

HEALTH CARE WORKERS, PREGNANCY AND COVID-19, A LESS TRAVELLED PATH

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Abstract: Pregnant females and infants seemingly be the vulnerable group for COVID-19. Unfortunately, we do not have much data on the type of risks they might encounter and the mode of transmission of this infection from mother to fetus. Moreover, the healthcare staff lack training and equipment to deal with any emergency regarding the mother and the child. This review aims to highlight the risks that make pregnant females prone to infection and the current state of training of healthcare workers and facilities they have. A systemic search was done on PubMed and Google Scholar with the key terms 'COVID-19,' 'pregnancy,' 'childbirth,' and 'health care workers.' Selected studies were then reviewed and analyzed. It was found that no sufficient data is available on the effect of COVID-19 on pregnant women or infants. However, it is shown that the number of pregnant females affected due to COVID-19 is less in comparison with Severe Acute Respiratory Syndrome (SARS) and Middle Eastern Respiratory Syndrome (MERS). There are no sufficient facilities available for healthcare workers to cope with the scenario. Studies revealed that pregnant women are susceptible to Coronavirus infections due to the physiological changes occurring during their pregnancies. Along with this, healthcare workers (nurses/midwives) must be trained and equipped well to deal with any undesired situation.

Key words: COVID-19, health workers, pregnancy

INTRODUCTION

The SARS-CoV-2 pandemic has become a threat to public health, social and cultural infrastructure, psychological wellbeing and the economy of the world (World Bank, 2020). With every passing day, this threat is becoming more and more aggressive. The mystery behind this novel pandemic is what makes it more terrifying. The terror of the SARS-CoV-2 virus has no limitations from infants to elderly adults; all are at the risk of being attacked by pathogens. Similarly, pregnant women and fetuses are assumed to be profoundly in danger during the catastrophe (Chmielewska *et al.*, 2021).

On December 31, 2019, the WHO regional office received the first array of susceptible cases with a respiratory infection and unspecified etiology in Wuhan, a densely populated and urbanized district in Hubei province China. That was the time when many symptomatic cases specific to the disease were reported and recognized. Initially, these cases were treated and diagnosed as pneumonia as the causative agent was still unknown. Later on, the Chinese Center for Disease Control and Prevention (CDC) and its many local units planned and conducted a widely spread project to find the root cause of the outbreak. After the extensive efforts, an association of a member of the Coronavirus (CoV) family was found in the outburst of the disease (Cascella *et al.*, 2021).

The WHO Director-General, Dr. Tedros Adhanom Ghebreyesus, declared on February 11, 2020, that the infection caused by the CoV family is COVID-19 (Corona Virus Disease 2019). Two similar incidents happened twenty years back, namely, Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS) in 2003 and 2012, respectively. SARS epidemic caused around 8000 cases and 800 death in 24 countries worldwide, including China. Similarly, MERS that emerged in Saudi Arabia took 800 lives with a fatality rate of 35% in 2,500 reported cases (Azhar *et al.*, 2019; WHO, 2019). The coronavirus family gives rise to pathogens that are mainly responsible for respiratory tract infection outbreaks. All the family members possess single-stranded RNA, and they can be extracted or isolated from several animal species other than humans. The viruses of Corona family have a unique attribute of surpassing the species barrier and can spread the disease in a wide range of the organism. These illnesses may vary in their severities; some pathogens can only cause common cold-like diseases

while others can cause fatal diseases like SERS, MERS and COVID-19. There is still an ongoing debate regarding the host of these pathogens. Some say it's a bat, and from bats, it infects other mammals before invading the human hosts. For SARS CoV, it was Himalayan Palm Civet, and for MERS, it was dromedary camel (Perlman and Netland, 2009). The likelihood of these viruses growing and spreading to such an extent that they become a global concern is a threat to public health and wellbeing. WHO declared COVID-19 on February 28, 2020, a severe risk to mankind.

