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## Associations among menopausal status, menopausal symptoms, and depressive symptoms in midlife women in Hunan Province, China

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### ABSTRACT

**Objective:** This study aimed to determine the associations among menopausal status, menopausal symptoms, and depressive symptoms in midlife women in Hunan, China.

**Methods:** A secondary analysis involving 3199 women aged 40–55 years was performed based on data from the Women Health Needs Survey 2018 in Hunan Province, central south China. The depressive symptoms were determined using the 9-item Patient Health Questionnaire. The menopausal symptoms were assessed using the Kupperman Menopausal Index. Demographic characteristics and menopausal status were measured using self-administered questionnaires.

**Results:** The prevalence of depressive symptoms was 19.3%. The three most common menopausal symptoms were insomnia (48.0%), fatigue (42.7%), and mood swing (39.8%). The increase in depressive symptoms was significantly associated with menopausal status and menopausal symptoms. After controlling for demographic variables, multivariate logistic regression showed that menopausal transition (odds ratio [OR] = 1.14, 95% confidence interval [95% CI] = 1.12–1.86), postmenopause (OR = 1.52, 95% CI = 1.09–2.11), and four menopausal symptoms including mood swing (OR = 1.32, 95% CI = 1.03–1.70), depressive mood (OR = 2.28, 95% CI = 1.79–2.91), palpitations (OR = 1.37, 95% CI = 1.06–1.77), and urinary tract infection (OR = 1.49, 95% CI = 1.16–1.92) were associated with depressive symptoms.

**Conclusions:** Independent of demographic variables, menopausal transition, postmenopause, and four menopausal symptoms (mood swing, depressive mood, palpitations, and urinary tract infection) increase the risk of depressive symptoms.

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### Introduction

According to the Global Burden of Disease Study 2013, depression is one of the most common mental illnesses<sup>1,2</sup>. Although depressive symptoms are not equal to depression, they represent an adverse effect of depression<sup>3,4</sup>. In addition, epidemiologic and clinic data show that depressive symptoms might increase the risk of cardiovascular diseases, diabetes, metabolic syndrome, and chronic pain, which have become a significant health burden<sup>5,6</sup>. Evidence suggests that women are at higher risk for depressive symptoms than men, with a higher lifetime prevalence including middle age<sup>7–9</sup>. Thus, it is important to examine the risk factors of depressive symptoms among midlife women.

A variety of factors have been identified to increase the risk of depressive symptoms among midlife women, such as poor education, unemployment<sup>10,11</sup>, living alone<sup>12</sup>, lacking regular exercise<sup>13</sup>, second-hand smoke<sup>14</sup>, a history of postpartum depression<sup>12</sup>, having multiple chronic diseases, and lacking social support<sup>15</sup>. Additionally, great attention has also been paid to exploring the associations between menopausal status, menopausal symptoms, and depressive symptoms among midlife women. Several studies showed that the prevalence of depressive symptoms varied across the

menopausal status<sup>16,17</sup>, while other studies failed to identify the association<sup>4,18,19</sup>. In addition, other studies reported that depressive symptoms in midlife women may be more strongly associated with menopausal symptoms than menopausal status<sup>20,21</sup>. Consequently, there has been no definitive consensus on whether depressive symptoms were related to menopausal status and menopausal symptoms<sup>9</sup>.

To our knowledge, related studies have been conducted elsewhere in China, such as Beijing<sup>22</sup>, Jiangsu<sup>23</sup>, Hong Kong<sup>15</sup>, and Taiwan<sup>25,26</sup>, with conflicting results. Zang *et al.*<sup>23</sup> found that women who experienced menopausal symptoms (poor sleep and hot flashes) were more likely to report depressive symptoms while menopausal status was not associated with depressive symptoms. On the contrary, Lin *et al.*<sup>26</sup> found that depressive symptoms were significantly associated with menopausal status. Furthermore, limitations exist in the previous research, such as focusing on special groups including women who lived in rural area<sup>23</sup> or who were Taiwanese aborigines<sup>24</sup>, a small sample size<sup>24,25</sup>, and selection bias<sup>22,25</sup> (recruiting participants from hospital rather than communities). Hence, the results cannot be generalized to the general population. Although there have been two population-based studies conducted in Taiwan<sup>26</sup> and Beijing<sup>8</sup>, respectively, the results based on data from more

than 10 years ago may not reflect the present situation. Our study is based on data from a large-scale survey among general midlife women, which may fill the gaps in existing research and provide the latest evidence.

