

[Open Peer Review on Qeios](#)

# [Review Article] Maternal Mental and Physical Problems During COVID-19 and Its Effects on Newborns

Mahdi Khalili<sup>1</sup>, Ramin Ghasemi Shayan<sup>2</sup>

<sup>1</sup> Islamic Azad University, Tabriz

<sup>2</sup> Tabriz University of Medical Sciences

**Funding:** No specific funding was received for this work.

**Potential competing interests:** No potential competing interests to declare.

## Abstract

Mental problems are common during pregnancy, but in the time of the COVID-19 era, they have increased and due to quarantine and social distancing, they have more destructive effects on pregnant women. Also, COVID-19 can have destructive effects on the growth and development of the fetus or baby by affecting different systems. Therefore, during this period, it is necessary to check any mood changes in the pregnant woman, and in case of illness, she must be under the supervision of a doctor to minimize the amount of damage. We assessed types of mental health issues and evaluated their causes and results. Also, the ways of transmission of COVID-19 from mother to baby were investigated. We also examined the problems created by SARS-COV-2 for the baby and categorized their effects and symptoms. The effects on babies can be caused in various ways, such as through the placenta or amniotic fluid, etc. Any changes in the fetus and newborn should be evaluated and recorded, and necessary measures for prevention and treatment should be taken.

**Mahdi Khalili<sup>1</sup>, and Ramin Ghasemi Shayan<sup>2,\*</sup>**

<sup>1</sup> *Medicine Faculty, Islamic Azad University of Tabriz, Tabriz, Iran*

<sup>2</sup> *Radiology Department, Paramedical Faculty, Tabriz University of Medical Sciences, Tabriz, Iran*

**\*Corresponding Author:** Ramin Ghasemi Shayan\*, [raminghasemi1377@gmail.com](mailto:raminghasemi1377@gmail.com)

**Keywords:** maternal, mental, COVID-19, newborns, physical.

## Introduction

Coronaviruses are a type of virus that can infect both humans and animals. They have a single strand of RNA and are enveloped in a protective layer. These viruses were first identified in the 1960s when they were extracted from people with

the common cold. They are known to cause respiratory illness in humans [1]. This virus can be transmitted from person to person and has caused a worldwide pandemic. The number of deaths continues to increase, and as a result, many nations have implemented measures such as public distancing and lockdowns to reduce the spread of the virus [2]. While the chief target of coronavirus infection is the lungs, it is essential to note that the virus can also affect other organs due to the widespread distribution of ACE2 receptors [3]. The presence of the virus in various organs may lead to harm in the cardiovascular, gastrointestinal, kidney, liver, central nervous system, and eye, and it is essential to closely monitor these potential complications [4]. According to the World Health Organization (WHO), maternal mental health refers to a woman's overall well-being and capability to manage the stress of daily life, work productively, and contribute to her community. It includes the capacity to care for herself and her family and positively impact those around her [5]. COVID-19 pandemic has led to increased levels of anxiety and depression among pregnant women and new mothers [6]. The pandemic has also resulted in reduced access to mental health services for pregnant and postpartum women due to social distancing measures and overwhelmed healthcare systems [7]. Pregnant women who contract COVID-19 are at higher risk of developing severe illness and complications such as preterm birth and preeclampsia which can further exacerbate maternal mental health issues [8]. The pandemic has also led to increased stressors such as financial insecurity and social isolation which can negatively impact maternal mental health during pregnancy and postpartum period [7]. It is common for women to experience depression and anxiety during pregnancy and the year after giving birth, with an estimated 10-20% of women experiencing major depressive episodes during this period [9]. Depression during pregnancy and the perinatal period can be difficult to recognize, and as a result, it is estimated that about 50% of women who experience depression go undiagnosed. It is essential for women to be aware of the signs of depression and to seek help if they are experiencing symptoms [10]. During pregnancy, women may experience emotional changes and an increase in hormone production as their body prepares for childbirth. These changes can be normal and expected, but for some women, they may be accompanied by symptoms of depression or anxiety. It is crucial for women to be aware of these potential changes and to seek support if they are experiencing difficulties [11]. Anxiety during pregnancy can negatively affect infant health, brain development, and overall well-being, potentially through biological changes that occur during pregnancy and fetal development. Mothers must address any anxiety or other mental health worries throughout pregnancy to promote the best possible outcomes for their infants [12]. Research has shown that stress experienced by a mother during pregnancy can increase the vulnerability of her offspring to adverse health outcomes from birth through adulthood. Pregnant women need to manage their stress to promote the best possible health outcomes for their children [13]. The effects of maternal stress during pregnancy can extend into later life, with early exposure to maternal psychological health complications predicting emotional and behavioral problems in childhood, many of which may continue into adulthood. Pregnant women must manage their mental health to promote the best possible outcomes for their children [14]. Maternal mental illness during pregnancy can negatively impact the offspring's mental health outcomes. Maternal anxiety, stress, and depression during pregnancy can expose the fetus to high maternal and placental stress hormones, which can affect the growth of the fetal nervous system and increase the risk of future physiological and behavioral problems in the child. It is essential to prioritize perinatal mental health to provide integrated mental health services and better support for defenseless families during this time. By understanding the impact of COVID-19 on maternal mental health and the impact of maternal mental health on infants, we can work to identify, diagnose, and prevent potential physical and mental health issues in the future..

Also the purpose of study could be to raise awareness about the importance of addressing maternal mental health during the pandemic and to highlight the potential impact it can have on newborns. Additionally, this study could aim to provide insights and recommendations for healthcare providers and policymakers to better support mothers and their mental health needs during this challenging time. Ultimately, your purpose should be to contribute to the body of knowledge on maternal mental health in the context of COVID-19 and advocate for improved care for mothers and their infants.

## Method

The present study aimed to investigate the effects of maternal mental health during the COVID-19 pandemic on newborns. A systematic review of literature was conducted to identify relevant articles published between January 2020 and March 2021. The following databases were searched: PubMed, Scopus, Web of Science, PsycINFO, and CINAHL. The search strategy included the following keywords: "maternal mental health," "postpartum depression," "anxiety," "stress," "COVID-19," "pandemic," and "newborns." The search was limited to studies published in English and conducted on human subjects. After removing duplicates, two reviewers independently screened the titles and abstracts of all identified articles for eligibility. Full-text articles were then assessed for inclusion based on predefined criteria. Studies were included if they reported on maternal mental health during the COVID-19 pandemic and its effects on newborns. A total of 172 articles met the inclusion criteria and were included in the final analysis. Data were extracted from each article using a standardized form that included information on study design, sample size, participant characteristics, measures of maternal mental health, and outcomes related to newborns. Quality assessment was performed using the Cochrane Risk of Bias tool for randomized controlled trials (RCTs) and the Newcastle-Ottawa Scale for observational studies. Any discrepancies between reviewers were resolved through discussion or consultation with a third reviewer. Data synthesis was conducted using a narrative approach due to heterogeneity in study designs and outcomes. Findings were organized according to themes related to maternal mental health during the COVID-19 pandemic and its effects on newborns. In conclusion, this systematic review provides a comprehensive overview of the current evidence regarding maternal mental health during the COVID-19 pandemic and its effects on newborns. The findings have important implications for healthcare providers working with pregnant women and new mothers during this challenging time.

## 1. Health disorders caused by COVID-19

The COVID-19 virus emerged in late 2019, and within a month, it was declared a public health emergency by the World Health Organization (WHO). By March 2020, the disease caused by the virus was classified as a pandemic by the WHO. The rapid spread of the virus and its global impact prompted the WHO to take these actions to address the crisis and support efforts to control the spread of the disease <sup>[15]</sup>. COVID-19, the disease caused by the novel coronavirus, has been found to result in higher rates of respiratory failure and death among infected individuals, especially those with underlying health conditions such as diabetes and heart disease. These comorbidities may make individuals more vulnerable to severe illness from the virus. People with underlying health conditions need to be particularly cautious and take steps to protect themselves from infection <sup>[16]</sup>. The COVID-19 pandemic has resulted in a range of mental health

problems for many people, including fear, anxiety, and stress. The public health measures taken in response to the pandemic, such as social distancing and lockdowns, have disrupted daily life and routines, causing uncertainty and worry for many individuals. These changes and the ongoing concerns about the virus and its impacts on health, the economy, and daily life have contributed to mental health problems for some people. It is crucial to prioritize mental health and to seek support if needed during this challenging time <sup>[17]</sup>.

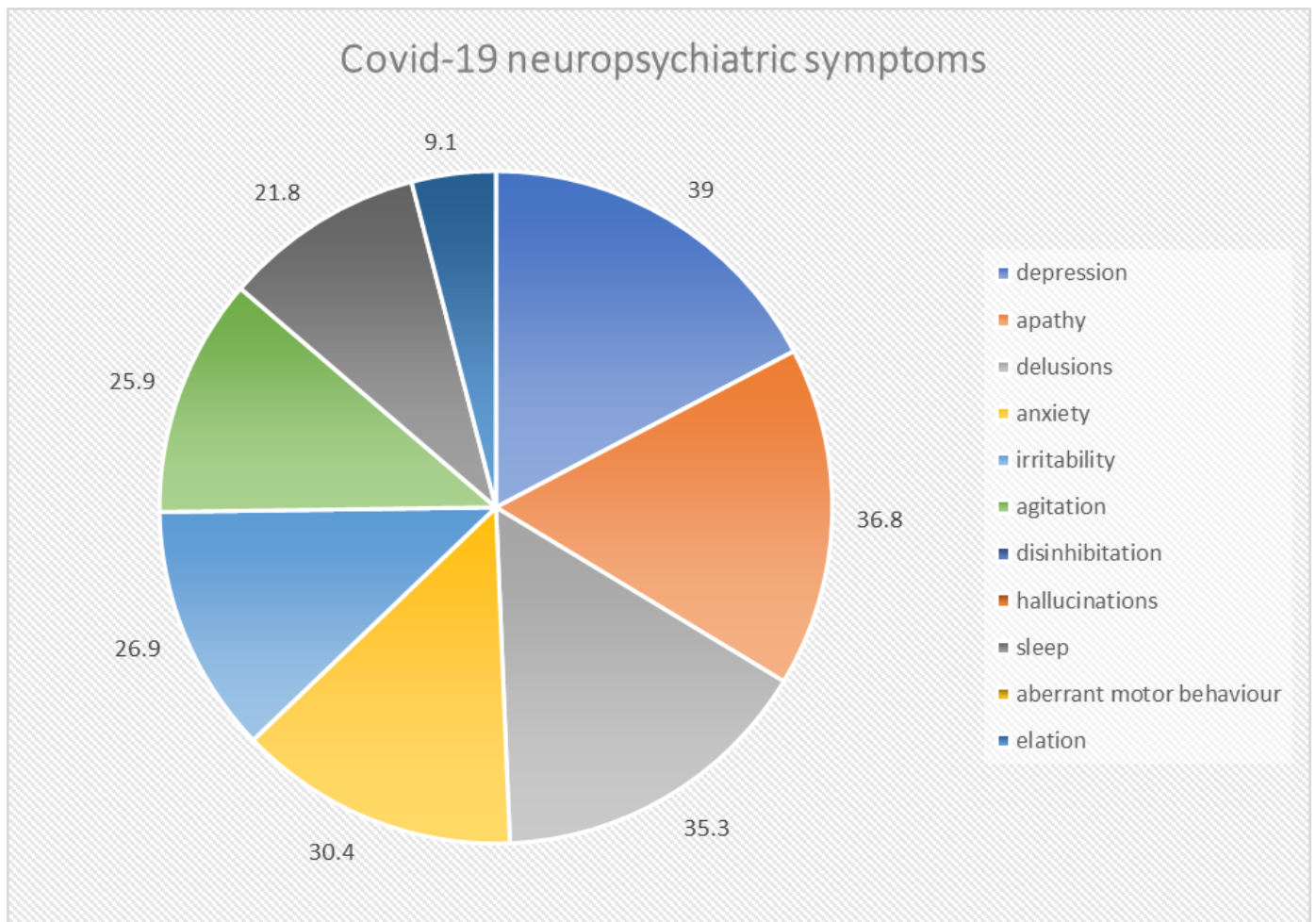
### 1.1. *Physical health disorders*

A new type of coronavirus, known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in December 2019 as the cause of a respiratory illness called coronavirus disease 2019, or COVID-19. This virus has caused a global pandemic, leading to widespread illness and death. The rapid spread of the virus and its global impact prompted the World Health Organization (WHO) to declare it a pandemic in March 2020 <sup>[18]</sup>. COVID-19 is characterized by a range of clinical symptoms that can vary in severity. Common symptoms include fever, dry cough, and fatigue; the virus can also affect the lungs in some cases. The specific symptoms and the severity of the illness can vary from person to person. It is essential for individuals to be aware of the signs and symptoms of COVID-19 and to seek medical attention if they are experiencing these symptoms <sup>[19]</sup>. In severe cases of COVID-19, individuals may develop complications such as acute respiratory distress syndrome, heart failure, renal failure, shock, and multi-organ failure. These complications can be life-threatening and may lead to death. Individuals with COVID-19 need appropriate medical care to manage these complications and prevent serious outcomes <sup>[20]</sup>. In addition to the more common symptoms of COVID-19, such as fever, dry cough, and fatigue, other studies have found that the virus can also cause joint or muscle pain, heart symptoms or conditions such as chest pain and rapid or irregular heartbeat, digestive symptoms like diarrhea and stomach pain, blood clots and vascular issues, and skin rash. Some people with COVID-19 may also experience changes in their menstrual cycle. It is essential for individuals to be aware of the wide range of symptoms that COVID-19 can cause and to seek medical attention if they are experiencing any unusual or concerning symptoms <sup>[21] [22] [23]</sup>

