The Psychiatric Burden in Pregnant and Postpartum Women during the COVID-19 Pandemic: A Clinical Snapshot

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Abstract

The coronavirus disease-2019 (COVID-19) or Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was declared a pandemic in March 2020 by the World Health Organization (WHO). The virus spreads through fomites and air transmission causing mild upper respiratory tract infection, severe acute respiratory distress, neurologic deficits, and death. The pandemic has been stressful for many, especially for pregnant and postpartum women. Since the transition to motherhood is challenging, pandemic-related factors have created an increase in the risk of mental health burden and psychiatric disorders in this cohort. This is attributed to a combination of neuroendocrine factors and pandemic-related factors such as quarantine, remote healthcare consultations, domestic violence, and the fear of infection. It is important to identify and treat mental health disorders in this cohort due to the negative impact on the mother and child, neurological changes (i.e. changes in gray matter volume) in patients with chronic psychiatric disorders, and the risk of self-harm/suicide. Here we review the current knowledge of psychiatric disorders in pregnant and postpartum women during the COVID-19 pandemic and consider potential future research.

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Original Manuscript

Review Article

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Abstract

The coronavirus disease-2019 (COVID-19) or Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was declared a pandemic in March 2020 by the World Health Organization (WHO). The virus spreads through fomites and air transmission causing mild upper respiratory tract infection, severe acute respiratory distress, neurologic deficits, and death. The pandemic has been stressful for

many, especially for pregnant and postpartum women. Since the transition to motherhood is challenging, pandemic-related factors have created an increase in the risk of mental health burden and psychiatric disorders in this cohort. This is attributed to a combination of neuroendocrine factors and pandemic-related factors such as quarantine, remote healthcare consultations, domestic violence, and the fear of infection. It is important to identify and treat mental health disorders in this cohort due to the negative impact on the mother and child, neurological changes (i.e. changes in gray matter volume) in patients with chronic psychiatric disorders, and the risk of self-harm/suicide. Here we review the current knowledge of psychiatric disorders in pregnant and postpartum women during the COVID-19 pandemic and consider potential future research.

Key Words: coronavirus; COVID-19; pregnancy; postpartum; post-traumatic stress disorder; mental health; depression; anxiety.

Introduction

COVID-19, caused by the SARS-CoV-2 virus, first emerged in Wuhan, China in November 2019. The virus has since then spread to multiple countries and was declared a pandemic by the WHO in March 2020 [1]. There have been over 130 million cases worldwide, with countries such as India, the United States of America, and Brazil with the highest number of cases. The virus is spread through human-to-human transmission and primarily invades pneumocytes. It can also attack

angiotensin-converting enzyme-2 receptors, which are located in renal, vascular, cardiac, and gastrointestinal cells. Symptoms can range from mild upper respiratory tract infection, severe pneumonia, neurological symptoms, mental health burden, and death [2].

Since the onset of the pandemic, several public health measures have been implicated. These include physical distancing, quarantine and lockdown, mandatory use of masks, and virtual healthcare consultations. Such implementations have led to an increase in financial stress and social deprivation. As a result, the mental health of many has been impacted. There has been a 25% increase in the cases of depression since the onset of the pandemic [3]. Those with a prior mental health disorder experience greater psychological distress, poor sleep, and lower levels of resilience [4]. Those infected with COVID-19 are at an even greater risk of developing mental health disorders.

Pregnant women are more susceptible to the virus due to their immunosuppression and edema of the upper respiratory tract making them prone to respiratory tract infections. Symptoms can range from asymptomatic or mild upper respiratory tract infection to debilitating pneumonia and severe acute respiratory syndrome. Some of these cases have led to emergency C-sections, intrauterine growth restriction, or preterm birth.

Given the physiologic changes during pregnancy and postpartum, including the transition to motherhood, it is of no surprise that they are susceptible to mood disorders. Postpartum depression, anxiety, and post-traumatic stress disorder (PTSD) are some of the common psychiatric disorders new mothers experience. Approximately, 20-30% of women globally experience at least one psychiatric disorder during pregnancy or postpartum [5].