Thus, the objective of our study is to determine the associations among menopausal status, menopausal symptoms, and depressive symptoms in general midlife women in Hunan province, China.

## Methods

### Participants

Data were obtained from the Women Health Needs Survey (WHNS) 2018, provided by the relevant government departments, Hunan Province. The survey was designed to investigate the most serious and common health problems faced by women of different age groups (10–19 years, 20–39 years, 40–49 years, and 50–70 years) and their health needs. It was conducted between May and August 2018. A multi-stage stratified random sampling method was used. First, one prefecture-level city was randomly selected from the eastern, western, southern, northern, and central regions of Hunan Province, respectively, as the primary sampling unit (PSU). Second, a district (urban area) and a county (rural area) in each PSU were randomly selected. Third, 20 communities were randomly selected from five sampled districts and five counties. The random method was the random number table method. Finally, all eligible women were recruited from each sampled community until the required sample size was reached (no less than 250 women per age group within each PSU were needed according to the project implementation document). The following eligibility criteria were applied at recruitment: women aged 10–70 years; current residents in Hunan Province; and able to complete the questionnaires independently or with the help of the investigators. Approval from the Institutional Review Board of the local organization where the researchers were affiliated was obtained. We used the data with permission which did not need separate ethical approval.

A total of 10,089 women aged 10–70 years were recruited. We selected 3447 women aged 40–55 years from the original WHNS database who were surveyed about their demographic data, menopausal status, menopausal symptoms, and depressive symptoms. Then we excluded 248 subjects based on the following exclusion criteria: incomplete data ( $n = 121$ ); women who had gynecological tumors ( $n = 34$ ) or breast cancer ( $n = 9$ ); women who took estrogen in the past 6 months ( $n = 15$ ); and women who were in artificial menopause ( $n = 69$ ). In total, 3199 women aged 40–55 years were included in the analysis. A flow chart depicting the selection of the participants is shown in [Figure 1](#).

### Sample size calculation

Because our research was a secondary analysis of the WHNS database, the sample size was predetermined by the size of the original study. The sample size estimation for the current study analysis was based on the methodology (multivariate

logistic regression) and was calculated using G\*Power 3.1. To detect a statistically significant relationship in a regression model, we assumed an odds ratio of 1.97 with a two-sided  $\alpha$ -level of 0.05 and 80% power based on the previous study<sup>26,27</sup>. According to the calculation, 117 participants were required per sampled district and per county. In total, 1170 participants were required in the five sampled districts and five sampled counties. Considering 20% non-responses, 1344 participants were needed. In fact, 3199 women aged 40–55 years were included in the analysis in the present study. Therefore, the predetermined sample size was sufficient.

### Procedure

Data collection was implemented by well-trained community health workers, with local familiarity. The training content included the purpose and procedures of the current study and the methods to collect questionnaires. Women were recruited through direct door-to-door visits. Informed consent was obtained.

### Measurements

#### *The general conditions questionnaire*

The general conditions questionnaire was self-designed and used to describe the demographic characteristics of the participants. The questionnaire included: age, height, weight, ethnicity, education, employment status, marital status, average monthly household income, smoking status, drinking status, and chronic diseases. Body mass index (BMI) was calculated as body weight in kilograms divided by the square of height in meters. The BMI was divided into four grades according to the China's Ministry of Health Disease Control Department criteria as follows:  $BMI < 18.5 \text{ kg/m}^2$  (underweight),  $18.5 \leq BMI < 24 \text{ kg/m}^2$  (normal),  $24 \leq BMI < 28 \text{ kg/m}^2$  (overweight), and  $BMI \geq 28 \text{ kg/m}^2$  (obese)<sup>28</sup>. We classified participants who were educated for more than 12 years as having a high education level, otherwise as having a low education level. Marital status was classified as being married (including married, remarried, and cohabitation) and being single (including single, separated, divorced, or widowed). Women who responded 'yes' to the question 'Has the doctor or other health care professionals ever told you that you had any of the following diseases (hypertension, coronary heart disease/stroke, diabetes, thyroid disorders, rarefaction of bone, joint pain, oral disease, nephropathy, gastrosis)' were classified as having chronic diseases.

