Postpartum mental health after medically complicated pregnancy

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Abstract

Mental health is a crucial aspect of overall well-being. The postpartum period is a vulnerable time for women's mental health, with poor mental health potentially impacting the long-term health of mothers and their children. Common postpartum mental disorders include depression, anxiety, and posttraumatic stress disorder (PTSD).

Medical complications during pregnancy, such as hypertensive disorders of pregnancy (HDP), gestational diabetes mellitus (GDM), and anaemia, are prevalent and can make pregnancy, childbirth, and the postpartum periods particularly challenging, sometimes resulting in life-threatening situations for the mother and/or her baby. It is therefore plausible that women who experience a pregnancy complication may be at increased risk of also experiencing a postpartum mental health disorder.

Published research indicates that HDP, GDM, and gestational anaemia may increase the risk of postpartum depression (PPD). There may be associations between a higher risk of anxiety and PTSD, but the evidence is unclear or under-researched. Postpartum mental health care is often neglected following medically complicated pregnancies, with a focus primarily on physical recovery. There are limited global guidelines addressing mental health care for mothers and their children, but growing recognition of the connection between medical complications and postpartum mental health has led to the development of some follow-up guidelines.

Research is necessary to better understand postpartum mental health in women with medical complications during pregnancy. Until more is known, all pregnant women with medical complications should be considered at high risk for postpartum mental disorders and receive appropriate follow-up care.

In brief

Pregnancy complications like HDP, GDM, and anaemia may increase the risk of postpartum mental disorders, especially depression, however the evidence for anxiety and PTSD is limited. Women with medical complications in pregnancy should be considered at high risk for mental disorders and receive appropriate and timely screening and follow-up.

Introduction

Mental health refers to a person's emotional, psychological, and social well-being, shaping how they think, feel, and interact with others. It affects stress management, decision-making, and quality of life. More than the absence of mental disorders, good mental health involves emotional balance, resilience, positive relationships, and a sense of purpose (World Health Organization (WHO), 2021).

Mental health assessment may involve various approaches, including screening tools and structured or semi-structured interviews. Screening instruments are standardised tools that quickly identify potential mental health disorders, though they are not diagnostic. They can be self-administered or interviewer-led, measuring symptoms over a short timeframe using cut-off scores to determine the need for further evaluation (American Psychiatric Association, 2022). Structured interviews follow a standardised format and can be conducted by trained laypeople or clinicians. They enhance diagnostic reliability by assessing symptom quantity and quality but may lack flexibility and contextual depth. Despite this, they are widely used in clinical and research settings (First et al., 2016). The gold standard for diagnosis is the semi-structured interview, conducted by a culturally competent clinician. This approach balances standardisation with clinical judgment, allowing for a detailed exploration of symptoms, history, and functioning while ensuring diagnostic accuracy (American Psychiatric Association, 2022; Beck and Perry, 2008).

A medical complication in pregnancy refers to any health problem that occurs during this period, potentially impacting the mother and/or the baby (Fairbrother et al., 2017). These complications may arise suddenly or develop gradually and result in potential challenges during the perinatal period. Medical complications in pregnancy may lead to severe maternal morbidity (SMM). SMM encompasses life-threatening complications during pregnancy or childbirth that are life-threatening often result in prolonged hospitalisation or intensive medical intervention (Callaghan et al., 2012).

Mental disorders during the postpartum period are common and can significantly impact a woman’s quality of life. These disorders may affect her ability to care for and nurture her

infant, potentially leading to long-term concerns for herself and the child's health and development (Slomian et al., 2019, Walker et al., 2013).

Common medical complications during pregnancy include hypertensive disorders of pregnancy (HDP), gestational diabetes mellitus (GDM) and anaemia. HDP affect 3–10% of pregnancies globally and are a major cause of maternal and perinatal complications (Wang et al., 2021). HDP include chronic hypertension (CH), and the pregnancy-specific disorders gestational hypertension (GH), and preeclampsia (Magee et al., 2022). HDP increase the need for specialised care, hospital admissions, may be life threatening, and are a major cause of preterm birth. They also raise the long-term risk of cardiovascular disease (CVD) by 2–4 times (Arnott et al., 2020, Dall'Asta et al., 2021). GDM affects approximately 14% of pregnancies (Wang et al., 2022) and can lead to risks for the mother and baby. These risks include future likelihood of developing Type 2 diabetes and increased risk of CVD for the mother. For the infant, risks include excessive birth weight, hypoglycaemia, respiratory distress, and a higher risk of obesity and diabetes later in life (Wicklow and Retnakaran, 2023). Anaemia in pregnancy affects up to 41.8% of pregnant women globally (World Health Organization, 2021). Women diagnosed with anaemia in pregnancy have an increased risk of infection and haemorrhage while their baby is at risk of preterm birth and low birth weight (Hickey and Smiley, 2012).

Published evidence on postpartum mental health following medical complications in pregnancy is mostly inconsistent and inconclusive (Roberts et al., 2019, Azami et al., 2019a, Azami et al., 2019b), but there is growing recognition of a possible association particularly with PPD. The World Health Organization highlights the importance of implementing interventions for women exhibiting early signs and symptoms of mental disorders (Behl, 2023). However, many women who could benefit from these interventions remain unidentified during the early postpartum period (Highet et al., 2023) as mental health is seldom prioritised. Early intervention is crucial to prevent or mitigate the progression of mental disorders (Highet et al., 2023). Recognising women who experience medically complicated pregnancies as being at higher risk for mental disorders could facilitate targeted screening in the early postpartum period, enabling timely intervention, support, and treatment.

A review of the litrature was therefore undertaken to examine postpartum mental health, specifically depression, anxiety and PTSD, following a pregnancy complicated by HDP, GDM or anaemia.

The electronic databases MEDLINE, EMBASE, Cochrane Central Register for Clinical Trials, Global Health, and PsycINFO were searched. Search terms were combinations of "Pregnancy Complications" OR "pregnancy complication" AND “postpartum” or “postnatal” or “after pregnancy” or “after birth” or “after childbirth” AND “mental health” or “mental illness” or “mental disorder” or “psychiatric illness”. Systematic reviews and meta-analyses were given priority over smaller studies for inclusion in this review, unless only smaller study publications were identified. In total, 20 publications were used in this review, 11 relating to PPD, 6 on anxiety and 7 on PTSD (some publications included studies on more than one mental disorder). Table 1 shows a summary of the publications included in this review on PPD, anxiety and PTSD following a pregnancy complicated by HDP, GDM or anaemia.

It is acknowledged that there is broad diversity in the pregnant and postpartum population, including that not all identify as women, and for these individuals non-gendered language is important for their individual clinical care. When describing the pregnant/postpartum population overall, this paper uses traditionally gendered terms such as "women" and “mothers” to align with the language and inclusion criteria used in the studies reviewed and clinical guidelines cited. This approach is not meant to exclude or invalidate the experiences of transgender, non-binary, or gender-diverse individuals, for whom knowledge on mental health outcomes following medically complicated pregnancies is scant and requires additional empirical investigation.

Postpartum depression, anxiety and PTSD

PPD is a mood disorder that occurs after childbirth, and is characterised by persistent feelings of sadness, hopelessness, low energy, and emotional detachment. PPD can begin within a few weeks of childbirth but may also develop months later. Its exact cause is multifactorial, involving hormonal changes, genetic predisposition, and psychosocial stressors (American Psychiatric Association, 2022). A systematic review and meta-analysis of 58 studies (37,294 women) found the overall prevalence of PPD in healthy mothers without

a history of depression to be 17% [95% CI 15-20%] (Shorey et al., 2018). However, prevalence varied based on the PPD assessment method. Self-reported assessment via PPD screening tools, identified a higher prevalence of 22.4% (95% CI [21.0–23.8%]), while structured clinical interviews identified a lower prevalence of 12.6% (95% CI [10.3–14.9%]) (Yin et al., 2020). Regional differences also exist, with the highest prevalence reported in the Middle East at 26% (95% CI [13–39%]) and the lowest in Europe at 8% (95% CI [5–11%]) (Alshikh Ahmad et al., 2021).

Anxiety disorders encompass various subtypes characterised by excessive fear and worry and related behavioural disturbances and include generalised anxiety disorder, panic disorder, and phobias (American Psychiatric Association, 2022). A systematic review and meta-analysis of 102 studies incorporating 221,974 women reported a global prevalence of perinatal anxiety disorders of 15.2% (95% CI [9.0–21.4%]) (Dennis et al., 2017). For generalised anxiety disorder, clinical interviews during the postpartum period revealed a prevalence of 4.1% (95% CI [1.9–6.2%]) (Dennis et al., 2017). Clinically diagnosed anxiety disorders had a prevalence of 9.9% (95% CI [6.1–13.8%]), while generalised anxiety disorder was observed in 5.7% (95% CI [2.3–9.2%]) (Dennis et al., 2017). Prevalence was higher in low-income countries compared to middle-income countries, reflecting a similar pattern observed for PPD (Dennis et al., 2017, Shorey et al., 2018).