Physical and social isolation, healthcare restrictions in routine prenatal and postnatal care, fear of infection in the baby, and domestic violence place pregnant and postpartum women at an increased risk of mental health issues [6]. It is important to diagnose and treat psychiatric disorders in these women due to pregnancy-related complications. A study by Chen and colleagues demonstrated that untreated depression and anxiety in pregnant mothers is associated with an

increased likelihood of preterm birth, low infant birth weight, adverse neurodevelopmental effects on the fetus and child, and suicide in new mothers [5]. Thus, it is crucial to identify and treat psychiatric disorders in this cohort given the emotional stress and restricted access to healthcare during the pandemic. At this time, the exact statistics for mental health disorders during the pandemic are not available; however, Table 1 shows data on maternal mental health disorders before the pandemic. Such data acts as a reference point to analyze the differences in maternal mental health disorders before and after the pandemic.

In this paper, we aim to provide a comprehensive review using existing knowledge and recent literature on the psychiatric burden in pregnant and postpartum women during the COVID-19 pandemic. We address common maternal psychiatric disorders and the associated neuroscience, prevention and treatment measures during the pandemic, and potential future research. Such research is important as it provides a stepping stone in identifying mental health disorders in expectants and new mothers, and acknowledges gaps in current research.

Methods

This is a literature review of studies investigating the psychiatric burden on pregnant and postpartum women during the COVID-19 pandemic. All published papers relevant to the topic were obtained through extensive search using databases such as Google Scholar, PubMed, ScienceDirect, and using any relevant keywords in different orders: “pregnancy”, “postpartum”, “depression”, “anxiety”, “coronavirus”, “COVID-19”, “insomnia”, “post-traumatic stress disorder”, “neuroplasticity”, “mental illness”.

Depression and Anxiety

Globally, 10% of pregnant women and 13% of new mothers experience a mental health disorder in their lifetime, particularly depression. This rate is higher in developing countries. Depression affects both the mother and child as she is less capable of meeting their needs [7]. Given

the increase in depression and anxiety during the current pandemic in this cohort, it is necessary to identify and treat such symptoms due to its complications [8-35]. Approximately 10-65% of pregnant women have developed anxiety or depressive symptoms during this challenging time [8,10,12,14-17,19,20,27,28,30,32-35]. Research shows that pregnant women with current anxiety and insomnia, and those with a prior history of depression and anxiety are more likely to report higher levels of/ anxiety compared to non-pregnant women [6,15,31].

Although Dong et al. (2021) report similar results in pregnant women in China, the incidence of anxiety did not differ during and before the pandemic [37]. On the contrary, Zhou et al. (2020) report that pregnancy is associated with lower depressive, anxiety, and insomnia symptoms compared to nulligravida women during the pandemic [6]. These results combined suggest that not all women have similar mental health experiences during the pandemic and that pregnant and nulligravida women may interpret the pandemic in different ways. Regardless, it is evident that the current pandemic affects the mental and physical health of many and is a matter that needs to be addressed [38].

Risk factors for depression and anxiety include pregnancy at a young age, relationship and marital difficulties, low socioeconomic status, poor social support, and substance use [8-10,12-15,19,21,24-28,30,39]. In addition, frequent news media visits, living with a COVID-19 positive patient, interruption of routine medical checkups, and use of public transport place pregnant and postpartum women at an even higher risk for depression and anxiety during the pandemic [22,27-29,37,39-41]. Concerns about their pregnancy and delivery, and transmission of infection to their fetus and family members, are also some of the additional psychiatric burden women experience during this time [8-10,26,39].

It is interesting to note a few studies have documented that depression and anxiety symptoms do not differ in severity across the pregnancy trimesters; however, depressive symptoms are prevalent in multiparous women whereas first-time pregnant women report more anxiety symptoms

[8,10,14,29]. A potential explanation for this observation could be attributed to strong social support during pregnancy which acts as a protective factor against varying degrees of depression, and anxiety associated with the birth of their first child. Not only during pregnancy but postpartum depression and anxiety have also increased during the pandemic [14,30,32,39,42-47].

