




Evolution and outcomes of COVID-19 in the pregnancy puerperal cycle: integrative literature review

Evolução e desfechos da COVID-19 no ciclo gravídico puerperal: revisão integrativa da literatura

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ABSTRACT | OBJETIVO: To describe through national and international scientific literature the evolution and outcomes of COVID-19 in pregnant and puerperal women. **METHOD:** This is an Integrative Literature Review carried out with studies in electronic media; in august 2022 with data extracted from Latin American and Caribbean Literature in Health Sciences, on the Medical Literature Analysis and Retrieval System Online portal via the National Library of Medicine, in English or Portuguese and published as of december 2019. The studies were screened using the Rayyan web application, and the methodological assessment of the studies was carried out according to their level of evidence and quality assessed using tools developed by the Joanna Briggs Institute. **RESULTS:** The review included twenty-two articles from observational studies, presented in a table, from which the following categories emerged: "Risk factors, vulnerability and characteristics of COVID-19 in pregnant and puerperal women" and "Serious outcomes of COVID-19 in pregnant and puerperal women". The infection caused by SARS-CoV-2 has caused numerous public health problems worldwide, with serious repercussions in the health field, in which pregnant and puerperal women had a higher risk of needing intensive care, intubation, higher frequency of admission to the Intensive Care Unit and mortality. **CONCLUSION:** Pregnancy and the postpartum period can be an important risk factor associated with COVID-19, and pregnant and postpartum women had a higher risk of death and unfavorable obstetric outcomes. There was a higher risk of death among pregnant and postpartum women, especially black women compared to white and brown women.

KEYWORDS: COVID-19. Pregnancy Complications. Pregnancy. Postpartum. Maternal Death.

RESUMO | OBJETIVO: Descrever através da literatura científica nacional e internacional sobre a evolução e desfechos da COVID-19 em gestantes e puérperas. **MÉTODO:** Trata-se de uma Revisão Integrativa da Literatura realizada com estudos em meio eletrônico; em agosto de 2022 com dados extraídos de Literatura Latino-americana e do Caribe em Ciências da Saúde, no portal *Medical Literature Analysis and Retrieval System Online via National Library of Medicine*, nos idiomas inglês ou português e publicados a partir de dezembro de 2019. A triagem dos estudos foi realizada no aplicativo web *Rayyan*, sendo que a avaliação metodológica dos estudos foi realizada pelo seu nível de evidência e a qualidade avaliada por meio de ferramentas elaboradas pelo *Joanna Briggs Institute*. **RESULTADOS:** Vinte e dois artigos compuseram a revisão, todos eles originados de estudos observacionais, apresentados em quadro, dos quais emergiram as seguintes categorias: "Fatores de risco, vulnerabilidade e características da COVID-19 em gestantes e puérperas" e "Desfechos graves da COVID-19 em gestantes e puérperas". A infecção provocada pela SARS-CoV-2 ocasionou inúmeros problemas de saúde pública mundialmente, com grave repercussão no âmbito da saúde, em que gestantes e puérperas tiveram risco maior de precisar de cuidados intensivos, intubação, maior frequência de admissão na Unidade de Terapia Intensiva e mortalidade. **CONCLUSÃO:** A gravidez e o pós-parto podem ser um importante fator de risco associado à COVID-19 e as gestantes e puérperas apresentaram maior risco de morte e desfechos obstétricos desfavoráveis. Evidenciou-se o maior risco de óbito entre gestantes e puérperas, principalmente de cor preta comparadas às brancas e pardas.

PALAVRAS-CHAVES: COVID-19. Complicações na Gravidez. Gravidez. Período Pós-Parto. Morte Materna.

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1. Introduction

In December 2019, a new coronavirus was described, following cases of illness recorded in China, capable of causing a highly contagious and fatal acute respiratory infection, which within three months spread quickly and worldwide.^{1,2}

Between February and November 2020, among the cases hospitalized with Severe Acute Respiratory Syndrome (SARS), there were pregnant women. From the beginning of the pandemic until November 2020, 231 deaths were confirmed among black pregnant women.³ In December 2020, of the confirmed cases of COVID-19 in pregnant women, 351 died.⁴ Later, in 2021, there was a proportion of pregnant women who required hospitalization⁵, a situation that continued in the first half of 2021 between April and August^{6,7}, and among maternal deaths resulting from COVID-19⁸, brown skin color was more frequent.^{9,10}

One of the first studies with pregnant women, carried out in China with three cases, concluded that there was no evidence of vertical transmission and that adverse maternal effects were rare.¹¹ Nine cases were aged between 26 and 40 years and 36 to 39 weeks of pregnancy, and all underwent cesarean section. Regarding the evolution of the pregnancy, one patient developed hypertension during pregnancy and the other developed pre-eclampsia at 31 weeks of gestation, both remaining stable throughout the pregnancy. Four pregnant women gave birth prematurely, but all occurred after 36 weeks of gestation. The authors concluded that clinical signs of COVID-19 pneumonia in pregnant women were similar to those in non pregnant women and found no evidence of vertical transmission.¹²

At the beginning of the pandemic, there was uncertainty about the effects of the virus on pregnancy and birth.^{12,13} However, as studies advanced, it became clear that pregnant women were at an increased risk of infection with SARS-CoV-2 compared to with the general population.¹⁻¹⁰ However, when pregnant women are infected, additional concerns arise due to the physiological changes typical of pregnancy, such as increased respiratory and immunological demands, which can increase the risk of complications.