PTSD encompasses a broad spectrum of symptoms, such as intrusive memories, avoidance of possible triggers, negative alterations in mood and cognition, and heightened arousal (e.g., hypervigilance) following exposure to trauma (American Psychiatric Association, 2022). The experience of PTSD is highly subjective and shaped by personal perception, meaning that individuals can respond to the same traumatic event in unique ways.

Many women may experience symptoms of acute stress disorder following a traumatic childbirth, although not all will develop PTSD (Handelzalts et al., 2024, Sachdeva et al., 2022). For those who develop PTSD, it can be related to the birth experience or be a pre-existing condition. Childbirth-onset PTSD (CB-PTSD) refers to PTSD that develops for the first time following a traumatic birth. It typically arises in women with no prior PTSD diagnosis and is directly linked to distressing experiences during labour, birth, or immediate

postpartum events (Ayers, 2008; Dekel et al., 2017). In contrast, a traumatic childbirth triggering PTSD symptoms in someone with a pre-existing diagnosis involves a reactivation or worsening of PTSD. In such cases, childbirth is not the original cause of the disorder but serves as a triggering event, often due to pain, loss of control, or perceived threat to life (Grekin and O'Hara, 2014; Nicholls and Ayers, 2007). Clinically, distinguishing between CB-PTSD and the reactivation of pre-existing PTSD is essential, as therapeutic approaches may differ depending on the trauma history and symptom origin.

Although measuring PTSD is challenging, a systematic review and meta-analysis of 59 studies (24,267 women), estimated the overall mean prevalence of PTSD in the general postpartum population at 5.44% (k = 28, 95% CI: 3.62–8.1%) (Yildiz et al., 2017).

Mental health following hypertensive disorders of pregnancy

Postpartum depression

HDP, particularly preeclampsia, are increasingly recognised as significant risk factors for PPD. A systematic review and meta-analysis of eight studies (> 1.2 million women) (Caropreso et al., 2020), identified preeclampsia as a significant risk factor for developing depression. In this review, women with preeclampsia experienced more severe depressive symptoms than those without the disorder (95% CI: 0.22–1.86, p = 0.01). Importantly, this association was identified in studies that excluded women with a history of mental disorders before pregnancy—a crucial consideration, given that the most consistent predictor of PPD is a history of depression (O'Hara and McCabe, 2013). Furthermore, Caropreso et al. (2020) noted that the heightened severity of depressive symptoms in women with preeclampsia persisted beyond the postpartum period, sometimes extending later into life.

However, findings across individual studies were inconsistent. Some failed to detect a significant association between preeclampsia and PPD, which may be explained by heterogeneity in study design, small samples (ranging from 20 to 175 participants), and wide variation in the timing of depression assessment, sometimes occurring 4 to 15 years after birth, potentially introducing recall bias and limiting the reliability of results. Additional evidence from a narrative review of 17 studies involving over 60,000 women also supports a potential association between HDP and increased risk of PPD, especially in more severe cases (Roberts et al., 2019). However, the authors highlighted methodological heterogeneity

and variation in assessment tools, limiting the strength of the conclusions. Notably, this review focused solely on postpartum mental disorders and did not account for pre-existing or antenatal mental health disorders.

In a large cohort study of nearly 5,000 women (Blom et al., 2010) those with a history of preeclampsia were 2.6 times more likely to experience PPD at two months postpartum than those without. Perinatal complications, particularly severe maternal morbidity (SMM), remained strong risk factors for PPD after adjusting for sociodemographic, obstetric, and psychological variables.

The severity of HDP appears to influence mental health. In a Dutch longitudinal study of 174 women, 44% of those with severe preeclampsia (at least one of: BP ≥160/110 mmHg, proteinuria >5g/day, HELLP (platelet count <100,000/µL, AST >30 U/L, ALT >30 U/L), seizure, or fetal growth restriction) reported depressive symptoms at six months postpartum, compared to 23% of those with mild preeclampsia (BP ≥140/90 and proteinuria ≥300 mg/day) (Hoedjes et al., 2011a).

The timing of HDP onset may also play a role, although evidence remains inconclusive. A Dutch cohort study with 14 years of follow-up (Mommersteeg et al., 2016) found a small but statistically significant increase in depressive symptoms among women with early-onset preeclampsia (<34 weeks) compared to normotensive women (B score: 0.8, 95% CI: 0.2–1.4, $p = 0.009$). Engelhard et al. (2002) found a higher prevalence of PPD in women who gave birth either preterm or at term with preeclampsia (33% and 26%, respectively) compared to those who delivered preterm (24%) or at term (7%) without complications, suggesting that preeclampsia itself may contribute to poor mental health. In contrast, another Dutch study found no significant difference in PPD between women who gave birth preterm with or without preeclampsia, indicating that preterm birth itself, rather than HDP, may have been the driving factor in that cohort (Baeck et al., 2009).

Preeclampsia is a significant risk factor for PPD, and this association is likely influenced by factors such as psychological history, severity and timing of the diagnosis, and the presence of adverse maternal and neonatal outcomes. Preeclampsia is often accompanied by serious

complications including placental abruption, stillbirth, fetal growth restriction, and preterm birth (Sibai et al., 2005), all of which are independently linked to increased risk of maternal depression. In addition, the emotional toll of experiencing a pregnancy complicated by preeclampsia, characterised by fear, loss, and acute stress, may further heighten vulnerability to PPD (Hoedjes et al., 2011a).

Postpartum anxiety

Evidence around anxiety following HDP is limited. In a narrative review of 17 studies, anxiety following HDP was reported in 26 to 32% of women up to 31 years postpartum, exceeding rates observed in the general postpartum population (Roberts et al., 2019). In contrast, a long-term observational study comparing 265 women with a history of early onset preeclampsia to a control group of 268 normotensive women, found no difference between the groups in the prevalence of mild anxiety, 31% versus 27%, respectively (p=0.3) (Mommersteeg et al. 2016). The average time since the index pregnancy was 14 years, raising the possibility of recall bias and the influence of unrelated experiences over time. On further analysis adjusting for age, education level, body mass index (BMI), having a partner, being unemployed and physical activity, the results showed no difference in anxiety between the two groups. A prospective cohort study reported no significant difference in postpartum anxiety following hypertensive or normotensive pregnancy at 6-months (392 women) (Roberts et al., 2022) and 2-years (365 women) (Shang et al., 2024) postpartum. However, women 2-years after gestational hypertension were more likely to have above threshold anxiety scores than after normotensive pregnancy.

Regarding anxiety severity, studies have indicated higher anxiety scores on screening instruments in women with a history of HDP compared to those without. However, only two reported statistically significant differences (Postma et al., 2014, Postma et al., 2016). These two small studies (145 and 137 women), conducted at approximately six years postpartum, primarily examined cognitive functioning following preeclampsia or eclampsia. Additionally, comparisons between primiparous and multiparous women, and among different HDP subtypes, showed no significant differences in anxiety scores (Abedian et al., 2015). Notably, one study (Postma et al., 2014) reported that women who experienced eclampsia had significantly higher anxiety scores than those who had preeclampsia or a normotensive

pregnancy, suggesting that more severe HDP may be associated with greater anxiety severity.

Postpartum posttraumatic stress disorder

Women who experience preeclampsia may have an increased risk of developing PTSD postpartum due to maternal and infant factors common to HDP. Younger maternal age, severe preeclampsia symptoms, unplanned caesarean section, need for intensive care, or experiencing a preterm birth, along with infant factors such as lower gestational age, lower birth weight, admission to the neonatal intensive care unit, and perinatal death, have been linked to higher rates of PTSD and its symptoms (Beck, 2017). It is unclear in the published research, whether the PTSD is childbirth-related or a pre-existing condition. The prevalence of postpartum PTSD varies, as shown in a narrative review conducted by Roberts et al. (2019) where the prevalence of PTSD following HDP ranged from 5.1% to 43%. Hoedjes et al. (2011b) found that the prevalence of PTSD among women after preeclampsia improved over time and reported a prevalence of 8.6% at 6 weeks postpartum and 5.1% at 12 weeks postpartum. Furthermore, 21.9% of the study participants reported postpartum PTSD symptoms of birth experience intrusions (intrusive thoughts, memories, nightmares, or flashbacks) at 6 weeks after childbirth, with 11.7% continuing to experience them at 12 weeks. This indicates that certain PTSD symptoms may be present without impairing a woman's ability to function or meeting the criteria for a formal diagnosis of the disorder.