During the pandemic, approximately 10-57% of women have developed anxiety symptoms and 13-45% have developed depressive symptoms during their postpartum period [30,32,39,42,47]. Contributing factors to their depressive symptoms include poor quality of sleep from taking care of the baby, obstetric complications, unplanned pregnancy, prior history of mental illness, and poor social support from family and healthcare providers [9,14,20,32,42]. Hence, it is important to identify women with depressive symptoms and provide appropriate management.

Significant risk factors for postpartum anxiety include the absence of a partner during delivery, proximity to a COVID-19 positive patient, and lack of healthcare access [30,48]. Untreated depression and anxiety can lead to poor bonding between the mother and child, progression to psychosis or self-harm and suicide. Hence, it is crucial to identify and treat these symptoms in such a vulnerable population.

Insomnia

Approximately 14-49% of pregnant women have developed insomnia during the pandemic. Women whose regular checkups are interrupted or those with a prior history of adverse anxiety or physical co-morbidities are more likely to develop insomnia [12,39]. Lin et al. (2021) conducted an online cross-sectional survey during the COVID-19 pandemic investigating anxiety, depressive, and insomnia symptoms in 751 pregnant women in Shenzhen, China. Results revealed that approximately 83% of participants had a lower perceived risk of contracting COVID-19 infection, with a prevalence of 35.4% of mild depressive and 13.4% of mild anxiety symptoms. In addition, overall poor sleep quality, shorter duration of sleep, difficulty falling asleep, and going to bed late were strongly associated with depressive and anxiety symptoms. These results could suggest that perceived low risk of COVID-19 infection may correlate with having mild anxiety and depressive symptoms in pregnant women, evident through insomnia as well [16].

A study by Khoury and colleagues (2021) in Canada demonstrated that insomnia severity did not differ by pregnancy trimesters; however, when accounting for pandemic-related factors such as financial and relationship difficulties, poor education, and the risk and effects of COVID-19 infection, there was a significant correlation with insomnia severity [8]. It is known that new mothers experience sleep disturbances; however, further research needs to be conducted to identify the risk factors and implications of insomnia on the mental and physical health of expectants and new mothers.

Postpartum Psychosis

Postpartum psychosis occurs in 1-2 per 1000 women within the first 2-4 weeks after delivery [49, 50]. Symptoms include delusions, mood swings, paranoia, and disorganized behaviour. The combination of psychosis, lapsed insight and judgement can lead to devastating consequences affecting the safety of both the mother and child. The etiology of postpartum psychosis is unclear; however, a potential explanation involves the combination of psychological, hormonal, and immune-system changes associated with pregnancy and parturition triggering the onset of psychotic symptoms [50]. Known risk factors for postpartum psychosis include a prior history of psychiatric disorders and stressful life events [50].

There have been multiple reports on the association between the COVID-19 pandemic and postpartum psychosis [51-53]. Chandra et al. (2020) presented a case of a 24-year-old healthy Indian woman two months postpartum with her first child. Her pregnancy was complicated by hypothyroidism and hypertension, along with pressure from her in-laws to deliver a baby boy. A few days after delivering a baby girl, the neonate was admitted to the neonatal intensive care unit for sepsis. This sparked the first psychotic episode in the mother which was resolved with medical treatment. Throughout the pandemic, the mother experienced familial stress and anxiety about being diagnosed with COVID-19. She displayed signs of agitation, mutism, and delusions of infecting her baby with COVID-19 leading to refusal of breastfeeding. Her physical examination and medical workup were normal, including Reverse Transcriptase-Polymerase Chain Reaction for COVID-19. A

diagnosis of postpartum psychosis was made and the appropriate medical care was given; however, symptoms of anxiety persisted even after completion of treatment. Several factors alongside the pandemic may have contributed to her postpartum psychosis. Social isolation and a loss of rituals and traditions surrounding the birth of her child, and emotional stress from her relatives may have been contributing factors. These observations demonstrate the need to develop culturally appropriate screening for mental health disorders for vulnerable groups to prevent mental illness during the pandemic [54].