#### *Menopausal status*

Menopausal status was categorized by the Stages of Reproductive Ageing Workshop + 10 criteria as follows<sup>29</sup>: the late reproductive stage (divided into two stages: stage 3b, menstrual cycles remained regular without change in length or early follicular phase follicle-stimulating hormone levels; stage 3a, there were subtle changes in menstrual cycle); menopausal transition (divided into two stages: early menopausal transition, marked by increased variability in

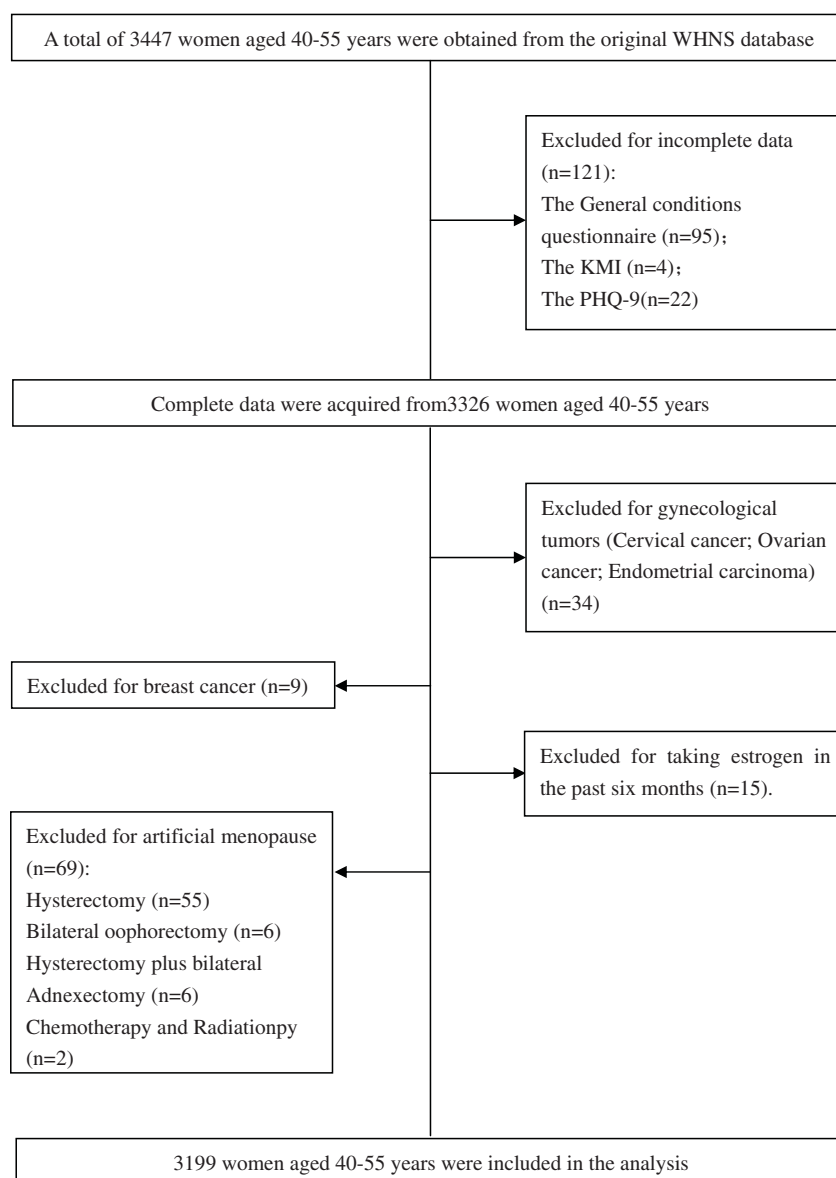


Figure 1. Flow chart for the selection of study participants.

menstrual cycle length, defined as a persistent difference of 7 days or longer in the length of consecutive cycles; late menopausal transition, defined as having an interval of amenorrhea of 60 days or more); and postmenopause, corresponding to the period after the last menstrual cycle. Limited by original data, we roughly divided the menopause stages into the late reproductive stage, menopausal transition, and postmenopause.

