

# COVID-19 Lockdowns' Paradoxical Effect on Premature Birth Rates: Review of Global Trends and Bio-Behavioral Implications

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## Abstract

The COVID-19 pandemic has had an unexpected impact on premature birth rates, a leading cause of neonatal morbidity and mortality. Research suggests that lockdowns may have inadvertently reduced modifiable risk factors such as infection, obesity, and environmental pollutants. Studies in California and Denmark reveal significant decreases in very preterm and premature births, especially among those with underlying conditions like hypertension and diabetes. These declines may be due to reduced exposure to environmental pollutants, changes in work-related stress, and altered healthcare practices. However, the situation in Shanghai presents a contrast, where the lockdown increased the risk of preterm birth among uninfected pregnant women, possibly due to stress from job loss and social isolation. The biobehavioral model emphasizes the importance of the prenatal environment and individual vulnerabilities in understanding spontaneous preterm delivery. The pandemic has also highlighted the need for preconception care, focusing on healthy birth spacing, chronic disease management, and mental health support. While the observed trends suggest a potential positive impact of lockdowns on premature births, the underlying mechanisms remain unclear. Future studies should explore the long-term effects of these changes and develop strategies to improve maternity care during public health crises. Recommendations include enhancing prenatal education, stress management, prenatal care accessibility, promoting healthy lifestyles, infection prevention, and establishing support systems for expectant parents. This preliminary evidence underscores the complex relationship between pandemics and preterm births, calling for further investigation into the causal links and implications for public health policy.

**Keywords:** COVID-19 Pandemic, Premature Birth Rates, Lockdowns, Neonatal

## Introduction

Premature birth is a significant cause of newborn death and long-term health issues, underscoring the importance of understanding and reducing its risk factors. Modifiable risk factors that have been identified include infection, obesity, antenatal care, work-related stress, and environmental pollutants, suggesting that some COVID-19 restrictions may have inadvertently decreased these risks.<sup>1</sup>

The COVID-19 pandemic has had a profound impact on global health systems, particularly on neonatal care. Lockdowns and social distancing measures have altered how parents interact with their newborns in neonatal intensive care units (NICUs). This separation raises concerns about the well-being of these infants and their families. The paper will also delve into why there were fewer premature births during the pandemic

and the effects on neonatal care.<sup>1</sup>

Lockdown measures likely reduced infectious diseases that can lead to preterm labor. Changes in lifestyle, such as increased time spent at home, may have decreased physical activity, impacting the risk of prematurity. The quality of antenatal care during the lockdown is another crucial factor, as disruptions in healthcare services could have affected high-risk pregnancies. On the other hand, some improvements in care may have emerged, such as increased monitoring or the use of telemedicine.<sup>2</sup>

The indirect effects of the lockdown, such as reduced air pollution and changes in social interactions, may have also played a role in reducing stress and exposure to toxins associated with preterm births. Additionally, it is important to explore the psychological impact of

the lockdown on pregnant women, as varying levels of stress could impact pregnancy outcomes.<sup>3</sup>

### Materials and Methods

In this oral review study, we examined the impact of quarantine during the COVID-19 pandemic on the rate of preterm birth. Our keywords included "COVID-19 pandemic", "preterm birth", "relationship between COVID-19 pandemic and preterm birth", and "lockdown during the quarantine period and preterm birth". We utilized online databases such as Google Scholar, Scopus, and Web of Science to search for relevant articles.

### Clinical Findings

The link between COVID-19 and preterm births (PTB) or very preterm births (VPTB) in California's diverse population was explored using data from the California Vital Statistics database, which included 240,147 live births. Researchers aimed to identify disparities in preterm birth risks related to COVID-19 among different racial/ethnic groups and individuals with chronic conditions such as hypertension, diabetes, and obesity. The data revealed that a COVID-19 diagnosis increased the risk of VPTB, PTB, and early term birth regardless of race or insurance status. Adjusted relative risks showed significant threats to delivery timing and neonatal health. Additionally, individuals with conditions like hypertension, diabetes, and obesity had a higher risk of PTB, leading to worse pregnancy outcomes.<sup>4</sup>