### 1.2. *Psychological health disorders*

Pandemics can have a significant impact on mental health. People may experience health anxiety, panic, adjustment disorders, depression, chronic stress, and insomnia. Misinformation and uncertainty about the virus and its impacts can contribute to mass hysteria. It is essential for individuals to prioritize their mental health during a pandemic and to seek support if needed. Taking steps to manage stress and get accurate information can help mitigate a pandemic's negative psychosocial impacts <sup>[24]</sup>. The lockdowns and other measures implemented in response to the COVID-19 pandemic have had many unintended consequences, including increased domestic violence cases. For women and children who live with domestic violence, the isolation and confinement of lockdown can make it difficult or impossible to escape their abusers. It is essential for governments and communities to address this issue and to provide support and resources for individuals who are experiencing domestic violence during this time <sup>[25]</sup>. Delirium, or a state of confusion and altered mental function, is a common complication in patients who require hospitalization for COVID-19. Delirium is typically seen in the acute stage of the illness when the virus is causing the most severe symptoms. The virus can cause delirium or result from other

factors such as underlying health conditions, certain medications, or hospitalization. It is essential for healthcare providers to be aware of the possibility of delirium in patients with COVID-19 and to take steps to manage and treat this condition [26]. Psychologists and mental health professionals have raised concerns about the impact of the COVID-19 pandemic on global mental health. The pandemic is anticipated to lead to increased cases of depression, suicide, and self-harm, in addition to other mental health problems. The disruptions caused by the pandemic, including social isolation, financial stress, and changes to daily routines, can contribute to these mental health issues. It is essential for individuals to prioritize their mental health during this time and to seek support if needed. Governments and communities can also play a role in addressing the mental health impacts of the pandemic by providing resources and support for struggling individuals [27]. The fear of contracting COVID-19 and the uncertainty surrounding the pandemic have caused significant stress and anxiety for many, including those who have never previously experienced mental illness. This fear can lead to the development of psychiatric symptoms such as depression, confusion, and anxiety. It is essential for individuals to manage their stress and anxiety during this time and to seek support if needed. Governments and communities can also play a role in addressing the mental health impacts of the pandemic by providing resources and support for struggling individuals [28]. Pregnant women, postpartum, experiencing a miscarriage, or suffering from intimate partner violence may be at exceptionally high risk for developing mental health problems during the COVID-19 pandemic. The added stress and uncertainty of the pandemic can exacerbate existing mental health issues and create new ones. It is essential for these women to prioritize their mental health and to seek support if needed. Governments and communities can also play a role in addressing the mental health impacts of the pandemic by providing resources and support for women who are particularly vulnerable [29]. Research has shown that a mother's mental health during pregnancy and early infancy can significantly impact child development, potentially more so than the direct effects of disaster-related prenatal stress. It is essential for pregnant women and new mothers to prioritize their mental health and to seek support if needed to promote the best possible outcomes for their children. Governments and communities can also play a role in addressing the mental health impacts of disasters by providing resources and support for women who are particularly vulnerable [30] [31] (Figure 1).



**Figure 1.** COVID-19 neuropsychiatric symptoms [32]: The COVID-19 pandemic and the measures taken to slow the virus's spread have negatively impacted the mental health of people with dementia and their caregivers. The disruptions and limitations caused by the pandemic have worsened neuropsychiatric symptoms in people with dementia and have increased stress and burden for caregivers.

## 2. Ways of transmission between mother and infant/neonate

### 2.1. Before birth

There is growing evidence that the relationship between a mother and her infant is complex and dynamic, with bidirectional influences that can shape individuals' mental and physical development. This relationship, known as the mother-infant dyad, is especially essential during a time of rapid brain development in both the mother and the infant. Researchers have identified epigenetic, behavioral, and psychosocial factors that can influence this relationship, and it is essential to consider the needs of both the mother and the infant when assessing and addressing any potential issues [33] [34] [35]. Intrauterine transmission is a severe complication that can occur when a viral infection is transmitted from a pregnant mother to her fetus. This can happen with infections caused by congenitally transmitted TORCH agents (Toxoplasma, other agents, rubella, cytomegalovirus, herpes simplex virus) and infections such as Zika virus and Ebola virus. These infections can cause serious health problems for the fetus, including birth defects and other complications [36] [37]. There is evidence from previous studies that fetal exposure to maternal viral infections during

pregnancy may be related to atypical child neurodevelopment and may potentially lead to worldwide developing interruptions or specific neurodevelopmental illnesses. This has led to speculation that maternal infection with SARS-CoV-2, the virus that causes COVID-19, during pregnancy may also be linked to these outcomes. More research is needed to understand the potential effects of maternal SARS-CoV-2 infection on fetal development and to identify any possible interventions that may be necessary to support the development of children exposed to the virus in utero [38] [39] [40]. Maternal-infant bonding is the emotional connection between a mother and her infant. This bond is considered an essential factor in a mother's ability to care for her infant, even in the face of the physical and emotional challenges of parenting. A robust maternal bond may help a mother to feel more connected to and invested in her child, leading to better caregiving practices and positive outcomes for the child [41] [42] [43].

### 2.1.1. *Intrauterine vertical transmission*

Pregnant women and their fetuses are well thought to be high-risk during infectious disease outbreaks. Pregnant women may be more vulnerable to infections and at more risk of severe problems from infections. In addition, infections during pregnancy can have serious consequences for the fetus, including birth defects, premature birth, and other complications [44]. Meanwhile the emergence of the novel coronavirus that causes COVID-19, there has been limited data on the potential impact of the virus on pregnant women and their fetuses. While some initial studies have suggested that the virus may be associated with adverse pregnancy outcomes, more research is needed to fully understand the risks and to identify any potential interferences that may be necessary to support the health of pregnant women and their fetuses during this time [45]. One of the unanswered questions about the COVID-19 pandemic is whether the virus that causes the disease, SARS-CoV-2, can be transmitted from a pregnant woman to her fetus. This process, known as vertical transmission, can potentially have severe consequences for the fetus. Researchers are working to understand the mechanisms by which the virus might be transmitted from a pregnant woman to her fetus and to identify any potential interventions that may be necessary to prevent or mitigate this type of transmission [36] [46] [47]. Several systems have been developed to categorize perinatal transmission of SARS-CoV-2. These systems typically require evidence of maternal infection, fetal exposure to the virus, and the persistence of the infection in the fetus or neonate (newborn). These systems are used to help researchers and healthcare providers understand the risks and consequences of perinatal transmission of SARS-CoV-2 and to identify any potential interventions that may be necessary to prevent or mitigate this type of transmission [48] [49] [50] [51]. The possibility of vertical transmission of SARS-CoV-2 from a mother to her fetus is a concern in perinatal medicine. While the virus is primarily transmitted through droplets, there is emerging evidence about the possibility of intrauterine transmission from a mother to her fetus. Some initial studies conducted at the start of the pandemic did not detect vertical transmission. Still, more research is needed to fully understand the risks and mechanisms of transmission [52] [53] [54] [55]. The most definitive evidence of intrauterine transmission of COVID-19, the disease caused by SARS-CoV-2, would be the confirmation of viral replication in fetal pulmonary tissues. However, this type of analysis is technically challenging and may only be feasible in some cases. Researchers are working to understand the risks and mechanisms of perinatal transmission of SARS-CoV-2 and to identify any potential interventions that may be necessary to prevent or mitigate this type of transmission [56]. There is evidence that, in rare cases, SARS-CoV-2 can be transmitted from a pregnant mother to her fetus. In one study, the SARS-CoV-2 genome was detected in

umbilical cord plasma, suggesting that mother-to-child transmission in utero may be possible in some cases. This transmission may be related to a high maternal and fetal inflammatory state. More research is needed to understand the risks and mechanisms of perinatal transmission of SARS-CoV-2 and to identify any potential interventions that may be necessary to prevent or mitigate this type of transmission [57].

## 2.2. After birth

The risk of a newborn acquiring SARS-CoV-2 from its mother is generally considered low. Some data suggests that there is no difference in the risk of neonatal SARS-CoV-2 infection whether the newborn is cared for in a separate room or remains in the mother's room [58] [59]. According to a recent study, the rate of newborns testing positive for SARS-CoV-2, the virus that causes COVID-19, when born to mothers with a diagnosis of SARS-CoV-2 infection is relatively low. The study found that less than 2% of babies born to mothers seeking hospital care for any reason and with a diagnosis of SARS-CoV-2 infection also tested positive for the virus. When the analysis was limited to babies with antenatal (during pregnancy) or intrapartum (during childbirth) exposure to the virus, the rate of newborns testing positive was even lower, at about 1%. These findings suggest that the risk of perinatal transmission of SARS-CoV-2 may be relatively low, but more research is needed to fully understand the risks and mechanisms of transmission [60]. Postnatal transmission of SARS-CoV-2 could occur through several mechanisms. One possibility is that the virus could be transmitted to an infant through the ingestion of breast milk from an infected mother. Another possibility is that the virus could be transmitted from an infected mother (or other caregivers) to the infant through respiratory or other infectious secretions [61] [62].

## 3. Mental and Physical impacts of SARS-Cov-2 infection in mothers

It is generally believed that COVID-19 infection during pregnancy has a clinical presentation and severity similar to that of non-pregnant adults. There is currently no evidence to suggest that COVID-19 infection during pregnancy is related to poor maternal or perinatal outcomes [63]. SARS-CoV and MERS-CoV, two other coronaviruses that have caused outbreaks in the past, have been associated with significant adverse maternal outcomes. For example, the maternal mortality rate was 25.8% during the SARS outbreak and 28.6% during the MERS outbreak. These viruses were also associated with preterm birth, fetal growth restriction, and perinatal death [64]. Exposure to natural disasters and disease outbreaks, such as the COVID-19 pandemic, can increase the prevalence of mental health problems during pregnancy. Pregnancy is already a period of increased risk for mental illness, so the added stress of a disaster or outbreak can exacerbate this risk [65]. Pregnancy can be a stressful time for women, even under normal circumstances. The COVID-19 pandemic has added a layer of stress and anxiety for many pregnant women. The fear of infection, the possibility of hospitalization, and the disruption of normal prenatal care routines can all contribute to increased anxiety [66]. The coronavirus pandemic has significantly influenced many people's mental health, including pregnant women. The fear of infection, the possibility of hospitalization, and the disruption of normal prenatal care routines can increase anxiety and stress. Pregnant women may also be concerned about the potential effects of the virus on their unborn babies. They may feel overwhelmed by the many changes and uncertainties brought about by the pandemic [67]. Pandemic-related stress



and adversity may lead to or exacerbate common prenatal mental health difficulties, such as depression. Pregnancy can be a time of increased risk for mental health problems, and the added stress and uncertainty of the coronavirus pandemic can exacerbate this risk. Depressive symptoms during pregnancy have been found to negatively affect maternal-child health, including an increased risk of preterm birth, low birth weight, and other complications [68].

### 3.1. *Anxiety*

Pregnancy can be a time of increased vulnerability to anxiety and other mental health problems. Several factors can contribute to this increased risk, including limited physical activity, fear of the event of labor, worry about the newborn's health, and the increased production of adrenal cortical hormones during pregnancy [69]. Pregnancy-related anxiety (PRA) is a common experience for many pregnant women, ranging from mild to severe. PRA can adversely affect pregnancy outcomes, including an increased risk of preterm birth, low birth weight, and other complications [70]. Many factors can contribute to anxiety and other mental health problems during epidemics and pandemics. These may include fear of infection and death, disruptions to daily routines due to quarantine measures, and uncertainty about the future [71]. Sustained, elevated anxiety and depression symptoms during pregnancy have increased the risk of postpartum depression. They may also be associated with an increased risk of prenatal infection and illness [72]. Severe anxiety during pregnancy has been found to significantly impact newborns' biological indicators, such as height, weight, and head circumference [73] [74]. Anxiety during pregnancy has been linked to several negative outcomes, including an increased risk of preterm birth and earlier gestational age [75] [76] (Figure 2, 3).