Governmental authorities worldwide are gathered and concerned to cease the distressing psychophysiological effects of this outbreak (Flaxman *et al.*, 2020). Health organizations continuously and efficiently share any new information and protocols about the Coronavirus to wisely handle the scenario and lessen this pandemic's destructive measures. The scientific community is also putting their heart and soul into identifying every little detail about the pathogen from its transmission mode to its clinical spectrum, from diagnostic measures to preventive and therapeutic approaches, so that many precious lives can be saved. Unfortunately, we are more at risk because of the uncertainty about the virus itself. What still needs to be found out is

- Host-virus interaction
- Evolution of the disease and its extent
- Duration of time when it reaches its peak.

As for the current time, the therapeutic approaches practiced to deal with the infections can only provide prevention and boost immunity to some extent. From the moment this disease was burst in China, the government has taken strict actions and implemented the policies on an emergency basis to deal with the crisis. Moreover, the citizens also rectify the severity of the situation so, they offered complete support and surrendered to the strict lockdown policies. This disease then gradually expands its paws to the nearby region and ultimately captures the globe by infecting 219 countries. By taking instant and effective decisions at the right time, the authorities managed to reduce the death ratio amongst the infected markedly (Clark *et al.*, 2020).

Every human being is susceptible and prone to get invaded by the pathogen. However, certain groups show extensive vulnerability towards the disease. These groups include infants, elderly individuals, and people already suffering from severe respiratory or immunological disorders. Pregnant females are also found to be a significant threat of getting affected by the pathogen (Dubey *et al.*, 2020). The complexity of this issue is not restricted to morbidity or mortality rate; it becomes more intricate because of the unavailability of healthcare services and the fear and avoidance of the patients to seek help from healthcare services. All these factors add to the liability of pregnant females and their children of acquiring the disease. Categorizing pregnant females as the vulnerable group is justified by various aspects (Been *et al.*, 2020).

Cardiorespiratory system

Pregnancy is a life-changing process, and there are many ways that your body adapts to the changes occurring during pregnancy. Various vital systems like cardiovascular and immune systems showed varied activity, making a pregnant woman even more susceptible to severe infectious diseases. Due to altered stimulation of the immune system, some women may get "Gestational Rhinitis" because of estrogen-mediated hyperemia in the naso-pharynx (Rasmussen, 2020). This nasal congestion may facade the symptoms of COVID-19 and make it more difficult to be diagnosed, which may lead to fatal consequences. Shortness of breath is a distinct symptom of COVID-19 (Guan, 2020); however, pregnant women sometimes face dyspnea as the need for oxygen increases in the body due to intensified metabolic workload and fetal oxygen demand (Nelson-Piercy, 2015; Gardner and Doyle, 2004). This results in altered residual and functional pulmonary volumes and total lung capacity. These pulmonary changes make it easy for the virus to remain unseen and replicate using the host's body while causing further damages (Shi *et al.*, 2020).

Immune system

Cytokines mediate inflammation and exhibit anti-microbial activity. T-helper (Th) lymphocytes produce cytokines that control immunity and inflammation. Th1-type cytokines, including interferon- (IFN-), interleukin (IL) 1, IL-1, IL-6, and IL-12, exhibit anti-microbial and pro-inflammatory activity. Th2-type cytokines, on the other hand, are anti-inflammatory and include IL-4, IL-10, IL-13, and transforming growth factor (TGF-). In pregnancy, to minimize the life-threatening risks to the fetus, the pro-inflammatory immunity mediated by Th-1 cells is suppressed and overtaken by type 2 T helper cells. This shift adds more to the susceptibility of a pregnant woman to infectious diseases (Berger, 2000). The pregnant females infected with COVID-19 show signs of both types of responses generated from Th1 and Th2 cells. The high expression of Th1 immunity increases the release of cytokines that induce inflammation. Along with cytokines, IL-6 is also elevated, contributing to the increased risk of mortality during pregnancy (Wong, 2004). Pregnant women's special needs should be addressed in awareness and

response strategies in the middle of this rapidly emerging pandemic that might have major implications for overall public health and medical setup. Because of concerns about fetal health during previous epidemics, physicians have been uncertain about providing treatment or protect pregnant women via vaccination (Huang *et al.*, 2020). In the event of a severe infectious disease threat, pregnant women should not be denied possibly life-sustaining interventions except there is a reasonable cause to do so. The benefits of maternal and fetal health treatments must be carefully weighed against the possible costs, as in all medical decisions made during pregnancy (Ruon *et al.*, 2020).

