

Exploring Biopsychosocial Factors Contributing to Suicide among Individuals in Perimenopause

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Abstract

Background:

The menopause transition is associated with hormonal, physical, and psychosocial changes that may contribute to increased mental health challenges among women. This study examined the relationship between menopause status, menopause symptom burden, mental health outcomes, perceived burdensomeness, thwarted belongingness, and unmet mental health treatment needs among adult women.

Methods:

This cross-sectional survey study included 368 adults who identify as female in the United States recruited between February and May 2026, with recruitment primarily focused in Wisconsin. Participants were categorized as other/pre-menopause ($n = 124$), likely perimenopause ($n = 112$), or post-menopause ($n = 132$). Linear and logistic regression models were used to examine associations with menopause status and menopause symptom count. Adjusted models controlled for age, race, annual household income, and education.

Results:

Greater menopause symptom burden was consistently associated with poorer mental health and psychosocial outcomes. Each additional menopause symptom was associated with higher depression, anxiety, perceived stress, perceived burdensomeness, and thwarted belongingness scores and a 35% increase in the odds of unmet mental health treatment need ($OR = 1.35$, 95% CI 1.18–1.57, $p < .001$). Compared with women in the other/pre-menopause group, women classified as likely perimenopausal had significantly higher scores for depression ($\beta = 3.8$, $p < .001$), anxiety ($\beta = 3.2$, $p < .001$), and perceived stress ($\beta = 3.4$, $p = .001$). Postmenopausal women also had significantly higher depression ($\beta = 4.2$, $p < .001$), anxiety ($\beta = 3.4$, $p < .001$), and perceived stress scores ($\beta = 2.4$, $p = .025$). Menopause status was not significantly associated with perceived burdensomeness or thwarted belongingness. Postmenopausal women had greater odds of reporting an unmet mental health treatment need compared with women in the other/pre-menopause group ($OR = 2.77$, 95% CI 1.26–6.28, $p = .013$).

Conclusions:

Menopause status and symptom burden were associated with poorer mental health outcomes, with symptom burden showing associations across broader range of outcomes. Routine assessments of menopause symptoms and mental health concerns may help identify women who could benefit from additional mental health support during these phases of life.

Introduction:

Suicide remains a critical public health concern, accounting for over 49,000 deaths annually.^{1,2} In 2023, 12.8 million adults experienced suicidal ideation, 3.7 million made a suicide plan, and 1.5 million

attempted suicide.² While suicide rates are highest among men, women comprise approximately 20% of suicides annually.¹ Further, a growing body of research supports that women experience menstrual cycle-dependent changes to mental health-related symptoms, including suicidal thoughts and behaviors.³ Midlife hormonal transitions may be particularly important, as women typically experience substantial fluctuations in reproductive hormones (e.g. estrogen, progesterone) during the menopausal transitions, which most commonly occurs between approximately 45 and 55 years of age.⁹

While research on menstrual cycle associated changes and women's mental health symptoms is limited, emerging research has shown that menstrual cycle changes are associated with changes in mood changes, impulsivity, suicidal ideation, and suicidal actions.^{5,6} Most interestingly, phases of the menstrual cycle with low estradiol and progesterone have been shown to be associated with an increased frequency of suicide attempt.⁷ Additionally, findings showed that psychotic symptoms associated with schizophrenia showed worsening when estrogen levels were lowest.⁸ This is of particular interest given the hormonal shifts women across their lifespan.

Menopause, a biological consequence of aging for women, marks the end of women's reproductive years and is defined as one year without a menstrual cycle.⁹ Perimenopause is the transitional phase directly preceding menopause, where blood estrogen levels begin to diminish secondary to a loss of ovarian follicular functioning¹³. Perimenopause is commonly defined as the onset of the physical changes of menopause including menstrual irregularity, hot flashes, and night sweats, up until menopause has been reached.⁹ Interestingly, the period of perimenopause, which typically occurs during the mid-to-late 40's until final menstrual period, is associated with an estimated seven times increased risk of suicidal ideation when compared to periods of pre and postmenopausal phases.^{4,13} Unlike the predictability of menstrual phases, perimenopause involves more erratic hormonal shifts that are associated with low mood, reduced libido, and sleep disruption, which can negatively impact quality of life.¹⁰ Emerging research has found evidence that perimenopausal women have elevated rates of suicidal thoughts and behaviors, though the experiences contributing to this increased risk are multifactorial.^{10,11} These symptoms have been shown to be particularly high among women experiencing vasomotor symptoms, sleep disruption and mood instability, factors often linked with low estrogen and progesterone level.¹²