On the contrary, Warselius et al. (2020) presented conflicting findings after conducting a nearly 30-year nationwide study of live births in Sweden and Denmark. They studied the association between stressful life events and a prior history of psychiatric disorders in the onset of postpartum psychosis. Results revealed that the death of a close relative, one of the most severe sources of stress, was not associated with postpartum psychosis [55]. The two studies mentioned could suggest cultural differences in the way women perceive and handle stress, reinforcing the notion of providing culturally appropriate management to patients.

PTSD

PTSD is a rare disorder seen in pregnant and postpartum women. According to the Diagnostic and Statistical Manual-5, the diagnosis involves at least one symptom from each criterion [56]. Criterion A involves direct or indirect exposure to a stressor. Criterion B involves repeated exposure of the traumatic event in the form of nightmares, physical and emotional reactivity after thinking of the trauma, upsetting memories, and flashbacks. Criterion C involves avoidance of trauma-related thoughts/feelings and trauma-related triggers. Criterion D (two required) involves negative changes in cognition and mood including the inability to recall features of the trauma, negative thoughts, self-blame or blaming others for the cause of the trauma and decreased interest in activities. Criterion E involves alterations in arousal and reactivity including aggression/irritability, destructive behaviour, hypervigilance, and sleep and concentration difficulties. Criterion F, G, and H state that the above

symptoms should last greater than a month causing significant distress in functioning that are attributed to medication, substance abuse, or illness [56].

The prevalence of PTSD in the general population is between 5-10%; however, pregnant women experience a higher rate of diagnosis [57]. The current pandemic has raised concerns about the increasing incidence of PTSD [58]. Given that pregnant and postpartum women are vulnerable to PTSD, a few studies have been conducted in its investigation.

Ravaldi et al. (2020) investigated the presence of PTSD during the COVID-19 pandemic in women living in Italy. He incorporated a series of psychometric tests and questionnaires assessing for PTSD. Results revealed the presence of clinically significant PTSD symptoms in approximately 10% of women, while a prior history of depression and anxiety predicted a higher likelihood of PTSD [31]. These findings encourage healthcare professionals to screen for uncommon mental health disorders in pregnant and postpartum women to deliver proper care and management.

Another similar study conducted by Liu et al. (2021) examined the relationship between a prior psychiatric diagnosis and the prevalence of PTSD. Out of the 1123 women assessed, those with a pre-existing mental health diagnosis were 1.6 to 3.7 times more likely to have significant levels of PTSD, depression, and generalized anxiety. Of the correspondents, approximately 10% reported clinically significant levels of PTSD, 22% showed signs of generalized anxiety disorder, and 36% displayed symptoms of major depressive disorder [59]. This data further emphasizes the need to screen for psychiatric disorders, especially during this challenging time.

Zhang et al. (2020) conducted a study in China during the early stages of the pandemic from January to February 2020 investigating the prevalence of PTSD among pregnant women. The study revealed approximately 40% of pregnant women had clinically significant PTSD [60]. Moreover, pregnant women living in Wuhan, Hubei had a higher prevalence of PTSD compared to women living in neighbouring provinces [60]. This could be attributed to the stressful environment in Wuhan, the epicentre of the pandemic.

Neuroplasticity in Pregnancy and Postpartum

There is vast evidence about the neuroscience behind psychiatric disorders. From the genetic basis to overt symptoms, neuromolecular mechanisms have been investigated in psychiatric disorders. It is challenging to conclude if neurological imbalances contribute to these disorders or if mental health disorders result in these neurological findings. Regardless, there is an interaction between the two systems.