**The Kupperman Menopausal Index.** This scale was originally developed by Delaplane *et al.*<sup>30</sup> in 1952 and revised by Wiklund *et al.*<sup>31</sup> in 1993. The Kupperman Menopausal Index has been widely used to evaluate the frequency of menopausal symptoms among Chinese women<sup>32,33</sup>. The Index contains 13 symptoms such as hot flashes and night sweats, paresthesia, insomnia, and so on. Participants respond to each symptom on a 4-point scale<sup>34</sup>: 0, not at all; 1, sometimes; 2, often; 3, always. The current study classified midlife women as having a symptom for those whose symptom

scores were  $\geq 0$ <sup>35</sup>. For example, if a women responded to the question 'paresthesia' as 1, 2, or 3, we classified that she had paresthesia. A Cronbach's  $\alpha$  value of 0.88 was found in the present study, which suggested good reliability.

**The 9-item Patient Health Questionnaire.** The 9-item Patient Health Questionnaire (PHQ-9) is a self-report questionnaire to assess depressive symptoms over the past 2 weeks<sup>36</sup>. This scale has been translated by scholars in mainland China and the Chinese version of the PHQ-9 has been widely used<sup>37</sup>. Participants responded to each question on a 4-point scale<sup>14</sup>: 0, not at all; 1, on several days; 2, on more than half of the days; or 3, nearly every day. The total scores of the PHQ-9 were the sum of scores for each item. The participants in the present study were categorized into two groups: non-depressive symptoms (the total scores were  $< 5$ ) and depressive symptoms (the total scores were  $\geq 5$ )<sup>12</sup>. A Cronbach's  $\alpha$  value of 0.86 was found in the present study, which suggested good reliability.

## Statistical analysis

Data were analyzed using SPSS 20.0. We used descriptive statistics to summarize the characteristics of participants. The chi-square test was used to analyze differences of characteristics across women with depressive symptoms or not. We used univariate logistic analysis to determine whether menopausal status and menopausal symptoms were associated with depressive symptoms. Multivariate logistic regression was used to control for demographic variables to examine whether menopausal status and menopausal symptoms were independently associated with depressive symptoms. A two-tailed  $p$ -value  $< 0.05$  was considered significant.

## Results

We conducted the analysis among 3199 women aged 40–55 years (in total, 248 women were excluded from the 3477 women aged 40–55 years based on the exclusion criteria). The mean age was  $46.54 \pm 4.31$  years. Among these

participants, 1869 (58.4%) were in the late reproductive stage, 724 (22.6%) were in menopausal transition, and 606 (19.0%) were in postmenopausal status. Demographic characteristics are presented in Table 1. The three most common menopause symptoms were insomnia (48.0%), fatigue (42.7%), and mood swing (39.8%) (Table 2).

The total scores for the PHQ-9 ranged from 0 to 23 with a median score of 2 (interquartile range 0–4). Overall, the prevalence of depressive symptoms among midlife women was 19.3% (the total scores of the PHQ-9 were  $\geq 5$ ). Depressive symptoms were most common in postmenopausal women compared to the women who were in the late reproductive stage and menopausal transition ( $\chi^2 = 45.95$ ,  $p = 0.000$ ). Distributions by age, BMI, education, employment status, marital status, smoking, drinking, and chronic diseases were significantly different between the two groups (Table 1). Midlife women with menopausal symptoms were more likely to suffer from depressive symptoms (Table 2).

The menopausal status and menopausal symptoms were statistically associated with depressive symptoms. After

