

# Role of Hormonal Changes During Menopause in Women and their Association with Mental Health

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**Abstract:** Menopause is a major biological transition in a woman's life characterized by progressive changes in ovarian function and fluctuations followed by a decline in estrogen and progesterone production. Although menopause is a normal physiological process, the accompanying hormonal changes may influence psychological well-being through interactions between reproductive hormones, neurotransmitter systems, sleep, vasomotor symptoms, and psychosocial factors. The menopausal transition has been identified as a period of increased vulnerability to depressive symptoms, anxiety, irritability, sleep disturbance, emotional instability, and cognitive difficulties. Evidence suggests that fluctuations in estradiol, rather than simply low estrogen concentration, may be particularly relevant to mood disturbances during perimenopause. Estrogen influences serotonin, dopamine, GABA, brain-derived neurotrophic factor, stress-response systems, and inflammatory pathways, providing several potential biological mechanisms linking reproductive aging with mental health.

**Keywords:** Menopause, Estrogen, Mental Health, Hormonal Changes, Perimenopause

## I. INTRODUCTION

Menopause represents an important stage of reproductive aging in women and is associated with substantial physiological, psychological, and social changes. The menopausal transition generally begins during perimenopause, when ovarian activity becomes increasingly irregular, followed by the final menstrual period and the postmenopausal period. During this transition, ovarian hormone production changes considerably, particularly the secretion and fluctuation of estradiol and progesterone. These hormonal alterations may influence multiple physiological systems, including the brain and central nervous system. Consequently, some women experience mood changes, anxiety, depressive symptoms, sleep disturbance, irritability, reduced concentration, and other psychological difficulties during the menopausal transition.

The relationship between menopause and mental health is complex. Menopause should not be regarded as a direct or inevitable cause of psychiatric illness in every woman. Rather, the transition may create a period of increased vulnerability in susceptible individuals. A systematic review published in 2023 examined 22 studies and concluded that depression and anxiety are common during menopause and that previous major depression, vasomotor symptoms, stressful life events, and psychosocial circumstances can increase vulnerability.

## HORMONAL CHANGES DURING MENOPAUSE

The most important endocrine changes during menopause involve the ovarian hormones estrogen and progesterone, accompanied by changes in follicle-stimulating hormone (FSH) and luteinizing hormone (LH). During the reproductive years, estradiol participates in the regulation of reproductive function as well as numerous processes within the brain. During perimenopause, estradiol does not necessarily decline in a smooth and linear manner. Instead, substantial fluctuations may occur before relatively stable low estrogen levels become established after menopause. Research has increasingly emphasized these fluctuations as potentially important for mood regulation.

Changes in progesterone and its neuroactive metabolites may also influence emotional regulation. The interaction between ovarian hormones and neurotransmitter systems provides a biological basis for understanding why some women experience mood symptoms during the menopausal transition. However, hormonal mechanisms are only one component of the overall explanation.

### **ESTROGEN AND BRAIN FUNCTION**

Estrogen has extensive effects on brain function. Estradiol interacts with estrogen receptors distributed throughout several brain regions involved in emotion, cognition, motivation, and stress regulation. It also affects neurotransmission involving serotonin and other signaling systems. Research has proposed that fluctuations in estrogen can influence serotonin availability and GABA-related mechanisms, potentially contributing to changes in mood and anxiety.

The possible relationship between estrogen and depression has been supported by observational and experimental research. A review of reproductive aging and mood disorders described evidence linking the menopause transition and depressive symptoms with periods of estradiol withdrawal. More recent research has emphasized that the variability of estradiol, rather than simply its absolute level, may be important in determining vulnerability to depression.

### **MENOPAUSE AND DEPRESSION**

Depression is one of the most important mental-health concerns associated with the menopausal transition. Women who have previously experienced depression may be particularly vulnerable to recurrence during perimenopause. A 2023 systematic review identified previous major depression as one of the strongest risk factors for menopausal-associated depression. Vasomotor symptoms, stressful life events and limited social support were also identified as relevant factors.

A systematic review and meta-analysis of prospective cohort studies published using literature available through July 2023 found that women in perimenopause had significantly greater odds of depressive symptoms or diagnoses than premenopausal women, with a pooled odds ratio of 1.40 (95% CI 1.21–1.61). Importantly, the analysis did not find a statistically significant increase in depression risk for postmenopausal women compared with premenopausal women, highlighting that the transition itself may be particularly important.

