COVID-19 infection during pregnancy: a systematic review to summarize possible symptoms, treatments, and pregnancy outcomes

Authors: Md. Mostaured Ali Khan[1□], Md. Nuruzzaman Khan[2,3*□], Md. Golam Mustagir[1], Juwel Rana[4,5], Md. Rajwanul Haque[6], and Md. Mosfequr Rahman[1]

Affiliations:

[1]Department of Population Science and Human Resource Development,
University of Rajshahi, Rajshahi-6205, Bangladesh.

[2]School of Public Health and Medicine,
Faculty of Health and Medicine,
The University of Newcastle, Australia

[3]Department of Population Sciences,
Jatiya Kabi Kazi Nazrul Islam University, Mymensingh, Bangladesh.

[4]Department of Biostatistics and Epidemiology,
University of Massachusetts Amherst, Amherst, MA, United States,

[5]Department of Public Health,
North South University, Bashundhara, Dhaka-1229, Bangladesh.

[6]MEL and Research, Practical Action,
House no. 28/A, Road no. 5, Dhanmondi, Dhaka-1205, Bangladesh

Corresponding Author:

Md. Nuruzzaman Khan
School of Public Health and Medicine,
Faculty of Health and Medicine,
The University of Newcastle, Australia
E-mail: sumonrupop@gmail.com

□ These authors have contributed equally is this study.

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Abstract

Background: The coronavirus disease 2019 (COVID-19); one of the most hazardous threats that the world has ever been faced, is now increasing exponentially worldwide. An increasing proportion of the women are now infected with this virus during their pregnancy, which may put them in danger in terms of adverse maternal and newborn outcomes. The aims of this systematic review were to summarize the possible symptoms, treatments, and pregnancy outcomes if the women are infected with COVID-19 during their pregnancy.

Methods: Four databases (Medline, Web of Science, Scopus, and CINAHL) were searched on March 25, 2020, using the following keywords: "COVID-19", "nCoV-2019", and "coronavirus." Articles included if they reported either the symptoms, treatments for the women who have been infected with the COVID-19 during their pregnancy or pregnancy outcomes. Further searches were conducted using the reference list of the selected articles and in the websites of the selected journals. All reported symptoms, treatments, and pregnancy outcomes were summarized through a narrative review of the selected articles' results.

Results: Total of eight studies selected for this study that comprises 100 infected pregnant women. The common symptoms of infection were fever (65%), cough (38%), fatigue (15%), and breathing difficulties (14%). Usual recommended treatments for general infected people to treat COVID-19 disease such as chloroquine, corticosteroids are not applicable for pregnant women because of potential adverse outcomes. Use of C-section was a common (85.4%) mode of delivery among the COVID-19 infected pregnant women than their counterparts. The occurrence of preterm birth (29.1%), and low birth weight (16.4%), were also among babies of the infected women.

Conclusions: The COVID-19 infected pregnant women often reported common symptoms of infection: fever, cough, and fatigue with numerous additional symptoms, including myalgia, and sore throat. The proposed treatments for infected pregnant women are different from what usually recommended for the general infected people. The healthcare providers may have appropriately informed about these symptoms and treatments; therefore, they could able to handle infection during pregnancy effectively, which may reduce the occurrence of adverse maternal and newborn consequences.

Keywords: Coronavirus; 2019-nCoV; COVID-19; Pregnant women, pregnancy

Introduction

The world is now facing a new coronavirus disease 2019 (COVID-19, started in December 2019 at Wuhan, China); a major epidemic threat that the world has ever been faced [1]. Since then, the virus has been spread to the 204 countries or territories and infected around 7 million people; around 33.5 thousand of which are died as of March 31, 2020 [2]. Importantly, these rates of infections and deaths have been changing daily because of its higher transmission capacity. Consequently, the witness countries' healthcare systems are now facing problems to treat properly to the infected people; though many of them are critically infected and need comprehensive care (5%) [3,4]. Essentially these increasing rates are reported when the World Health Organization (WHO) has declared COVID-19 as global pandemic and asked countries to take aggressive measures that are even reflected in countries various initiatives [5,6]. The roots of transmission of this virus from an infected to non-infected person are contact with infected person's respiratory droplets (coughs or sneezes) [7], and touching surfaces or objects that were touched by the infected person [7,8], and has the capacity to infect 2.28 person in a day [9].