Despite suicide being a leading cause of death for women, including perimenopausal women,^{2,4} significant gaps remain in the understanding of menstrual changes and women's mental health, highlighting a critical need to better understand and address suicide risk in this population. Given the acknowledged increased mental health symptoms that women experience during periods of low estrogen and progesterone, as well as the increased risk of suicide attempt during the perimenopausal phase, further exploration into this is warranted. While associations with biological changes, psychological stressors, and social stressors are all believed to contribute to this risk, the multifactorial nature of the risk factors remain largely underexplored. As such, this study aims to explore the biopsychosocial factors contributing to mental health challenges and suicidal thoughts and behaviors

among women in the perimenopausal stage of life. Additionally, we sought to determine whether perceived burdensomeness and thwarted belongingness, two constructs associated with suicidal thoughts and behaviors, were associated with experiences of perimenopause.¹⁴

Methods:

Study Design and Participants

This cross-sectional survey study examines the relationship between menopause status and mental health outcomes among adult women in the United States. Participants were recruited between February and May of 2026 through community events and online recruitment strategies. Recruitment occurred at community health fairs, hair salons, women's church events, women empowerment events, and through flyers posted on community boards in community-based health care clinic spaces. The study was also shared on Facebook and LinkedIn. An outside survey recruitment company (Cint) was engaged to help obtain additional responses. Although the survey was open to women across the United States, recruitment primarily focused on women living in Wisconsin.

This study was approved by the Medical College of Wisconsin Institutional Review Board. All participants consented to participate. Survey data was collected using Qualtrics. Participants did not receive an incentive.

Women who reported not having a menstrual period for at least 12 consecutive months were categorized as postmenopausal. Women who had not reached postmenopause were categorized as likely perimenopausal if they were between 40-55 years of age and reported at least one indicator of menopausal transition, including menstrual absence of at least 60 days during the previous year, reporting a menstrual cycle that was more than five days late, or three or more menopause-related symptoms (e.g., hot flashes, insomnia). Women who did not meet the criteria for likely perimenopause or postmenopause were categorized as other/pre-menopause.

A menopause symptom count was also created by adding the number of menopause related symptoms reported by each participant. Higher scores indicated a greater number of menopause symptoms.

Mental Health and Psychosocial Outcomes

Depression symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9). Total scores ranged from 0-27, with higher scores indicating more severe depression symptoms.

Anxiety symptoms were measured using the Generalized Anxiety Disorder-7 (GAD-7). Total scores ranged from 0-21, with higher scores indicating more severe anxiety symptoms.

Perceived stress was measured using the 10-item Perceived Stress Scale. Positively worded items were reverse scored before calculating the total score. Higher Scores indicated greater perceived stress.

Perceived social support was measured using 12 items. A mean score was calculated across the items, with higher scores indicating greater perceived social support.

Perceived burdensomeness was measured using three survey items, and thwarted belongingness was measured using nine items. Positively worded belongingness items were reversed scored. Mean scores were calculated for each construct, with higher scores indicating greater perceived burdensomeness and greater thwarted belongingness.

Suicidal ideation during the past 12 months was measured using a single yes or no survey question. Unmet mental health treatment need was also measured using a yes or no question asking whether participants needed mental health treatment during the past year but was unable to obtain it.

Our data collection tool was developed for this study and is included as supplementary material.

Statistical Analysis

All statistical analyses were performed using R version 4.5.1 (2025-06-13 ucrt). Descriptive statistics were used to summarize demographic, socioeconomic, menopause-related experiences, mental health, and psychosocial characteristics. Continuous variables were presented as means and standard deviations, while categorical variables are presented as frequencies and percentages.

Differences in experiences across menopause status groups were examined using one-way analysis of variance for continuous variables and Pearson's chi-square tests for categorical variables.

Linear regression models were used to examine whether menopause status was associated with depression, anxiety, perceived stress, perceived burdensomeness, thwarted belongingness, and suicidal ideation. Logistic regression was used to examine associations between menopause status and unmet mental health treatment need, and separate logistic regression models examine menopause symptoms count as the primary predictor. All adjusted models controlled for age, race, annual household income, and education

Additional regression models examined menopause symptom count as the primary predictor of mental health and psychosocial outcomes while adjusting for age, race, annual household income, and education. Linear regression models were used for depression, anxiety, perceived stress, perceived burdensomeness, and thwarted belongingness, while logistic regression was used to examine the association between menopause symptom count and unmet mental health treatment need.

Complete case analysis was used, meaning participants with missing data for variables included in a specific model were excluded from that analysis. Statistical significance was set at $p < .05$.