COVID-19 susceptibility and severity during pregnancy

No estimate has been made yet about the magnitude of how COVID-19 affects pregnant female. Neither can this be predicted that how much pregnant female is at risk of getting the disease and which degree? However, we do have some data from previous epidemics, MERS and SARS. Preliminary data recommended that medical outcomes could variate from asymptomatic to severity during pregnancy and, in the worst case, deaths. The problem with the diagnosis of COVID-19 in pregnant females is that commonly around 80% of the females show cough and fever (Hui and Zumla, 2019).

The effects of SARS on pregnant women

During the outbreak of SARS back in 2003 in Hong Kong, 12 pregnant females were identified as the carrier of SARS-CoV, out of which three patients died with a mortality rate of 25%20. However, clinical manifestations were as similar as those of non-pregnant females. It was also identified that clinical outcomes varied according to the onset of the disease. The complication in labor and delivery were also observed in the females suffering from SARS-CoV (Wong *et al.*, 2015). Infants born with gastrointestinal complexities with unknown etiology. In studies conducted at that time, no significant differentiation was found between the symptoms of pregnant females affected with SARS-CoV with the non-pregnant patients. Still, severity in symptoms and adversity in the outcomes was observed in pregnant females compared to the non-pregnant subjects (Wong *et al.*, 2004). Pregnant patients are more likely to get renal failure and other problems, stay longer in hospitals, and need intensive care (Shek *et al.*, 2003). Health care providers worked hard to cease transmitting the disease to the pregnant women, community and their families (Ng *et al.*, 2004). They isolated the patients, wore respirators and tested every individual before entering the hospital. Only limited visitors were allowed to visit the patients with all the precautions taken. By practicing all the safety measures, the staff had managed to reduce the transmission and mortality rate (Park *et al.*, 2016)

The effects of MERS on pregnant women

Like in SARS, there is limited data available on the effect of the pathogen on pregnant females during MERS outburst. Reportedly, 13 cases were identified of pregnant women. Some of them were asymptomatic, while the rest showed symptoms just like the other patients, but the adversity of the symptoms was far more than the non-pregnant female. Because of acute respiratory syndrome, a few pregnant women had to be admitted to the intensive care unit. In such cases, infant mortality was also observed (Asiri *et al.*, 2016).

STEPS TO PREVENT INFECTION AND PREVENTIVE TESTING

Health care providers being the sole person to cater to these sensitive cases, must be aware of the actions and strategies to be followed to save as many lives as possible.

- a. Every person stepping in must be checked and tested for the infections
- b. The attendee and the patient must follow standardized precautions.
- c. Pregnant women must be concerned about the current crisis and its impact on her and her baby's life. Such patients must be dealt with utmost care and affection.
- d. Suspicious symptoms must not be neglected if detected in any of the patients.
- e. If the patient was tested and suspected to be infected, she should be isolated immediately, and the health care worker who was attending the patient must be tested.
- f. Advisable treatment should be given to the patient (Lapinsky, 2017).

Management of COVID-19 during pregnancy

Managing the COVID-19 positive patients is a distressing task on its own, but the situation becomes more critical if it involves an expecting mother. Health care professionals must be aware of the immediate action plan and should be equipped accordingly. A health care worker must have knowledge and skills to perform the following measures;

- a. The testing procedure of SARS-CoV-2

- b. Isolation process
- c. Oxygen therapy is given to the patient if needed
- d. Antibiotics course to avoid any secondary bacterial infection.
- e. Diet and fluid intake of the patient
- f. Close monitoring of the fetal activity inside the womb and the contractions of the uterus.
- g. Isolated delivery
- h. Observations to be made postpartum.

It is the time to worry if,

- a. Fetal heart rate is varied
- b. Infant with respiratory and pulmonary malfunctioning
- c. Altered functioning of mother's vital organs
- d. Severe pulmonary inflammation and shortness of breath

As the susceptibility of pregnant females to COVID-19 is still anonymous, every patient must be examined closely for the symptoms or any other impediments (Centers for Disease Control & Prevention, 2020). This review aims to provide the recent data and situation for awareness and find ways to make the susceptible subjects safer.