The virus is prevalent in all age clusters irrespective of sex; however, it could cause more adverse consequences, including deaths for the persons who have pre-existing non-communicable diseases including diabetes, hypertension, chronic respiratory diseases, and cancer [1]. Importantly, majority of the deaths reported worldwide have occurred among people who had history of one or more morbidity, that are often common among the elderly [1,10]. The causes are many; however, major is the poor immunity capacity of the people having one or more morbidity.

Women during pregnancy often face several pregnancy related complications and more susceptible to respiratory pathogens that may put them at higher risk of adverse

consequences. Getting COVID-19 infected at this stage, therefore, may put them in further risk of occurring adverse pregnancy and newbron outcomes including deaths; however, the estimate is lacking [11]. The Severe Acute Respiratory Syndrome (SARS) that was reported in 2007 and similar to the present COVID-19 was showed devastating consequences if it had occurred during pregnancy [9,12]. Earlier diagnosis of the COVID-19 infection status, as well as proper treatment, are important to reduce these adverse consequences. Clear understanding of all possible symptoms following infection during pregnancy and proper treatments are important for that.

The available studies on the symptoms of COVID-19 are mainly conducted for the general infected people, where fever, cough, fatigue, and shortness of breath were the common symptoms [13-18]. Importantly, these symptoms are varied for the pregnant women that are reported in the few relevant studies, though not consistent across studies. For instance, Liu et al. [19] identified cough, shortening of breath, and fatigue alongside with fever were the most important symptoms of COVID-19 among pregnant women, whereas cough and fever were reported as vital symptoms of COVID-19 in the Zhu et al. [20] study. The treatments given to the COVID-19 infected pregnant women are also varied. Oxygen support, antiviral therapy, and antibiotic therapy were the treatments had given to the infected pregnant women included in the Liu et al. [21] study. Alternatively, Zhu et al.'s study [20] reported that antibiotic therapy was avoided for all infected pregnant women and had given oxygen support and antiviral therapy. Under these circumstances, summarizing all possible symptoms and treatments are important to assist healthcare personnel; thus, they would able to make evidence-based decision to identify infected women early and provide the most effective treatments. Moreover, knowledge of the possible adverse outcomes would help healthcare personnel to take earlier precautionary measrues. Therefore, this study summarized the symptoms,

treatments, and pregnancy outcomes for the women who have been infected with COVID-19 during their pregnancy.

Methods

A systematic review following the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) consensus statement was conducted [22]. Relevant and available studies related to COVID-19 infection among pregnant women were included.

Search strategy

Systematic computerized literature searches of the Medline, Web of Science, Scopus, and Cinahl database were conducted on March 25, 2020. Studies published since the COVID-19 started were included. Searches were conducted on the basis of individual comprehensive search strategy for each database. We developed search strategy consisting of free-text words, words in title/abstract and medical subject headings (MeSH), combined using the Boolean operators (AND, OR). We also searched reference list of the included articles and selected journals websites.

Study selection criteria

Studies were selected based on the inclusion and exclusion criteria outlined below-

Inclusion criteria

Studies included if they reported COVID-19 infection among pregnant women and the following: symptoms of the infection, treatment given, and outcome of pregnancy (if the delivery had occurred). Studies published in English language worldwide irrespective of study design were included.

Exclusion criteria

Studies excluded if they reported COVID-19 infection among non-pregnant women or general patients and wrote in other languages than English. We also excluded review papers and the studies where the exposure status (COVID-19 among pregnant women) and the symptoms, treatments, and the outcomes were not clearly reported.