Results:

Sample Characteristics

Table 1 presents the demographic, socioeconomic, menopause-related, mental health and psychosocial characteristics of participants by menopause status. The analytic sample included 368 women categorized as other/pre-menopause (n = 124), likely perimenopause (n = 112), and post-menopause (n = 132). Mean age differed across menopause status groups ($p < .001$). Women in the other/premenopausal group had mean age of 40 years (SD = 7) compared with 47 years (SD = 4) among women in the likely perimenopause group and 48 years (SD = 6) among postmenopausal women.

Significant differences across menopause status groups were observed for race ($p = .011$), relationship status ($p = .013$), menopause symptom counts ($p < .001$), depression symptoms measured by the PHQ-9 ($p = .031$), and anxiety symptoms measured by the GAD-7 ($p = .039$). No statistically significant differences were observed across menopause status groups for ethnicity, income, employment, education, perceived stress, social support, perceived burdensomeness, thwarted belongingness, unmet mental health treatment need, or suicidal ideation during the past 12 months.

Bivariate Analyses

In the unadjusted analyses, depression symptoms differed significantly across menopause status groups ($p = .031$). Women in the post-menopause group reported the highest mean PHQ-9 scores ($M = 9.9$, $SD = 7.0$), followed by women in the likely perimenopause group ($M = 9.4$, $SD = 7.0$). Women in the other/pre-menopause group reported the lowest mean depression scores ($M = 7.6$, $SD = 7.0$).

Similarly, anxiety symptoms differed significantly across menopause status groups ($p = .039$). Women in the post-menopause group reported the highest mean GAD-7 scores ($M = 8.7$, $SD = 6.4$), followed by women in the likely perimenopause group ($M = 8.3$, $SD = 5.6$). Women in the other/pre-menopause group reported the lowest mean anxiety scores ($M = 6.8$, $SD = 6.4$).

No statistically significant difference were observed across menopause status groups for perceived stress (PSS-10), social support, unmet mental health treatment need, or suicidal ideation during the past 12 months.

Adjusted Regression Analyses

Table 2 presents the adjusted associations between menopause status and mental health outcomes after controlling for age, race, income and education.

Menopause status was significantly associated with depression symptoms. Compared to women in the other/pre-menopause group, women classified as likely perimenopausal reported PHQ-9 scores that were nearly four points higher ($\beta = 3.85$, $p < .001$), while post-menopausal women reported PHQ-9 scores that were more than four points higher ($\beta = 4.23$, $p < .001$). Age was also associated with lower depression scores ($\beta = -0.29$, $p < .001$), suggesting that women in both the likely perimenopause and post-menopause groups experienced greater depressive symptom severity than women in the other/pre-menopause group, independent of age and other demographic factors.

Menopause status was also significantly associated with anxiety symptoms after adjustment. Women in both the likely perimenopause and post-menopause groups reported higher anxiety symptom scores than women in the other/pre-menopause group, even after accounting for demographic and socioeconomic factors. Similar to depression, women transitioning to menopause reported higher levels of anxiety symptoms than women in the other/pre-menopause group.

Although perceived stress was not significant in the bivariate analyses, it became significant in the adjusted model. Women in the likely perimenopause group reported significantly higher perceived stress scores than women in the other/pre-menopause group ($\beta = 3.28$, $p < .002$), and post-menopause women also reported higher stress scores ($\beta = 2.24$, $p < .035$). Age remained significantly associated with lower perceived stress scores. Although perceived stress did not differ significantly across groups in the unadjusted analyses, the adjusted findings suggest that women in the likely perimenopause and post-menopause groups experienced greater perceived stress after accounting for demographic and socioeconomic differences.

After adjustment for age, race, income, and education, menopause status was not significantly associated with perceived burdensomeness or thwarted belongingness. Compared with women in the other/pre-menopause group, women in the likely perimenopause and post-menopause groups reported similar levels of perceived burdensomeness and thwarted belongingness after controlling for demographic and socioeconomic characteristics.

For unmet mental health treatment need, postmenopausal women were significantly greater odds of reporting that they needed mental health treatment but were unable to obtain it compared to women in the other/pre-menopause group (OR = 2.77, 95% CI [1.26, 6.28], $p = .013$), shown in Table 3. No significant difference were observed between likely perimenopause women and women in the other/pre-menopause group. This implies that postmenopausal women may face greater barriers to obtaining needed mental health treatment compared to women who have not yet reach menopause.

Additional analyses examined whether increasing menopause symptom burden was associated with mental health outcomes after controlling for age, race, income, and education. Menopause symptom count was significantly associated with all mental health outcomes examined.