Several physiologic changes occur during pregnancy and postpartum. These changes are attributed primarily to endocrine factors such as sex steroid hormones. Neuroplasticity in expectants and new mothers is a novel field that documents extensive reversible changes in the maternal brain during pregnancy and postpartum. A study by Hoekema and colleagues (2016), demonstrated that first-time pregnant mothers undergo reductions in gray matter volumes primarily in the anterior and posterior cortical midline and in certain regions of the lateral prefrontal and temporal cortex, which persists for at least two years postpartum [61]. Another study has also demonstrated exogenous sex steroid hormones outside of pregnancy (i.e. hormone treatment in gender dysphoria) associated with gray matter volume reductions [62]. These studies combined suggest that hormones are mediators of neuroplasticity during pregnancy and have lasting effects on a woman's brain.

On the contrary, one study found that between 2-4 weeks postpartum to 3-4 months postpartum, mothers show increases in gray matter volumes in the parietal lobe, prefrontal cortex, and midbrain. No gray matter volume reductions were found in the early postpartum period as opposed to the other studies mentioned above. These contradictory studies could suggest a compensatory volume regeneration within these brain regions following gray matter volume reductions during pregnancy [63].

During pregnancy, the maternal hypothalamic-pituitary-adrenal (HPA) axis undergoes substantial changes due to the production of placental corticotropin-releasing hormone (CRH) and rise in serum estrogen, progesterone, and cortisol levels. After delivery of the placenta, there is a

sudden withdrawal of these hormones that remain at a low throughout the postpartum period. This is thought to be one of the mediators of postpartum depression; however, the exact molecular mechanisms have not yet been discovered [64]. It could be that the chronic exposure to high levels of pregnancy hormones has sensitized the maternal body to a certain environment, such that the immediate withdrawal of these hormones creates a state of imbalance in the maternal brain and body. Further investigation is required to study these mechanisms in depth.

Based on the HPA axis theory, Wang and colleagues (2020) investigated the effect of postpartum withdrawal of estrogen and progesterone, and depression and anxiety-like behaviour in rodents [64]. They hormonally treated rats with estrogen and progesterone to mimic a pregnancy-like state and then infused a glucocorticoid receptor inhibitor in the dorsal hippocampus to analyze their behaviour. After the withdrawal of these hormones: 1) there was a significant reduction in the number of glucocorticoid receptors in the hippocampus, and 2) the rats demonstrated depression and anxiety-like behaviour similar to postpartum depression when they were infused with the glucocorticoid receptor inhibitor [64]. These results support the significance of the HPA axis during pregnancy and postpartum, and its association with psychiatric disorders.

Depression in the mother affects fetal neurodevelopment. A study by Sonmez and colleagues (2019) investigated the association between cord blood brain-derived neurotrophic factor (BDNF) concentration in the neonate and maternal depression during pregnancy. BDNF is primarily responsible for neuroplasticity, neuronal growth and differentiation, and the development and recovery of serotonergic and noradrenergic neurons from toxicity. Results revealed that cord venous blood BDNF levels in infants of depressed mothers were two times lower compared to infants of non-depressed mothers [65]. This could be linked to the increased rates of emotional, cognitive, and behavioural problems observed in children of depressed mothers.

Neurological research in postpartum psychosis is scarce. However, a study revealed that women who give birth at night are at increased risk of sleep deprivation associated with the long

labour hours. It is thought to involve the disruption of the circadian rhythm and the associated neurotransmitters- dopamine and serotonin. The exact mechanisms of postpartum psychosis have not been identified; however, it is known that a prior history of bipolar disorder is associated with an increased likelihood of postpartum psychosis [66]. In addition, an MRI study investigating the brain morphology in postpartum psychosis revealed that women who suffered a recent episode of postpartum psychosis had a smaller size and surface area of the anterior cingulate gyrus, superior temporal gyrus, and parahippocampal gyrus compared to women who were at risk (i.e. history of bipolar disorder, schizoaffective disorder, prior episode of postpartum psychosis in a previous pregnancy, but not in the current pregnancy) for postpartum psychosis in the current pregnancy. The latter group also displayed larger volumes of the superior and inferior frontal gyrus compared to healthy women. These findings reveal structural brain changes in women with a history of postpartum psychosis and those who are at risk [67].