Data extraction and analysis

Two authors (MMAK, and MGM) extracted information by using a pre-designed, trailed, and modified data extraction sheet. The extracted information included: year of publication, study location, study design, study sample size, symptoms reported, treatment given, and the outcome of the pregnancy (if delivery had occurred). The corresponding author solved any disagreement on information extraction. The modified Newcastle-Ottawa scale as part of the data extraction strategy, was used to assess study quality.

The information recorded were dichotomous in nature. We, therefore, used narrative synthesis to summaries findings from all the retrieved studies. All symptoms following the COVID-19 infection among pregnant women, the treatments given to them, and the outcomes of their pregnancy were presented in detail along with relevant data if available.

Results

Study selection

A total of 1,817 articles dating from the inception of the COVID-19 were identified, of which 1,706 articles were excluded based on the title, abstract, and relevance of the research questions. One hundred eleven articles were selected for full-text review, of which 103 articles were excluded because study sample were general infected population (95), reported different outcomes (4) and wrote in other languages than English (2). Total of 8 articles were finally selected for this study.

The background characteristics of the selected studies are summarized in Table 1. All included studies were conducted in China following the initiation of the COVID-19 outbreak in December 2019. Five of the eight included studies were followed retrospective cohort study design, two were cross-sectional, and 1 was a case report. Total of 100 women was included in the selected eight articles; their mean age was 30 years, and majority of them were in the third trimester of pregnancy (gestational age 22-41 weeks).

Symptoms of COVID-19 among pregnant women

Table 2 presents the symptoms reported in the included studies. Where available, the symptoms were reported case basis included in the studies. The fever (65%), cough (38%) were major symptoms following the COVID-19 infection among pregnant women (**Figure 2**). The other symptoms reported were fatigue (15%), breathing difficulties (14%), and myalgia (6%). Sore throat (5%), diarrhea (4%), poor appetite (3%), headache (2%), and malaise (2%) were also reported among pregnant women following the COVID-19 infection. Two different pregnant women were also reported mulligrubs and cholecystitis, respectively, which were added to the common symptoms.

Treatments used to treat COVID-19 diseases among pregnant women

The treatment pattern of the COVID-19 infection among pregnant women during their pregnancy or following delivery are summarized in Table 3. Of the seven articles included, four articles reported similar treatments; that was oxygen therapy and antibiotic therapy. Antiviral therapy was also used in some cases. Cefoperazone Sodium, Cephalosporins, Quinolones, Macrolides, were the commonly used antibiotics in antibiotic therapy, whereas in antiviral therapy, Lopinavir (400mg), Ritonavir (100mg), Arbidol, and Oseltamavir were commonly used.

Pregnancy outcomes following delivery among the COVID-19 infected women

The maternal and newborn outcomes following the COVID-19 infection during pregnancy
are summarized in Table 4. This study included 100 women, of which the delivery-related
information was available for 59 women; 55 had given live-birth, and the remaining four
were still pregnant at the time of study conducted. Of all delivery occurred, 85.4% had gone
through the C-section, and around 29.1% of the total delivery were premature. Among these
reviewed cases, one maternal death and one neonatal death were also reported following the
COVID-19 infection. The birth weight of the babies was normal in most cases, though 16.4%
of the newborns had low birthweight (LBW). Only one of the included studies repoted
evidence of mother to child transmission of the COVID-19 infection after 36 hours of
delivery.

Discussion

The world is now experiencing an exponential increase of the COVID-19 infected people; a
significant proportion of them are pregnant women. We summarized the symptoms following
the COVID-19 infection among pregnant women, and the treatments are commonly given to
them and the outcomes of the pregnancy. Total of eight studies included in this review in
which 100 infected pregnant women data were analyzed; majority of them were in the third
trimester of pregnancy. All the included studies were conducted in China. Symptoms reported
by the pregnant women following COVID-19 infection were slightly different from the
common symptom of general infected people; however, fever, and cough were common.
Oxygen and antibiotic therapy were given as treatments for majority of the infected pregnant
women. Of the sample analyzed in the included eight studies, 55 of them given baby
following the infection occurred. Around 85.4% of the infected pregnant women had gone
through the C-section; around 29.1% of women had given premature birth, and total of 16.4%
of these babies was born with LBW. These summary findings are important, as it will enable
healthcare personnel for the better management of pregnant women who have been infected

with the COVID-19, which potentially reduce adverse consequences for women as well as their babies.

