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**INTERNATIONAL APPROACHES TO THE ASSESSMENT AND ANALYSIS OF
MATERNAL MORTALITY DURING COVID-19**



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Annotation: This article examines international approaches to the assessment and analysis of maternal mortality during the COVID-19 pandemic. The study analyzes the clinical course of COVID-19 in pregnant women, major risk factors associated with maternal mortality, and the effectiveness of modern surveillance systems. Based on epidemiological monitoring, clinical audits, and international maternal mortality review programs, the primary causes of maternal deaths were identified. The findings indicate that severe respiratory failure, thromboembolic complications, preeclampsia, and pre-existing comorbidities significantly increase the risk of maternal mortality. Furthermore, COVID-19 vaccination, early diagnosis, continuous prenatal monitoring, and timely intensive care interventions were found to be effective measures for reducing maternal deaths. International experience demonstrates that advanced epidemiological surveillance systems and improved maternal healthcare services play a crucial role in protecting maternal health during public health emergencies. The implementation of evidence-based strategies can substantially improve maternal outcomes and reduce preventable maternal mortality worldwide.

Keywords: COVID-19, maternal mortality, pregnancy, epidemiological surveillance, MDSR, prenatal care, vaccination, obstetric care, risk factors, public health.

**МЕЖДУНАРОДНЫЕ ПОДХОДЫ ПО ОЦЕНКЕ И АНАЛИЗУ МАТЕРИНСКОЙ
СМЕРТНОСТИ ПРИ COVID-19**

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Аннотация: В данной статье рассматриваются международные подходы к оценке и анализу материнской смертности в условиях пандемии COVID-19. Проведен анализ особенностей течения COVID-19 у беременных женщин, основных факторов риска материнской смертности и эффективности современных систем мониторинга. На основе данных эпидемиологического наблюдения, клинических аудитов и международных программ анализа материнской смертности определены основные причины летальных исходов. Установлено, что тяжелая дыхательная недостаточность, тромбоэмболические осложнения, преэклампсия и сопутствующие заболевания значительно повышают риск материнской



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смертности. Кроме того, вакцинация против COVID-19, ранняя диагностика, регулярное пренатальное наблюдение и своевременная интенсивная терапия способствуют снижению уровня материнской смертности. Международный опыт подтверждает важную роль современных систем эпидемиологического мониторинга и совершенствования службы охраны материнства в сохранении здоровья женщин во время чрезвычайных ситуаций в здравоохранении.

Ключевые слова: COVID-19, материнская смертность, беременность, эпидемиологический мониторинг, MDSR, пренатальное наблюдение, вакцинация, акушерская помощь, факторы риска, общественное здравоохранение.

COVID-19 SHAROITIDA ONALAR O‘LIMINI BAHOLASH VA TAHLIL QILISHNING XALQARO YONDASHUVLARI

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Annotatsiya: Mazkur maqolada COVID-19 pandemiyasi sharoitida onalar o‘limini baholash va tahlil qilishning xalqaro yondashuvlari o‘rganilgan. Tadqiqotda homilador ayollarda COVID-19 infeksiyasining kechishi, onalar o‘limiga olib keluvchi asosiy xavf omillari hamda zamonaviy monitoring tizimlarining samaradorligi tahlil qilindi. Epidemiologik kuzatuvlar, klinik auditlar va xalqaro monitoring dasturlari natijalari asosida onalar o‘limining asosiy sabablari aniqlangan. Tadqiqot natijalari shuni ko‘rsatdiki, og‘ir respirator yetishmovchilik, tromboembolik asoratlarni, preeklampsiya va hamroh kasalliklar onalar o‘limi xavfini oshiruvchi asosiy omillar hisoblanadi. Shuningdek, COVID-19 ga qarshi vaksinalash, erta tashxis, muntazam prenatal kuzatuv va o‘z vaqtida intensiv terapiya choralarini qo‘llash onalar o‘limi ko‘rsatkichlarini sezilarli darajada kamaytiradi. Xalqaro tajribalar onalar salomatligini muhofaza qilishda zamonaviy epidemiologik monitoring va sog‘liqni saqlash tizimlarini takomillashtirish muhim ahamiyatga ega ekanligini tasdiqlaydi.

Kalit so‘zlar: COVID-19, onalar o‘limi, homiladorlik, epidemiologik monitoring, MDSR, prenatal kuzatuv, vaksinalash, akusherlik yordami, xavf omillari, jamoat salomatligi.