**Table 1.** Demographic data of participants.

| Variable                               | Total       | With depressive symptoms <sup>f</sup> | Non-depressive symptoms <sup>g</sup> | $\chi^2$ | p-Value |
|--|-------------|---------------------------------------|--------------------------------------|----------|---------|
| Number of women                        | 3199        | 617 (19.3)                            | 2862 (80.7)                          |          |         |
| Menopausal status                      |             |                                       |                                      | 45.95    | 0.000   |
| Late reproductive stage                | 1869 (58.4) | 286 (15.3)                            | 1583 (84.7)                          |          |         |
| Menopausal transition                  | 724 (22.6)  | 178 (24.6)                            | 546 (75.4)                           |          |         |
| Postmenopause                          | 606 (19.0)  | 153 (25.2)                            | 453 (74.8)                           |          |         |
| Age (years)                            |             |                                       |                                      | 23.68    | 0.000   |
| 40–44                                  | 1205 (37.7) | 192 (15.9)                            | 1013 (84.1)                          |          |         |
| 46–49                                  | 1237 (38.7) | 237 (19.2)                            | 1000 (80.8)                          |          |         |
| 50–55                                  | 757 (23.6)  | 188 (24.8)                            | 569 (75.2)                           |          |         |
| BMI (kg/m <sup>2</sup> )               |             |                                       |                                      | 9.94     | 0.019   |
| <18.5 (underweight)                    | 108 (3.4)   | 31 (28.7)                             | 77 (71.3)                            |          |         |
| 18.5–24 (normal weight)                | 2225 (69.5) | 410 (18.4)                            | 1815 (81.6)                          |          |         |
| 24–28 (overweight)                     | 738 (23.1)  | 156 (21.1)                            | 582 (78.9)                           |          |         |
| $\geq 28$ (obese)                      | 128 (4.0)   | 20 (15.6)                             | 108 (84.4)                           |          |         |
| Ethnic                                 |             |                                       |                                      | 0.00     | 0.950   |
| Han                                    | 3141 (98.2) | 606 (19.3)                            | 2535 (80.7)                          |          |         |
| Minority                               | 58 (1.8)    | 11 (19.0)                             | 47 (81.0)                            |          |         |
| Education level                        |             |                                       |                                      | 16.27    | 0.000   |
| Low <sup>a</sup>                       | 2054 (64.2) | 354 (17.2)                            | 1700 (82.8)                          |          |         |
| High <sup>b</sup>                      | 1145 (35.8) | 263 (23.0)                            | 882 (77.0)                           |          |         |
| Employment status                      |             |                                       |                                      | 15.53    | 0.000   |
| Employed                               | 1768 (55.3) | 294 (16.6)                            | 1474 (83.4)                          |          |         |
| Unemployed                             | 1431 (44.7) | 323 (22.6)                            | 1108 (77.4)                          |          |         |
| Marital status                         |             |                                       |                                      | 4.062    | 0.044   |
| Being married <sup>c</sup>             | 2955 (92.4) | 558 (18.9)                            | 2397 (81.1)                          |          |         |
| Being single <sup>d</sup>              | 244 (7.6)   | 59 (24.2)                             | 185 (75.8)                           |          |         |
| Average monthly household income (RMB) |             |                                       |                                      | 4.15     | 0.126   |
| <3000                                  | 996 (31.1)  | 182 (18.3)                            | 814 (81.7)                           |          |         |
| 3000–5000                              | 949 (29.7)  | 171 (18.0)                            | 778 (82.0)                           |          |         |
| >5000                                  | 1254 (39.2) | 264 (21.1)                            | 990 (78.9)                           |          |         |
| Smoking                                |             |                                       |                                      | 4.75     | 0.029   |
| Not current smoker                     | 3085 (96.4) | 586 (19.0)                            | 2499 (81.0)                          |          |         |
| Current smoker                         | 114 (3.6)   | 31 (27.2)                             | 83 (72.8)                            |          |         |
| Drinking                               |             |                                       |                                      | 9.17     | 0.002   |
| Not current drinker                    | 2879 (90.0) | 535 (18.6)                            | 2344 (81.4)                          |          |         |
| Current drinker                        | 320 (10.0)  | 82 (25.6)                             | 238 (74.4)                           |          |         |
| Chronic diseases <sup>e</sup>          |             |                                       |                                      | 46.60    | 0.000   |
| No                                     | 2206 (69.0) | 355 (16.1)                            | 1851 (83.9)                          |          |         |
| Yes                                    | 993 (31.0)  | 262 (26.4)                            | 731 (73.6)                           |          |         |

<sup>a</sup>Participants who were educated for 12 years and less.

<sup>b</sup>Participants who were educated for more than 12 years.

<sup>c</sup>Being married included married, remarried, or cohabitation.

<sup>d</sup>Being single included unmarried, separated, divorced, or widowed.

<sup>e</sup>Participants who were told they have a disease (hypertension, coronary heart disease/stroke, diabetes, thyroid disorders, rarefaction of bone, joint pain, oral disease, nephropathy, gastrositis) by doctors or other health-care professionals.

<sup>f</sup>Total scores of the 9-item Patient Health Questionnaire were five or more.

<sup>g</sup>Total scores of the 9-item Patient Health Questionnaire were less than five.