### **MENOPAUSE AND ANXIETY**

Anxiety symptoms may also occur during the menopausal transition. However, evidence regarding clinically diagnosed anxiety disorders is less consistent than evidence concerning depressive symptoms. An earlier systematic review found limited and methodologically heterogeneous evidence regarding anxiety during menopause and emphasized difficulties in distinguishing psychological symptoms from physical menopausal symptoms such as hot flashes.

More recent evidence suggests that anxiety and depression can occur together during the menopausal transition. The 2023 systematic review concluded that menopausal vulnerability to anxiety may involve interactions between estrogen fluctuations, vasomotor symptoms, sleep disturbance, and psychosocial stressors.

### **VASOMOTOR SYMPTOMS, SLEEP AND MENTAL HEALTH**

Hot flashes and night sweats are among the most recognizable symptoms of menopause. Although they are primarily physiological manifestations of altered thermoregulatory functioning, they can have important psychological consequences. Frequent night sweats may interrupt sleep, while recurrent hot flashes can produce discomfort, embarrassment, fatigue, and daytime distress.

Sleep disturbance may subsequently contribute to irritability, poor concentration, anxiety, and depressive symptoms. Thus, the association between menopause and mental health may involve both direct biological effects of hormonal fluctuation and indirect effects mediated through sleep and physical symptoms. The 2023 systematic review identified vasomotor symptoms as an important risk factor for menopausal depression.

### **HORMONAL MECHANISMS UNDERLYING PSYCHOLOGICAL CHANGES**

Several biological pathways may explain the relationship between hormonal changes and mental health during menopause. Estrogen interacts with serotonergic neurotransmission and may influence brain-derived neurotrophic factor and inflammatory processes. Changes in estrogen signaling may therefore affect neuronal plasticity, emotional regulation, and stress responsiveness.

Another important mechanism concerns the hypothalamic-pituitary-adrenal stress system. Alterations in reproductive hormones may influence the sensitivity of stress-response pathways. At the same time, psychosocial stress may affect the perception and severity of menopausal symptoms. Consequently, the relationship between hormones and mental health is likely bidirectional and multifactorial rather than linear.

### **COGNITIVE AND EMOTIONAL CHANGES**

Some women report memory difficulties, reduced concentration, mental fatigue, and difficulties with attention during perimenopause. A systematic review and meta-analysis examining cognition and mood during perimenopause identified the menopausal transition as a period in which mood and certain cognitive functions may change, although results vary across studies and cognitive domains.

Subjective cognitive complaints should therefore be considered in the context of sleep quality, anxiety, depression, stress, and vasomotor symptoms. Not every perceived cognitive change indicates neurological disease. The interaction between hormonal fluctuations and psychological or sleep-related factors is important when interpreting these experiences.

### **PSYCHOSOCIAL FACTORS**

Hormonal changes alone cannot explain the diversity of psychological experiences during menopause. Midlife may coincide with major life changes, including changes in family responsibilities, employment, relationships, financial circumstances, caregiving responsibilities, and perceptions of aging. These factors can interact with biological vulnerability.

The 2023 systematic review found that stressful life events, low social support, negative perceptions of menopause and certain socioeconomic factors may increase psychological vulnerability, while social support, counseling, healthy lifestyle practices, and mindfulness may provide protective effects.

### **HORMONE THERAPY AND MENTAL HEALTH**

The possible role of estrogen in mood regulation has led researchers to examine whether estrogen therapy can improve depressive symptoms associated with menopause. Evidence needs to be interpreted carefully because hormone therapy is primarily prescribed according to an individual's overall clinical circumstances and menopausal symptoms rather than solely for prevention of depression.

A 2023 systematic review and meta-analysis of 14 randomized controlled trials reported that exogenous estrogen was associated with improvements in depressive mood compared with control conditions. The authors also reported that women in perimenopause appeared particularly sensitive to estrogen-related effects. These findings support the biological importance of estrogen fluctuations but do not mean that hormone therapy is appropriate for every woman.