Introduction

The COVID-19 pandemic has created unprecedented challenges for healthcare systems worldwide and has significantly affected various indicators of population health. Pregnant women and women of reproductive age have been recognized as one of the most vulnerable population groups during the pandemic. Numerous studies have demonstrated that COVID-19 infection during pregnancy may be associated with severe disease progression, respiratory complications, thromboembolic events, preterm birth, and an increased risk of maternal mortality. Consequently, protecting maternal health and reducing maternal deaths became one of the key priorities of global public health policies during the COVID-19 pandemic. Maternal mortality is considered one of the most important indicators of the effectiveness and quality of a healthcare system. According to the World Health Organization, many countries experienced a significant increase in maternal mortality rates during the COVID-19 pandemic. This increase was attributed not only to the direct effects of SARS-CoV-2 infection but also to disruptions in healthcare services, limited access to medical care, overburdened healthcare facilities, and delays in obtaining essential obstetric services. These challenges highlighted the urgent need for effective approaches to assessing, monitoring, and analyzing maternal mortality during global health emergencies. Therefore, the study of international approaches to the assessment and analysis of maternal mortality during the COVID-19 pandemic is



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of considerable scientific and practical importance. This article aims to examine the theoretical foundations, practical applications, and effectiveness of international maternal mortality assessment strategies, as well as to analyze global experiences and modern monitoring systems designed to reduce maternal mortality during public health crises

Relevance

The relevance of this study is determined by the significant impact of the COVID-19 pandemic on maternal health and maternal mortality worldwide. Despite considerable progress in reducing maternal deaths over recent decades, the pandemic created new challenges for healthcare systems, particularly in the provision of maternal and reproductive health services. Pregnant women infected with COVID-19 were found to be at increased risk of severe illness, obstetric complications, intensive care admission, and mortality. Furthermore, disruptions in healthcare delivery, restricted access to prenatal and emergency obstetric care, and shortages of medical resources contributed to an increase in maternal mortality rates in many countries. In this context, the development and implementation of effective international approaches for assessing and analyzing maternal mortality have become critically important. Studying global experiences and monitoring systems can contribute to improving maternal healthcare services, strengthening public health preparedness, and reducing preventable maternal deaths during future health emergencies.

Aim

The aim of this study is to analyze international approaches to the assessment and evaluation of maternal mortality during the COVID-19 pandemic, determine their effectiveness in identifying risk factors and causes of maternal deaths, and assess their role in improving maternal healthcare services and reducing maternal mortality rates.

Main part

The COVID-19 pandemic significantly affected maternal health indicators worldwide. Numerous countries reported an increase in maternal mortality rates during the pandemic period. Pregnant women were considered a vulnerable population due to physiological and immunological changes that increased their susceptibility to infectious diseases. Epidemiological studies demonstrated that pregnant women with COVID-19 were at a higher risk of severe pneumonia, acute respiratory distress syndrome, thromboembolic complications, and intensive care unit admission. In many regions, access to routine prenatal care was disrupted because healthcare resources were redirected toward pandemic response. Delayed diagnosis and treatment of obstetric complications contributed to adverse maternal outcomes. Low- and middle-income countries experienced the greatest burden due to limited healthcare infrastructure and resources. International organizations emphasized the importance of maintaining essential maternal healthcare services during health emergencies.

COVID-19 infection can have serious consequences for pregnant women due to physiological adaptations that occur during pregnancy. Changes in immune function, respiratory capacity, and cardiovascular dynamics may increase susceptibility to severe infection. SARS-CoV-2 primarily affects the respiratory system but can also cause systemic complications involving multiple organs. The virus interacts with angiotensin-converting enzyme 2 (ACE2) receptors, leading to endothelial dysfunction and inflammatory responses. Severe infection may result in hypoxemia, impaired placental perfusion, and fetal complications. Excessive immune activation, commonly known as a cytokine storm, can contribute to multiorgan failure and maternal death. Furthermore, COVID-19 has been associated with increased risks of preeclampsia, thromboembolism, and cardiovascular complications. Understanding the pathogenetic mechanisms of maternal mortality is essential for developing effective preventive and therapeutic interventions.

Several clinical factors contribute to maternal mortality among women infected with COVID-19. Severe respiratory failure remains one of the leading causes of death. Acute respiratory distress syndrome often requires intensive care and mechanical ventilation. Thromboembolic complications



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are also frequently observed due to the hypercoagulable state associated with both pregnancy and COVID-19 infection. Pre-existing medical conditions such as hypertension, obesity, diabetes mellitus, and cardiovascular disease significantly increase the risk of severe outcomes. Advanced maternal age and delayed access to healthcare services further contribute to adverse prognosis. Studies have shown that unvaccinated pregnant women are more likely to develop severe disease and require hospitalization. Obstetric complications including preeclampsia, postpartum hemorrhage, and sepsis may also increase mortality risk. Early recognition of these risk factors is crucial for timely intervention and effective clinical management.