**Table 2.** Menopausal symptoms of participants.

| Variable                     | Total       | With depressive symptoms <sup>a</sup> | Non-depressive symptoms <sup>b</sup> | $\chi^2$ | p-Value |
|------------------------------|-------------|---------------------------------------|--------------------------------------|----------|---------|
| Insomnia                     |             |                                       |                                      | 80.36    | 0.000   |
| No                           | 1664 (52.0) | 221 (13.3)                            | 1443 (86.7)                          |          |         |
| Yes                          | 1535 (48.0) | 396 (25.8)                            | 1139 (74.2)                          |          |         |
| Fatigue                      |             |                                       |                                      | 117.27   | 0.000   |
| No                           | 1833 (57.3) | 234 (12.8)                            | 1599 (87.2)                          |          |         |
| Yes                          | 1366 (42.7) | 383 (28.0)                            | 983 (72.0)                           |          |         |
| Mood swing                   |             |                                       |                                      | 151.56   | 0.000   |
| No                           | 1926 (60.2) | 237 (12.3)                            | 1689 (87.7)                          |          |         |
| Yes                          | 1273 (39.8) | 380 (29.9)                            | 893 (70.1)                           |          |         |
| Headache                     |             |                                       |                                      | 96.94    | 0.000   |
| No                           | 1936 (60.5) | 266 (13.7)                            | 1670 (86.3)                          |          |         |
| Yes                          | 1263 (39.5) | 351 (27.8)                            | 912 (72.2)                           |          |         |
| Dizziness                    |             |                                       |                                      | 82.49    | 0.000   |
| No                           | 2054 (64.2) | 299 (14.6)                            | 1755 (85.4)                          |          |         |
| Yes                          | 1145 (35.8) | 318 (27.8)                            | 827 (72.2)                           |          |         |
| Arthralgia and myalgia       |             |                                       |                                      | 93.41    | 0.000   |
| No                           | 2125 (66.4) | 308 (14.5)                            | 1817 (85.5)                          |          |         |
| Yes                          | 1074 (33.6) | 309 (28.8)                            | 765 (71.2)                           |          |         |
| Hot flashes and night sweats |             |                                       |                                      | 78.03    | 0.000   |
| No                           | 2300 (71.9) | 355 (15.4)                            | 1945 (84.6)                          |          |         |
| Yes                          | 899 (28.1)  | 262 (29.1)                            | 637 (70.9)                           |          |         |
| Paresthesia                  |             |                                       |                                      | 110.37   | 0.000   |
| No                           | 2394 (74.8) | 360 (15.0)                            | 2034 (85.0)                          |          |         |
| Yes                          | 805 (25.2)  | 257 (31.9)                            | 548 (68.1)                           |          |         |
| Depression                   |             |                                       |                                      | 254.48   | 0.000   |
| No                           | 2496 (78.0) | 334 (13.4)                            | 2162 (86.6)                          |          |         |
| Yes                          | 703 (22.0)  | 283 (40.3)                            | 420 (59.7)                           |          |         |
| Palpitations                 |             |                                       |                                      | 173.80   | 0.000   |
| No                           | 2521 (78.8) | 2155 (85.5)                           | 366 (14.5)                           |          |         |
| Yes                          | 678 (21.2)  | 251 (37.0)                            | 427 (63.0)                           |          |         |
| Sex life                     |             |                                       |                                      | 81.20    | 0.000   |
| No                           | 2525 (78.9) | 405 (16.0)                            | 2120 (84.0)                          |          |         |
| Yes                          | 674 (21.1)  | 212 (31.5)                            | 462 (68.5)                           |          |         |
| Urinary tract infection      |             |                                       |                                      | 123.77   | 0.000   |
| No                           | 2671 (83.5) | 423 (15.8)                            | 2248 (84.2)                          |          |         |
| Yes                          | 528 (16.5)  | 194 (36.7)                            | 334 (63.3)                           |          |         |
| Skin formication             |             |                                       |                                      | 128.52   | 0.000   |
| No                           | 2816 (88.0) | 461 (16.4)                            | 2355 (83.6)                          |          |         |
| Yes                          | 383 (12.0)  | 156 (40.7)                            | 227 (59.3)                           |          |         |

<sup>a</sup>Total scores of the 9-item Patient Health Questionnaire were five or more.

<sup>b</sup>Total scores of the 9-item Patient Health Questionnaire were less than five.

adjusting for demographic variables (age, BMI, ethnic, education, employment status, marital status, average monthly household income, smoking, drinking, and chronic diseases), the menopausal transition and postmenopause were still statistically associated with depressive symptoms. In addition, women during postmenopausal periods were most likely to suffer from depressive symptoms. After adjusting for demographic variables, four kinds of menopausal symptoms (mood swing, depressive mood, palpitations, and urinary tract infection) were still statistically associated with depressive symptoms. Nevertheless, the associations among other menopausal symptoms and depressive symptoms diminished (Table 3).