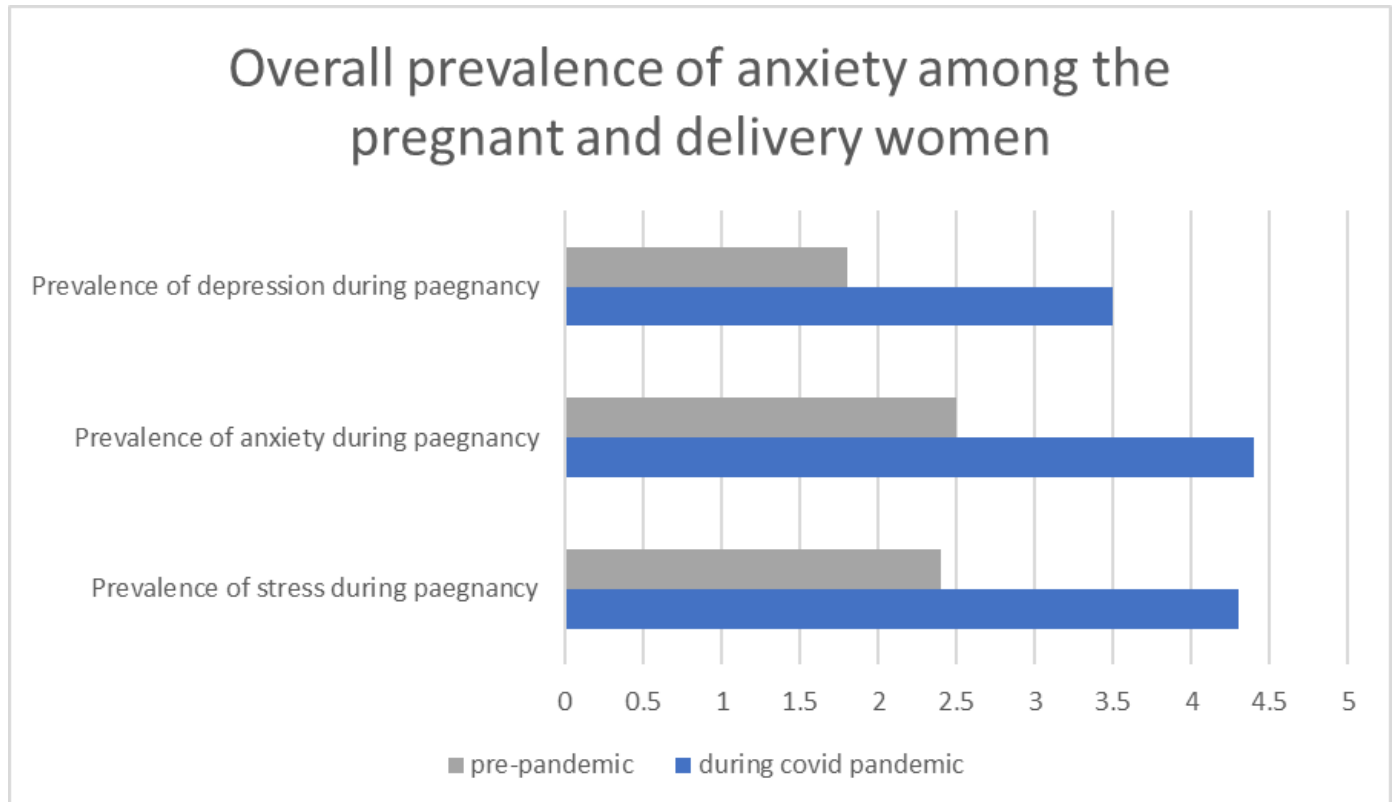
### 3.2. *Depression*

Depression during pregnancy, or prenatal depression (PND), is predictive of postpartum depression (PPD), a type of mood disorder that occurs after giving birth. PPD can adversely affect mothers, their offspring, and their families [77]. In addition to fear of infection with COVID-19, unintended negative consequences of social distancing measures, such as travel restrictions and economic downturn, are significantly associated with depressive symptoms. These measures can be stressful and disruptive to people's daily lives and can contribute to feelings of anxiety and depression [78]. Previous studies have found that pregnant women with low education levels may be at augmented risk for anxiety and depression. This may be due to various factors, including increased stress and lack of access to resources and support [79]. Untreated depression can have serious consequences, including the risk of suicide. It is essential for pregnant women who are taking antidepressants to continue their treatment as prescribed, even if they become pregnant. Discontinuing antidepressant treatment abruptly can be dangerous and increase the risk of relapse and other serious consequences [80]. Depression during pregnancy can have negative impacts on both maternal and fetal health. Some potential risks associated with untreated depression during pregnancy include preterm birth, small for gestational age, stillbirth, low birth weight, and an increased risk of autism spectrum disorder (ASD) in the child. Pregnant women with untreated depression may also be at increased risk for complications during delivery and for developing postpartum depression after giving birth [81]. Maternal depression can negatively impact a woman's overall health and well-being, including her nutrition and immune function. Depression can cause changes in appetite and energy levels, leading to malnutrition and an increased

risk of illness. Additionally, depression has been linked to changes in the immune system, which can also increase the risk of illness [82] (Figure 2, 3).

### 3.3. Stress

The impact of these stressors on pregnant women and their offspring is of concern, as prenatal adversity and stress are known to have long-term adverse effects on child development and health outcomes. Pregnant women may be particularly vulnerable to the effects of stress due to the many physical and hormonal changes that occur during pregnancy [83]. The COVID-19 pandemic has significantly impacted pregnant women, their mental health, and their risk of developing various physical health problems. The fear of contracting the virus and the restrictions and disruptions to daily life caused by the pandemic have increased anxiety and depression among pregnant women. These mental health issues can, in turn, negatively affect pregnancy outcomes and the health of both the mother and the infant [84]. Chronic stress can cause complications in mothers, such as headaches, difficulties sleeping, fast breathing, and tachycardia. Some individuals may experience obsessive thoughts, anxiety or worry, irritability, problems with eating (such as eating too much or too little or choosing unhealthy foods), and difficulty relaxing or winding down as a result of the disruptions to daily life and routines [85]. Prenatal stress not only affects mothers but also can cause problems for infants. Some studies show that high stress levels during pregnancy may cause specific problems throughout childhood, like trouble paying attention or being frightened. It's probable that stress also may affect a baby's brain growth or immune system [86] (Figure 2, 3).



**Figure 2.** comparison of depression, anxiety, and stress frequency in time pre-pandemic and during the COVID-19 pandemic [87][88][45]. statistics show that the prevalence of these problems, depending on the situation, increased. Loneliness, financial problems, and emotional changes are some of these problems.

### 3.4. *OCD (obsessive-compulsive disorder)*

There is increasing evidence that obsessive-compulsive disorder (OCD) is common during pregnancy and postpartum. If left untreated, it can have lasting effects on both the mother and child [89]. There is evidence that OCD is common during pregnancy and the postpartum period, and if left untreated, it can have lasting effects on both the mother and her child. This may be because pregnancy and early parenthood are when mothers are particularly concerned about their child's safety and feel a strong sense of responsibility for them [90]. The perinatal period (including pregnancy and early parenthood) is when women are more likely to develop or experience worsening OCD. Pregnant and postpartum women are 1.5-2 times more likely to have OCD than the general population [91]. Pregnant women may be at an increased risk for developing obsessive-compulsive disorder (OCD) during the COVID-19 pandemic due to increased stress and fear of contagion. Previous research has shown that pregnant and postpartum women are 1.5-2 times more likely to experience OCD than the general population, and the pandemic may exacerbate these risks. The prevalence of OCD symptoms in pregnant women during the pandemic is currently unknown [92]. If left untreated, OCD can have negative consequences on both mothers and their children in the long term. Mothers may struggle to find enjoyment in their relationship with their children, and children may be more prone to experiencing internalizing disorders, including a wide range of OCD symptoms [89] [93]. untreated OCD in pregnant or postpartum women can lead to Baby Blues, a common, short-term mood disorder after childbirth. Baby Blues can cause mood changes, overreacting to things, quickly bursting into tears, feeling irritability, and in severe cases, postpartum psychosis [94] [95] (Figure 3).

### 3.5. *PTSD (post-traumatic stress disorder)*

PTSD is a mental health disorder that can occur after a person experiences or witnesses a traumatic event. It is more common in pregnant and postpartum women than in the general population, with rates ranging from (6-8% vs. 4-5%) [96]. Pregnant women can develop PTSD from experiencing a traumatic event, including accidents, violence, or disasters [97] [98]. During the period around childbirth, stress may cause the reactivation of past traumatic experiences, leading to the development of PTSD. Early identification of psychological distress, including attachment style, is essential for targeted interventions to reduce the harmful effects of postpartum depression and PTSD on a woman's mental health, bonding with her infant, and the child's development [99]. Prenatal PTSD can have long-term consequences for the mother and the child if it is not appropriately treated. Pregnant women with PTSD may be at higher risk for complications during pregnancy and adverse birth outcomes, such as preeclampsia, low birth weight, and preterm birth, which can negatively impact the development of the infant [50][100][101][102][103][104][105]. Pregnant women with PTSD may experience worsening symptoms, difficulties bonding with their newborns, and an increased risk of postpartum depression [106]. PTSD during pregnancy can have negative impacts on both the mother and the newborn, including worsening symptoms and increased risk of postpartum depression in the mother, potential problems with bonding, and increased risk of complications for the infant (Figure 3).

### 3.6. *Tokophobia*

Tokophobia is a severe phobia of pregnancy and childbirth that can result in the avoidance of having children<sup>[107][108]</sup>. Tokophobia, or a fear of pregnancy, can result in symptoms such as sleep problems, panic attacks, nightmares, and behaviors that involve avoiding pregnancy or childbirth<sup>[109]</sup>. The onset of COVID-19 caused significant changes in the expectations of childbirth for many women, with over half reporting feelings of fear, sadness, and uncertainty. Only about one-sixth of women still associate joy with delivery<sup>[110]</sup>. A large percentage of women expressed fear about childbirth after the onset of COVID-19, specifically about the tokophobia construct, which relates to fear of birth<sup>[111]</sup>. Tokophobia, or fear of pregnancy, can result in using contraception to delay or avoid pregnancy and may lead to abortion or cesarean delivery during childbirth<sup>[112]</sup>. A study found that tokophobia can cause sleep problems, increased levels of a stress hormone called cortisol, increased requests for c-sections, more prolonged labor, antenatal depression, anxiety disorders, an increased risk of postnatal depression, PTSD, avoidance of future pregnancy or longer intervals between pregnancies, increased use of assisted birth methods, a more substantial need for pain relief during childbirth, and even sterilization. It can also lead to a loss of self-control, fear of one's incompetence, changes in eating habits and physical activity, and fear of not being able to care for a baby<sup>[113][114][115]</sup>. People with tokophobia may choose a C-section, and consider abortion or adoption for their baby, even when a vaginal delivery is safe (Figure 3).

**Figure 3.** Maternal Disorders by their frequencies, causes, and results in detail. Frequencies of the disorders mentioned above are marked by three ranges of colors indicating maximum (red:>70%), medial (yellow: >30%, <70%), and minimum (green: <30%) which are organized by overall circumstance globally through related studies.