A prospective cohort study in Australia investigated PTSD following HDP (GH and preeclampsia) versus normotensive pregnancy at 6-months (Roberts et al., 2022) and 2-years postpartum (Shang et al., 2024). Findings reported that the overall prevalence of post-HDP PTSD at both time points was low at around 1%. However, about 8% of women with a history of preeclampsia perceived their childbirth experience as traumatic, compared to 2.5% of those who were normotensive during pregnancy (p=0.003). Preterm birth, regardless of the cause, has been noted to be a key PTSD trigger. Baecke, et al. (2009) found PTSD rates were significantly higher in women following preterm births (41–44%) than term births (11%), while Engelhard. et al. (2002) reported 28% PTSD prevalence in preterm births versus 17% in term preeclampsia, suggesting preterm birth and the preeclampsia experience may both contribute to PTSD.

The evidence on mental health following HDP highlights preeclampsia as a significant risk factor for developing PPD, with affected women experiencing more severe depressive symptoms than those without the disorder. However, the evidence regarding postpartum anxiety and PTSD is less conclusive, suggesting no significant differences between women who experienced HDP and those who did not.

Mental health following gestational diabetes mellitus

Postpartum depression

The psychological stress experienced by women with GDM, due to concerns about potential complications for the pregnancy and fetus from uncontrolled diabetes, may contribute to antenatal mental disorders that can persist into the postpartum period (Sun et al., 2023). Studies on the relationship between GDM and PPD consistently indicate increased PPD following GDM. In a systematic review and meta-analysis by Azami et al. (2019a), of 18 studies (2,370,958 women), GDM significantly increased the risk of PPD, with a pooled relative risk (RR) of 1.59 (95% CI: 1.22–2.07, p = 0.001). When stratified by study design, the RR was 1.67 (95% CI: 1.22–2.28) for 15 cohort studies, 1.37 (95% CI: 0.91–2.05) for two cross-sectional studies, and 1.29 (95% CI: 0.98–1.68) for one case-control study; indicating again that study design may impact on risk estimates. The authors noted significant heterogeneity among the included studies, indicating variability in the methods and populations, but concluded that GDM can be a risk factor for PPD.

Postpartum anxiety

A systematic review and meta-analysis by Wilson et al. (2020) explored the prevalence of antenatal and postpartum mental disorders in women with GDM compared to those without GDM. The review included three studies (>350,000 women) on postpartum anxiety following GDM, with two lacking a specific screening time point and one assessing anxiety up to a year postpartum. Prevalence rates ranged from 14% to 18%, consistent with those seen in the general postpartum population. All included studies found no significant difference in postpartum anxiety between women with and without GDM.

Postpartum posttraumatic stress disorder

No publications were found on the association between GDM and postpartum PTSD.

Overall, the evidence on mental health following GDM is limited. Existing research suggests an increased risk of PPD following a pregnancy complicated by GDM. However, in the limited existing literature, no significant differences in the prevalence or severity of anxiety or PTSD have been observed between women with GDM and those without.

Mental health following anaemia

Postpartum depression

Several studies have explored the association between anaemia during pregnancy and the risk of PPD, though findings have been mixed. A meta-analysis of eight studies involving 2,785 women found a significant association between gestational anaemia and PPD, with a relative risk of 1.24 (95% CI: 1.001–1.536, $p = 0.048$), independent of the timing of anaemia or depression assessment (Azami et al., 2019b). However, a prospective cohort study from Finland (Kemppinen et al., 2022) involving 1,273 women, 24% of whom had gestational anaemia, reported no significant difference in depressive symptoms at six months postpartum (OR 1.32, 95% CI: 0.75–2.31, $p = 0.33$). Similarly, a retrospective study of 519 women over 35 years found no overall association between anaemia and PPD, although more severe anaemia was linked to increased risk (Tian et al., 2022). A prospective study of 103 women following uncomplicated caesarean sections also found no association between postpartum anaemia and PPD (Chandrasekaran et al., 2018).

Postpartum anxiety

Evidence suggests an association between anaemia and anxiety in the general population, possibly because of the effects of iron deficiency on cerebral neurotransmitter metabolism. However, research specifically investigating the link between gestational anaemia and postpartum anxiety is limited, with only one publication identified for this review. A cohort study from Finland (Kemppinen et al., 2022) including 1,273 women, 301 (24%) of whom had gestational anaemia (Hb level < 11.0 g/dL), found a weak association between gestational anaemia and anxiety during the early and late pregnancy stages, but no significant association postpartum. At six months postpartum, median scores on the Pregnancy Related Anxiety Questionnaire (PRAQ) (van den Burgh, 1990) were 1.0 (0-20) and 1.0 (0-29) for the anaemic and control groups respectively (OR 0.16, 0.63-0.94, p=0.69).

Postpartum posttraumatic stress disorder

No publications were found on the association between anaemia in pregnancy and postpartum PTSD.

Overall, the evidence linking anaemia to PPD is mixed and inconclusive, potentially influenced by anaemia severity and differences in study design. To date, no studies have demonstrated a significant association between anaemia and postpartum anxiety or PTSD.

Mental health following severe maternal morbidity (SMM)

Increasing evidence links SMM with elevated risks of postpartum mental health disorders, including PPD, anxiety, and PTSD. Women who experience SMM are significantly more likely to develop psychological distress compared to those with uncomplicated pregnancies and births (Bick et al., 2016; Creanga et al., 2015; Duval et al., 2022). For example, Geller et al. (2010) found increased prevalence of childbirth-related PTSD symptoms among women surviving severe obstetric events. Similarly, Olde et al. (2006) highlighted that traumatic childbirth experiences inherent to SMM contribute significantly to PPD and PTSD. These mental health challenges may be compounded by physical recovery demands, prolonged hospital stays, and disruption of maternal-infant bonding (Redshaw and Henderson, 2015).

The severity and type of SMM may influence psychological outcomes. Seefeld et al., (2020) demonstrated that life-threatening conditions, such as haemorrhage and eclampsia, are associated with greater postpartum psychological morbidity. Social support and good quality care, including empathetic communication during hospitalisation, are important protective factors that can mitigate adverse outcomes (Bick et al., 2016).

Despite recognition of these mental health risks, routine mental health screening for women affected by SMM remains limited. Integrating trauma-informed mental health assessment and care into postpartum follow-up is critical for early identification and intervention (Callaghan et al., 2012; Geller et al., 2010). Multidisciplinary approaches involving midwifery, obstetric and mental health providers are recommended to address the complex needs of this high-risk group.

Postpartum mental health in priority and under-served populations

Priority and under-served groups, including people from racial and cultural minorities and gender-diverse individuals face numerous risk factors that warrant focused attention. These groups are likely under-represented in the literature, compounding challenges regarding evidence-based care recommendations.

Women from racially, culturally, and linguistically diverse backgrounds experience disproportionately high rates of postpartum mental health disorders. Research shows that women from ethnic minority groups such as Black, Hispanic, Indigenous, refugee and migrant populations, are more likely to report symptoms of PPD, anxiety, and psychological distress compared to non-minority women (Liu et al., 2019; Brown and Lumley, 2016). These disparities are driven by living with socioeconomic disadvantage, discrimination, trauma, limited access to culturally appropriate services, and language barriers (Abrams et al., 2009; Schmied et al., 2017). Compounding these challenges is a widespread underdiagnosis of mental health issues in these populations, largely due to cultural stigma, mistrust of healthcare systems, and the lack of culturally safe screening tools and care models. Additionally, migrant women often face challenges maintaining traditional postpartum practices, such as family support, rest, and cultural rituals, that typically provide emotional and practical mental health protection after childbirth. Being separated from their usual support networks and practices and living in a different cultural environment can interrupt these protective customs, increasing their vulnerability to postpartum mental health disorders (Schmied et al., 2017).

Gender-diverse and LGBTQ+ individuals who become pregnant often face elevated risks for postpartum mental health disorders, frequently entering pregnancy with pre-existing mental health disorders. A large retrospective study of transgender and gender nonconforming youth (aged up to 17) found they were 3.5–13.9 times more likely to be diagnosed with depression and 3.2–10.1 times more likely to be diagnosed with anxiety compared to their cisgender peers (Becerra-Culqui et al., 2018). These findings reflect broader trends in the adult gender-diverse population, where up to 40% experience serious mental health disorders and lifetime suicide attempt rates far exceed those of the general population (James et al., 2016).