Several questions have been aroused on maternal and neonatal safety if women were infected with the COVID-19 during pregnancy. The causes are complications following getting infected and evidence of higher adverse consequences if it has happened with existing morbidity, and these could be added to the usual pregnancy and delivery-related complications. These, may increase the occurrence of adverse maternal health and birth outcomes though estimates are lacking. Importantly, earlier detection of the infection through tests, symptoms, and effective treatments could reduce this risk. As revealed in this study based on available published research, fever, cough, fatigue, breathing difficulties are common symptoms among pregnant women following the COVID-19 infection, these symptoms are also common among the general patients [23,24]. Though majority of the symptoms are almost similar, pregnant infected women had some additional symptoms, including sore throat, myalgia, and poor appetite. Postpartum fever was also highly observed for women following delivery. Therefore, close monitoring of these symptoms could be an effective way of early detection of COVID-19 infection during pregnancy. Previous corona like virus outbreak, such as infection of the SARS during pregnancy, reported malaise, chills, and rigors as common symptoms along with fever, cough, and breathing difficulties [25].

Given no specific treatments or vaccines are discovered yet, the COVID-19 infection during pregnancy would put healthcare providers in additional challenges [23]. This is because of the possible adverse effects of the medicine used on the fetus as well as pregnancy. For instance, there are evidence that medicine such as chloroquine and hydroxychloroquine that are currently recommending for patients with the COVID-19 [26] may cause fetal harm [27] and may adversely affect newborn through transferring from mother body by breastmilk [28,29]. Therefore, precautious are needed in the treatments of infected pregnant women. This study

revealed that most infected pregnant women were given symptomatic and supportive treatments considering pregnancy, though anti-inflammatory and antiviral treatments had been used in some cases [30,31]. Importantly, this study summarized the common given antiviral treatments to the infected pregnant women were oseltamivir, lopinavir (400mg), and ritonavir (100mg); the medicine which are different from usual recommended medicines to treat the COVID-19 in general population [26]. Therefore, healthcare providers may have to be careful about given antiviral treatments to the infected pregnant women.

Additionally, oxygen therapy and antibiotic therapy (e.g., cefoperazone sodium) have been used in some cases [31,32]. Notably, further cautious measures are needed to choose the medicine from previous experience on SARS and its treatments, which is considered similar to COVID-19 infection and there are many similarities on treatments given for these infections. For instance, the oxygen and antiviral therapy (drug includes Ribavirin, Ritonavir, Lopinavir) are used in both SARS and COVID-19 [33]. However the corticosteroids was not used to treat COVID-19 though it was used to treat SARS among pregnant women. There is evidence that the use of corticosteroids during pregnancy increase the risk of preterm birth, low birthweight and preeclampsia [34].

Additional important findings of this study were the higher occurrence of adverse maternal newborn outcomes among COVID-19 infected mothers. For instance, as this study reported, around 83% of the infected mothers had birth reported use of C-section; a rate that is significantly higher than the usual WHO's recommendation of 1-5% use of C-section to avoid death and severe morbidity in mother and newborns [35,36]. Getting COVID-19 infection increases complex viral infection among women in pregnancy; therefore, C-section is recommended to reduce perinatal and neonatal adverse outcomes [37]. We also confirm the evidence of the higher occurrence of preterm birth and LBW among the COVID-19 infected mothers than their counterparts. These associations are unique as the previous round of viral

infection such as SARS did not find any evidence of association between infection during pregnancy and occurrence of LBW and preterm birth [38-41]. Viral infection affects pregnancy and fetal growth by gaining access to the placenta and decidua via hematogenous transmission or the lower reproductive tract that lead to the occurrence of such adverse outcomes [42]. However, effects can vary across cell types and gestational age and can be influenced by changes in the uterine environment and maternal immunity [42]. Therefore, earlier preparedness of the healthcare sectors to handle these adverse consequences would be helpful to reduce further adverse outcomes, including maternal and perinatal mortality.