There has been limited research on the neurobiology behind PTSD in pregnant and postpartum women. PTSD in postpartum women may possess a distinct neuromolecular mechanism compared to non-childbearing women. The dynamic presentation of PTSD may involve disruptions of the HPA axis, overactivation of the amygdala, and mitigation of hippocampal and cortical performance [68]. Further research is required to understand the neuroscience behind PTSD in pregnant and postpartum women.

Management of Psychiatric Disorders in Pregnant and Postpartum Women

Maternal suicide now exceeds hypertension and hemorrhage as a cause of maternal mortality in the first year of postpartum. Hence, it is crucial to identify and treat psychiatric disorders in new mothers due to its complications mentioned above. There are limited studies in the diagnosis, prevention and treatment of psychiatric disorders in pregnant and postpartum women during the COVID-19 pandemic. Based on insight from another pandemic, such as the SARS outbreak in 2003, there has been a higher prevalence of PTSD and depression in adults. Moreover, a longer duration of

quarantine was correlated with the severity of PTSD and depressive symptoms during that time [69]. Based on such data, it is evident that developing psychological interventions is necessary to avoid short-term and long-term complications.

It is important to develop and provide resources for pregnant and postpartum women especially for those who lack a strong support system and are reluctant to seek help due to fear of infection. Research shows that modifiable factors such as strong social support and a positive cognitive assessment act as protective factors against exacerbated psychiatric symptoms and aids in their recovery [8,10]. A strong support system decreases the likelihood of experiencing mental health burdens and psychiatric illnesses, whereas having a poor social support system is associated with maternal anxiety and impaired risk perception. Furthermore, spousal support has been shown to aid in the recovery of mental health burdens in their pregnant wives. For example, combined therapy focusing on the consequences of mental health problems and psychoeducation enhances spousal bonds and speeds recovery [70].

Healthcare professionals offer immense guidance for patients further enhancing their patient's support system [71]. The American College of Obstetrics and Gynecology recommends that obstetricians screen patients at least once during their pregnancy and postpartum visit for depression and anxiety. For at-risk patients, close monitoring for worsening of condition and suicide is warranted. Patients exhibiting mood symptoms should begin treatment and/or referral when indicated [72]. The US Preventive Services Task Force also recommends perinatal screening for mental health disorders as the standard of care. If the pregnant mother is experiencing a mental health burden during her pregnancy, early screening and appropriate psychological interventions should be done to prevent a firm diagnosis of a psychiatric disorder [36,73]. These include identifying the source of stress, offering mental health support resources (i.e. counselling or referral to a therapist), emotional support, and monitoring the patient's mental health condition [16,74].

Apart from social support, characteristics such as self-confidence and resilience, are correlated with a lower level of psychological distress [75]. A woman's self-confidence and the belief that she can endure and recover from challenges help with the ability to cope with stressors. Due to the current limitations in social interactions, a greater sense of loneliness and tension between family members can occur which adds to their mental health burden. Thus, during this exceptional period, a pregnant woman's positive outlook on her relationships and the support she receives from various sources can be beneficial in reducing psychological distress [75].

Another protective factor against mental health illness is physical activity. Research suggests pre-and postpartum exercise can reduce depression [76]. Healthcare professionals should explicitly ask patients about the impact of the pandemic on their physical activity as a tool for depression screening. Efforts should be made to recommend exercises tailored to a patient's physical health and environment. Daily exercise, even in the form of virtual fitness classes, represents a potential non-pharmacological tool to support the physical and mental health of pregnant women, during and even after the pandemic [77]. In the absence of contraindications, the physical activity of mothers should always be encouraged [1].

