebai S, Fangli L. Analysis on the potential trajectory categories and predictive indicators of sleep disorders in perimenopausal Women[J]. *Maternal and child health care of China*. 2025;40(07): 1314–8. <http://doi.org/10.19829/j.zgfybj.issn.1001-4411.2025.07.038>.
31. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med*. 2013;35(2):121–6. <https://doi.org/10.4103/0253-7176.116232>.
32. Zung WW. A rating instrument for anxiety disorders. *Psychosomatics*. 1971;12(6):371–9. [https://doi.org/10.1016/S0033-3182\(71\)71479-0](https://doi.org/10.1016/S0033-3182(71)71479-0).
33. Duan Quanquan SL. Differential validity of SAS and SDS among psychiatric non-psychotic outpatients and their partners. *Chinese Mental Health Journal*. 2012;26(09):676–679. doi: 10.3969/j.issn.1000-6729.2012.09.007.
34. Zung WW. A self-rating depression, scale. *Arch Gen Psychiatry*. 1965;12:63–70. <https://doi.org/10.1001/archpsyc.1965.01720310065008>.
35. Xie Yaning. A preliminary study on the reliability and validity of the simple coping style scale. *Chin J Clin Psychol*. 1998;0253–4. <https://doi.org/10.16128/j.cnki.1005-3611.1998.02.018.114>.
36. Folkman S, Lazarus RS. Manual for the ways of coping questionnaire. Palo Alto, CA: Consulting Psychologists; 1988.
37. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4).
38. Liu Xianchen T, Maoqin H, Lei W, Hongxin Z, Guifang G, Chunni, et al. Reliability and validity of the Pittsburgh sleep quality index. *Chin J Psy*. 1996;29(2):103–7.
39. Muthén LK, Muthén BO. *MuthénStatistical analyses with latent variables. Mplus user's Guide: 4th Edition*, Los Angeles, CA: Muthén & Muthén, 1998:17–38.
40. Ding CS. *Fundamentals of applied multidimensional scaling for educational and psychological research*. Cham, Switzerland: Springer International Publishing/Springer Nature; 2018.
41. Lo YT. Likelihood ratio tests of the number of components in a normal mixture with unequal variances. *STAT PROBABIL LETT*. 2005;71(3):225–35.
42. Sun D, Shao H, Li C, Tao M. Sleep disturbance and correlates in menopausal women in Shanghai. *J Psychosom Res*. 2014;76(3):237–41. <https://doi.org/10.1016/j.jpsychores.2013.12.002>.
43. Kravitz HM, Ganz PA, Bromberger J, Powell LH, Sutton-Tyrrell K, Meyer PM. Sleep difficulty in women at midlife: a community survey of sleep and the menopausal transition. *Menopause*. 2003;10(1):19–28. <https://doi.org/10.1097/00042192-200310010-00005>.
44. Madaeva IM, Semenova NV, Kolesnikova LI. Ethnic features of sleep disorders in climacteric women. *Zh Nevrol Psikhiatr Im S S Korsakova*. 2019;119(4):244–9. <https://doi.org/10.17116/jnevro.201911904244>.
45. Gallicchio L, Kalesan B. Sleep duration and mortality: a systematic review and meta-analysis. *J Sleep Res*. 2009;18(2):148–58. <https://doi.org/10.1111/j.1365-2869.2008.00732.x>.
46. Alison K, Shea W, Wolfman M, Fortier CN, Soares. Guideline No.422c: menopause: mood, sleep, and cognition. *J Obstet Gynecol Can*. 2021;43(11):1316–e13231. <https://doi.org/10.1016/j.jogc.2021.08.009>.
47. Richmond RC, Howe LJ, Heilbron K, Jones S, Liu J. 23andMe research Team, et al. Correlations in sleeping patterns and circadian preference between spouses. *Commun Biol*. 2023;6(1):1156. <https://doi.org/10.1038/s42003-023-05521-7>.
48. Chinese Medical Doctor Association(CMDA)'s General Practitioners Sub-association. The primary care branch of Beijing Institute of obstetrics & Gynecology. Consensus on health management in climacteric women in primary medical institutions edition. *Chin Gen Pract*. 2021;24(11):1317–24. <https://doi.org/10.12114/j.issn.1007-9572.2021.00.402>.
49. Jiang Guilin Q, Ruxiao. Effect of perimenopausal syndrome symptoms and family care on sleep quality. *J Community Med*. 2020;18(24):1635–8. <https://doi.org/10.19790/j.cnki.JCM.2020.24.01>.
50. Caretto M, Giannini A, Simoncini T. An integrated approach to diagnosing and managing sleep disorders in menopausal women. *Maturitas*. 2019;128:1–3. <https://doi.org/10.1016/j.maturitas.2019.06.008>.
51. Wang H, Zhang Q, Lin Y, Liu Y, Xu Z, Yang J. Keep moving to retain the healthy self: the influence of physical exercise in health anxiety among Chinese menopausal women. *Behav Sci (Basel)*. 2023;13(2):140. <https://doi.org/10.3390/bs13020140>.
52. Simbar M, Nazarpour S, Alavi Majd H, Dodel Andarvar K, Jafari Torkamani Z, Alsadat Rahnemai F. Is body image a predictor of women's depression and anxiety in postmenopausal women? *BMC Psychiatry*. 2020;20(1):202. <https://doi.org/10.1186/s12888-020-02617-w>.
53. Weiying P, Ying C. To explore the effects of psychological counseling combined with physical exercise on the quality of life and negative emotions of perimenopausal women. *Maternal Child Health Care China*. 2022;37(11):2104–7. <https://doi.org/10.19829/j.zgfybj.issn.1001-4411.2022.11.049>.
54. Ying C, Weiying P. To analyze the incidence and influencing factors of anxiety in perimenopausal women. *Maternal Child Health Care China*. 2022;37(13):2341–4. <https://doi.org/10.19829/j.zgfybj.issn.1001-4411.2022.13.005>.
55. Liu Jing H, Lu Z, Xiuhua C, Zhengmao. Tang wei. Perimenopausal women anxiety depression mood sleep quality epidemiological investigation and influencing factors analysis. 2023;38(08):1524–8. <https://doi.org/10.19829/j.zgfybj.issn.1001-4411.2023.08.043>.
56. Wang M, Kartsonaki C, Guo Y, Lv J, Gan W, Chen ZM, et al. Factors related to age at natural menopause in china: results from the China kadoorie biobank. *Menopause*. 2021;28(10):1130–42. <https://doi.org/10.1097/GME.0000000000001829>.

57. Baron KG, Reid KJ. Circadian misalignment and health. *Int Rev Psychiatry*. 2014;26(2):139–54. <https://doi.org/10.3109/09540261.2014.911149>.
58. Tandon VR, Sharma S, Mahajan A, Mahajan A, Tandon A. Menopause and sleep disorders. *J Midlife Health*. 2022;13(1):26–33. https://doi.org/10.4103/jmhjh_18_22.

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