Disorder	Frequency	Causes	Results	Ref.
Anxiety		<ol style="list-style-type: none"> <li>1. Hormonal changes of pregnancy</li> <li>2. prior heartbreaking miscarriages</li> <li>3. sleep difficulties</li> </ol>	<ol style="list-style-type: none"> <li>1. preterm birth</li> <li>2. low birth weight</li> <li>3. earlier gestational age</li> <li>4. smaller head circumference</li> </ol>	<p>[75]</p> <p>[116]</p> <p>[76]</p>
Depression		<ol style="list-style-type: none"> <li>1. pregnancy was undesirable or unplanned</li> <li>2. have had problematic relationships with their mother — any unresolved emotional conflicts may be awakened</li> <li>3. working as it may be challenging to balance a career with motherhood, mainly if colleagues are not understanding or supportive</li> <li>4. teenage or very young mothers</li> </ol>	<ol style="list-style-type: none"> <li>1. preterm birth</li> <li>2. low birth weight</li> <li>3. malnutrition</li> <li>4. febrile illness</li> </ol>	<p>[75]</p> <p>[117]</p> <p>[118]</p>

<p><b>stress</b></p>		<ol style="list-style-type: none"> <li>1. 1. worried about what to expect during labor and birth</li> <li>2. 2. how to take care of baby</li> <li>3. 3. hormonal changes</li> </ol>	<ol style="list-style-type: none"> <li>1. 1. preterm labor</li> <li>2. 2. preterm delivery</li> <li>3. 3. low infant birth weight</li> <li>4. 4. shorten the gestational length</li> <li>5. 5. preeclampsia</li> <li>6. 6. gestational diabetes</li> </ol>	<p>[119]</p> <p>[120]</p>
<p><b>PTSD</b></p>		<ol style="list-style-type: none"> <li>1. 1. serious road accidents</li> <li>2. 2. violent personal assaults, such as sexual assault, mugging, or robbery</li> <li>3. 3. serious health problems</li> <li>4. 4. childbirth experiences</li> </ol>	<ol style="list-style-type: none"> <li>1. 1. lower mean birth weight</li> </ol> <p>(PTSD is highly comorbid with depression and other anxiety disorders, which have also been associated with lower birth weight in infants and other adverse outcomes.)</p>	<p>[121]</p> <p>[96]</p>
<p><b>OCD</b></p>		<ol style="list-style-type: none"> <li>1. 1. family history</li> <li>2. 2. differences in the brain</li> <li>3. 3. life events</li> <li>4. 4. personality</li> </ol>	<ol style="list-style-type: none"> <li>1. 1. mood changes</li> <li>2. 2. Baby Blues</li> <li>3. 3. over-react to things</li> <li>4. 4. burst into tears easily</li> <li>5. 5. feel irritable</li> <li>6. 6. Postpartum Psychosis</li> </ol>	<p>[94]</p> <p>[95]</p>
<p><b>Tokophobia</b></p>		<ol style="list-style-type: none"> <li>1. 1. fear of childbirth in family</li> <li>2. 2. heard frightening birth stories from people in your family</li> <li>3. 3. have had an anxiety disorder</li> <li>4. 4. experienced sexual abuse, assault, or rape</li> <li>5. 5. had gynecological problems</li> </ol>	<ol style="list-style-type: none"> <li>1. 1. Choose a Cesarean birth (C-section), even though a safe vaginal delivery is possible.</li> <li>2. 2. Seek an abortion if they become pregnant.</li> <li>3. 3. Put their baby up for adoption.</li> </ol>	<p>[107]</p> <p>[122]</p> <p>[123]</p> <p>[124]</p>

## 4. COVID-19 effects on infants

Maternal mental health problems can majorly impact children's social and emotional development and result in ongoing financial and personal costs [125]. The Prenatal environment has a significant influence on fetal development [13]. Pregnancy is accompanied by emotional changes and increased hormone production in mothers [126]. Negative emotions and stress during pregnancy may affect the mother's HPA (hypothalamic–pituitary adrenal) axis and weaken her immune system [127]. Birth weight is essential in the fetal programming paradigm, which refers to how the prenatal environment can influence the developing fetus [128].

### 4.1. *Intrauterine growth retardation(IUGR)*

In some pregnant women with SARS-CoV, examination of the placenta showed increased subchorionic and intervillous fibrin in 40% of samples and thrombotic vasculopathy (a condition involving the formation of blood clots in small blood vessels) associated with fetal growth restriction in 28% of samples. These effects on the placenta are similar to those infected with SARS-CoV-2. However, no cases of chronic villitis (inflammation of the small blood vessels in the placenta) were observed in any samples [129]. Infections can lead to intrauterine growth restrictions and preterm births. Studies have shown that the placenta can be affected by SARS-CoV-2, with increased fibrin and thrombotic vasculopathy observed in some samples [130] (Figure4).

### 4.2. *Premature births - preterm births*

It's possible that the higher rate of early delivery in the COVID-positive groups could be due to the severity of the mother's illness or other factors, such as preeclampsia, which can lead to early delivery. It's also possible that the higher rate of cesarean delivery could be due to the need to deliver the baby quickly to free up the mother's respiratory system or due to other obstetrical indications [131][132][133]. A nationwide study found no connection between being born when public health measures to control the spread of COVID-19 were in place and the risk of premature birth [134]. The COVID-19 lockdown has had a major impact on people's lives, including changes to work environments, reduced physical interactions, and increased focus on hygiene. These changes may have influenced risk factors for premature birth [135] (Figure4).

### 4.3. *infected neonates by positive COVID19 (distress + pneumonia)*

Babies born to mothers with COVID-19 infections may also have the infection and may have severe respiratory symptoms that require prolonged respiratory support. These symptoms may appear later and may be severe [136]. Most newborn babies with COVID-19 infection either showed no symptoms or only mild symptoms, typically required no assistance with breathing, and had a good outlook after an average of 10 days of hospitalization [137] (Figure4).

### 4.4. *Low birth weight*

Birth weight is commonly recorded and reliable information, especially for individuals born after the 1960s<sup>[138]</sup>. COVID-19 has not only caused a worldwide health disaster, but it has also had psychosocial and financial impacts. Financial downturns, such as the financial crisis in 2008, have been linked to decreases in average birth weight in countries that have been greatly affected<sup>[139][140][141]</sup>. A review of nine studies found that among pregnant individuals infected with COVID-19, there were higher rates of preterm delivery (63.8%) and low birth weight (42.8%)<sup>[142][143]</sup> (Figure4).

#### 4.5. *Miscarriage (spontaneous abortion)*

Disruptions to healthcare services and the implementation of lockdown policies may cause the undesirable effect of COVID-19 on pregnancy and newborn health outcomes<sup>[144]</sup>. COVID-19 infection during the time around conception may increase the risk of miscarriage. Still, studies have not been able to compare miscarriage rates between COVID-19-positive and negative pregnant women because they either did not have proper controls or only included COVID-19 cases. The rate of miscarriage among COVID-19 cases is similar to that of the general pregnant population<sup>[145]</sup>. Some studies have looked at the impact of COVID-19 on the risk of spontaneous abortion in early pregnancy. These studies compared the frequency of SARS-CoV-2 infection in women who had a spontaneous abortion in the first trimester and women who were still pregnant at 12 weeks. The findings suggest that COVID-19 infection during the first trimester of pregnancy does not appear to increase the risk of early pregnancy loss<sup>[146]</sup> (Figure4).

#### 4.6. *Stillbirth*

There is conflicting evidence about the rates of preterm births and stillbirths during the COVID-19 pandemic<sup>[147]</sup>. A study has shown that the coronavirus can infect and harm the placenta, which supplies oxygen and nutrients to the fetus in the uterus. The significant damage it can cause can result in stillbirth, which is the death of a baby before or during birth<sup>[148]</sup>. A study found that women in the United States with COVID-19 were more likely to experience stillbirth than women without COVID-19, with the risk particularly high during SARS-CoV-2. The study analyzed data from over 1.2 million delivery hospitalizations between March 2020 and September 2021<sup>[149]</sup> (Figure4).

#### 4.7. *Neonatal asphyxia*

Birth asphyxia is when a newborn baby cannot start or maintain breathing after birth<sup>[150]</sup>. Perinatal asphyxia is a condition that occurs when a fetus or infant does not receive enough oxygen during the peripartum period, which can lead to severe complications due to decreased blood flow and oxygen to the body. This can be caused by problems with placental gas exchange (prenatal) or pulmonary gas exchange (immediate postnatal). Hypoxia (partial lack of oxygen) or anoxia (complete lack of oxygen) can occur in vital organs<sup>[151]</sup>. Birth asphyxia and respiratory distress syndrome were seen in 1.8% and 6.4% of newborns, respectively<sup>[152]</sup> (Figure4).

#### 4.8. *Amniotic fluid abnormality*

In pregnant women infected with SARS-COV-2, it is suggested that the infection may cause a decrease in amniotic fluid,

known as oligohydramnios. It is recommended that these women receive more frequent ultrasound scans and regular check-ups to monitor for any signs of oligohydramnios [153]. There is currently no information about whether oligohydramnios or low amniotic fluid in pregnant women with COVID-19 is temporary. It is unclear if there is a connection between anhydramnios (absence of amniotic fluid) and COVID-19. However, healthcare professionals should be vigilant about monitoring fetal growth and health in pregnant women with COVID-19 who have been diagnosed with anhydramnios [154] (Figure4).

#### 4.9. Cyanosis

There is limited medical literature about children, especially infants, who have been infected with COVID-19. However, it is known that children generally experience milder symptoms and have better outcomes than adults with the virus [155]. Clinicians should be aware that infants may have mild or subtle presentations of COVID-19 and consider testing for the virus in brief episodes of apnea, cyanosis, and stridor. Caregiver testing and quarantine protocols may also be necessary to prevent the further spread of the disease. This is particularly essential as the COVID-19 pandemic is expected to continue in the coming years [156] (Figure4).

#### 4.10. Congenital defects

It is imperative to understand how the timing of infection with COVID-19, the variant strain of the virus, the sex of the fetus, and other prenatal and postnatal exposures may affect the neurodevelopment of children to fully understand the potential long-term impact of the COVID-19 pandemic on future generations [40]. COVID-19 may cause lasting birth defects in babies either through infection or through medical treatment measures taken to address the infection [157]. Additional research is needed to confirm the relationship between COVID-19 and congenital anomalies. Still, current evidence suggests that there is either no risk or low risk of these anomalies in infants whose mothers had COVID-19 [158] (Figure4).

**Figure 4.** The effects of COVID-19 on the baby and the fetus, which disrupts the growth and development of the neonate/fetus with a direct or indirect effect (effect on the mother) by their frequency, symptoms, and results in detail.

Disorder	Frequency	Symptoms	Results	Ref.
IUGR		<ol style="list-style-type: none"> <li>1. appears malnourished</li> <li>2. thin or pale skin</li> <li>3. breathing difficulties</li> <li>4. feeding issues</li> <li>5. low blood sugar</li> <li>6. body temperature issues</li> <li>7. appears yellow (jaundice)</li> <li>8. infection (sepsis)</li> </ol>	<ol style="list-style-type: none"> <li>1. perinatal asphyxia</li> <li>2. meconium</li> <li>3. aspiration</li> <li>4. persistent pulmonary hypertension</li> <li>5. hypothermia</li> <li>6. hypoglycemia hyperglycemia</li> <li>7. hypocalcemia</li> <li>8. polycythemia</li> <li>9. jaundice</li> <li>10. feeding difficulties</li> <li>11. feed intolerance</li> <li>12. necrotizing enterocolitis, late-onset sepsis</li> <li>13. pulmonary hemorrhage</li> </ol>	[159] [160]



			<ul style="list-style-type: none"> <li>13. pulmonary hemorrhage</li> <li>14. abnormal physical growth</li> <li>15. neurodevelopmental outcome</li> </ul>	
<b>Premature births</b>		<ul style="list-style-type: none"> <li>1. Contractions (the abdomen tightens like a fist) every 10 minutes or more often</li> <li>2. Change in vaginal discharge (a significant increase in the amount of discharge or leaking fluid or bleeding from the vagina)</li> <li>3. Pelvic pressure—the feeling that the baby is pushing down</li> <li>4. Low, dull backache</li> <li>5. Abdominal cramps with or without diarrhea</li> </ul>	<ul style="list-style-type: none"> <li>1. Breathing problems</li> <li>2. Heart problems</li> <li>3. Brain problems</li> <li>4. Temperature control problems</li> <li>5. Gastrointestinal problems</li> <li>6. Blood problems</li> <li>7. Metabolism problems</li> <li>8. Immune system problems</li> <li>9. Cerebral palsy</li> <li>10. Impaired learning</li> <li>11. Vision problems</li> <li>12. Hearing problems</li> <li>13. Dental problems</li> <li>14. Behavioral and psychological problems</li> <li>15. Chronic health issues</li> </ul>	[161] [162]
<b>Infected neonates by positive COVID-19</b>		<ul style="list-style-type: none"> <li>1. Cough</li> <li>2. Fever or chills</li> <li>3. Shortness of breath or difficulty breathing</li> <li>4. Muscle or body aches</li> <li>5. Sore throat</li> <li>6. New loss of taste or smell</li> <li>7. Diarrhea</li> <li>8. Headache</li> <li>9. New fatigue</li> <li>10. Nausea or vomiting</li> <li>11. Congestion or runny nose</li> </ul>	<ul style="list-style-type: none"> <li>1. Need to receive critical care</li> <li>2. Coryzal signs</li> </ul>	[163] [164]
<b>Low birth weight</b>		<ul style="list-style-type: none"> <li>1. Low oxygen levels at birth</li> <li>2. Inability to maintain body temperature.</li> <li>3. Difficulty feeding and gaining weight.</li> <li>4. Infection.</li> <li>5. Breathing problems, such as infant respiratory distress syndrome</li> </ul>	<ul style="list-style-type: none"> <li>1. risk of dying</li> <li>2. long-term neurologic disability impaired language</li> <li>3. impaired academic achievement</li> <li>4. cardiovascular disease</li> <li>5. diabetes</li> <li>6. intracranial hemorrhage</li> <li>7. respiratory distress sepsis</li> <li>8. blindness gastrointestinal disorders</li> </ul>	[165] [166]
<b>Miscarriage</b>		<ul style="list-style-type: none"> <li>1. Vaginal bleeding</li> <li>2. cramping and pain in your lower tummy.</li> <li>3. A discharge of fluid from your vagina.</li> <li>4. A discharge of tissue from your vagina.</li> <li>5. No longer experiencing the symptoms of pregnancy, such as feeling sick and breast tenderness</li> </ul>	<ul style="list-style-type: none"> <li>1. fell tired</li> <li>2. lose appetite</li> <li>3. have difficulty sleeping</li> <li>4. sense of guilt</li> <li>5. shock</li> </ul>	[167] [168] [169]