Due to pandemic-related healthcare restrictions, patients are unable to come as close to healthcare services compared to before the pandemic. The use of virtual health care services has been adopted to diagnose and treat expectant and postpartum women with psychiatric illnesses [78]. Furthermore, virtual cognitive-behavioural programs and tele-education on pregnancy and birth planning have also been implemented and are effective in alleviating symptoms of depression and anxiety [79]. Nevertheless, healthcare professionals, including obstetrics and gynecologists, have a responsibility of communicating with patients to reassure them of their availability and support despite the novel changes in the pandemic [80].

Communication methods such as routine follow-up over the phone or video calling, and ensuring that patients understand their treatment plan will aid in their prognosis [36]. Telepsychiatry is telemedicine that concerns mental health and psychiatric disorders. This is beneficial for patients to consult experts in the field of psychiatry who would have not been able to otherwise due to a lack of access. Patients and physicians have reported satisfaction with the use of telehealth for mental health assessments and treatments given its convenience, privacy, and security [81]. This in turn enhances patient-physician relationships.

While virtual communication is effective, in-person consultations always have their place. Given the use of personal protective equipment (PPE) during this time, there are communication challenges between healthcare workers and patients. This can lead to miscommunication of information and affects patient care. An experimental study done by Hampton and colleagues (2020) investigated the impact of wearing PPE on communication in the operating room. They simulated background noise conditions from various hospital environments and assessed participants for their ability to interpret speech with and without PPE. Results revealed poor speech discrimination and communication with PPE compared to without PPE use. If patients are unable to comprehend their clinician, it can be challenging to establish a trusting relationship. This can lead to poor compliance with treatment worsening a patient's condition. Alternative ways can be used to address this issue, such as writing down the treatment plan on a whiteboard or emailing the discussion and treatment plan to patients after their visit [82]. Further research is required to investigate the barriers of communication and PPE use in healthcare.

There are various screening tools used to identify at-risk patients and prevent and treat disorders. Categorizing pregnant women into groups based on risk status can provide a framework to aid in the development of management policies [83]. The use of psychoeducation and screening questionnaires act as screening measures for psychiatric disorders in this cohort [84]. The Edinburgh Postnatal Depression scale is an effective screening tool for postpartum depression. It is available in

50 languages consisting of 10 self-reported questions and takes less than five minutes to complete. It includes questions on anxiety, depression, changes in sleep patterns, energy and appetite. Furthermore, screening for bipolar disorder is essential as it increases the risk for acute exacerbation, postpartum psychosis, and acute mood instability. Administering the Mood Disorder Questionnaire can help identify patients with a history of bipolar disorder or those who are at-risk. Some physicians prefer to ask patients if they exhibit symptoms of bipolar disorder (i.e. limited sleep, grandiose sense of self, and mania) which is also an effective screening method [85].

Early universal screening for substance abuse during the mother's first prenatal visit is recommended. If the mother engages in substance use/abuse, short conversations involving feedback and advice, and referral for treatment can improve maternal and fetal outcomes. Routine follow-up should include developmental, medical, and social support. Since substance abuse is associated with other psychiatric disorders (i.e. depression and anxiety), it is necessary to screen for those as well. The National Institute on Drug Abuse (NIDA) Quick Screen is a simple and effective screening tool to assess for substance use in mothers. Some states in the U.S.A require legal involvement if a mother is engaging in substance use, which can result in the loss of child custody. Hence, obstetricians are required to be up to date on the legal guidelines in their practicing state [85].

Interventions such as relaxation techniques and mindfulness exercises, distress tolerance skills, and strong interpersonal skills aid in the alleviation of mental health problems via a positive feedback mechanism. A simple 15-minute daily meditation or even journaling can help increase positive moods. This is consistent with previous research which supports the efficacy of these techniques in attenuating depressed and anxious moods. An additional benefit of this psychological intervention is the avoidance of pharmacological intervention and its associated side effects [85]. In addition, it is recommended that before hospital discharge after delivery, patients be informed about various mental health resources if they require emotional support [78].