METHODOLOGY

A systemic search was done on PubMed and Google Scholar with the key terms 'COVID-19' 'pregnancy,' 'childbirth,' and 'health care workers.' Around 547 studies were identified in the given time frame of one year. Systemic reviews were included in this review article for comparison. Studies that focused on patients with pre-existing respiratory or some immunological disorder were excluded. A total of 19 studies fit into the inclusion criteria.

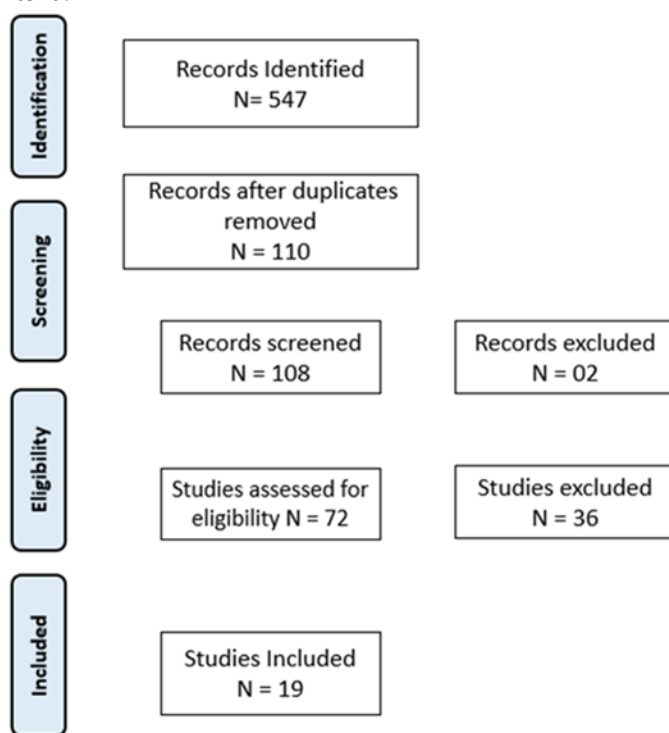


Fig. 1. Flow diagram of literature search and selection processes in a systematic review

RESULTS

There is a scarcity of data to assess the risk of contracting COVID-19 during pregnancy and vertical transmission. Questions such as

- How vulnerable might pregnant women be for being infected with the SARS-CoV-2 virus?
- What makes them prone to attain the infective pathogen?
- What are the possibilities of the infant inheriting the infection from the mother?
- Which route of transmission of the infection is involved in transferring the infection from the mother to the baby?

- When will be the curative drugs be made available for the treatment of COVID-19 disease?
- Will the preventive treatments or interventions be safe enough to be applied on a pregnant subject?
- What is the impact of the existing drugs and vaccination of the SARS-CoV-2 virus on the mother's and infant's quality of life?
- How well trained and well equipped the health facilities are to cater such sensitive cases?
- What to expect in the coming five years about the child's health and wellbeing, born under the stress of COVID-19?

These and more questions are yet to be answered. In such uncertainty, it is tough to predict anything concerning the scenario.

Table 1. Common physiological changes in Pregnant Women which makes them vulnerable to COVID-19.

Author	Year	Physiological changes in Pregnant Women which makes them vulnerable to COVID-19
Rasmussen <i>et al.</i> (2020)	2020	Cardiovascular system is weak
Nelson-Piercy <i>et al.</i> (2015)	2015	Compromised Respiratory system
Berger <i>et al.</i> (2010)	2000	Immune
Wong <i>et al.</i> (2004)	2004	Increased expression of Th1 immunity
Brussieres <i>et al.</i> (2015)	2015	Anxiety
Rasmussen <i>et al.</i> (2012)	2012	Cardiovascular and respiratory disorders
Shek <i>et al.</i> (2003)	2003	Renal Failure
Ayaz <i>et al.</i> (2020)	2020	Anxiety/Stress
Guasch <i>et al.</i> (2020)	2020	Hypoxia

Table 2. Challenges faced by healthcare workers during pandemic and epidemic situations in dealing with patients.