		<ol style="list-style-type: none"> <li>6. crampy pelvic pain</li> <li>7. uterine bleeding</li> <li>8. eventually expulsion of tissue</li> </ol>	<ol style="list-style-type: none"> <li>6. sadness</li> <li>7. anger</li> <li>8. anxiety</li> <li>9. depression</li> </ol>	
<b>Stillbirth</b>		<ol style="list-style-type: none"> <li>1. Stop fetal movement and kicks.</li> <li>2. Spotting or bleeding.</li> <li>3. No fetal heartbeat heard with the stethoscope or Doppler</li> <li>4. No fetal movement or heartbeat is seen on ultrasound, which makes the definitive diagnosis that a baby is stillborn</li> </ol>	<ol style="list-style-type: none"> <li>1. Grief and sadness</li> <li>2. Anger</li> <li>3. Guilt</li> <li>4. Anxiety</li> <li>5. Depression</li> <li>6. Difficulty bonding with subsequent children</li> <li>7. Difficulty with intimacy in relationships</li> <li>8. Changes in self-esteem</li> <li>9. Difficulty with work or other responsibilities</li> <li>10. sore breasts</li> <li>11. breast milk production</li> <li>12. vaginal bleeding</li> </ol>	<a href="#">[170]</a> <a href="#">[171]</a> <a href="#">[172]</a>
<b>Neonatal Asphyxia</b>		<ol style="list-style-type: none"> <li>1. Not breathing or feeble breathing.</li> <li>2. Skin color bluish, gray, or lighter than expected.</li> <li>3. Low heart rate.</li> <li>4. Poor muscle tone.</li> <li>5. Weak reflexes.</li> <li>6. Too much acid in the blood (acidosis)</li> <li>7. Amniotic fluid stained with meconium (first stool)</li> <li>8. Seizures.</li> <li>9.</li> </ol>	<ol style="list-style-type: none"> <li>1. neurologic insult</li> <li>2. respiratory distress</li> <li>3. pulmonary hypertension</li> <li>4. liver myocardial</li> <li>5. renal dysfunction</li> </ol>	<a href="#">[151]</a> <a href="#">[173]</a>
<b>Amniotic fluid abnormality) oligohydramnios)</b>		<ol style="list-style-type: none"> <li>1. Leaking of the amniotic fluid</li> <li>2. Low amniotic fluid on an ultrasound</li> <li>3. Baby is smaller than what is normal for gestational age (IUGR)</li> <li>4. Low maternal weight gain</li> <li>5. Preterm premature rupture of membranes (PPROM)</li> <li>6. Abdominal discomfort</li> <li>7. A sudden drop in fetal heart rate</li> <li>8. Little to no fetal movement or decreasing fetal movement</li> <li>9. Abnormal findings on a fetal monitor, including fetal distress</li> </ol>	<ol style="list-style-type: none"> <li>1. Stillbirth</li> <li>2. lower APGAR score or congenital anomalies</li> <li>3. cardiovascular and renal problems</li> <li>4. congenital malformations</li> </ol>	<a href="#">[174]</a> <a href="#">[175]</a> <a href="#">[176]</a>
<b>Cyanosis</b>		<ol style="list-style-type: none"> <li>1. blue discoloration of the skin and mucous membranes</li> </ol>	<ol style="list-style-type: none"> <li>1. Cardiac diseases</li> <li>2. metabolic neurologic infectious</li> </ol>	<a href="#">[177]</a> <a href="#">[178]</a>

Cyanosis		1. skin discoloration of the skin and mucous membranes	3. parenchymal and non-parenchymal pulmonary disorders	
----------	--	--	--	--

## Discussion

The main objective of this review article was to explore the impact of the COVID-19 pandemic on maternal mental health and its potential effects on newborns. The discussion section will focus on the findings of this review and their implications, as well as how they relate to previous works of literature. The COVID-19 pandemic has had a significant impact on mothers and infants around the world. The virus and the measures taken to control its spread have disrupted parenting and child-rearing routines and access to healthcare and support services. The additional burden of caring for children during lockdowns, social distancing measures, and concerns about contracting the virus can affect mental health. This can be incredibly challenging for mothers who are already at higher risk of mental health issues, such as those with a history of depression or anxiety. Pregnant women and new mothers may also face challenges in accessing healthcare during the pandemic. Some may have had to delay or miss prenatal care visits or give birth without the support of loved ones due to hospital restrictions on visitors. New mothers may struggle to access postpartum care and support, such as lactation consultations and support groups. The impact of COVID-19 on newborn health goes beyond the immediate effects of the virus. Infants may be more vulnerable to the impact of maternal stress and anxiety and disrupted access to healthcare and support services. This can have long-term consequences on their development and well-being. The pandemic has disrupted access to healthcare for many people, including mothers and infants. Some mothers may have been unable to access prenatal care or have had to delay giving birth due to hospital capacity and restrictions on visitors. Infants may have missed vaccinations or well-child visits due to disruptions in healthcare services. Neonates may be at higher risk of contracting COVID-19 due to their compromised immune systems and close contact with their mothers and caregivers. In some cases, neonates may also be more vulnerable to severe illness if they contract the virus. Mental health problems during pregnancy can have significant consequences for both the mother and the baby. Pregnancy is a time of physical and emotional changes, and it is common for expectant mothers to experience stress, anxiety, and mood changes. However, when these feelings become persistent or severe, they can be classified as maternal mental health problems. Maternal mental health problems during pregnancy can include depression, anxiety, and perinatal obsessive-compulsive disorder (OCD). These conditions can have adverse effects on the mother's physical and emotional well-being, as well as on the development and health of the baby. Depression during pregnancy can affect a mother's ability to care for herself and her baby. It can also lead to complications such as preterm labor and low birth weight. Anxiety during pregnancy can also negatively affect the mother's health and the baby's development and increase the risk of preterm labor. Perinatal OCD is a type of obsessive-compulsive disorder that occurs during pregnancy or postpartum and is characterized by obsessive thoughts and compulsive behaviors related to the baby. It can negatively affect the mother's mental health and her ability to care for her baby. PTSD is a mental health condition that can occur after a person

experiences a traumatic event. It is characterized by symptoms such as flashbacks, avoidance of event reminders, and hyperarousal (constantly on guard). These symptoms can hurt a person's daily life and relationships. PTSD can affect pregnant women in several ways. It can cause distress and interfere with the ability to enjoy pregnancy and bond with the baby. It can also increase the risk of preterm labor and low birth weight. Women with PTSD may also be more likely to engage in unhealthy behaviors, such as smoking or substance abuse, which can adversely affect the baby's health. Tokophobia, or a fear of childbirth, can have significant consequences for infants and their mothers. When a pregnant woman experiences tokophobia, it can affect her ability to carry her pregnancy to term and can lead to adverse outcomes for the baby. One of the most common consequences of tokophobia for infants is the increased risk of preterm birth. Preterm birth, defined as birth before 37 weeks of pregnancy, can cause a range of health problems for babies, including respiratory issues, feeding difficulties, and developmental delays. Preterm infants are also at higher risk of long-term health problems, such as cerebral palsy, vision and hearing issues, and learning disabilities. Tokophobia can also affect the bonding process between mothers and their infants. When a mother experiences tokophobia, she may be less likely to engage in activities that promote bonding, such as breastfeeding and skin-to-skin contact. This can have negative effects on the infant's development and well-being. Overall, the COVID-19 pandemic has had a significant impact on mothers and infants. It is essential to recognize mothers' challenges and provide support and resources to help them navigate this difficult time. This may include access to mental health services, support for breastfeeding, and assistance with accessing healthcare and support services. The results of this review suggest that the COVID-19 pandemic has had a significant impact on maternal mental health, with increased rates of anxiety, depression, and stress reported among pregnant and postpartum women. These mental health challenges can have negative consequences for both mothers and their newborns, including increased risk for preterm birth, low birth weight, and developmental delays. These findings are consistent with previous research that has highlighted the importance of maternal mental health for infant development. Studies have shown that maternal stress during pregnancy can have lasting effects on children's cognitive and emotional development, as well as their physical health. However, it is important to acknowledge the limitations of this study. Due to the rapidly evolving nature of the COVID-19 pandemic, many studies included in this review were conducted in a short period of time and may not reflect long-term effects. Additionally, many studies relied on self-reported measures of mental health symptoms rather than clinical diagnoses. Despite these limitations, this review highlights the urgent need for interventions to support maternal mental health during the COVID-19 pandemic. Strategies such as telehealth services, online support groups, and virtual therapy sessions may be particularly effective in reaching women who are unable or unwilling to seek in-person care. In conclusion, this review underscores the importance of prioritizing maternal mental health during times of crisis such as the COVID-19 pandemic. By providing support for pregnant and postpartum women experiencing anxiety or depression, we can help ensure positive outcomes for both mothers and their newborns.

## Conclusion

This paper sheds light on the significant impact of the COVID-19 pandemic on maternal mental health and its potential effects on newborns. The findings suggest that the pandemic has increased the risk of perinatal mental health disorders, which can have long-term consequences for both mothers and infants. It is crucial to provide adequate support and

resources to new mothers during this challenging time to prevent adverse outcomes. This paper adds to the existing literature by highlighting the need for more research on maternal mental health during pandemics. Future studies should focus on identifying effective interventions that can mitigate the negative effects of COVID-19 on maternal mental health and improve outcomes for newborns. Additionally, research should explore how social distancing measures and isolation impact maternal mental health and identify strategies to address these challenges. Overall, this paper underscores the importance of prioritizing maternal mental health during pandemics like COVID-19. By providing support and resources to new mothers, we can help ensure that they receive the care they need to promote their well-being and that of their infants.

## Statements and Declarations

**Funding:** This article did not have any funding resources.

**Conflict of interest:** Ramin Ghasemi Shayan declares that he has no conflict of interest. Mahdi Khalili declares that he has no conflict of interest.

**Animal or human declaration:** This article does not contain any studies with animals or humans performed by any of the authors.

**Ethical Approval:** N/A

**Competing interests:** There are no competing interests.

**Authors' contributions:** The main idea of the article was from Mr. Mahdi Khalili and literature search and data analyses were performed by all the authors. Ramin Ghasemi Shayan drafted and critically revised the work.

## References

- <sup>^</sup> Velavan TP, Meyer CG. *The COVID-19 epidemic. Trop Med Int Health.* 2020;25(3):278-80.
- <sup>^</sup> Yuki K, Fujiogi M, Koutsogiannaki S. *COVID-19 pathophysiology: A review. Clin Immunol.* 2020;215:108427.
- <sup>^</sup> Hamming I, Timens W, Bulthuis ML, Lely AT, Navis G, van Goor H. *Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. J Pathol.* 2004;203(2):631-7.
- <sup>^</sup> Renu K, Prasanna PL, Valsala Gopalakrishnan A. *Coronaviruses pathogenesis, comorbidities and multi-organ damage - A review. Life Sci.* 2020;255:117839.
- <sup>^</sup> Webb R, Uddin N, Ford E, Easter A, Shakespeare J, Roberts N, et al. *Barriers and facilitators to implementing perinatal mental health care in health and social care settings: a systematic review. Lancet Psychiatry.* 2021;8(6):521-34.
- <sup>^</sup> Saccone G, Florio A, Aiello F, Venturella R, De Angelis MC, Locci M, et al. *Psychological impact of coronavirus disease 2019 in pregnant women. Am J Obstet Gynecol.* 2020;223(2):293-5.
- <sup>a, b</sup> Thapa SB, Mainali A, Schwank SE, Acharya G. *Maternal mental health in the time of the COVID-19 pandemic. Acta*