It is important to keep in mind that any change in the mental and physical status of the mother can impair care for their infant. Hence, it is imperative to identify and treat psychiatric symptoms/disorders in the mother. Nevertheless, a coordinated multidisciplinary approach leads to successful outcomes in mothers. For example, it is evident that raising awareness about disease transmission, education on neonatal care and early referral to psychiatric consultation for high-risk patients contribute to psychiatric wellness in pregnant and postpartum women.

Barriers and Future Studies

When looking at neuroplasticity, there is limited research on how the psychiatric burden of the current pandemic has affected the brains of pregnant and postpartum women. Specifically, the effect of chronic depression during the pandemic on neurological changes should be further studied. In addition, since cord blood BDNF levels were lower in the infants of depressed mothers, further research should investigate the correlation between the levels of BDNF and the severity of depression in mothers.

While there is a lot of research done on the mental health impact of this pandemic in pregnant and postpartum women, there are still several areas that should be further studied. Pertaining to anxiety and depression, the relationship of parity and mental health should be further investigated as the current data is inconsistent. Additionally, more research is needed comparing anxiety and depression in pregnancies that took place pre-and during the pandemic in the same population. This will give more information if the symptoms were due to the pandemic or pregnancy itself. Overall, since limited data has been gathered regarding the association between insomnia in pregnant and postpartum women during the pandemic, further research is required.

Prospective investigations are necessary to determine the contributing factors for postpartum psychosis during this pandemic. Currently, there is limited literature on postpartum psychosis and ethnic differences during the pandemic. Future studies should focus on investigating the incidence and prevalence of postpartum psychosis across multiple countries and ethnicities. Furthermore,

prospective studies may focus on the possible intervention efforts in postpartum psychosis during times of increased stress like the pandemic.

Current research is limited to the link between PTSD and comorbid mental health disorders. In the future, studies should focus on the possible trauma from the challenges related to the COVID-19 pandemic, such as unexpected separation from family members, possible illness/death in the family, and general anxiety. In addition, as the pandemic progresses, prospective studies should focus on the severity of depression in mothers.

Overall, future research should focus on the effects of socioeconomic status and different cultural norms during pregnancy and birth on mental health. Furthermore, a comparison should be made based on the country's response to the pandemic and the participants' distance from the epicentre of the pandemic. The current pandemic's effect on mental health can also be compared with previous pandemics.

Conclusion

In conclusion, the COVID-19 pandemic has led to significant psychiatric burdens in pregnant and postpartum women. The prevalence of depression, anxiety, insomnia, and PTSD have all increased during this challenging time. Strong social support from family, friends, and healthcare professionals has a significant impact on mental well-being. Routine screening and follow-ups can help identify mothers at-risk for psychiatric disorders. There is limited literature on this topic hence future studies should focus on investigating the neuromolecular mechanisms, and management and treatment options during the pandemic.

Table 1. Maternal Mental Health Statistics Prior to COVID-19

Illness	Country	Prevalence (%)
Postpartum depression [86]	Australia	7.5 (6-8 weeks)
	Italy	13.8 (1-3 months)
	India	23 (6-8 weeks)
	Thailand	16.8
	Morocco	18.7 (2 weeks)
	Indonesia	22
	Brazil	20.7 (6-8 weeks)
Anxiety	Sweden [87]	15.6
	Croatia [88]	35 (the perinatal period) 17 (immediately after childbirth) 20 (6 weeks postpartum)
	Germany [89]	11-17 (the perinatal period)
Insomnia	Turkey [90]	52.2
	United States [91]	78
	Norway [92]	62.2
	Poland [93]	39.6
Postpartum Psychosis	Global [94]	0.5
Postpartum OCD	Brazil [95]	2.3

	United States [96]	11.2
PTSD	Global [97]	4-6

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Conflicts of Interest

None declared.

Abbreviations

COVID-19: Coronavirus Disease-2019

WHO: World Health Organization

PTSD: Post-Traumatic Stress Disorder

HPA: Hypothalamic-Pituitary-Adrenal Axis

CRH: Corticotropin-Releasing Hormone

BDNF: Brain-Derived Neurotrophic Factor

PPE: Personal Protective Equipment

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