Each additional menopause-related symptom was associated with a 1.24 point increase in depression scores ($\beta = 1.24$, $p < .001$), a 1.07-point increase in anxiety scores ($\beta = 1.07$, $p < .001$), and a 1.01-point increase in perceived stress scores ($\beta = 1.01$, $p < .001$). In addition, each additional menopause-related symptom was associated with a 35% increase in the odds of reporting an unmet mental health treatment need (OR = 1.35, 95% CI: 1.18, 1.57; $p < .001$).

These findings indicate that greater menopause symptom burden is consistently associated with poorer mental health outcomes, including higher levels of depression, anxiety, perceived stress, and difficulty obtaining needed mental health treatment.

Associations Between Menopause Symptom Count and Mental Health Outcomes

Tables 4 and 5 present the adjusted associations between menopause symptom counts and mental health outcomes after controlling for age, race, income, and education. Increasing menopause symptoms counts were significantly associated with higher depression ($\beta = 1.2$, $p < .001$), anxiety ($\beta = 1.1$, $p < .001$), perceived stress ($\beta = 1.$, $p < .001$), greater perceived burdensomeness ($\beta = 0.05$, $p = .003$) and greater thwarted belongingness ($\beta = 0.05$, $p = .003$). Age remained significantly associated with lower scores across all mental health and psychosocial outcomes. Each additional menopause symptom was also associated with a 35% increase in the odds of reporting a need for mental health treatment that could not be obtained (or = 1.35, 95% CI [1.18, 1.57], $p < .001$).

Overall menopause status was significantly associated with depression, anxiety, and perceived stress and unmet mental health treatment need after adjustment for age, race, income, and education. In contrast, menopause status was not significantly associated with perceived burdensomeness or thwarted belongingness. Among the mental health outcomes examined, depression showed the strongest association with menopause status, suggesting that women experience the menopause transition increase risk for depression symptoms independent of age and other demographic factors. Additionally, increasing menopause symptom burden was consistently associated with poorer mental health outcomes, including higher depression, anxiety, and stress scores as well as greater unmet mental health treatment need. Together, it highlights that both menopause status and menopause related symptom burden contribute to mental health challenges during menopausal transition.

Discussion

The purpose of this study was to examine the relationship between menopause status, menopause symptom burden, and mental health outcomes among adult women. Overall, women classified as likely perimenopausal and post menopausal reported significantly higher levels of depression, anxiety, and perceived stress than women in the other/pre-menopause group after adjusting for age, race, annual household income, and education. Although menopause status was not significantly associated with perceived burdensomeness or thwarted belongingness, increasing menopause symptom burden was associated with higher levels of depression, anxiety, perceived stress, perceived burdensomeness, and thwarted belongingness, as well as greater odds of reporting an unmet need for mental health treatment. Together, these findings suggest that both menopausal stage and the severity of menopause-related symptoms contribute to women's mental health during menopausal transition.

The findings related to depression, anxiety, and perceived stress are consistent with previous research demonstrating that women experience increased psychological distress during the menopause transition, including higher levels of depressive symptoms and anxiety.^{3, 12} Fluctuating estrogen levels during perimenopause have been associated with depressive symptoms, anxiety, sleep disturbances, mood changes, and emotional dysregulation.¹³ Emerging evidence also suggests that the menopause transition may represent a period of heightened vulnerability for suicidal thoughts and behaviors^{10, 12}.

Our findings build upon this literature by demonstrating that these associations remain significant after accounting for important demographic and socioeconomic characteristics.

One notable finding was that menopause symptom burden appeared to be a stronger and more consistent predictor of mental health outcomes than menopause status alone. Each additional menopause symptom was independently associated with higher depression, anxiety, perceived stress, perceived burdensomeness, and thwarted belongingness scores. In addition, each additional menopause-related symptom was associated with a 35% increase in the odds of reporting an unmet need for mental health treatment. These findings suggest that women's lived experience of menopause-related symptoms may provide additional insight into mental health risk beyond classification by menopausal stage alone. Women reporting a greater number of menopause-related symptoms may represent a subgroup at particularly elevated risk for psychological distress regardless of whether they are classified as perimenopausal or postmenopausal.