Author	Year	Challenges faced by Midwives/ Nurses
Erland E. <i>et al.</i> (2017)	2017	Fear of contagious disease
Jones S. <i>et al.</i> (2017)	2017	Unable to provide best care due to protective measures
Kollie <i>et al.</i> (2017)	2017	Difficulty in choosing personal or professional responsibility

This table shows how healthcare workers felt during previous epidemics and pandemics while dealing with pregnant females due to their fear and anxiety issues.

Table 3. The number of pregnant women tested positive of SARS-CoV-2 in different regions of the world.

Author	Year	Study area	Test design	Pregnancy (n)	Age group	Virus detected in mother
Chen <i>et al.</i> (2020)	2020	China	Retrospective	9	26–40	SARS-CoV-2
Zhu <i>et al.</i> (2020)	2020	Wuhan	Retrospective	9	25–35	SARS-CoV-2
Penfield <i>et al.</i> (2020)	2020	New York	Retrospective	11	22–40	SARS-CoV-2
Knight <i>et al.</i> (2020)	2020	UK	Prospective	427	n/a	SARS-CoV-2
Lokken <i>et al.</i> ((2020).	2020	USA	Retrospective	46	26–34	SARS-CoV-2
Lumbreras – Marquiz <i>et al.</i> (2020).	2020	Mexico	Retrospective	308	26–39	SARS-CoV-2
Andrikopoulou <i>et al.</i> (2020)	2020	New York	Case series	158	n/a	SARS-CoV-2

This data is extracted from Diriba *et al.* (2020).

When it comes to handling a patient who is vulnerable to COVID-19, extreme care and precision are required. It takes a lot of effort and training of the health care workers to be able to tackle the cases and reciprocate the preventive measure with every case. Nurses, gynecologists and midwives are the key people in handling the situation. Their training and protection should be the priority. For this purpose, health care staff must be provided with essential instruments to be safe while dealing with COVID-19 patients. The health care workers should have,

- Respirators
- Effective sanitizers
- Protective kit
- Proper ventilation and
- Limited exposure with patients

Along with being well-resourced, the attendees should also be skilled to give proper care, treatment and life expectancy to the patient. Pregnancy is a stress on its own. On top of it, the fear of either losing your life or your child is a horrifying feeling. These stresses pile up and exacerbate the complications. Not only the stress of a pregnant women but the stress that midwives and nurses are going through may also affect their health and work productivity (Table2).

There is not much data available on the outcome of COVID-19 on mothers and their child neither many deaths are reported, however a few studies are explained in.

Physiological Changes

As mentioned earlier, to adapt to give birth, the body goes through several changes. Many vital systems are burdened to meet the need of the body and the fetus. For ensuring the survival of the fetus, the immunity gets weakened to a certain degree to avoid any autoimmune damage to the fetus. Cardiovascular system, respiratory system, gastrointestinal system all gone through physiological stress during pregnancy. This might be the cause to suspect pregnant women as a vulnerable entity towards COVID-19 (Therarajan *et al.*, 2020).

Anxiety and Pregnancy

Apart from physiological disturbance, there are many psychological hindrances encountered when a patient visited the health care facility. Anxiety, fear, stress and depression account for a huge chunk of psychological manifestations of an expecting female. A study revealed that mental stress in pregnant women exponentially increased during the pandemic (Ayaz *et al.*, 2020). Stress does not have a pleasant impact on your body. Persistent stress induce changes in your metabolic activities and your cognitive abilities. The elevated level of stress hormones (Cortisol) can distinctively increase the chances of miscarriage, stillbirth or disturbed metabolism and compromised immunity of the mother and the child (Akiki *et al.*, 2016). Stress also increases the vulnerability to infections by the deterioration of the immune system. The health care providers must be attentive and skilled to wrestle with this challenge (Brussieres *et al.*, 2015).

Mortality Rate Before and After Pandemic

Maternal mortality rates during childbirth are increased globally to an unwanted extent. There is no distinction between developed or underdeveloped countries. The estimated reason for this was stated to be the carelessness of the staff and malpractice of the standards. However, up till now, there is no distinguished data available that concludes COVID-19 as a major cause of maternal or neonatal mortality.