The potential impact of Denmark's nationwide lockdown from March 12 to April 14, 2020, due to COVID-19 on premature birth rates was analyzed using data from the Danish Neonatal Screening Biobank. Researchers compared gestational ages of singleton infants during the lockdown to the same timeframe in the previous five years (2015-2019) and categorized them based on prematurity levels. The study found a notable decrease in extremely premature births during the lockdown compared to previous years. However, no similar changes were observed in other prematurity categories before the lockdown, and overall singleton birth numbers remained stable. Limitations included the potential impact of increased intrauterine deaths or early neonatal mortality on the observed number of extremely premature children.<sup>2,5</sup>

The national lockdown in the United States starting in March 2020 may have led to a significant decrease

in preterm births, particularly those from cesarean or induced deliveries. Data from the National Center for Health Statistics covering singleton births from 2010 to 2020 were analyzed, adjusting for seasonal and trend variations. The decrease in preterm births post-lockdown was more pronounced for cesarean and induced deliveries, indicating changes in medical practices rather than natural pregnancy progress. Less in-person obstetric care during the pandemic likely reduced diagnoses and interventions for conditions requiring early delivery. A minor decrease in spontaneous preterm births also suggests a modest influence of the lockdown on those cases. Home births increased during this period, reflecting changing patient behavior, but did not account for the majority of preterm deliveries. Overall, there was a significant decline of 0.53 percentage points in preterm births.<sup>6</sup>

The findings suggest that the lockdown may have reduced extreme prematurity, possibly due to changes in physical activity, environmental exposure, and psychological stress affecting pregnant women's immune response. Further research is needed to confirm these findings and explore causal links.<sup>2,4,6</sup>

In contrast to previous studies, the COVID-19 lockdown in Shanghai affected preterm birth rates among uninfected pregnant women. Research conducted at the International Peace Maternity and Child Health Hospital from January 24 to March 24 in both 2020 and 2019 aimed to determine the impact of the lockdown on preterm birth rates, focusing on different types of preterm births. The study revealed that women in their second trimester during the lockdown had a higher risk of preterm birth compared to the same period in the previous year, with an odds ratio of 1.43. Those in their third trimester also faced a greater risk, particularly with premature rupture of membranes, although no significant differences were observed in other types of preterm birth. The increased risk may be attributed to stress related to job loss and social isolation, as well as disruptions to regular healthcare. The authors suggest that anxiety may impact stress response systems, although direct evidence to support this claim is lacking.<sup>7</sup>

### Discussion

There has been a decrease in premature births during the pandemic period.<sup>1</sup> The reasons for this reduction are not fully understood, but they may be associated

with the following factors:

### **Reduction in Environmental Pollutants and Decrease in Premature Birth Admissions**

The lockdowns have led to significant reductions in air pollution, which is a known risk factor for premature birth. The improved air quality could have had a beneficial impact on the health of expectant mothers and their developing babies.<sup>8</sup>

Pesticides and heavy metals can disrupt fetal growth and cause serious health issues such as preterm labor, neonatal death, and growth problems. The Developmental Origins of Health and Disease (DOHaD) hypothesis indicates that early exposure to these toxins can lead to diseases later in life through changes in gene expression. Alcohol and tobacco smoke also impact fetal development, with maternal smoking linked to respiratory problems in children. E-cigarette use during pregnancy raises concerns due to nicotine's effects on lung health. Effective interventions, like counseling and incentive programs, can help reduce smoking in pregnant women. Noise pollution is another environmental concern that can potentially increase stress and affect infant hearing. Water pollution, such as with tetrachloroethylene (PCE), may cause long-term neurological issues, and emerging research suggests links to mental health conditions. Exposure to phthalates can lead to negative pregnancy outcomes. Lifestyle factors also matter, with poor diets impacting fetal health. It is crucial for healthcare practitioners to understand these risks and educate patients about healthy practices. Governments should ensure strict regulations on air and water quality and hold manufacturers responsible for product safety, especially for expectant mothers.<sup>9</sup>