These mental health vulnerabilities may be further exacerbated during pregnancy and the postpartum period due to a complex set of psychological and social challenges, including gender dysphoria, minority stress, and exclusion from gender-affirming care (Greenfield & Darwin, 2021; MacDonald et al., 2016; Vigod et al., 2025). Gender dysphoria may intensify with pregnancy-related bodily changes, while minority stress, stemming from stigma, discrimination, and societal invalidation, contributes to chronic emotional distress. Compounding these factors, many individuals report feeling misgendered, invisible, or unwelcome in cisnormative perinatal care environments (Light et al., 2014; MacDonald et al., 2016). Together, these intersecting stressors significantly increase the risk of mental health disorders before and after birth.

Therefore, priority and under-served populations already face elevated risks for mental health disorders. Given that a history of mental disorder is a well-established risk factor for postpartum mental disorders (Bayrampour et al., 2018), the addition of a medical complication during pregnancy may further amplify the likelihood and severity of PPD, anxiety or PTSD in these groups. Addressing these disparities requires an approach that includes cultural and gender-sensitive screening, inclusive language, peer support, and targeted training for healthcare professionals. Making maternity and obstetric care fair and inclusive is essential so that all birthing people, no matter their race, background, or gender, receive appropriate and compassionate mental health support.

Consequences of postpartum mental disorders on maternal and child health

Postpartum mental disorders can have a profound impact on the health of mothers and their children. Women with PPD generally experience poorer physical and mental health, along with a lower quality of life at one year postpartum. A systematic review of 122 studies on maternal and infant health outcomes linked PPD to weight retention, sleep difficulties, cognitive decline, social relationship issues, lower self-esteem, and reduced vitality compared to non-depressed mothers (Slomian et al., 2019). Additionally, women diagnosed with depression in the early postpartum weeks were more likely to continue experiencing depressive symptoms at one year postpartum compared to those without perinatal depression (Slomian et al., 2019).

Maternal mental health during the postpartum period also influences child health and development. The reported impacts are far reaching, including in infancy where maternal depressive episodes at five months postpartum have been linked to poorer child health outcomes in the following months, including slower growth, increased illness, reduced quality of life, problematic sleep behaviours and impaired motor development (Slomian et al., 2019). These associations have been reported to be linked to mother-child bonding issues which are more prevalent among women who experience a mental health disorder. A systematic review of 133 studies involving 110,968 mothers found that bonding difficulties often co-occurred with maternal depression or anxiety (O'Dea et al., 2023). PPD may also negatively affect a child's cognitive and language development, potentially due to disruptions in the family environment and mother-child interactions (McManus and Poehlmann, 2012, Slomian et al., 2019, Walker et al., 2013).

The impact of maternal mental health disorders on mother-child bonding is also thought to play a role in the development of the long-term consequences observed in children of mothers with PPD. An observational study of over 9,000 English women with PPD found that their children had twice the risk of behavioural issues at 3.5 years of age and were more than twice as likely to be diagnosed with depression at 18 years of age (Netsi et al., 2018). However, the extent to which these outcomes are influenced by various mediating factors remains unclear (Howard et al., 2014). Overall, research on the medium- to long-term mental health effects on mothers and children remains inconclusive due to the limited number of studies (Glasheen et al., 2010).

Potential neurobiological mechanisms of postpartum mental disorders following medically complicated pregnancies

There is a dearth of literature on the mechanisms of postpartum mental disorders and little understanding of how those mechanisms operate in the context of a medically complicated pregnancy. Pre-conception mental disorder is a significant risk factor for the development of postpartum mental disorders (Bayrampour et al., 2018); moreover, symptoms of so-called 'postpartum' mental disorders commonly arise during the prenatal period. This makes it difficult to discern whether discrete mechanisms are involved in the development of perinatal mental disorder under these different circumstances. The role of steroid hormones

in the onset or exacerbation of peripartum mental health disorders has naturally been probed given this is a period of enormous hormonal flux. While there is no consistent evidence for aberrations in steroid hormone changes during the perinatal period amongst those with perinatal mental disorders, instead, it is thought that perinatal mental disorders may be partly caused by adverse reactions to normative hormonal changes experienced by a subset of 'hormonally sensitive' individuals (Bloch et al., 2000). Viewed through this lens, postpartum mental disorders may have common shared biological vulnerabilities with other affective conditions that occur during normative hormonal changes, including premenstrual dysphoric disorder, perimenstrual exacerbations of mental disorder, and perimenopausal depression and anxiety (Rubinow and Schmidt, 2018).

Although the exact causes of hormone sensitivity are unclear, animal studies suggest that changes in downstream metabolites of steroid hormones (such as allopregnanolone) or their receptors (such as GABA, the major inhibitory neurotransmitter system), which are involved in anxiety regulation, may be involved (Pawluski et al., 2021). Psychosocial stress, which is often experienced during the peripartum period and is further exacerbated during a medically complicated pregnancy, may promote or unmask hormone sensitivity (Schweizer-Schubert et al., 2020). Research also suggests that the hypothalamic-pituitary-adrenal axis, which regulates the stress response, becomes dysregulated in peripartum mental disorder– although the nature of this dysregulation is inconsistent across studies (Pawluski et al., 2021). The maternal immune system also undergoes substantive change during the peripartum period, and abnormalities in pregnancy-associated immune changes have been linked to peripartum mental disorders (Dye et al., 2021). Stress-induced release of pro-inflammatory cytokines associated with medical complications during pregnancy, including preeclampsia (Caropreso et al., 2020) could therefore heighten risk for development of peripartum mental disorders in these women.

Clinical practice implications and treatments

Table 2 summarises the mental health care of women with a medically complicated pregnancy.

It is clear that postpartum mental disorders, such as PPD, anxiety, and PTSD, affect a significant proportion of women and can have lasting consequences for maternal and infant wellbeing (Stewart and Vigod, 2019). Early identification, compassionate care, and evidence-based treatment are essential for improving outcomes. Management depends on the severity of the mental disorder and known as 'Stepped Care', with mild-moderate severity often managed with non-pharmacological options, and medications added when the non-pharmacological options are unsuccessful (Vigod et al., 2025). Collaboration between primary care providers, midwives, obstetricians, and mental health professionals is vital to delivering integrated and personalised care. Culturally competent and trauma-informed approaches are particularly important, as women from diverse backgrounds may experience additional barriers to accessing support (Austin et al., 2021). Addressing these challenges through early screening and coordinated care pathways is essential to promoting recovery and safeguarding maternal-infant health (Howard et al., 2014).

Screening

Screening plays a crucial role in accurately identifying women who may be experiencing mental health symptoms, enabling timely referral for formal mental health assessments and appropriate follow-up care. This approach aims to enhance outcomes for women and their babies (Highet et al., 2023). The 2023 Australian Clinical Practice Guideline, developed by the Centre of Perinatal Excellence (COPE), provides evidence-based recommendations for perinatal mental health care. It advocates for postpartum screening to detect common mental health disorders such as depression and anxiety, psychosocial risk factors, and the quality of mother-child interactions. This screening should begin 6-12 weeks after childbirth, with at least one follow-up within the first year incorporated into standard maternal and infant checks at six weeks postpartum and again at 6-8 months, a time when symptoms are often more likely to emerge (Highet et al., 2023). The UK's NICE guidelines (National Insitiute for Health and Care Excellence, 2014) offer similar recommendations, especially for women with a history of mental disorders. Both guidelines recommend posttraumatic birth counselling for women with PTSD or traumatic births.

Postpartum mental health care is often overlooked after a medically complicated pregnancy, as the emphasis tends to be on the physical monitoring and recovery of the mother and

infant, with limited global guideline recommendations addressing mental health needs. However, the recently published 2023 SOMANZ guideline (Society of Obsteric Medicine Australia and New Zealand (SOMANZ), 2023) highlights the importance of mental health screening following HDP and provides guidance on long-term follow-up care, including opportunistic screening for PPD and anxiety at each follow-up visit. These visits should be scheduled shortly after postpartum discharge from hospital, 3-6 months and 12-months postpartum, and then annually.

Continuity of care

Midwifery continuity of care is a model in which a known midwife or small group of midwives provides care throughout pregnancy, labour, birth, and the postnatal period. This model has been shown to significantly improve maternal and neonatal outcomes, enhance maternal satisfaction, reduce intervention rates, and promote physiological birth (Homer et al., 2019; Sandall et al., 2024). It also contributes to improved mental health by reducing maternal stress and anxiety, facilitating early bonding, and supporting the establishment and continuation of breastfeeding.

Continuity of care fosters a trusting and therapeutic relationship between the woman and her care provider, improving communication and enabling personalised and responsive care, which is particularly important for women with medically or psychosocially complex pregnancies. These women often experience fragmented care and higher levels of anxiety, and benefit from coordinated, continuous support (Roberts et al., 2017).