The study has several strengths and limitations. This is the first study of its kind that highlighted the symptoms, the treatments, and the pregnancy outcomes among women who have been infected with the COVID-19. The findings may help physicians to take proper initiatives. We did not set any time and study design restrictions that allowed us to include a higher number of studies. However, the major limitation is generalizability; all studies included in this review were conducted in China. Different treatments may be used to treat COVID-19 during pregnancy in other countries. Moreover, none of the studies included reported quantitative data that restricts us to narrate the selected study's findings rather than given any pool estimates. Nevertheless, this study still important and will make healthcare providers informed about the symptoms, treatments, and possible outcomes if pregnant women have been detected with the COVID-19.

Conclusion

This study confirms fever, cough, and breathing difficulties are the major symptoms of COVID-19 infection among pregnant women. These are similar to the symptoms reported for the general infected patients; however, some additional symptoms are postpartum fever and breathing difficulty. The recommended treatments such as chloroquine and

hydroxychloroquine for the infected people are not applicable for the pregnant women because of their potential adverse affect on the fetus and newborn, therefore supportive and symptomatic treatment are given to them. The COVID-19 infection during pregnancy also increase risks of several adverse outcomes, including higher rates of C-section delivery, low birth weight, and preterm birth. Healthcare providers may consider these for effective management of COVID-19 infected pregnant women, which would reduce pregnancy-related adverse consequences including maternal and newborn morbidity and mortality

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Authors Contribution

Conceptualization: MMAK

Research design: MMAK, and MNK

Data curation: MMAK, and MGM

Analysis: MMAK, MGM, and MNK

Draft preparation: MMAK, MNK and MGM

Supervision: MNK

Critical review: JR, MMR, and MRH

Conflicts of interest

The authors have no competing interest to declare.

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Table 1. Background characteristics of the selected studies.

SL no.	Authors	Study design	Study location	Study date	Study sample size	Mean age of study sample, (±SD)	Gestational weeks at admission (in weeks)
1	Chen et al. [43]	Retrospective cohort	Wuhan, China	12 Feb, 2020	9	29.9 (±2.9)	36-40
2.	Liu et al. [21]	Cross sectional	Hubei, China	7 Mar, 2020	15	32.0 (±5.0)	12-38
3.	Liu et al. [19]	Cross sectional	Hubei, China	11 Mar, 2020	41	NA	22-40
4.	Liu et al. [44]	Retrospective cohort	Hubei, China	28 Feb, 2020	13	29.7 (±2.1)	25-38
5.	Wang et al. [45]	Case report	Suzhou, China	28 Feb, 2020	1	28 (±NA)	30
6.	Chen et al. [46]	Retrospective cohort	Hubei, China	16 Mar, 2020	4	29 (±3.9)	37-38
7.	Zhu et al. [20]	Retrospective cohort	Hubei, China	10 Feb 2020	10	30.7 (±1.8)	NA
8.	Yu et al. [47]	Retrospective cohort	Wuhan, China	24 Mar, 2020	7	32.1 (±1.5)	37-41+

Note: NA: Not Available

Table 2. Detailed case specific symptoms of the COVID-19 infection among pregnant women.