- Obstet Gynecol Scand.* 2020;99(7):817-8.
8. <sup>^</sup>Allotey J, Stallings E, Bonet M, Yap M, Chatterjee S, Kew T, et al. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. *Bmj.* 2020;370:m3320.
  9. <sup>^</sup>Gavin NI, Gaynes BN, Lohr KN, Meltzer-Brody S, Gartlehner G, Swinson T. Perinatal depression: a systematic review of prevalence and incidence. *Obstet Gynecol.* 2005;106(5 Pt 1):1071-83.
  10. <sup>^</sup>Bandelow B, Michaelis S. Epidemiology of anxiety disorders in the 21st century. *Dialogues Clin Neurosci.* 2015;17(3):327-35.
  11. <sup>^</sup>Fleming AS, Ruble D, Krieger H, Wong PY. Hormonal and experiential correlates of maternal responsiveness during pregnancy and the puerperium in human mothers. *Horm Behav.* 1997;31(2):145-58.
  12. <sup>^</sup>Punamäki RL, Repokari L, Vilksa S, Poikkeus P, Tiitinen A, Sinkkonen J, et al. Maternal mental health and medical predictors of infant developmental and health problems from pregnancy to one year: does former infertility matter? *Infant Behav Dev.* 2006;29(2):230-42.
  13. <sup>a, b</sup>Erickson NL, Gartstein MA, Dotson JAW. Review of Prenatal Maternal Mental Health and the Development of Infant Temperament. *J Obstet Gynecol Neonatal Nurs.* 2017;46(4):588-600.
  14. <sup>^</sup>Pearson RM, Evans J, Kounali D, Lewis G, Heron J, Ramchandani PG, et al. Maternal depression during pregnancy and the postnatal period: risks and possible mechanisms for offspring depression at age 18 years. *JAMA Psychiatry.* 2013;70(12):1312-9.
  15. <sup>^</sup>Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic-A review. *Asian J Psychiatr.* 2020;51:102119.
  16. <sup>^</sup>Kim EJ, Marrast L, Conigliaro J. COVID-19: Magnifying the Effect of Health Disparities. *J Gen Intern Med.* 2020;35(8):2441-2.
  17. <sup>^</sup>Chaturvedi SK. Covid-19, Coronavirus and Mental Health Rehabilitation at Times of Crisis. *J Psychosoc Rehabil Ment Health.* 2020;7(1):1-2.
  18. <sup>^</sup>Beigel JH, Tomashek KM, Dodd LE, Mehta AK, Zingman BS, Kalil AC, et al. Remdesivir for the Treatment of Covid-19 - Final Report. *N Engl J Med.* 2020;383(19):1813-26.
  19. <sup>^</sup>Shi Y, Wang G, Cai XP, Deng JW, Zheng L, Zhu HH, et al. An overview of COVID-19. *J Zhejiang Univ Sci B.* 2020;21(5):343-60.
  20. <sup>^</sup>Zaim S, Chong JH, Sankaranarayanan V, Harky A. COVID-19 and Multiorgan Response. *Curr Probl Cardiol.* 2020;45(8):100618.
  21. <sup>^</sup>Saeed S, Tadic M, Larsen TH, Grassi G, Mancina G. Coronavirus disease 2019 and cardiovascular complications: focused clinical review. *J Hypertens.* 2021;39(7):1282-92.
  22. <sup>^</sup>CDC. Long COVID or Post-COVID Conditions 2022 [
  23. <sup>^</sup>Abramoff M. COVID-19: Evaluation and management of adults with persistent symptoms following acute illness ("Long COVID") 2022 [updated Nov 18, 2022].
  24. <sup>^</sup>Banerjee D. The impact of Covid-19 pandemic on elderly mental health. *Int J Geriatr Psychiatry.* 2020;35(12):1466-7.
  25. <sup>^</sup>Kumar A, Nayar KR. COVID 19 and its mental health consequences. *J Ment Health.* 2021;30(1):1-2.

26. <sup>^</sup>Kathirvel N. Post COVID-19 pandemic mental health challenges. *Asian J Psychiatr*. 2020;53:102430.
27. <sup>^</sup>Yao H, Chen JH, Xu YF. Patients with mental health disorders in the COVID-19 epidemic. *Lancet Psychiatry*. 2020;7(4):e21.
28. <sup>^</sup>Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. *Psychiatry Clin Neurosci*. 2020;74(4):281-2.
29. <sup>^</sup>Almeida M, Shrestha AD, Stojanac D, Miller LJ. The impact of the COVID-19 pandemic on women's mental health. *Arch Womens Ment Health*. 2020;23(6):741-8.
30. <sup>^</sup>Vardi N, Zalsman G, Madjar N, Weizman A, Shoval G. COVID-19 pandemic: Impacts on mothers' and infants' mental health during pregnancy and shortly thereafter. *Clin Child Psychol Psychiatry*. 2022;27(1):82-8.
31. <sup>^</sup>Harville E, Xiong X, Buekens P. Disasters and perinatal health:a systematic review. *Obstet Gynecol Surv*. 2010;65(11):713-28.
32. <sup>^</sup>Wei G, Diehl-Schmid J, Matias-Guiu JA, Pijnenburg Y, Landin-Romero R, Bogaardt H, et al. The effects of the COVID-19 pandemic on neuropsychiatric symptoms in dementia and carer mental health: an international multicentre study. *Sci Rep*. 2022;12(1):2418.
33. <sup>^</sup>Firestein MR, Dumitriu D, Marsh R, Monk C. Maternal Mental Health and Infant Development During the COVID-19 Pandemic. *JAMA Psychiatry*. 2022;79(10):1040-5.
34. <sup>^</sup>Weaver IC, Cervoni N, Champagne FA, D'Alessio AC, Sharma S, Seckl JR, et al. Epigenetic programming by maternal behavior. *Nat Neurosci*. 2004;7(8):847-54.
35. <sup>^</sup>Atzil S, Hendler T, Feldman R. Specifying the Neurobiological Basis of Human Attachment: Brain, Hormones, and Behavior in Synchronous and Intrusive Mothers. *Neuropsychopharmacology*. 2011;36(13):2603-15.
36. <sup>a, b</sup>Schwartz DA. An Analysis of 38 Pregnant Women With COVID-19, Their Newborn Infants, and Maternal-Fetal Transmission of SARS-CoV-2: Maternal Coronavirus Infections and Pregnancy Outcomes. *Arch Pathol Lab Med*. 2020;144(7):799-805.
37. <sup>^</sup>Schwartz DA. The Origins and Emergence of Zika Virus, the Newest TORCH Infection: What's Old Is New Again. *Arch Pathol Lab Med*. 2017;141(1):18-25.
38. <sup>^</sup>Shuffrey LC, Firestein MR, Kyle MH, Fields A, Alcántara C, Amso D, et al. Association of Birth During the COVID-19 Pandemic With Neurodevelopmental Status at 6 Months in Infants With and Without In Utero Exposure to Maternal SARS-CoV-2 Infection. *JAMA Pediatr*. 2022;176(6):e215563.
39. <sup>^</sup>Martins-Filho PR, Tanajura DM, Santos HP, Jr., Santos VS. COVID-19 during pregnancy: Potential risk for neurodevelopmental disorders in neonates? *Eur J Obstet Gynecol Reprod Biol*. 2020;250:255-6.
40. <sup>a, b</sup>Shook LL, Sullivan EL, Lo JO, Perlis RH, Edlow AG. COVID-19 in pregnancy: implications for fetal brain development. *Trends Mol Med*. 2022;28(4):319-30.
41. <sup>^</sup>Liu CH, Hyun S, Mittal L, Erdei C. Psychological risks to mother-infant bonding during the COVID-19 pandemic. *Pediatr Res*. 2022;91(4):853-61.
42. <sup>^</sup>Condon JT, Corkindale CJ. The assessment of parent-to-infant attachment: Development of a self-report questionnaire instrument. *Journal of Reproductive and Infant Psychology*. 1998;16(1):57-76.

43. <sup>^</sup> Kennell J, McGrath S. Starting the process of mother-infant bonding. *Acta Paediatr.* 2005;94(6):775-7.
44. <sup>^</sup> Dashraath P, Wong JLJ, Lim MXK, Lim LM, Li S, Biswas A, et al. Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. *Am J Obstet Gynecol.* 2020;222(6):521-31.
45. <sup>a, b</sup> Hyland P, Shevlin M, McBride O, Murphy J, Karatzias T, Bentall RP, et al. Anxiety and depression in the Republic of Ireland during the COVID-19 pandemic. *Acta Psychiatr Scand.* 2020;142(3):249-56.
46. <sup>^</sup> Schwartz DA, Graham AL. Potential Maternal and Infant Outcomes from (Wuhan) Coronavirus 2019-nCoV Infecting Pregnant Women: Lessons from SARS, MERS, and Other Human Coronavirus Infections. *Viruses.* 2020;12(2).
47. <sup>^</sup> Qiao J. What are the risks of COVID-19 infection in pregnant women? *Lancet.* 2020;395(10226):760-2.
48. <sup>^</sup> Jamieson DJ, Rasmussen SA. An update on COVID-19 and pregnancy. *Am J Obstet Gynecol.* 2022;226(2):177-86.
49. <sup>^</sup> Blumberg DA, Underwood MA, Hedriana HL, Lakshminrusimha S. Vertical Transmission of SARS-CoV-2: What is the Optimal Definition? *Am J Perinatol.* 2020;37(8):769-72.
50. <sup>a, b</sup> Shah PS, Diambomba Y, Acharya G, Morris SK, Bitnun A. Classification system and case definition for SARS-CoV-2 infection in pregnant women, fetuses, and neonates. *Acta Obstet Gynecol Scand.* 2020;99(5):565-8.
51. <sup>^</sup> World Health O. Definition and categorization of the timing of mother-to-child transmission of SARS-CoV-2: scientific brief, 8 February 2021. Geneva: World Health Organization; 2021 2021. Contract No.: WHO/2019-nCoV/mother-to-child\_transmission/2021.1.
52. <sup>^</sup> Naz S, Rahat T, Memon FN. Vertical Transmission of SARS-CoV-2 from COVID-19 Infected Pregnant Women: A Review on Intrauterine Transmission. *Fetal Pediatr Pathol.* 2021;40(1):80-92.
53. <sup>^</sup> Narang K, Enninga EAL, Gunaratne M, Ibirogba ER, Trad ATA, Elrefaei A, et al. SARS-CoV-2 Infection and COVID-19 During Pregnancy: A Multidisciplinary Review. *Mayo Clin Proc.* 2020;95(8):1750-65.
54. <sup>^</sup> Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *Lancet.* 2020;395(10226):809-15.
55. <sup>^</sup> Zhu H, Wang L, Fang C, Peng S, Zhang L, Chang G, et al. Clinical analysis of 10 neonates born to mothers with 2019-nCoV pneumonia. *Transl Pediatr.* 2020;9(1):51-60.
56. <sup>^</sup> Wang C, Zhou YH, Yang HX, Poon LC. Intrauterine vertical transmission of SARS-CoV-2: what we know so far. *Ultrasound Obstet Gynecol.* 2020;55(6):724-5.
57. <sup>^</sup> Fenizia C, Biasin M, Cetin I, Vergani P, Mileto D, Spinillo A, et al. Analysis of SARS-CoV-2 vertical transmission during pregnancy. *Nat Commun.* 2020;11(1):5128.
58. <sup>^</sup> Cojocar L, Crimmins S, Sundararajan S, Goetzinger K, Elsamadicy E, Lankford A, et al. An initiative to evaluate the safety of maternal bonding in patients with SARS-CoV-2 infection. *J Matern Fetal Neonatal Med.* 2022;35(18):3540-6.
59. <sup>^</sup> Walker KF, O'Donoghue K, Grace N, Dorling J, Comeau JL, Li W, et al. Maternal transmission of SARS-COV-2 to the neonate, and possible routes for such transmission: a systematic review and critical analysis. *Bjog.* 2020;127(11):1324-36.
60. <sup>^</sup> Allotey J, Chatterjee S, Kew T, Gaetano A, Stallings E, Fernández-García S, et al. SARS-CoV-2 positivity in offspring and timing of mother-to-child transmission: living systematic review and meta-analysis. *Bmj.* 2022;376:e067696.
61. <sup>^</sup> Hughes BL. COVID-19: Overview of pregnancy issues 2022 [