Integrating midwifery continuity within a collaborative, multidisciplinary framework, alongside obstetric, medical, and mental health specialists, offers a safe and effective approach to managing complex care needs. Such integrated models improve clinical outcomes, increase patient satisfaction, reduce healthcare costs, and help to protect the woman's mental health (Sandall et al., 2024).

Support

Social, informational, emotional, and practical support in the postpartum period is vital in helping women navigate the complex transition to motherhood, including shifts in family

dynamics, finances, work responsibilities, and physical and psychological adjustment. Research in the general postpartum population indicates that adequate social support is associated with lower levels of PPD and improved maternal well-being (Gutiérrez-Zotes et al., 2016). Emotional and informational support from partners, family, and healthcare providers enhances maternal confidence, reduces stress, and promotes positive parenting experiences (Leahy-Warren et al., 2012). Practical assistance, such as help with infant care, household tasks, and daily routines, also plays a critical role in easing this adjustment (Razurel et al., 2013).

Taken together, these forms of support create a protective environment that fosters maternal resilience, promotes good mental health, and supports optimal outcomes for both mother and baby.

Interventions

Postpartum mental health interventions aim to address conditions such as PPD, anxiety, and PTSD. These interventions may include lifestyle modifications, psychological therapies, pharmacological treatment, and/or somatic treatments such as non-invasive neuromodulation or electroconvulsive therapy (ECT), tailored to the severity and nature of the disorder (Vigod et al., 2025). The Canadian Network for Mood and Anxiety Treatments (CANMAT) Guideline (Vigod et al., 2025) clearly maps out the management and treatment of PPD and anxiety according to the severity of the disorder, beginning with lifestyle, psychosocial and/or complementary and alternative medicine.

Lifestyle changes can play an important role in supporting postpartum mental health. Evidence suggests that certain lifestyle modifications, including exercise, nutrition, sleep management, and social support, can help mitigate PPD, anxiety, and other mental health disorders (Daley et al., 2018, Guan et al., 2021). A 2022 systematic review of postpartum interventions for women after HDP or GDM found that online lifestyle modules and extended post-hospital care, led to small reductions in depression and anxiety symptoms (Shang et al., 2022). However, these improvements were minimal, leaving the effectiveness of lifestyle interventions for improving mental health after a medically complicated pregnancy unclear. Other opportunities for interventions that are accessible for postpartum

women should also be explored, including utilising social media and other digital platforms (Gow et al., 2024).

Mindfulness, the practice of being fully present and aware of one's thoughts, emotions, and surroundings without judgment, is increasingly being used in health care. It promotes acceptance and emotional balance and can be practiced through meditation or everyday activities. Mindfulness is effective in reducing stress and enhancing overall well-being. Mindfulness programs have shown promise in reducing anxiety and depression symptoms in postpartum women (Goyal et al., 2014).

Early supportive strategies, such as open communication and providing space for women to reflect on their birth experience, can help identify emerging concerns and mitigate the severity of postpartum mental health disorders (Roberts et al., 2017). Timely involvement of social workers or perinatal mental health teams can also offer critical support, particularly for women at higher risk, and contributes to a more integrated and responsive model of care (Roberts et al., 2017).

Medical treatment for postpartum mental disorders may include cognitive-behavioural therapy (CBT), which focuses on changing negative thought patterns and behaviours. CBT is a common therapeutic approach for treating PPD. Additionally, medications such as antidepressants, particularly selective serotonin reuptake inhibitors (SSRIs), are often prescribed for PPD and anxiety (Meltzer-Brody et al., 2013). In line with evidence for hormone sensitivity as a mechanism of peripartum mental disorder, zuranolone, an allopregnanolone analogue, and the first oral medication specifically indicated for the treatment of peripartum depression, was approved by the United States Food and Drug Administration in 2023 (Deligiannidis et al., 2023).

Women with CB-PTSD often benefit from trauma-focused interventions that specifically address the birth experience, such as cognitive processing therapy or Eye Movement Desensitisation and Reprocessing (EMDR). EMDR involves helping individuals process traumatic memories by combining focused recall of the trauma with bilateral sensory stimulation, most commonly through side-to-side eye movements, but also via alternating

sounds or taps. It is a psychotherapy approach designed to help process and recover from traumatic experiences (Dekel et al., 2017; Ayers et al., 2008). In contrast, women with a pre-existing PTSD diagnosis may require broader therapeutic strategies that include processing earlier traumatic experiences, while also addressing how the childbirth event acted as a psychological trigger (Grekin and O'Hara, 2014; Nicholls and Ayers, 2007). It is important to tailor treatment to the nature of the trauma as this ensures a more effective and compassionate approach to postpartum mental health care.

Conclusions

Medical complications during pregnancy, such as HDP, GDM, and gestational anaemia, are thought to increase the risk of postpartum mental disorders, particularly PPD. While these pregnancy complications may also be linked to a higher risk of anxiety disorders and PTSD, the evidence remains limited or inconclusive. Women who experience SMM or who belong to priority population/minority groups, may have pre-existing mental disorders that may be exacerbated with the addition of a medical complication during pregnancy. Mental health disorders in the postpartum period can have long-term consequences for the mother and child, and some interventions have shown benefit. Despite a significant body of research on postpartum mental health, the subject of medically complicated pregnancies remains under-researched. Further studies are needed to enhance our understanding of postpartum mental health in this group. Until more is known, all women with such complications should be considered at high risk for postpartum mental disorders and receive appropriate screening and follow-up care.

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AH conceived the study. LR, JS, MG, BG and AH wrote the original draft paper. All authors made significant contributions to drafting and/or revising the manuscript. All authors approved the final version of the manuscript.

References

ABEDIAN, Z., SOLTANI, N., MOKHBER, N. & ESMAILY, H. 2015. Depression and anxiety in pregnancy and postpartum in women with mild and severe preeclampsia. *Iran Journal of Nursing and Midwifery Research,* 20**,** 454-9.

ABRAMS, L. S., DORING, K., & CURRAN, L. 2009. Barriers to service use for postpartum depression symptoms among low-income ethnic minority mothers in the United States. *Qualitative Health Research, 19*(4), 535–551.

ALSHIKH AHMAD, H., ALKHATIB, A. & LUO, J. 2021. Prevalence and risk factors of postpartum depression in the Middle East: a systematic review and meta-analysis. *BMC Pregnancy Childbirth,* 21**,** 542.

AMERICAN PSYCHIATRIC ASSOCIATION 2022. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5-TR (5th ed., Text Revision),* Arlington, VA, American Psychiatric Association.

ARNOTT, C., NELSON, M., ALFARO RAMIREZ, M., HYETT, J., GALE, M., HENRY, A., CELERMAJER, D. S., TAYLOR, L. & WOODWARD, M. 2020. Maternal cardiovascular risk after hypertensive disorder of pregnancy. *Heart,* 106**,** 1927-1933.

AUSTIN, M.-P., HIGHET, N., & EXPERT WORKING GROUP. 2021. *Mental health care in the perinatal period: Australian clinical practice guideline*. Centre of Perinatal Excellence (COPE). Retrieved from https://www.cope.org.au/wp-content/uploads/2022/05/COPE-Perinatal-Mental-Health-Guideline_2021.pdf

AYERS, S., JOSEPH, S., McKENZIE-McHARG, K., SLADE, P., WIJMA, K. 2008. *Post-traumatic stress disorder following childbirth: current issues and recommendations for future research*. Journal of Psychosomatic Obstetrics and Gynaecology, 29(4): 240-50.

AZAMI, M., BADFAR, G., SOLEYMANI, A. & RAHMATI, S. 2019a. The association between gestational diabetes and postpartum depression: A systematic review and meta-analysis. *Diabetes Research and Clinical Practice,* 149**,** 147-155.

AZAMI, M., BADFAR, G., KHALIGHI, Z., QASEMI, P., SHOHANI, M., SOLEYMANI, A. & ABBASALIZADEH, S. 2019b. The association between anemia and postpartum depression: A systematic review and meta-analysis**.** *Caspian Journal of Internal Medicine,* 10(2):115–124.

BAECKE M, SPAANDERMAN ME & VAN DER WERF SP 2009. Cognitive function after pre-eclampsia: an explorative study. *Journal of Psychosomatic Obstetrics & Gynecology,* 30**,** 58-64.

BAYRAMPOUR, H., VINTURACHE, A., HETHERINGTON, E., LORENZETTI, D. L., & TOUGH, S. 2018. Risk factors for antenatal anxiety: A systematic review of the literature. *Journal of Reproductive and Infant Psychology*, *36*(5), 476–503.