Authors	Fever	Postpartum fever	Cough	Sore throat	Breathing difficulty	Myalgia	Fatigue[1]	Malaise	Diarrhea	Headache	Poor appetite
					Initial symptoms of COVID-19						
Chen et al. [43] (n=9)											
Case 1	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 2	✓	✓	✓	✗	✗	✓	✗	✗	✗	✗	✗
Case 3	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 4	✓	✓	✗	✗	✓	✗	✗	✗	✓	✗	✗
Case 5	✓	✓	✗	✗	✗	✓	✗	✓	✗	✗	✗
Case 6	✓	✗	✓	✓	✗	✓	✗	✓	✗	✗	✗
Case 7	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
Case 8	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 9	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗
Total (n)	7	6	4	2	1	3	0	2	1	0	0
Liu et al. [21] (n=15)	13	1	9	1	1	3	4	0	1	0	0
Pregnant (4)	4	0	3	0	1	0	1	0	0	0	0
Delivered (11)	9	1	6	1	0	3	3	0	1	0	0
Liu et al. [19] (n=41)	16	14	15	0	5	0	5	0	0	0	3
Liu et al. [44] (n=13)											
Case 1	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗
Case 2	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗
Case 3	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 4	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 5	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 6	✓	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
Case 7	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗
Case 8	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗	✗
Case 9	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗
Case 10	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗
Case 11	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗
Case 12	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 13	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Total	10	0	2	1	3	0	4	0	0	0	0
Wang et al. [45] (n=1)	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Chen et al. [46] (n=4)											

Case 1	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✗
Case 2	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗
Case 3	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗	✗
Case 4	✓	✗	✗	✗	✗	✗	✓	✗	✗	✓	✗
Total	3	0	2	0	3	0	2	0	0	2	0
Zhu et al. [20] (n=10)											
Case 1	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 2	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 3	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 4	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 5	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 6	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 7	✓	✗	✓	✓	✗	✗	✗	✗	✓	✗	✗
Case 8	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 9	✓	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 10	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Total	9	0	5	1	0	0	0	0	1	0	0
Yu et al. [47] (n=7)											
Case 1	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 2	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗
Case 3	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗
Case 4		✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
Case 5	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 6	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Case 7	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Total	6	0	1	0	1	0	0	0	1	0	0
Overall total (n=100)	65	21	38	5	14	6	15	2	4	2	3
Percentage (%)	65	21	38	5	14	6	15	2	4	2	3

Table 3. Treatments given to pregnant women following the COVID-19 infection and the delivery methods (if pregnancy had been ended with delivery).

Studies	Overall treatment			
	Oxygen support	Antiviral therapy[1]	Antibiotic therapy[2]	Corticosteroid
Chen et al. [43] (n=9)				
Case 1	✓	✓	✓	✗
Case 2	✓	✓	✓	✗
Case 3	✓	✓	✓	✗
Case 4	✓	✗	✓	✗
Case 5	✓	✗	✓	✗
Case 6	✓	✗	✓	✗
Case 7	✓	✓	✓	✗
Case 8	✓	✓	✓	✗
Case 9	✓	✓	✓	✗
Total (n)	9	6	9	0
Liu et al. [21] (n=15)				
Pregnant (n=4)	3	0	4	0
Delivered (n=11)	11	11	11	0
Liu et al. [19] (n=41)	-	-	-	-
Liu et al. [44] (n=13)	-	-	-	-
Wang et al. [45] (n=1)[a]	✓	✓	✓	✗
Chen et al. [46] (n=4)	-	-	-	-
Zhu et al. [20] (n=10)	2	5	✗	✗
Yu et al. [47] (n=7)[b,c]	✓	✓	✓	✗

Note: [1]Specific treatment: Arbidol, Oseltamivir, Lopinavir, Ritonavir, ganciclovir, interferon was given in the study of Wang et al. [45], Zhu at al. [20], and Yu et al. [47]; [2]Specific treatment: Cefoperazone Sodium, Cephalosporins, Quinolones, Macrolides, Sulbactam Sodium (anti-bacterial treatment) (Wang et al. and Zhu at al.); [a]Human Serum Albumin based delivery; [b] Traditional Chinese medicine was also used; [c] two patients were treated with a single antibiotic and five patients were given combination therapy