62. <sup>^</sup>El-Goly AMM. Management of COVID-19 Infection During Pregnancy, Labor, and Puerperium. *Covid-19 Infections and Pregnancy*. 2021;63-89.
63. <sup>^</sup>Elshafeey F, Magdi R, Hindi N, Elshebiny M, Farrag N, Mahdy S, et al. A systematic scoping review of COVID-19 during pregnancy and childbirth. *Int J Gynaecol Obstet*. 2020;150(1):47-52.
64. <sup>^</sup>Wastnedge EAN, Reynolds RM, van Boeckel SR, Stock SJ, Denison FC, Maybin JA, et al. Pregnancy and COVID-19. *Physiol Rev*. 2021;101(1):303-18.
65. <sup>^</sup>Tomfohr-Madsen LM, Racine N, Giesbrecht GF, Lebel C, Madigan S. Depression and anxiety in pregnancy during COVID-19: A rapid review and meta-analysis. *Psychiatry Res*. 2021;300:113912.
66. <sup>^</sup>Moyer CA, Compton SD, Kaselitz E, Muzik M. Pregnancy-related anxiety during COVID-19: a nationwide survey of 2740 pregnant women. *Arch Womens Ment Health*. 2020;23(6):757-65.
67. <sup>^</sup>Mizrak Sahin B, Kabakci EN. The experiences of pregnant women during the COVID-19 pandemic in Turkey: A qualitative study. *Women Birth*. 2021;34(2):162-9.
68. <sup>^</sup>Glover V. Maternal depression, anxiety and stress during pregnancy and child outcome; what needs to be done. *Best Pract Res Clin Obstet Gynaecol*. 2014;28(1):25-35.
69. <sup>^</sup>Khamees RE, Taha OT, Ali TYM. Anxiety and depression during pregnancy in the era of COVID-19. *J Perinat Med*. 2021;49(6):674-7.
70. <sup>^</sup>Hamzehgardeshi Z, Omidvar S, Amoli AA, Firouzbakht M. Pregnancy-related anxiety and its associated factors during COVID-19 pandemic in Iranian pregnant women: a web-based cross-sectional study. *BMC Pregnancy and Childbirth*. 2021;21(1):208.
71. <sup>^</sup>Haghdoust SM, Khanbabayi Gol M. The Necessity of Paying More Attention to the Neurological and Psychological Problems Caused by COVID-19 Pandemic During Pregnancy. *International Journal of Women's Health*. 2020;8:243-4.
72. <sup>^</sup>Bayrampour H, Tomfohr L, Tough S. Trajectories of Perinatal Depressive and Anxiety Symptoms in a Community Cohort. *J Clin Psychiatry*. 2016;77(11):e1467-e73.
73. <sup>^</sup>Shahhosseini Z, Poursaghar M, Khalilian A, Salehi F. A Review of the Effects of Anxiety During Pregnancy on Children's Health. *Mater Sociomed*. 2015;27(3):200-2.
74. <sup>^</sup>Glover V. Prenatal stress and its effects on the fetus and the child: possible underlying biological mechanisms. *Adv Neurobiol*. 2015;10:269-83.
75. <sup>a, b, c</sup>Davenport MH, Meyer S, Meah VL, Strynadka MC, Khurana R. Moms Are Not OK: COVID-19 and Maternal Mental Health. *Front Glob Womens Health*. 2020;1:1.
76. <sup>a, b</sup>Madhavanprabhakaran GK, D'Souza MS, Nairy KS. Prevalence of pregnancy anxiety and associated factors. *International Journal of Africa Nursing Sciences*. 2015;3:1-7.
77. <sup>^</sup>Casper J. P. Zhang, Ph.D., M.P.H. <https://orcid.org/--->, Huailiang Wu, M.B.B.S., Zonglin He, M.B.B.S., Nga-Kwo Chan, M.B.B.S., Jian Huang, Ph.D., M.P.H., Huiyun Wang, Ph.D., et al. Psychobehavioral Responses, Post-Traumatic Stress and Depression in Pregnancy During the Early Phase of COVID-19 Outbreak. *Psychiatric Research and Clinical Practice*. 2021;3(1):46-54.
78. <sup>^</sup>Matsushima M, Horiguchi H. The COVID-19 Pandemic and Mental Well-Being of Pregnant Women in Japan: Need for Economic and Social Policy Interventions. *Disaster Med Public Health Prep*. 2022;16(2):449-54.

79. <sup>^</sup> Kahyaoglu Sut H, Kucukkaya B. Anxiety, depression, and related factors in pregnant women during the COVID-19 pandemic in Turkey: A web-based cross-sectional study. *Perspect Psychiatr Care*. 2021;57(2):860-8.
80. <sup>^</sup> Chan J, Natekar A, Einarson A, Koren G. Risks of untreated depression in pregnancy. *Can Fam Physician*. 2014;60(3):242-3.
81. <sup>^</sup> Jahan N, Went TR, Sultan W, Sapkota A, Khurshid H, Qureshi IA, et al. Untreated Depression During Pregnancy and Its Effect on Pregnancy Outcomes: A Systematic Review. *Cureus*. 2021;13(8):e17251.
82. <sup>^</sup> Dadi AF, Akalu TY, Wolde HF, Baraki AG. Effect of perinatal depression on birth and infant health outcomes: a systematic review and meta-analysis of observational studies from Africa. *Arch Public Health*. 2022;80(1):34.
83. <sup>^</sup> King LS, Feddoes DE, Kirshenbaum JS, Humphreys KL, Gotlib IH. Pregnancy during the pandemic: the impact of COVID-19-related stress on risk for prenatal depression. *Psychol Med*. 2021:1-11.
84. <sup>^</sup> Preis H, Mahaffey B, Lobel M. The role of pandemic-related pregnancy stress in preference for community birth during the beginning of the COVID-19 pandemic in the United States. *Birth*. 2021;48(2):242-50.
85. <sup>^</sup> Ruiz RJ, Avant KC. Effects of maternal prenatal stress on infant outcomes: a synthesis of the literature. *ANS Adv Nurs Sci*. 2005;28(4):345-55.
86. <sup>^</sup> Zietlow AL, Nonnenmacher N, Reck C, Ditzen B, Müller M. Emotional Stress During Pregnancy - Associations With Maternal Anxiety Disorders, Infant Cortisol Reactivity, and Mother-Child Interaction at Pre-school Age. *Front Psychol*. 2019;10:2179.
87. <sup>^</sup> Liu Y, Chen H, Zhang N, Wang X, Fan Q, Zhang Y, et al. Anxiety and depression symptoms of medical staff under COVID-19 epidemic in China. *J Affect Disord*. 2021;278:144-8.
88. <sup>^</sup> Zhu J, Sun L, Zhang L, Wang H, Fan A, Yang B, et al. Prevalence and Influencing Factors of Anxiety and Depression Symptoms in the First-Line Medical Staff Fighting Against COVID-19 in Gansu. *Front Psychiatry*. 2020;11:386.
89. <sup>a, b</sup> Namouz-Haddad S, Nulman I. Safety of treatment of obsessive compulsive disorder in pregnancy and puerperium. *Can Fam Physician*. 2014;60(2):133-6.
90. <sup>^</sup> UK O. OCD during a prenatal or postnatal period [
91. <sup>^</sup> Starcevic V, Eslick GD, Viswasam K, Berle D. Symptoms of Obsessive-Compulsive Disorder during Pregnancy and the Postpartum Period: a Systematic Review and Meta-Analysis. *Psychiatr Q*. 2020;91(4):965-81.
92. <sup>^</sup> Mahaffey BL, Levinson A, Preis H, Lobel M. Elevated risk for obsessive-compulsive symptoms in women pregnant during the COVID-19 pandemic. *Arch Womens Ment Health*. 2022;25(2):367-76.
93. <sup>^</sup> Challacombe FL, Salkovskis PM. Intensive cognitive-behavioural treatment for women with postnatal obsessive-compulsive disorder: a consecutive case series. *Behav Res Ther*. 2011;49(6-7):422-6.
94. <sup>a, b</sup> Challacombe FL, Salkovskis PM, Woolgar M, Wilkinson EL, Read J, Acheson R. Parenting and mother-infant interactions in the context of maternal postpartum obsessive-compulsive disorder: Effects of obsessional symptoms and mood. *Infant Behav Dev*. 2016;44:11-20.
95. <sup>a, b</sup> VanderKruik R, Barreix M, Chou D, Allen T, Say L, Cohen LS. The global prevalence of postpartum psychosis: a systematic review. *BMC Psychiatry*. 2017;17(1):272.
96. <sup>a, b</sup> Seng JS, Rauch SA, Resnick H, Reed CD, King A, Low LK, et al. Exploring posttraumatic stress disorder symptom profile among pregnant women. *J Psychosom Obstet Gynaecol*. 2010;31(3):176-87.

97. <sup>^</sup>Khoramroudi R. The prevalence of posttraumatic stress disorder during pregnancy and postpartum period. *J Family Med Prim Care*. 2018;7(1):220-3.
98. <sup>^</sup>Malak SM, Crowley MJ, Mayes LC, Rutherford HJ. Maternal anxiety and neural responses to infant faces. *J Affect Disord*. 2015;172:324-30.
99. <sup>^</sup>Ostacoli L, Cosma S, Bevilacqua F, Berchiolla P, Bovetti M, Carosso AR, et al. Psychosocial factors associated with postpartum psychological distress during the Covid-19 pandemic: a cross-sectional study. *BMC Pregnancy Childbirth*. 2020;20(1):703.
100. <sup>^</sup>Padin AC, Stevens NR, Che ML, Erondy IN, Perera MJ, Shalowitz MU. Screening for PTSD during pregnancy: a missed opportunity. *BMC Pregnancy Childbirth*. 2022;22(1):487.
101. <sup>^</sup>Shaw JG, Asch SM, Kimerling R, Frayne SM, Shaw KA, Phibbs CS. Posttraumatic stress disorder and risk of spontaneous preterm birth. *Obstet Gynecol*. 2014;124(6):1111-9.
102. <sup>^</sup>Shaw JG, Asch SM, Katon JG, Shaw KA, Kimerling R, Frayne SM, et al. Post-traumatic Stress Disorder and Antepartum Complications: a Novel Risk Factor for Gestational Diabetes and Preeclampsia. *Paediatr Perinat Epidemiol*. 2017;31(3):185-94.
103. <sup>^</sup>Yonkers KA, Smith MV, Forray A, Epperson CN, Costello D, Lin H, et al. Pregnant women with posttraumatic stress disorder and risk of preterm birth. *JAMA Psychiatry*. 2014;71(8):897-904.
104. <sup>^</sup>Lev-Wiesel R, Chen R, Daphna-Tekoah S, Hod M. Past traumatic events: are they a risk factor for high-risk pregnancy, delivery complications, and postpartum posttraumatic symptoms? *J Womens Health (Larchmt)*. 2009;18(1):119-25.
105. <sup>^</sup>Rosen D, Seng JS, Tolman RM, Mallinger G. Intimate partner violence, depression, and posttraumatic stress disorder as additional predictors of low birth weight infants among low-income mothers. *J Interpers Violence*. 2007;22(10):1305-14.
106. <sup>^</sup>ARBOR A. Pregnancy and PTSD: Surprising findings could help moms-to-be at risk 2016 [
107. <sup>a, b</sup>Bhatia MS, Jhanjee A. Tokophobia: A dread of pregnancy. *Ind Psychiatry J*. 2012;21(2):158-9.
108. <sup>^</sup>Hofberg K, Brockington I. Tokophobia: an unreasoning dread of childbirth. A series of 26 cases. *Br J Psychiatry*. 2000;176:83-5.
109. <sup>^</sup>Poggi L, Goutaudier N, Séjourné N, Chabrol H. When Fear of Childbirth is Pathological: The Fear Continuum. *Matern Child Health J*. 2018;22(5):772-8.
110. <sup>^</sup>Calderani E, Giardinelli L, Scannerini S, Arcabasso S, Compagno E, Petraglia F, et al. Tocophobia in the DSM-5 era: Outcomes of a new cut-off analysis of the Wijma delivery expectancy/experience questionnaire based on clinical presentation. *J Psychosom Res*. 2019;116:37-43.
111. <sup>^</sup>Ravaldi C, Wilson A, Ricca V, Homer C, Vannacci A. Pregnant women voice their concerns and birth expectations during the COVID-19 pandemic in Italy. *Women Birth*. 2021;34(4):335-43.
112. <sup>^</sup>Aguilera-Martín Á, Gálvez-Lara M, Blanco-Ruiz M, García-Torres F. Psychological, educational, and alternative interventions for reducing fear of childbirth in pregnant women: A systematic review. *J Clin Psychol*. 2021;77(3):525-55.
113. <sup>^</sup>Elyasi F, Khani S, Azizi M. The Effect of Tokophobia on Mother and Child's Health: A Literature Review. *Journal of*

*Pediatrics Review*. 2019;7(5):17-.