**Table 1: Relationship Between Hormonal Changes and Mental Health**

| <b>Hormonal/Physiological Change</b> | <b>Possible Mental-Health Association</b>           | <b>Potential Mechanism</b>                                  | <b>Supporting Evidence</b>         |
|--------------------------------------|-----------------------------------------------------|-------------------------------------------------------------|------------------------------------|
| Estradiol fluctuation                | Depressive symptoms and mood instability            | Effects on serotonin, neuroplasticity and stress regulation | Gordon et al.; 2018; 2023 evidence |
| Declining estradiol                  | Increased vulnerability to depression in some women | Altered estrogen-sensitive neural pathways                  | Gordon et al.; Soares, 2023        |

|                                           |                                                            |                                                                  |                                           |
|-------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------|
| Increased FSH/LH                          | Associated with reproductive aging and hormonal transition | Reduced ovarian function and endocrine feedback changes          | Gordon et al.; 2018                       |
| Progesterone-related changes              | Possible mood and sleep effects                            | Changes in neuroactive steroid signaling                         | Reproductive-aging literature             |
| Vasomotor symptoms                        | Anxiety, depressive symptoms and sleep disturbance         | Night sweats/hot flashes may disrupt sleep and increase distress | Alblooshi et al., 2023                    |
| Hormonal instability during perimenopause | Greater depressive vulnerability                           | Rapid endocrine fluctuations may affect brain neurotransmission  | Zhang et al., 2023                        |
| Postmenopausal low estrogen               | Variable psychological effects                             | Adaptation to a relatively stable hormonal state                 | Alblooshi et al., 2023; Maki et al., 2013 |

### INTEGRATED BIOPSYCHOSOCIAL PERSPECTIVE

The relationship between menopause and mental health is best understood through an integrated biopsychosocial model. Biological factors include estradiol fluctuations, changes in progesterone, altered FSH and LH levels, neurotransmitter activity, vasomotor symptoms, and sleep disruption. Psychological factors include previous depression, anxiety, coping mechanisms, perceptions of aging, and emotional responses to menopausal symptoms. Social factors include family relationships, employment, financial circumstances, caregiving responsibilities, and availability of social support.

This perspective is important because two women experiencing comparable hormonal changes may have substantially different psychological outcomes. One woman may experience minimal emotional disturbance, whereas another may develop clinically significant depressive or anxiety symptoms. The difference may reflect previous psychiatric history, psychosocial stress, symptom severity, sleep quality, and individual sensitivity to hormonal fluctuations.

### IMPLICATIONS FOR WOMEN'S MENTAL HEALTH

Recognition of menopause as a potential period of psychological vulnerability has important implications for healthcare. Healthcare professionals should consider mood, anxiety, sleep, vasomotor symptoms, previous psychiatric history, and psychosocial stress when assessing women during perimenopause and early post menopause. Screening should not assume that all psychological symptoms are caused by hormones; clinically significant depression or anxiety requires appropriate assessment.

Interventions may include education about menopause, regular physical activity, adequate sleep, psychological counseling, stress-management techniques, social support, and appropriate medical management. For women with significant symptoms, individualized treatment decisions can consider both physical and psychological manifestations of menopause.

### DISCUSSION

The literature published between 2010 and 2023 provides substantial evidence for an association between the menopausal transition and mental-health symptoms, while also demonstrating that the relationship is complex. The evidence does not support the idea that menopause inevitably causes depression or anxiety. Instead, the transition appears to represent a period during which some women become more vulnerable to psychological symptoms.

A particularly important finding is the distinction between hormonal level and hormonal fluctuation. Estradiol may fluctuate considerably during perimenopause before eventually reaching lower postmenopausal levels. Evidence from

2023 suggests that these fluctuations may be more relevant to depressive mood than a simple measurement of low estrogen.

At the same time, psychosocial factors remain essential. Previous depression, stressful life events, poor social support, sleep problems, and severe vasomotor symptoms can increase psychological burden. Therefore, an exclusively endocrine explanation would provide an incomplete understanding of menopause-related mental health.

## II. CONCLUSION

Menopause is an important period of reproductive aging during which substantial hormonal changes can interact with neurological, psychological, and social processes. Fluctuations in estradiol and changes in other reproductive hormones may influence neurotransmission, stress regulation, sleep, cognition, and emotional functioning. Research published through 2023 indicates that the menopausal transition, particularly perimenopause, can represent a period of increased vulnerability to depressive symptoms and, to a lesser extent, anxiety. However, hormonal changes should not be considered the sole cause of psychological difficulties. Previous mental-health history, vasomotor symptoms, sleep disturbance, stressful life events, social support, and individual coping mechanisms all contribute to outcomes. Evidence regarding estrogen-based interventions indicates potential benefits for depressive mood in selected women, but treatment decisions require individualized clinical assessment. Overall, a biopsychosocial approach that integrates hormonal, psychological, and social dimensions is most appropriate for understanding and addressing mental health during menopause.

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