BECERRA-CULQUI, T. A., LIU, Y., NASH, R., CROMWELL, L., FLANDERS, W. D., GETAHUN, D., GIAMMETTEI, S.V., HUNKELER, E,M,. LASH, T.L., MILLMAN, A., QUINN, V.P., ROBINSON, B., ROBLIN, D., SANDBERG, D.E., SILVERBERG, M.J., TANGPRICHA, V., & GOODMAN, M. 2018. Mental health of transgender and gender nonconforming youth compared with their peers. *Pediatrics, 141*(5), e20173845.

BECK, C. T. 2017. Trauma and PTSD in pregnancy and childbirth. *Journal of Perinatal & Neonatal Nursing,* 31**,** 14-22.

BECK, S.M. and PERRY, J.C. 2008. 'The definition and function of interview structure in psychiatric and psychotherapeutic interviews', *Psychiatry*, **71**(1), pp. 1–12. https://doi.org/10.1521/psyc.2008.71.1.1.

BEHL R 2023. The World Health Organization's recommendations on postnatal mental health: The advances made and consolidated limitations. *Ethics, Medicine and Public Health,* 31.

BICK, D., MacARTHUR, C., HUNT, L., & WILLIAMSON, L. 2016. Postnatal care following severe maternal morbidity: Women's perceptions and experiences. *BMC Pregnancy and Childbirth, 16*, 243.

BLOCH, M., SCHMIDT, P. J., DANACEAU, M., MURPHY, J., NIEMAN, L. & RUBINOW, D. R. 2000. Effects of gonadal steroids in women with a history of postpartum depression. *American Journal of Psychiatry,* 157**,** 924-30.

BLOM, E. A., JANSEN, P. W., VERHULST, F. C., HOFMAN, A., RAAT, H., JADDOE, V. W., COOLMAN, M., STEEGERS, E. A. & TIEMEIER, H. 2010. Perinatal complications increase the risk of postpartum depression. The Generation R Study. *British Journal of Obstetrics and Gynaecology,* 117**,** 1390-8.

BROWN, A., & LUMLEY, J. 2016. Postnatal depression in culturally and linguistically diverse women: A comparative study. *Journal of Paediatrics and Child Health, 42*(12), 700–706.

CALLAGHAN, W. M., CREANGA A. A., & KUKLINA, E. V. 2012. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstetrics & Gynecology, 120*(5), 1029–1036.

CAROPRESO, L., DE AZEVEDO CARDOSO, T., ELTAYEBANI, M. & FREY, B. N. 2020. Preeclampsia as a risk factor for postpartum depression and psychosis: a systematic review and meta-analysis. *Archives of Womens Mental Health,* 23**,** 493-505.

CHANDRASEKARAN, N., DE SOUZA, L. R., URQUIA, M. L., YOUNG, B., MCLEOD, A., WINDRIM, R. & BERGER, H. 2018. Is anemia an independent risk factor for postpartum depression in women who have a cesarean section? - A prospective observational study. *BMC Pregnancy and Childbirth,* 18**,** 400.

CREANGA, A. A., SYVERSON, C., SEED, K., & CALLAGHAN, W. M. 2015. Pregnancy-related mortality in the United States, 2011–2013. *Obstetrics & Gynecology, 128*(1), 177–186.

DALEY, A. J., MACARTHUR, C. & MCDONOUGH, S. 2018. Exercise interventions for postnatal depression: A systematic review. *British Journal of General Practice,* 68**,** e198-e205.

DALL'ASTA, A., D'ANTONIO, F., SACCONE, G., BUCA, D., MASTANTUONI, E., LIBERATI, M., FLACCO, M. E., FRUSCA, T. & GHI, T. 2021. Cardiovascular events following pregnancy complicated by pre-eclampsia with emphasis on comparison between early- and late-onset forms: systematic review and meta-analysis. *Ultrasound in Obstetrics and Gynecolology,* 57**,** 698-709.

DEKEL, S., STUEBE, C., & DISHY, G. 2017. Childbirth Induced Posttraumatic Stress Syndrome: A Systematic Review of Prevalence and Risk Factors*. Frontiers in Psychology*, 11(8), 560.

DELIGIANNIDIS, K. M., MELTZER-BRODY, S., MAXIMOS, B., PEEPER, E. Q., FREEMAN, M., LASSER, R., BULLOCK, A., KOTECHA, M., LI, S., FORRESTAL, F., RANA, N., GARCIA, M.,

LECLAIR, B. & DOHERTY, J. 2023. Zuranolone for the Treatment of Postpartum Depression. *American Journal of Psychiatry,* 180**,** 668-675.

DENNIS, C. L., FALAH-HASSANI, K. & SHIRI, R. 2017. Prevalence of antenatal and postnatal anxiety: systematic review and meta-analysis. *British Journal of Psychiatry,* 210**,** 315-323.

DUVAL, C. J., YOUSSEFZADEH, A. C., SWEENEY, H. E., MCGOUGH, A. M., MANDELBAUM, R. S., OUZOUNIAN, J. G. & MATSUO, K. Association of severe maternal morbidity and post-traumatic stress disorder. *American Journal of Obstetrics & Gynecology Global Reports*, 2(4), 100111.

DYE, C., LENZ, K. M. & LEUNER, B. 2021. Immune System Alterations and Postpartum Mental Illness: Evidence From Basic and Clinical Research. *Frontiers in Global Women's Health,* 2**,** 758748. 2022.

ENGELHARD I, VAN RIJ M, BOULLART I, EKHART T, SPAANDERMAN M, VAN DEN HOUT M & ET AL 2002. Posttraumatic stress disorder after pre-eclampsia: an exploratory study. *General Hospital Psychiatry,* 24**,** 260-264.

FAIRBROTHER, N., YOUNG, A. H., ZHANG, A., JANSSEN, P. & ANTONY, M. M. 2017. The prevalence and incidence of perinatal anxiety disorders among women experiencing a medically complicated pregnancy. *Archives of Women's Mental Health,* 20**,** 311-319.

FIRST, M.B., WILLAIMA, J.B.W., KARG, R.S., and SPITZER, R.L. 2016. *Structured Clinical Interview for DSM-5® Disorders—Clinician Version (SCID-5-CV)*. Arlington, VA: American Psychiatric Association Publishing.

FURUTA, M., SANDALL, J., COOPER, D. & BICK, D. 2014. The relationship between severe maternal morbidity and psychological health symptoms at 6-8 weeks postpartum: a prospective cohort study in one English maternity unit. *BMC Pregnancy and Childbirth,* 14**,** 133.

GELLER, S. E., ADAMS, M. M., & JOHNSON, J. V. 2010. Posttraumatic stress disorder after childbirth: Prevalence, course, and risk factors. *Journal of Psychosomatic Obstetrics & Gynecology, 31*(1), 13–21.

GLASHEEN, C., RICHARDSON, G. A. & FABIO, A. 2010. A systematic review of the effects of postnatal maternal anxiety on children. *Archives of Women's Mental Health,* 13**,** 61-74.

GOW, M. L., HENDERSON, M., HENRY, A., ROBERTS, L. & ROTH, H. 2024. Australian postpartum women want reputable health information delivered via social networking sites. *Australian and New Zealand Journal of Obstetrics and Gynaecology,* 64**,** 643-646.

GOYAL, M., SINGH, S., SIBINGA, E. M., GOULD, N. F., ROWLAND-SEYMOUR, A., SHARMA, R., BERGER, Z., SLEICHER, D., MARON, D. D., SHIHAB, H. M., RANASINGHE, P. D., LINN, S., SAHA, S., BASS, E. B. & HAYTHORNTHWAITE, J. A. 2014. Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. *Journal of the American Medical Association - Internal Medicine,* 174**,** 357-68.

GREENFIELD, M., & DARWIN, Z. 2021. Trans and non-binary people's experiences of pregnancy and childbirth: A systematic review and thematic synthesis of the qualitative literature. *BMC Pregnancy and Childbirth, 21*, 664.

GREKIN, R., & O'HARA, M. W. (2014). Prevalence and risk factors of postpartum posttraumatic stress disorder: A meta-analysis. *Clinical Psychology Review, 34*(5), 389–401.

GUAN, H., LI, X. & LIN, X. 2021. The role of nutrition in the prevention of postpartum depression: A systematic review. *Nutrients,* 13**,** 526.

GUTIÉRREZ-ZOTES, A., LABAD, J., MARTÍN-SANTOS, R., GARCÍA-ESTEVE, L., GELABERT, E., JOVER, M., GUILLAMAT, R., MAYORAL, F., GORNEMANN, I., CANELLAS, F., GRATACÓS, M., GUITART, M., ROCA, M., COSTAS, J., IVORRA, J. L., NAVINÉS, R., DE DIEGO-OTERO, Y., VILELLA, E. & SANJUAN, J. 2016. Coping strategies for postpartum depression: a multi-centric study of 1626 women. *Archives of Women's Mental Health,* 19**,** 455-61.