114. <sup>^</sup>Makara-Studzińska M, Zaręba K, Kawa N, Matuszyk D. Tokophobia and Anxiety in Pregnant Women during the SARS-CoV-2 Pandemic in Poland-A Prospective Cross-Sectional Study. *Int J Environ Res Public Health*. 2022;19(2).
115. <sup>^</sup>McClymont R. Tokophobia – how to cope with a fear of childbirth and pregnancy [updated Aug 31, 2021].
116. <sup>^</sup>Collier S. How can you manage anxiety during pregnancy? 2021 [Available from: <https://www.health.harvard.edu/blog/how-can-you-manage-anxiety-during-pregnancy-202106252512>].
117. <sup>^</sup>Field T, Diego M, Hernandez-Reif M. Prenatal depression effects on the fetus and newborn: a review. *Infant Behav Dev*. 2006;29(3):445-55.
118. <sup>^</sup>Dadi AF, Akalu TY, Baraki AG, Wolde HF. Epidemiology of postnatal depression and its associated factors in Africa: A systematic review and meta-analysis. *PLoS One*. 2020;15(4):e0231940.
119. <sup>^</sup>Coussons-Read ME. Effects of prenatal stress on pregnancy and human development: mechanisms and pathways. *Obstet Med*. 2013;6(2):52-7.
120. <sup>^</sup>Groulx T, Bagshawe M, Giesbrecht G, Tomfohr-Madsen L, Hetherington E, Lebel CA. Prenatal Care Disruptions and Associations With Maternal Mental Health During the COVID-19 Pandemic. *Front Glob Womens Health*. 2021;2:648428.
121. <sup>^</sup>Van V. Mental Health Impacts of COVID-19 on Pregnant Women. Harvard University publication.
122. <sup>^</sup>International L. 10 Ways to Help Overcome Your Birth Fears December 28, 2018 [
123. <sup>^</sup>Barnhill JW. Specific Phobic Disorders. 2022.
124. <sup>^</sup>Demšar K, Svetina M, Verdenik I, Tul N, Blickstein I, Globevnik Velikonja V. Tokophobia (fear of childbirth): prevalence and risk factors. *J Perinat Med*. 2018;46(2):151-4.
125. <sup>^</sup>Hazell Raine K, Nath S, Howard LM, Cockshaw W, Boyce P, Sawyer E, et al. Associations between prenatal maternal mental health indices and mother-infant relationship quality 6 to 18 months' postpartum: A systematic review. *Infant Ment Health J*. 2020;41(1):24-39.
126. <sup>^</sup>Harris R, Gibbs D, Mangin-Heimos K, Pineda R. Maternal mental health during the neonatal period: Relationships to the occupation of parenting. *Early Hum Dev*. 2018;120:31-9.
127. <sup>^</sup>Liou SR, Wang P, Cheng CY. Effects of prenatal maternal mental distress on birth outcomes. *Women Birth*. 2016;29(4):376-80.
128. <sup>^</sup>Lewis AJ, Austin E, Galbally M. Prenatal maternal mental health and fetal growth restriction: a systematic review. *J Dev Orig Health Dis*. 2016;7(4):416-28.
129. <sup>^</sup>Arthurs AL, Jankovic-Karasoulos T, Roberts CT. COVID-19 in pregnancy: What we know from the first year of the pandemic. *Biochim Biophys Acta Mol Basis Dis*. 2021;1867(12):166248.
130. <sup>^</sup>Bhowmik S. Pregnancy outcomes of pregnant women infected by SARS-CoV-2. *News-Medicalnet*. 2022.
131. <sup>^</sup>Melo GC, Araújo K. COVID-19 infection in pregnant women, preterm delivery, birth weight, and vertical transmission: a systematic review and meta-analysis. *Cad Saude Publica*. 2020;36(7):e00087320.
132. <sup>^</sup>Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med*. 2002;21(11):1539-58.
133. <sup>^</sup>Li N, Han L, Peng M, Lv Y, Ouyang Y, Liu K, et al. Maternal and Neonatal Outcomes of Pregnant Women With Coronavirus Disease 2019 (COVID-19) Pneumonia: A Case-Control Study. *Clin Infect Dis*. 2020;71(16):2035-41.

134. <sup>^</sup> Pasternak B, Neovius M, Söderling J, Ahlberg M, Norman M, Ludvigsson JF, et al. Preterm Birth and Stillbirth During the COVID-19 Pandemic in Sweden: A Nationwide Cohort Study. *Ann Intern Med.* 2021;174(6):873-5.
135. <sup>^</sup> Hedermann G, Hedley PL, Bækvad-Hansen M, Hjalgrim H, Rostgaard K, Poorisrisak P, et al. Danish premature birth rates during the COVID-19 lockdown. *Arch Dis Child Fetal Neonatal Ed.* 2021;106(1):93-5.
136. <sup>^</sup> Abasse S, Essabar L, Costin T, Mahisatra V, Kaci M, Braconnier A, et al. Neonatal COVID-19 Pneumonia: Report of the First Case in a Preterm Neonate in Mayotte, an Overseas Department of France. *Children (Basel).* 2020;7(8).
137. <sup>^</sup> Trevisanuto D, Cavallin F, Cavicchiolo ME, Borellini M, Calgaro S, Baraldi E. Coronavirus infection in neonates: a systematic review. *Archives of Disease in Childhood - Fetal and Neonatal Edition.* 2021;106(3):330.
138. <sup>^</sup> Nilsen TS, Kutschke J, Brandt I, Harris JR. Validity of Self-Reported Birth Weight: Results from a Norwegian Twin Sample. *Twin Res Hum Genet.* 2017;20(5):406-13.
139. <sup>^</sup> Wen J. Impact of COVID-19 pandemic on birth outcomes: A retrospective cohort study in Nanjing, China. *Front Public Health.* 2022;10:923324.
140. <sup>^</sup> Margerison-Zilko CE, Li Y, Luo Z. Economic Conditions During Pregnancy and Adverse Birth Outcomes Among Singleton Live Births in the United States, 1990-2013. *Am J Epidemiol.* 2017;186(10):1131-9.
141. <sup>^</sup> Ueda P, Kondo N, Fujiwara T. The global economic crisis, household income and pre-adolescent overweight and underweight: a nationwide birth cohort study in Japan. *Int J Obes (Lond).* 2015;39(9):1414-20.
142. <sup>^</sup> Dileep A, ZainAlAbdin S, AbuRuz S. Investigating the association between severity of COVID-19 infection during pregnancy and neonatal outcomes. *Sci Rep.* 2022;12(1):3024.
143. <sup>^</sup> Smith V, Seo D, Warty R, Payne O, Salih M, Chin KL, et al. Maternal and neonatal outcomes associated with COVID-19 infection: A systematic review. *PLoS One.* 2020;15(6):e0234187.
144. <sup>^</sup> Homer CSE, Leisher SH, Aggarwal N, Akuze J, Babona D, Blencowe H, et al. Counting stillbirths and COVID 19—there has never been a more urgent time. *The Lancet Global Health.* 2021;9(1):e10-e1.
145. <sup>^</sup> Cavalcante MB, de Melo Bezerra Cavalcante CT, Cavalcante ANM, Sarno M, Barini R, Kwak-Kim J. COVID-19 and miscarriage: From immunopathological mechanisms to actual clinical evidence. *J Reprod Immunol.* 2021;148:103382.
146. <sup>^</sup> Cosma S, Carosso AR, Cusato J, Borella F, Carosso M, Bovetti M, et al. Coronavirus disease 2019 and first-trimester spontaneous abortion: a case-control study of 225 pregnant patients. *Am J Obstet Gynecol.* 2021;224(4):391.e1-.e7.
147. <sup>^</sup> Shah PS, Ye XY, Yang J, Campitelli MA. Preterm birth and stillbirth rates during the COVID-19 pandemic: a population-based cohort study. *Cmaj.* 2021;193(30):E1164-e72.
148. <sup>^</sup> Schwartz DA, Avvad-Portari E, Babál P, Baldewijns M, Blomberg M, Bouachba A, et al. Placental Tissue Destruction and Insufficiency From COVID-19 Causes Stillbirth and Neonatal Death From Hypoxic-Ischemic Injury. *Arch Pathol Lab Med.* 2022;146(6):660-76.
149. <sup>^</sup> DeSisto CL WB, Simeone RM, et al. Risk for Stillbirth Among Women With and Without COVID-19 at Delivery Hospitalization. *CDC*
150. <sup>^</sup> World Health Organization M, Newborn Health/Safe M. Basic newborn resuscitation: a practical guide. *appswho.int.* 1998.
151. <sup>a, b</sup> Gillam-Krakauer M, Gowen Jr CW. Birth Asphyxia. *StatPearls. Treasure Island (FL): StatPearls Publishing Copyright © 2022, StatPearls Publishing LLC.; 2022.*

152. <sup>^</sup>Yoon SH, Kang JM, Ahn JG. *Clinical outcomes of 201 neonates born to mothers with COVID-19: a systematic review. Eur Rev Med Pharmacol Sci. 2020;24(14):7804-15.*
153. <sup>^</sup>Aliji N, Aliu F. *Oligohydramnion in COVID19. Eur J Obstet Gynecol Reprod Biol. 2020;249:102.*
154. <sup>^</sup>Kasuga Y, Sou Y, Fukuoka M, Kawaida M, Ikenoue S, Okita H, et al. *A case of temporary anhydramnios after COVID-19 infection. Eur J Obstet Gynecol Reprod Biol. 2022;272:255-6.*
155. <sup>^</sup>Kornitzer J, Johnson J, Yang M, Pecor KW, Cohen N, Jiang C, et al. *A Systematic Review of Characteristics Associated with COVID-19 in Children with Typical Presentation and with Multisystem Inflammatory Syndrome. Int J Environ Res Public Health. 2021;18(16).*
156. <sup>^</sup>Needleman JS, Hanson AE. *COVID-19-associated apnea and circumoral cyanosis in a 3-week-old. BMC Pediatr. 2020;20(1):382.*
157. <sup>^</sup>Khan MSI, Nabeka H, Akbar SMF, Al Mahtab M, Shimokawa T, Islam F, et al. *Risk of congenital birth defects during COVID-19 pandemic: Draw attention to the physicians and policymakers. J Glob Health. 2020;10(2):020378.*
158. <sup>^</sup>Satnarine T, Lee Kin C-M. *COVID-19 Exposure: A Possible Association with Congenital Anomalies and Adverse Neonatal Outcomes. Journal of Medical and Health Studies. 2022;3(2):44-8.*
159. <sup>^</sup>Sharma D, Shastri S, Sharma P. *Intrauterine Growth Restriction: Antenatal and Postnatal Aspects. Clin Med Insights Pediatr. 2016;10:67-83.*
160. <sup>^</sup>Iftikhar N. *Intrauterine Growth Restriction (IUGR): Symptoms, Diagnosis, and More. Healthline. 2022.*
161. <sup>^</sup>Dance A. *Survival of the littlest: the long-term impacts of being born extremely early. Nature. 2020;582(7810):20-3.*
162. <sup>^</sup>Cdc. *Premature Birth. Centers for Disease Control and Prevention. 2019.*
163. <sup>^</sup>Milestone A. *Coronavirus in Babies and Children. www.hopkinsmedicine.org. 2022.*
164. <sup>^</sup>Gale C, Quigley MA, Placzek A, Knight M, Ladhani S, Draper ES, et al. *Characteristics and outcomes of neonatal SARS-CoV-2 infection in the UK: a prospective national cohort study using active surveillance. The Lancet Child & Adolescent Health. 2020;5(2).*
165. <sup>^</sup>Cutland CL, Lackritz EM, Mallett-Moore T, Bardaji A, Chandrasekaran R, Lahariya C, et al. *Low birth weight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2017;35(48 Pt A):6492-500.*
166. <sup>^</sup>The Children's Hospital of P. *Low Birthweight | Children's Hospital of Philadelphia. Chopedu. 2014.*
167. <sup>^</sup>Choices NHS. *Symptoms - Miscarriage. NHS. 2019.*
168. <sup>^</sup>T. Dulay A. *Spontaneous Abortion - Gynecology and Obstetrics. Merck Manuals Professional Edition. 2022.*
169. <sup>^</sup>Choices NHS. *Miscarriage - Afterwards. nhs.uk. 2018.*
170. <sup>^</sup>Page JM, Blue NR, Silver RM. *Fetal Growth and Stillbirth. Obstet Gynecol Clin North Am. 2021;48(2):297-310.*
171. <sup>^</sup>Human M, Green S, Groenewald C, Goldstein RD, Kinney HC, Odendaal HJ. *PSYCHOSOCIAL IMPLICATIONS OF STILLBIRTH FOR THE MOTHER AND HER FAMILY: A CRISIS-SUPPORT APPROACH. Social Work (Stellenbosch). 2014;50(4).*
172. <sup>^</sup>Australia H. *Your body after stillbirth or neonatal death. www.pregnancybirthbaby.org.au. 2021.*
173. <sup>^</sup>Iribarren I, Hilario E, Álvarez A, Alonso-Alconada D. *Neonatal multiple organ failure after perinatal asphyxia. An Pediatr (Engl Ed). 2022;97(4):280.e1-.e8.*

174. <sup>^</sup>Zilberman Sharon N, Pekar-Zlotin M, Kugler N, Accart Z, Nimrodi M, Melcer Y, et al. *Oligohydramnios: how severe is severe? J Matern Fetal Neonatal Med.* 2022;35(25):5754-60.
175. <sup>^</sup>Cakmak Celik F, Aygun C, Kucukoduk S, Bek Y. *Maternal and neonatal outcomes in advanced maternal age: a retrospective cohort study. The Journal of Maternal-Fetal & Neonatal Medicine.* 2016;30(20):2452-6.
176. <sup>^</sup>Bakhsh H, Alenizy H, Alenazi S, Alnasser S, Alanazi N, Alsowinea M, et al. *Amniotic fluid disorders and the effects on prenatal outcome: a retrospective cohort study. BMC Pregnancy and Childbirth.* 2021;21(1):75.
177. <sup>^</sup>C Eichenwald E. *UpToDate. Uptodatecom.* 2019.
178. <sup>^</sup>Izraelit A, Ten V, Krishnamurthy G, Ratner V. *Neonatal cyanosis: diagnostic and management challenges. ISRN Pediatr.* 2011;2011:175931.