## Discussion

The study was a secondary analysis based on data from the large-scale WHNS 2018 in Hunan, China and highlighted the importance of a better understanding of the role of menopausal symptoms and menopausal status in depressive symptoms among general midlife women. The mean age of the 3199 midlife women was  $46.54 \pm 4.31$  years and 58.4%

were in late reproductive status, 22.6% were in menopausal transition, and 19.0% were postmenopausal. The characteristics of the women were comparable to the study conducted in Beijing, China<sup>22</sup>.

The prevalence of depressive symptoms among midlife women was 19.3%, which was lower than the prevalence obtained in Kerala<sup>12</sup> (24.2%) and India<sup>38</sup> (31.0%). This might be due to the small sample size of previous studies. Additionally, the lower prevalence compared to previous studies in southern Taiwan<sup>25</sup> (38.7%) and Beijing<sup>8</sup> (23.9%) might be because our participants were recruited from communities while the previous studies sampled from hospitals. However, a population-based study in Taiwan<sup>26</sup> showed that only 4.7% of midlife women experienced depressive symptoms. This might involve different research tools. We found that insomnia, fatigue, and mood swing were the most common menopausal symptoms. However, hot flashes and sweating, followed by insomnia and depressive mood, were most common among Ethiopian woman<sup>16</sup>. Drying skin, feeling tired, and loose skin were most common among Korean women<sup>39</sup>. The differences might have two explanations. First, racial and ethnic differences included the prevalence of symptoms. Second, the menopausal symptoms were

**Table 3.** Associations among menopausal status, menopausal symptoms, and depressive symptoms.

| Variable                    | OR (95% CI)       | p-Value | Adjusted OR (95% CI) <sup>a</sup> | p-Value |
|-----------------------------|-------------------|---------|-----------------------------------|---------|
| Late reproductive stage     | 1                 | 0.000   | 1                                 | 0.007   |
| Menopausal transition       | 1.80 (1.46, 2.23) |         | 1.14 (1.12, 1.86)                 |         |
| Postmenopausal              | 1.87 (1.50, 2.36) |         | 1.52 (1.09, 2.11)                 |         |
| Insomnia                    |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.770   |
| Yes                         | 2.27 (1.89, 2.72) |         | 0.97 (0.76, 1.23)                 |         |
| Fatigue                     |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.251   |
| Yes                         | 2.66 (2.22, 3.19) |         | 1.16 (0.90, 1.49)                 |         |
| Mood swing                  |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.028   |
| Yes                         | 3.03 (2.53, 3.64) |         | 1.32 (1.03, 1.70)                 |         |
| Headache                    |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.133   |
| Yes                         | 2.42 (2.02, 2.89) |         | 1.20 (0.95, 1.51)                 |         |
| Dizziness                   |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.967   |
| Yes                         | 2.26 (1.89, 2.70) |         | 1.00 (0.79, 1.26)                 |         |
| Arthralgia and myalgia      |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.445   |
| Yes                         | 2.28 (1.99, 2.85) |         | 0.91 (0.72, 1.16)                 |         |
| Hot flashes and night sweat |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.737   |
| Yes                         | 2.25 (1.88, 2.71) |         | 1.04 (0.83, 1.31)                 |         |
| Paresthesia                 |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.470   |
| Yes                         | 2.65 (2.20, 3.19) |         | 1.10 (0.85, 1.41)                 |         |
| Depressive mood             |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.000   |
| Yes                         | 4.36 (3.61, 5.27) |         | 2.28 (1.79, 2.91)                 |         |
| Palpitations                |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.016   |
| Yes                         | 3.46 (2.86, 4.19) |         | 1.37 (1.06, 1.77)                 |         |
| Sex life                    |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.823   |
| Yes                         | 2.40 (1.98, 2.92) |         | 1.03 (0.81, 1.31)                 |         |
| Urinary tract infection     |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.002   |
| Yes                         | 3.09 (2.51, 3.79) |         | 1.49 (1.16, 1.92)                 |         |
| Skin formication            |                   |         |                                   |         |
| No                          | 1                 | 0.000   |                                   | 0.120   |
| Yes                         | 3.51 (2.80, 4.41) |         | 1.26 (0.94, 1.69)                 |         |

CI, confidence interval; OR, odds ratio.