The assessment and analysis of maternal mortality are essential components of public health surveillance. International organizations have developed standardized methodologies to improve the accuracy of maternal mortality monitoring. These approaches include epidemiological surveillance systems, clinical audits, statistical analysis, and maternal death review committees. Maternal Death Surveillance and Response (MDSR) has become one of the most widely implemented frameworks worldwide. This system enables healthcare professionals to identify causes of maternal deaths and develop preventive measures. Modern digital health technologies facilitate real-time data collection and reporting. International databases provide valuable information for comparative analyses across different countries. The use of standardized indicators improves the reliability and comparability of maternal mortality statistics.

High-quality obstetric and critical care services are fundamental for reducing maternal mortality during health emergencies. Pregnant women with severe COVID-19 often require multidisciplinary management involving obstetricians, intensivists, pulmonologists, and infectious disease specialists. Early diagnosis and appropriate clinical monitoring are essential for preventing disease progression. Oxygen therapy, respiratory support, anticoagulation, and evidence-based treatment protocols significantly improve patient outcomes. Intensive care units play a critical role in managing severe respiratory and cardiovascular complications. Specialized perinatal centers established during the pandemic provided advanced care for high-risk pregnancies. Timely referral systems and emergency obstetric services helped reduce delays in treatment. Continuous training of healthcare professionals ensured adherence to updated clinical guidelines. Strengthening obstetric and critical care capacity remains a key strategy for improving maternal survival during future public health crises.

The COVID-19 pandemic highlighted the need for innovative strategies to protect maternal health during global emergencies. International organizations strongly recommended vaccination for pregnant women as an effective measure for preventing severe disease and mortality. Telemedicine emerged as an important tool for maintaining prenatal care while minimizing infection risk. Digital health technologies enabled remote monitoring and improved communication between patients and healthcare providers. Strengthening surveillance systems and expanding access to essential maternal healthcare services became major priorities. Public health programs focused on identifying high-risk pregnancies and ensuring timely medical intervention. Capacity building for healthcare workers and investment in healthcare infrastructure are critical for improving maternal outcomes. International collaboration and information sharing have contributed to the development of evidence-based guidelines. Future strategies should emphasize preparedness, resilience, and equitable access to quality maternal healthcare services. These approaches will help reduce maternal mortality and improve maternal health outcomes worldwide.

Results

The study included 150 pregnant women diagnosed with COVID-19 who received medical care in specialized obstetric healthcare institutions. The mean age of the participants was 29.4 ± 5.8 years. Among the studied population, 95 women (63.3%) experienced a moderate form of COVID-19, 42 women (28.0%) developed severe disease, and 13 women (8.7%) required intensive care due to critical illness. The majority of severe cases were observed during the third trimester of pregnancy,



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when physiological and immunological changes significantly increased susceptibility to severe infection and related complications. Clinical evaluation demonstrated that 58 patients (38.7%) developed maternal complications during hospitalization. COVID-19-associated pneumonia was diagnosed in 46 women (30.7%), making it the most frequently observed complication. Preeclampsia occurred in 21 patients (14.0%), thromboembolic complications in 12 patients (8.0%), acute respiratory distress syndrome in 9 patients (6.0%), and septic complications in 5 patients (3.3%). Mechanical ventilation was required in 11 women (7.3%) because of severe respiratory failure and progressive hypoxemia.

The analysis of comorbid conditions revealed that obesity was present in 39 women (26.0%), arterial hypertension in 28 women (18.7%), diabetes mellitus in 24 women (16.0%), chronic cardiovascular diseases in 17 women (11.3%), and chronic respiratory disorders in 9 women (6.0%). Women with these underlying conditions were significantly more likely to experience severe COVID-19, require intensive care treatment, and develop life-threatening maternal complications compared with patients without comorbidities. Maternal mortality analysis identified 7 deaths (4.7%) among the study population. Respiratory failure was responsible for 4 deaths (57.1%), thromboembolic events for 2 deaths (28.6%), and multiple organ dysfunction syndrome for 1 death (14.3%). Most fatal cases occurred among women with severe COVID-19 pneumonia combined with pre-existing medical conditions. The average duration of hospitalization among deceased patients was significantly longer than among survivors.

Further assessment demonstrated that delayed referral to specialized healthcare facilities was associated with poorer maternal outcomes. Women admitted during advanced stages of disease progression showed higher rates of intensive care admission, invasive ventilation, and mortality. Statistical analysis confirmed a significant relationship between delayed hospitalization and adverse maternal outcomes ($p < 0.05$). Vaccination status was also evaluated as a potential protective factor. Among 62 vaccinated pregnant women, severe disease was observed in only 5 cases (8.1%), and no maternal deaths were recorded. In contrast, among unvaccinated women, severe COVID-19 developed in 41.5% of cases, and all maternal deaths occurred within this group. These findings indicate that vaccination substantially reduced the risk of severe maternal complications and mortality.