Availability of Healthcare Facilities in Pakistan and other South Asian Countries:

Pakistan is not manufacturing any equipment required for the prevention from COVID-19. Thus these equipment are to be imported from the neighboring countries. This accounts for a major drawback as insufficient gadgets, and required stuff is a huge hurdle in treating people. Increasing incidences of COVID-19 positive patients is another factor that may contribute to compromised care of pregnant individuals, as they need isolation from every patient during their stay in the hospital to avoid any sort of infectious transmission (Sarkar *et al.*, 2015; Khalid and Ali, 2020). Lack of availability of rooms and beds in public and private hospitals also limits the stay of a pregnant woman in hospital, which may deprive their chances to survive. Most importantly, exposure of a newborn to an environment where hundreds of patients are suffering from the disease is hazardous (Khalid and Ali, 2020). Another important concern is the casual attitude of south Asian people and health care staff towards the Coronavirus. Some myths and superstitions are leading to challenging consequences. Awareness about the intensifying situation must be delivered to the layman for them to realize how dangerous this could be for them and to the community (Khalid and Ali, 2020).

Maternal Mortality Rate in South Asian Countries:

According to a recent United Nations study, severe cuts in the provision and use of critical public health services across South Asia as a result of COVID-19 could have led to an estimated 228,000 additional child deaths in 2020. An additional 11,000 maternal deaths are also predicted (UNICEF, 2021).

DISCUSSION

Pregnancy is a physiological condition that puts women at risk of contracting a virus. Apart from the effects of COVID19 infection on a pregnant woman, there are concerns about the fetal and neonatal outcome; hence, pregnant women are a population that needs special consideration in terms of prevention, diagnosis, and management.

If a pregnant woman got infected by Coronavirus, the first action of the virus on to the host body is to diminish the immunity to maximize their span of life. Data suggests that COVID-19 patients exhibit lessen white blood cells, thrombocytes and lymphocytes. All these cells are of great value in mediating immune responses against any pathogen or antigen. The weak immunity will give an edge to the virus to grow and reproduce at a high rate. The weaker our immunity goes, the stronger the virus becomes. The immune system of a pregnant lady is already depressed, and if they are affected by the Coronavirus, there are chances that it will harm the host and also the life inside the host (Diriba *et al.*, 2020).

Several researches suggest that many vital system of a pregnant women are compromised including cardiovascular system, immune system and respiratory system to name a few which makes them vulnerable for any kind of infection (Table 1). There are many lessons that can learnt and actions should be taken accordingly. The issues that healthcare workers suffered from previous pandemic and epidemic situations must be taken seriously and should be resolved to make sure the wellbeing of the staff and safety of the pregnant females (Table 2). A varied number of pregnant women are tested positive in different regions of the world (Table 3). These numbers are comparatively lesser than in SARS and MERS but still appropriate measures should be taken to avoid any severe consequences

Severe anxiety issues may also contribute to worsening the breathing patterns. In Pakistan, early age marriages is also a core reason behind anxiety issues during pregnancy. Pregnant females are more concerned about their health in their early pregnancy (Ahmed *et al.*, 2004). A significant mode of transmission is still not known, which is responsible for sharing and transferring the infection between mother and fetus. Breastfeeding was thought to a source of transmission, but fortunately, this is not the scenario. It is also a possibility that there is no vertical transmission takes place. If it is proved valid, this will lift a burden from the shoulders (Agadjanyan *et al.*, 2015). Health care providers must be taken care of, and awareness sessions must be conducted for them so they will update their prior knowledge according to the new information available.

CONCLUSION

It is concluded that pregnant female are susceptible to acquiring viral infections, but it is still unknown that how and to which extent this virus can affect the health of the mother and the fetus. Moreover, the mode of transmission of virus from mother to fetus is still unknown. On the other hand, healthcare workers are going through so much distress because of lack of training and lack of equipment to facilitate them. Unfortunately, only limited information is available in this regard. All countries affected by the virus outbreak must publish their research findings, and clinical guidance as a foundation for future treatment before more evidence and expertise become accessible. Sharing data will aid countries that are likely to be affected by the virus outbreak in the future in preventing COVID-19-related maternal and neonatal complications.

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