HANDELZALTS, J. E., KALFON-HAKHMIGARI, M., RAICHIN, A. & PELED, Y. 2024. Postpartum acute stress disorder symptoms, social support, and quality of couple's relationship associations with childbirth PTSD. *Frontiers in Psychiatry,* 15**,** 1310114.

HICKEY, C. A. & SMILEY, K. 2012. Anemia in pregnancy: Prevalence and implications. *Journal of Obstetrics and Gynaecology,* 32**,** 1265-1271.

HIGHET, N., EXPERT WORKING GROUP & EXPERT SUBCOMMITTEES 2023. Mental Health Care in the Perinatal Period: Australian Clinical Practice Guideline. Melbourne: Centre of Perinatal Excellence (COPE).

HOEDJES, M., BERKS, D., VOGEL, I., FRANX, A., DUVEKOT, J. J., STEEGERS, E. A. & RAAT, H. 2011a. Poor health-related quality of life after severe preeclampsia. *Birth,* 38**,** 246-55.

HOEDJES, M., BERKS, D., VOGEL, I., FRANX, A., VISSER, W., DUVEKOT, J. J., HABBEMA, J. D., STEEGERS, E. A. & RAAT, H. 2011b. Symptoms of post-traumatic stress after preeclampsia. *Journal of Psychosomatic Obstetrics and Gynaecology,* 32**,** 126-34.

HOMER, C. S. E., LEAP, N., BRODIE, P. M., SANDALL, J. & TRACY, S. K. 2019. Midwifery continuity of care in a publicly-funded Australian healthcare system. *Women and Birth,* 32**,** 410-418.

HOWARD, L. M., MOLYNEAUX, E., DENNIS, C. L., ROCHAT, T., STEIN, A. & MILGROM, J. 2014. Non-psychotic mental disorders in the perinatal period. *Lancet,* 384**,** 1775-88.

JAMES, S. E., HERMAN, J. L., RANKIN, S., KEISLING, M., MOTTET, L., & ANAFI, M. 2016. *The Report of the 2015 U.S. Transgender Survey*. National Center for Transgender Equality.

KEMPPINEN, L., MATTILA, M., EKHOLM, E., HUOLILA, L., PELTO, J., KARLSSON, H., MÄKIKALLIO, K. & KARLSSON, L. 2022. Gestational anemia and maternal antenatal and postpartum psychological distress in a prospective FinnBrain Birth Cohort Study. *BMC Pregnancy and Childbirth,* 22**,** 704.

LEAHY-WARREN, P., MCCARTHY, G. & CORCORAN, P. 2012. First-time mothers: social support, maternal parental self-efficacy and postnatal depression. *Journal of Clinical Nursing,* 21**,** 388-97.

LIGHT, A. D., OBEDIN-MALIVER, J., SEVELIUS, J. M., & KERNS, J. L. 2014. Transgender men who experienced pregnancy after female-to-male gender transitioning. *Obstetrics and Gynecology*, 124(6), 1120–1127.

LIU, C. H., GIALLO, R., DOAN, S. N., SEIDMAN, L. J., & TRONICK, E. 2019. Racial and ethnic differences in postpartum depression: A population-based study. *Archives of Women's Mental Health, 22*(3), 373–382.

MACDONALD, T., NOEL-WEISS, J., WEST, D., WALKS, M., BIENER, M., KIBBE, A., & MYLER, E. 2016. Transmasculine individuals' experiences with lactation, chestfeeding, and gender identity: A qualitative study. *BMC Pregnancy and Childbirth, 16*, 106.

MAGEE, L. A., BROWN, M. A., HALL, D. R., GUPTE, S., HENNESSY, A., KARUMANCHI, S. A., KENNY, L. C., MCCARTHY, F., MYERS, J., POON, L. C., RANA, S., SAITO, S., STAFF, A. C., TSIGAS, E. & VON DADELSZEN, P. 2022. The 2021 International Society for the Study of Hypertension in Pregnancy classification, diagnosis & management recommendations for international practice. *Pregnancy Hypertension,* 27**,** 148-169.

MAUTNER, E., GREIMEL, E., TRUTNOVSKY, G., DAGHOFER, F., EGGER, J. W. & LANG, U. 2009. Quality of life outcomes in pregnancy and postpartum complicated by hypertensive disorders, gestational diabetes, and preterm birth. *Journal of Psychosomatic Obstetrics and Gynaecology,* 30**,** 231-7.

MCMANUS, B. M. & POEHLMANN, J. 2012. Maternal depression and perceived social support as predictors of cognitive function trajectories during the first 3 years of life for preterm infants in Wisconsin. *Child: Care, Health and Development,* 38**,** 425-34.

MELTZER-BRODY, S., BLEDSOE-MANSORI, S. E., JOHNSON, N., KILLIAN, C., HAMER, R. M., JACKSON, C., WESSEL, J. & THORP, J. 2013. A prospective study of perinatal depression and trauma history in pregnant minority adolescents. *American Journal of Obstetrics and Gynecology,* 208**,** 211.e1-7.

MOMMERSTEEG, P. M., DROST, J. T., OTTERVANGER, J. P. & MAAS, A. H. 2016. Long-term follow-up of psychosocial distress after early onset preeclampsia: the Preeclampsia Risk EValuation in FEMales cohort study. *Journal of Psychosomatic Obstetrics and Gynaecology,* 37, 101-9.

NATIONAL INSITIUTE FOR HEALTH AND CARE EXCELLENCE 2014 (updated 2020) Antenatal and postnatal mental health: clinical management and service guidance. Clinical guideline [CG192].

NETSI, E., PEARSON, R. M., MURRAY, L., COOPER, P., CRASKE, M. G. & STEIN, A. 2018. Association of Persistent and Severe Postnatal Depression With Child Outcomes. *Journal of the American Medical Association - Psychiatry,* 75**,** 247-253.

NICHOLLS, K., & AYERS, S. 2007. Childbirth-related post-traumatic stress disorder in couples: A qualitative study. *British Journal of Health Psychology, 12*(4), 491–509.

O'DEA, G. A., YOUSSEF, G. J., HAGG, L. J., FRANCIS, L. M., SPRY, E. A., ROSSEN, L., SMITH, I., TEAGUE, S. J., MANSOUR, K., BOOTH, A., DAVIES, S., HUTCHINSON, D. & MACDONALD, J. A. 2023. Associations between maternal psychological distress and mother-infant bonding: a systematic review and meta-analysis. *Archives of Women's Mental Health,* 26**,** 441-452.

O'HARA, M. W., & McCABE, J. E. 2013. Postpartum depression: current status and future directions. *Annual Review of Clinical Psychology*, 9, 379–407.

OLDE, E., van der HART, O., KLEBER, R. J., & van SON, M. J. 2006. Posttraumatic stress following childbirth: A review. *Clinical Psychology Review, 26*(1), 1–16.

PAWLUSKI, J. L., SWAIN, J. E. & LONSTEIN, J. S. 2021. Neurobiology of peripartum mental illness. *Handbook of Clinical Neurology,* 182**,** 63-82.

POSTMA, I. R., BOUMA, A., ANKERSMIT, I. F. & ZEEMAN, G. G. 2014. Neurocognitive functioning following preeclampsia and eclampsia: a long-term follow-up study. *American Journal of Obstetrics and Gynecology,* 211**,** 37.e1-9.

POSTMA, I. R., BOUMA, A., DE GROOT, J. C., AUKES, A. M., AARNOUDSE, J. G. & ZEEMAN, G. G. 2016. Cerebral white matter lesions, subjective cognitive failures, and objective neurocognitive functioning: A follow-up study in women after hypertensive disorders of pregnancy. *Journal of Clinical and Experimental Neuropsychology,* 38, 585-98.

RAZUREL, C., KAISER, B., SELLENET, C. & EPINEY, M. 2013. Relation between perceived stress, social support, and coping strategies and maternal well-being: a review of the literature. *Women Health,* 53**,** 74-99.

REDSHAW, M., & HENDERSON, J. (2015). Safely delivered? A national survey of women's experiences of maternity care 2014. *National Perinatal Epidemiology Unit, University of Oxford*. https://www.npeu.ox.ac.uk/downloads/files/mbrrace-uk/reports/Safely-Delivered-2015.pdf

ROBERTS, L. M., DAVIS, G. K. & HOMER, C. S. 2017. Pregnancy with gestational hypertension or preeclampsia: A qualitative exploration of women's experiences. *Midwifery,* 46**,** 17-23.

ROBERTS, L., DAVIS, G. K. & HOMER, C. S. E. 2019. Depression, Anxiety, and Post-traumatic Stress Disorder Following a Hypertensive Disorder of Pregnancy: A Narrative Literature Review. *Frontiers in Cardiovascular Medicine,* 6**,** 147.