### **Changes in Maternal Stress and Reduction in Premature Birth Admissions**

The pandemic may have led to a decrease in work-related stress for some women, as a result of remote work or reduced commuting, potentially resulting in a lower incidence of stress-induced preterm labor.<sup>2</sup> Job characteristics, including occupational fatigue, are associated with the risk of preterm delivery among low-income black and white women with prior pregnancies. A study involving 943 black and 425 white women discovered that the only significant work factor linked to fewer preterm deliveries for black

women was the ability to take unscheduled breaks when feeling tired. The overall occupational fatigue index did not demonstrate a significant correlation with preterm delivery in either group. While previous studies have connected job stress to preterm delivery, this study suggests that the relationship is more complex due to the high-risk profile of the participants. Various other factors, such as smoking, alcohol use, and pregnancy history, were taken into account, which could influence the outcomes.<sup>10</sup>

### **Reduction in Infections and Reduction in Premature Birth Admissions**

The biobehavioral model for spontaneous preterm delivery indicates that maternal stress is a significant risk factor affecting neuroendocrine and immune systems. Chronic stress can trigger early activation of maternal-placental-fetal endocrine systems, leading to premature labor. It can also weaken immunity, increasing the chances of infections that may result in preterm birth. The model highlights that not all stressed women or those with infections will experience early birth, suggesting individual vulnerability factors. A holistic approach is needed to understand preterm birth, incorporating insights from various disciplines and recognizing the vital role of the prenatal environment and stress across diverse populations. Additionally, the role of cytokines and other mediators in the stress-immune-infection relationship is crucial. Pro-inflammatory cytokines like IL-1, IL-6, and TNF- $\alpha$  have been associated with preterm delivery, potentially influencing prostaglandins and metalloproteases. Maintaining a balance between Th1 and Th2 cytokines is crucial, as a shift towards Th1 may contribute to adverse pregnancy outcomes.<sup>11</sup>

### **Enhanced Prenatal Care and Reduction in Premature Birth Admissions**

Women may have had more time to focus on self-care and prenatal appointments due to reduced work and social obligations. This could have led to better monitoring and management of pregnancy complications, thereby reducing the risk of premature birth. The COVID-19 pandemic has led to substantial changes in maternity healthcare provision and healthcare-seeking behavior. The observed declines in antenatal care and increased reliance on virtual care present challenges that must be addressed to ensure the well-being of

pregnant women and newborns. Future research should focus on understanding the long-term implications of these changes and developing strategies to improve maternity care in the face of similar health crises. Additionally, there is an urgent need to ensure equitable access to quality healthcare services for all pregnant women, regardless of their socioeconomic status or location.<sup>12</sup>

The significance of preconception care in preventing preterm births and enhancing maternal and child health is crucial. Preconception care involves various steps for women and couples before pregnancy. These steps include preventing teen pregnancies, promoting healthy birth spacing, ensuring a healthy weight and nutrition, completing vaccinations, and managing chronic illnesses, infections, mental health issues, and intimate partner violence.<sup>4,13</sup>

Key components of preconception care include ensuring healthy birth spacing through effective contraception and promoting at least 18-24 months between pregnancies. It also involves addressing underweight and obesity, managing chronic conditions like hypertension and diabetes, providing folic acid to prevent defects, treating sexually transmitted infections, tackling mental health issues like depression, promoting smoking cessation, and addressing intimate partner violence.<sup>4,13</sup>

Research priorities focus on enhancing the delivery and effectiveness of preconception care, especially in low and middle-income countries where preterm birth rates are high. These priorities include operational research on nutrition and chronic disease management, integrating preconception care into other health programs, using community health workers, and leveraging mobile health technology.<sup>13</sup>

### **Behavioral Changes and Reduction in Premature Birth Admissions**

The pandemic may have led to healthier lifestyle changes such as reduced smoking and alcohol consumption, as well as increased adherence to prenatal care guidelines, contributing to lower rates of premature births.<sup>1,2,6</sup>