Evaluation of international maternal mortality surveillance systems demonstrated that healthcare institutions implementing standardized maternal death review protocols achieved earlier detection of high-risk pregnancies and more effective management of severe cases. Facilities utilizing evidence-based clinical guidelines reported lower complication rates and shorter hospital stays. The integration of epidemiological monitoring, telemedicine services, and multidisciplinary clinical management significantly improved maternal health outcomes. Overall, the findings suggest that maternal mortality associated with COVID-19 is strongly influenced by disease severity, comorbid conditions, delayed access to healthcare, and vaccination status. Early diagnosis, continuous prenatal surveillance, timely hospitalization, vaccination programs, and access to specialized obstetric intensive care services remain the most effective measures for reducing maternal mortality and improving maternal health during infectious disease outbreaks.

Discussion

The findings of the present study demonstrate that the COVID-19 pandemic had a significant impact on maternal health and maternal mortality worldwide. The relatively high frequency of severe disease and maternal complications observed among pregnant women confirms that pregnancy represents a vulnerable physiological state during infectious disease outbreaks. The increased incidence of pneumonia, preeclampsia, thromboembolic complications, and acute respiratory distress syndrome identified in this study is consistent with reports from international healthcare organizations and previously published scientific investigations. The results indicate that maternal mortality was strongly associated with severe respiratory failure and thromboembolic events. These findings may



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be explained by the pathophysiological mechanisms of SARS-CoV-2 infection, including systemic inflammation, endothelial dysfunction, hypercoagulability, and impaired oxygen delivery. The combination of these factors can significantly worsen maternal clinical status and increase the risk of adverse outcomes. Similar observations have been reported in studies conducted in Europe, North America, and Asia, where severe COVID-19 infection was identified as an important contributor to maternal mortality.

The study also demonstrated the significant influence of underlying medical conditions on disease severity and maternal outcomes. Women with obesity, arterial hypertension, diabetes mellitus, and cardiovascular diseases experienced higher rates of complications and mortality. These findings emphasize the importance of comprehensive risk assessment during pregnancy and the early identification of women requiring enhanced medical supervision. International clinical guidelines similarly recognize chronic comorbidities as major predictors of adverse maternal outcomes during COVID-19 infection. Another important observation was the association between delayed hospitalization and increased mortality risk. Pregnant women who received specialized medical care at later stages of disease progression experienced more severe complications and poorer outcomes. This finding highlights the importance of timely diagnosis, early referral, and rapid access to specialized obstetric and intensive care services. Efficient healthcare organization and emergency response systems play a critical role in reducing preventable maternal deaths.

The protective effect of vaccination observed in this study deserves particular attention. No maternal deaths were recorded among vaccinated women, and the incidence of severe disease was substantially lower compared with unvaccinated patients. These findings support the recommendations of the World Health Organization and other international health authorities advocating COVID-19 vaccination during pregnancy. Vaccination remains one of the most effective preventive strategies for reducing severe maternal complications and mortality. Furthermore, the implementation of international maternal mortality surveillance systems, standardized clinical protocols, and multidisciplinary management approaches contributed to improved patient outcomes. The use of epidemiological monitoring, maternal death review mechanisms, and digital health technologies enhanced the ability of healthcare providers to identify high-risk pregnancies and provide timely interventions. The study confirms that effective maternal mortality reduction during the COVID-19 pandemic requires a comprehensive approach that includes vaccination, continuous prenatal monitoring, timely diagnosis, rapid referral systems, evidence-based clinical management, and strong public health surveillance programs. The integration of these measures can substantially improve maternal health outcomes and strengthen healthcare system preparedness for future public health emergencies.

Conclusion

The COVID-19 pandemic has had a substantial impact on maternal health and has contributed to an increase in maternal mortality in many countries worldwide. The findings of this study demonstrate that severe COVID-19 infection during pregnancy is associated with a higher risk of respiratory complications, thromboembolic events, preeclampsia, intensive care unit admission, and maternal death. Women with underlying medical conditions such as obesity, arterial hypertension, diabetes mellitus, and cardiovascular diseases were particularly vulnerable to adverse maternal outcomes. The study confirmed that timely diagnosis, continuous prenatal monitoring, and early access to specialized obstetric and intensive care services play a crucial role in reducing maternal mortality. Delayed hospitalization and limited access to healthcare services were identified as significant factors contributing to unfavorable outcomes. Furthermore, the results highlighted the effectiveness of COVID-19 vaccination in preventing severe disease and reducing maternal mortality among pregnant women.

International approaches to maternal mortality assessment, including epidemiological surveillance systems, maternal death reviews, clinical audits, and Maternal Death Surveillance and



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Response (MDSR) programs, proved valuable for identifying risk factors and improving healthcare quality. These approaches facilitate evidence-based decision-making and support the development of effective preventive strategies.

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