ROBERTS, L., HENRY, A., HARVEY, S. B., HOMER, C. S., DAVIS G. K. 2022. Depression, anxiety and posttraumatic stress disorder six months following preeclampsia and normotensive pregnancy: a P4 study. *BMC Pregnancy and Childbirth*

RUBINOW, D. R. & SCHMIDT, P. J. 2018. Is there a role for reproductive steroids in the etiology and treatment of affective disorders? *Dialogues in Clinical Neuroscience,* 20**,** 187-196.

SACHDEVA, J., NAGLE YANG, S., GOPALAN, P., WORLEY, L. L. M., MITTAL, L., SHIRVANI, N., SPADA, M., ALBERTINI, E., SHENAI, N., MOORE SIMAS, T. A. & BYATT, N. 2022. Trauma Informed Care in the Obstetric Setting and Role of the Perinatal Psychiatrist: A Comprehensive Review of the Literature. *Journal of the Academy of Consultation-Liaison Psychiatry,* 63**,** 485-496.

SANDALL, J., FERNANDEZ TURIENZO, C., DEVANE, D., SOLTANI, H., GILLESPIE, P., GATES, S., JONES, L.V., SHENNAN, A.H. & RAYMENT-JONES, H. 2024 'Midwife continuity of care models versus other models of care for childbearing women', *Cochrane Database of Systematic Reviews*, 2024(4), CD004667.

SCHMIED, V., BLACK, E., NAIDOO, N., DAHLEN, H., & LIAMPUTTONG, P. 2017. Migrant women's experiences, meanings and ways of dealing with postpartum depression: A meta-ethnographic study. *PLoS ONE, 12*(1), e0172385.

SCHWEIZER-SCHUBERT, S., GORDON, J. L., EISENLOHR-MOUL, T. A., MELTZER-BRODY, S., SCHMALENBERGER, K. M., SLOPIEN, R., ZIETLOW, A. L., EHLERT, U. & DITZEN, B. 2020. Steroid Hormone Sensitivity in Reproductive Mood Disorders: On the Role of the GABA(A) Receptor Complex and Stress During Hormonal Transitions. *Frontiers in Medicine (Lausanne),* 7**,** 479646.

SEEFELD, L., McCARTHY, E. P., & ZIVIN, K. 2020. The association of severe maternal morbidity with postpartum mental health disorders. *Maternal and Child Health Journal, 24*(10), 1279–1287.

SHANG, J., DOLIKUN, N., TAO, X., ZHANG, P., WOODWARD, M., HACKETT, M. L. & HENRY, A. 2022. The effectiveness of postpartum interventions aimed at improving women's mental health after medical complications of pregnancy: a systematic review and meta-analysis. *BMC Pregnancy and Childbirth,* 22**,** 809.

SHANG, J., HACKETT, M. L., HARRIS, K., WOODWARD, M., ROBERTS, L. M., ZHANG, P. & HENRY, A. 2024. Mental health in the two years following hypertensive and normotensive pregnancy: The Postpartum, Physiology, Psychology and Paediatric follow-up (P4) cohort study. *Pregnancy Hypertension,* 35**,** 43-50.

SHOREY, S., CHEE, C. Y. I., NG, E. D., CHAN, Y. H., TAM, W. W. S. & CHONG, Y. S. 2018. Prevalence and incidence of postpartum depression among healthy mothers: A systematic review and meta-analysis. *Journal of Psychiatric Research,* 104**,** 235-248.

SIBAI, B., DEKKER, G.,& KUPFERMINC, M. 2005. Pre-eclampsia. *Lancet*, 365(9461):785-99

SLOMIAN, J., HONVO, G., EMONTS, P., REGINSTER, J.-Y. & BRUYÈRE, O. 2019. Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes. *Women's Health,* 15**,** 1745506519844044.

SOCIETY OF OBSTERIC MEDICINE AUSTRALIA AND NEW ZEALAND (SOMANZ) 2023. Hypetension in Pregnancy Guideline. Sydney.

STEWART, D. E., & VIGOD, S. N. 2019. Postpartum depression: Pathophysiology, treatment, and emerging therapeutics. *Annual Review of Medicine*, 70, 183–196.

SUN, S., PELLOWSKI, J., PISANI, C., PANDEY, D., GO, M., CHU, M., RUAN, J. & WERNER, E. F. 2023. Experiences of stigma, psychological distress, and facilitative coping among pregnant people with gestational diabetes mellitus. *BMC Pregnancy and Childbirth,* 23**,** 643.

TIAN, Q., CHEN, S. & JIANG, D. 2022. Effects of anemia during the third trimester of pregnancy on postpartum depression and pregnancy outcomes in pregnant women older than 35 years: a retrospective cohort study. *Annals of Palliative Medicine,* 11**,** 1048-1057.

VAN DEN BERGH, B. R. H. 1990. The influence of maternal emotions during pregnancy on fetal and neonatal behavior. *Pre- and Peri-natal Psychology Journal, 5*(2), 119–130.

VIGOD, S. N., FRET, B. N., CLARK, C. T., GRIGORIADIS, S., BARKER, L. C., BROWN, H. K., CHARLEBOIS, J., DENNIS, C. L., FAIRBROTHER, N., GREEN, S. M., LETOURNEAU, N. L., OBERLANDER, T. F., SHARMA, V., SINGLA D. R., STEWART, D. E., TOMASI, P., ELLINGTON, B. D., FLEURY, C., TARASOFF, L. A., TOMFOHR-MADSEN, L. M., DA COSTA, D., BEAULIEU, S., BRIETZKE, E., KENNEDY, S. H., LAM, R. W., MILEV, R. V., PARIKH, S. V., RAVINDRAN, A. V., SAMAAN, Z., SCHAFFER, A., TAYLOR, V. H., TOURJMAN, S. V., AMERINGEN, M. V., YATHAM, L. N., & VAN LIESHOUT, R. J. 2025. Canadian Network for Mood and Anxiety Treatments 2024 Clinical Practice Guideline for the Management of Perinatal Mood, Anxiety, and Related Disorders: Guide de pratique 2024 du Canadian Network for Mood and Anxiety Treatments pour le traitement des troubles de l'humeur, des troubles anxieux et des troubles connexes périnatals. *Canadian Journal of Psychiatry, 70(6), 429-489.*

WALKER, M. J., DAVIS, C., AL-SAHAB, B. & TAMIM, H. 2013. Reported maternal postpartum depression and risk of childhood psychopathology. *Maternal and Child Health Journal,* 17**,** 907-17.

WANG, H., LI, N., CHIVESE, T., WERFALLI, M., SUN, H., YUEN, L., HOEGFELDT, C. A., ELISE POWE, C., IMMANUEL, J., KARURANGA, S., DIVAKAR, H., LEVITT, N., LI, C., SIMMONS,

D. & YANG, X. 2022. IDF Diabetes Atlas: Estimation of Global and Regional Gestational Diabetes Mellitus Prevalence for 2021 by International Association of Diabetes in Pregnancy Study Group's Criteria. *Diabetes Research and Clinical Practice,* 183**,** 109050.

WANG, W., XIE, X., YUAN, T., WANG, Y., ZHAO, F., ZHOU, Z. & ZHANG, H. 2021. Epidemiological trends of maternal hypertensive disorders of pregnancy at the global, regional, and national levels: a population-based study. *BMC Pregnancy and Childbirth,* 21**,** 364.

WICKLOW, B. & RETNAKARAN, R. 2023. Gestational Diabetes Mellitus and Its Implications across the Life Span. *Diabetes & Metabolism Journal,* 47**,** 333-344.

WILSON, C. A., NEWHAM, J., RANKIN, J., ISMAIL, K., SIMONOFF, E., REYNOLDS, R. M., STOLL, N. & HOWARD, L. M. 2020. Is there an increased risk of perinatal mental disorder in women with gestational diabetes? A systematic review and meta-analysis. *Diabetic Medicine,* 37**,** 602-622.

WORLD HEALTH ORGANIZATION (WHO). 2021. *Mental health: Strengthening our response* [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response. [Accessed 20/01/2025 2025].

WORLD HEALTH ORGANIZATION 2021. The Global Prevalence of Anaemia in 2019. Geneva: WHO.

YILDIZ, P. D., AYERS, S. & PHILLIPS, L. 2017. The prevalence of posttraumatic stress disorder in pregnancy and after birth: A systematic review and meta-analysis. *Journal of Affective Disorders,* 208**,** 634-645.

YIN, H., WARDENAAR, K. J., XU, G., TIAN, H. & SCHOEVERS, R. A. 2020. Mental health stigma and mental health knowledge in Chinese population: a cross-sectional study. *BMC Psychiatry,* 20**,** 323.