The pandemic may have influenced pregnant women to adopt healthier diets, which are essential for fetal development and reducing the risk of gestational diabetes and other complications. Increased awareness and concern for their health could have led to better

adherence to health recommendations, potentially reducing the risk of infection and transmission of diseases, including COVID-19. Enhanced focus on sleep, rest, and physical activity is crucial for managing stress and ensuring a healthy pregnancy outcome. Engaging in activities that avoid strong emotions, stress, and depressing situations can significantly improve mental health during pregnancy, which is vital for the well-being of both the mother and the baby. The study highlights a positive change in the lifestyles of pregnant women during the COVID-19 pandemic, which could have a beneficial effect on the health of the population in the future. The results suggest that pregnant women may have become more health-conscious due to the heightened health concerns and stress associated with the pandemic.<sup>8,13</sup>

### **Modifiable Risk Factors for Premature Birth**

Premature birth is influenced by a complex interplay of genetic, environmental, and behavioral factors. Modifiable risk factors include:

- Smoking: Smoking during pregnancy increases the risk of preterm birth. The pandemic may have influenced some mothers to quit or reduce smoking due to health concerns or increased awareness.
- Alcohol Consumption: Alcohol use is associated with an increased risk of preterm delivery. The closure of bars and restaurants and social distancing measures could have led to a decrease in alcohol intake among pregnant women.
- Nutrition: Healthier eating habits during lockdowns may have reduced the incidence of poor nutrition, which is a risk factor for premature birth.
- Physical Activity: While some women may have engaged in less physical activity due to restrictions, others might have had more time to exercise safely during pregnancy, which is associated with better pregnancy outcomes.
- Stress Management: The pandemic may have prompted expectant mothers to engage in stress-reducing activities, such as yoga or meditation, which can lower the risk of premature birth.
- Access to Prenatal Care: The shift to telemedicine and increased focus on prenatal care may have improved access and adherence to essential prenatal services.<sup>1,2,14</sup>

### **Recommendations for Education, Advice, and Care**

1. **Prenatal Education:** Provide comprehensive education on the risks of premature birth and the importance of modifiable factors such as smoking cessation, alcohol avoidance, and maintaining a balanced diet.

2. **Stress Management:** Offer stress-reduction strategies and mental health support, including telehealth services, to help expectant mothers manage anxiety and stress during the pandemic.

3. **Prenatal Care Accessibility:** Ensure that women continue to receive regular prenatal check-ups, even in the face of pandemic-related disruptions. This may involve innovative approaches like home monitoring and virtual consultations.

4. **Encouraging Healthy Lifestyles:** Promote physical activity within the constraints of social distancing guidelines and provide resources for home workouts tailored to pregnant women.

5. **Support Systems:** Create virtual support networks and groups for expectant parents to connect and share experiences, helping to mitigate the isolation caused by hospital restrictions.

6. **Infection Prevention:** Reinforce the importance of hand hygiene and respiratory etiquette to reduce the risk of infections that can lead to premature birth.

7. **Research and Monitoring:** Continue to investigate the long-term effects of the pandemic on premature birth rates and neonatal outcomes to inform future care and policy decisions.<sup>1,2</sup>

## Conclusion

The findings suggest an association but do not prove causation, and results may not apply to countries with different premature birth rates or lockdown measures. The findings indicate that the lockdown may have reduced extreme prematurity, possibly due to changes in physical activity, environmental exposure, and psychological stress affecting pregnant women's immune response. The biological mechanisms are unclear, requiring further research to confirm these findings and explore causal links. The study shows preliminary evidence linking the COVID-19 lockdown to fewer premature births, but caution is advised due to the small number of cases. Prenatal care guidelines emphasize the need for vaccination, nutrition, oral health, and reducing environmental stress. It calls for sensitive communication about these recommendations, particularly for socioeconomically disadvantaged pregnant women. Further research is needed to explore the

effects of public health measures on preterm birth rates and the long-term health implications for mothers and babies.

## Conflict of Interest

The author declares no conflicts of interest.

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