Table 4. Maternal and newborn adverse outcomes following the COVID-19 infection among pregnant women

SL no.	Authors	Still pregnant	Delivery	Normal delivery	C-section	Still birth	Live birth	Preterm birth	Maternal death	Neonatal death	Birthweight in kg, Mean (±SD)	Low birthweight	Neonatal asphyxia	COVID-19 in newborn
1	Chen et al. [43]	0	9	0	9	0	9	4	0	0	3.01 (±0.38)	1	0	0
2.	Liu et al. [21]	4	11	1	10	0	11	-	0	0	-	-	0	0
3.	Liu et al. [19]	-	-	-	-	-	-	-	0	0		-	-	-
4.	Liu et al. [44]	0	13	3	10	0	13	6	0	1	-	-	-	-
5.	Wang et al. [45]	0	1	0	1	0	1	0	0	0	1.83	1	0	0
6.	Chen et al. [46]	0	4	1	3	0	4	0	0	0	3.4 (±2.8)	0	0	0
7.	Zhu et al. [20]	0	10	3	7	0	10	6	1	0	2.4 (±1.6)	7	0	0
8.	Yu et al. [47]	0	7	0	7	0	7	0	0	0	3.3 (±1.4)	0	0	1

Note: kg: Killogram
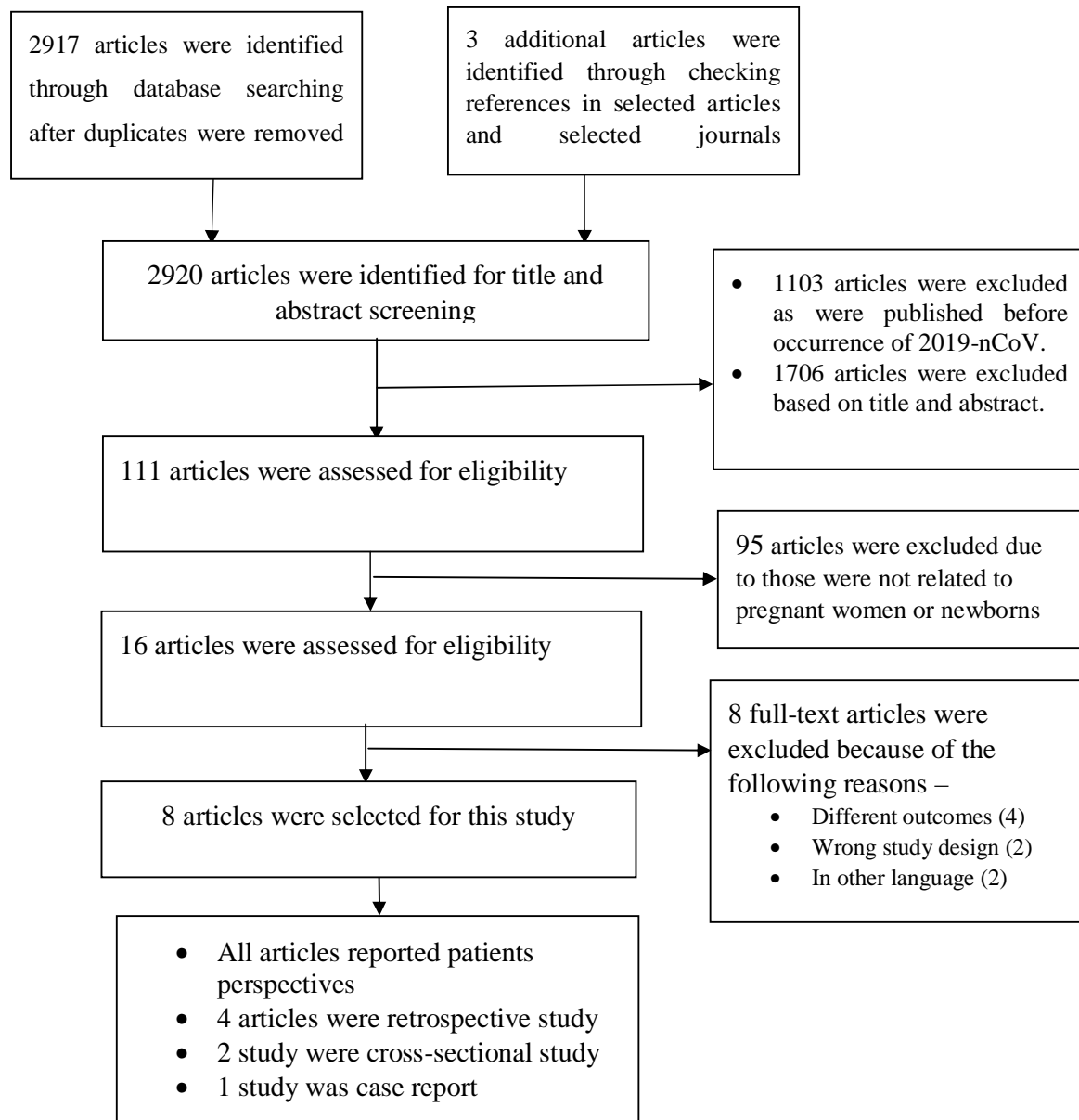
Figure 1. Schematic representation of studies included in the systematic review using PRISMA checklist and flow diagram
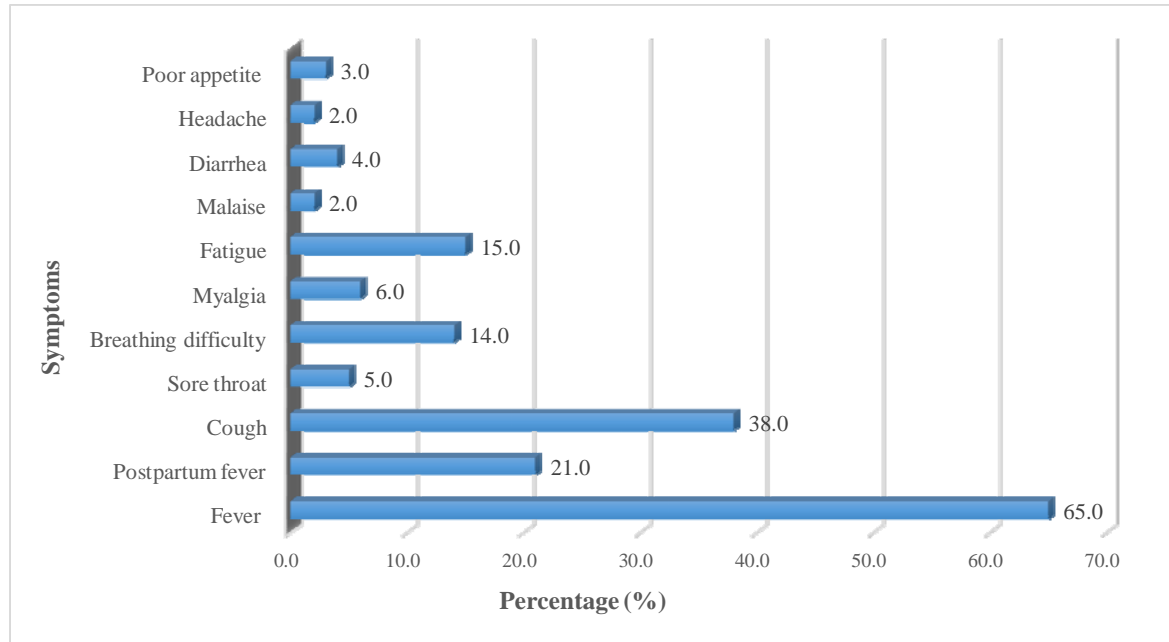
Figure 2. Symptoms of the COVID-19 infection during pregnancy.