Interestingly, menopause status itself was not significantly associated with perceived burdensomeness or thwarted belongingness after adjustment, despite these interpersonal constructs being central components of the Interpersonal Theory of Suicide.¹⁴ The theory proposes that perceived burdensomeness and thwarted belongingness contribute to suicidal desire when experienced together. However, increasing menopause symptom burden was associated with higher perceived burdensomeness and greater thwarted belongingness. These findings suggest that interpersonal distress may be driven more by the cumulative burden of menopause-related symptoms than by menopausal stage itself. Since perceived burdensomeness and thwarted belongingness are well-established risk factors for suicidal thoughts and behaviors, future research should continue to explore how menopause-related symptoms influence interpersonal functioning and suicide risk among midlife women.

Another important finding was that postmenopausal women were significantly more likely to report an unmet need for mental health treatment than women in the other/pre-menopause group. Likewise, increasing menopause symptom burden was associated with greater odds of reporting difficulty obtaining needed mental health care. These findings may reflect barriers to recognizing menopause-related mental health concerns, limited access to behavioral health services, stigma surrounding menopause and mental health, or insufficient screening for psychological symptoms during midlife healthcare visits. Previous qualitative work has similarly described women's frustration with having menopause-related mental health concerns overlooked or minimized by healthcare providers.¹¹

Together, these findings support the potential value of integrating behavioral health services within women's healthcare settings, including primary care and obstetrics and gynecology clinics. Evidence from Collaborative Care models has consistently demonstrated improvements in the identification and treatment of depression through team-based care delivered within medical settings, and more recent evidence suggests that these models can be successfully implemented across diverse healthcare systems in the United States while improving access to behavioral health services.¹⁵ Expanding

integrated behavioral health services to include routine mental health screening and referral pathways for women experiencing menopause-related symptoms may improve early identification, timely intervention, and access to evidence-based behavioral health care and suicide prevention.

This study contributes to the existing literature in several important ways. Although previous studies have largely focused on depression, anxiety, or suicidality during perimenopause, this study examined a broader range of psychosocial outcomes, including perceived stress, perceived burdensomeness, thwarted belongingness, and unmet mental health treatment need.^{10,12} Additionally, this study evaluated both menopause status and menopause symptom burden, demonstrating that symptom burden may be a more informative indicator of women's mental health than menopause stage alone. These findings support the importance of considering both biological changes and women's symptom experiences when assessing mental health during midlife.

Several limitations should be considered when interpreting these findings. First, the cross-sectional design precludes conclusions regarding causality or the temporal relationship between menopause and mental health outcomes. Second, all measures were self-reported and may be subject to recall or reporting bias. Third, menopause status was determined by using participant responses rather than clinical assessment, which may have resulted in some misclassification. Finally, although participants were recruited nationally, in-person recruitment efforts primarily focused on women living in Wisconsin, which may limit the generalizability of these findings.

Despite these limitations, this study has several strengths. It included women across multiple stages of the menopausal transition and evaluated a broad range of validated mental health and psychosocial measures. Furthermore, examining both menopause status and menopause symptom burden provided complementary perspectives on how menopause relates to women's mental health. By adjusting for important demographic and socioeconomic factors, this study contributes to a more comprehensive understanding of mental health during the menopausal transition. Because some participants were recruited through community and healthcare settings in Wisconsin, these findings may also help inform future public health initiatives aimed at strengthening routine mental health screening, referral pathways, and integrated behavioral health services for women experiencing the menopausal transition.

Conclusions

Women in the menopause transition, particularly those reporting a greater number of menopause-related symptoms, experienced poorer mental health outcomes and greater unmet mental health treatment needs than women in other phases of life. These findings support the importance of routinely assessing mental health symptoms during the menopause transition and suggest that menopause symptom burden may help identify women at increased risk for psychological distress. As healthcare systems continue to adopt integrated behavioral health models, incorporating routine mental health screening into primary care and women's health settings may improve early identification of depression, anxiety, and psychosocial distress while facilitating timely referral to behavioral health providers. Future

longitudinal studies are needed to better understand the temporal relationship between menopausal symptoms and mental health and to identify interventions that improve psychological well-being during this stage of life.

Declarations

Ethics approval and consent to participate: This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board at the Medical College of Wisconsin (FWA00000820). Informed consent was obtained from all participants.

Consent for publication: Not applicable.

Availability of data and materials: Aggregate, de-identified study data will be made available upon reasonable request to the corresponding author.

Competing interests: There are no competing interests to report.

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Author's contributions: SK conceived of the manuscript and oversaw the study. SK managed data collection, and SSR and SH conducted data analysis and interpretation. PB and SSR conducted the literature review. SK and SSR led manuscript writing, and all authors read and approved the final version.

Tables

Tables 1-5 are available in the Supplementary Files section.

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Supplementary Files

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- [PerimenopauseSurveyProtocol.pdf](#)
- [Tables.docx](#)