<sup>a</sup>Adjusting for demographic variables.

measured by different tools. Our study used the Kupperman Menopausal Index while the previous study used the 11-item Menopause Rating Scale and the 29-item Menopause-Specific Quality of Life Questionnaire. Different scales involve diverse menopausal symptoms and evaluation criteria. Our findings were also different from those of another study in Beijing by Liu *et al.*<sup>40</sup>, which showed that the three most common menopausal symptoms were fatigue, irritability, and arthralgia. One possible reason for the difference was that our study focused on the general population while Liu *et al.*'s study focused on nurses. Nurses in China are a special group and fatigue was common among them due to their heavy workload. In addition, long periods of stressful work might also make nurses irritable. The differences suggested that occupations played a role in self-reported menopausal symptoms.

We found that postmenopausal women were most likely to report depressive symptoms. However, a study among 743 rural women in Jiangsu<sup>23</sup> showed that there was no association of menopausal status and depressive symptoms. Yen *et al.*<sup>24</sup> conducted a survey of 672 rural aboriginal women in Taiwan and showed contrary results. This suggests

that the results of previous studies with a smaller sample size and a particular population may be not representative of the facts in the general population. It also illustrates the significance of our large-scale study. Our results were consistent with the previous studies in Canadian<sup>41</sup> and Portuguese<sup>42</sup> women. The following reasons may explain why postmenopausal women are vulnerable to experience depressive symptoms. Evidence has suggested that estrogen could protect the brain and modulate the white matter microstructure of the insula so as to reduce the susceptibility of midlife women to depressive symptoms<sup>43</sup>. Thus, postmenopausal women are more likely to experienced depressive symptoms due to the lower estrogen levels. In addition, women in China constructed the menopause as marking the watershed between a healthy life and a shift toward senescence, serious diseases, and biological changes<sup>44</sup>. Also, studies have shown that negative attitudes toward menopause were one of the risk factors of depressive symptoms<sup>45</sup>.

Studies in western countries showed that hot flashes increased the risk of depressive symptoms<sup>16,46</sup>. However, our study found no association. The potential mechanism may involve variations in the prevalence and severity of

menopausal symptoms among different races. Studies have shown that Caucasians were more likely to suffer from hot flashes compared to Asian women, including Chinese<sup>38,47</sup>. However, we found that four kinds of the menopausal symptoms (mood swing, depressive mood, palpitations, and urinary tract infection) were independently associated with depressive symptoms after adjusting for the demographic variables. The results suggested that negative emotions were associated with depressive symptoms<sup>12</sup>. We found that urinary tract infection was significantly associated with depressive symptoms in midlife women, which is in accordance with a population-based survey in Korean women<sup>48</sup>. This was probably because urinary tract infections were often characterized by frequent, urgent, and inexhaustible urination, which would affect quality of life and self-esteem, and thus would further lead to negative emotions and aggravate depressive symptoms<sup>49</sup>.

### Limitations and strengths

Several limitations of the current study should be considered. First, owing to the cross-sectional design, no causations could be inferred. Thus, a well-designed longitudinal study is warranted. Second, the results were based on self-reported data, so memory bias and concealment of information were possible. In addition, due to the limitation of the original data, we failed to compare the depressive symptoms across the early and late menopausal transition. Third, we only used the PHQ-9 to assess depressive symptoms. Although the PHQ-9 is widely used clinically by health-care professionals to screen for depressive symptoms, there are many other valid tools (such as the Hamilton Depression Rating Scale, Montgomery–Asberg Depression Rating Scale, and Beck Depression Inventory), which may yield a variation in prevalence results. In addition, we only conducted the research in Hunan Province. Consequently, our results are not able to be generalized to other provinces in China. A nationwide study is needed to provide a comprehensive understanding.

Despite these deficiencies, several strengths should be noted. First, our study was based on data from a large-scale epidemiological study among general midlife women and we highlighted the importance to focus on depressive symptoms among midlife women. Second, the participants were recruited from communities instead of medical institutions, and thus were able to better reflect the facts and avoid some sampling bias.

### Conclusion

We found menopausal transition and postmenopausal women are vulnerable to depressive symptoms. In addition, four menopausal symptoms (mood swing, depressive mood, palpitations, and urinary tract infection) increase the risk of depressive symptoms independently. The findings suggest that community health-care providers should pay more attention to midlife women with the aforementioned risk factors.

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