The outcomes of COVID-19 in the pregnancy and puerperal cycle vary, from asymptomatic forms to

severe cases that require admission to the Intensive Care Unit (ICU) and, in some cases, result in maternal death. Additionally, there are concerns about the potential adverse effects of the infection on fetal and neonatal health, including premature birth and intrauterine growth restriction.¹³ It was still unknown whether COVID-19 increased the risk of miscarriage; experts in the media have expressed concerns about women terminating pregnancies for fear of congenital infection. However, scientific information about the effect of COVID-19 on the course and outcome of pregnancy in the first and second trimesters was not yet available.¹⁴

In another case series carried out in 2020 in China, 12 pregnancies had a fatality rate of 25%, complications included Severe Acute Respiratory Syndrome (SARS) in four cases, disseminated intravascular coagulopathy in three cases, renal failure in three cases, secondary bacterial pneumonia in two and sepsis in two patients. Mechanical ventilation was 3 times more likely among pregnant women compared to non pregnant women, among seven infections in the first trimester, four ended in miscarriage, and four out of every five women with SARS after 24 weeks of gestation had a premature birth.¹⁵

It is worth noting that, for Middle East Respiratory Syndrome, there were 13 reports of cases in pregnant women in China, of which two were asymptomatic, identified as part of a contact investigation; three patients (23%) died, two pregnancies ended in fetal death and two premature births.¹² Pregnant women represent a high-risk population during infectious disease outbreaks, physiological and mechanical changes in pregnancy increase susceptibility to infections in general, particularly when the cardiorespiratory system is affected, and stimulate rapid progression to respiratory failure in pregnant women.¹⁶

The scenario in Latin America in 2020 is reported by Brazilian researchers in a Letter to the Editor, in which they report that in Brazil, Iran and Mexico, there is the possibility of an increased risk of maternal death from COVID-19. Therefore, it is possible that we SARS-COV-2 virus in the pregnancy puerperal cycle, developing countries, limited resources for the provision of health care have a high risk of maternal death due to COVID-19.¹³ In the global context, literature reviews, which aimed to identify the evolution of COVID-19 in pregnant and postpartum women according to

color of the skin included six studies, three carried out in North America, two in Latin America and one in Europe. It is noteworthy that two Latin American studies were carried out in Brazil and found black skin color to be a risk factor for severe COVID-19.¹⁶⁻¹⁹ Data released by the United Nations (UN) observed that maternal mortality in women black women by COVID-19 was almost twice as high as that observed in white women.^{20,21}

Considering the gaps in knowledge about the consequences of COVID-19 during pregnancy and the postpartum period, the need for knowledge about the evolution of the disease, the possibility of clinical outcomes, and to recognize that pregnant and postpartum women face unique physiological and immunological changes becomes evident, which may influence susceptibility to SARS-CoV-2 infection. And since the outcome of COVID-19 affects the obstetric population, it is essential to implement preventive and appropriate management measures, aiming to protect obstetric health. Therefore, this study is justified, aiming to describe, through national and international scientific literature, the evolution and outcomes of COVID-19 in pregnant and postpartum women.

2. Method

This is an Integrative Literature Review (ILR), capable of determining current knowledge on a specific topic, by allowing the analysis and synthesis of results from independent studies on the same subject.²² Therefore, it followed six steps for its execution, being they: 1 - elaboration of the guiding question; 2 - definition of the sample, based on the establishment of criteria for inclusion/exclusion of studies and the search in the scientific literature; 3 - data collection, with the description of the characteristics of the selected studies; 4 - critical analysis of studies, carried out based on the definition of the level of evidence; 5 - interpretation of results and 6 - presentation of the review.²²

To define the guiding question of the study, the PICO²³ strategy was used, an acronym for Patient, Intervention, Comparison and Outcomes, where: "P" - pregnant and postpartum women with COVID-19; "I" - hospitalization; "C" - comparison between pregnant

and postpartum women; and "O" - outcomes: maternal death from COVID-19. Thus asking: What is the outcome of pregnant and postpartum women with COVID-19 during the pandemic?

The following inclusion criteria were established: articles that answered the study question; available in full electronically; in English or Portuguese and published from December 2019 until the date of data collection. The exclusion criteria were: duplicate articles, letters, editorials, experience reports, reviews, course completion works, dissertations and theses, and studies that did not suit the research problem and the objective of the study. The time frame was established considering the emergence of the coronavirus in China in December 2019.

The literature search took place in August 2022 in the following databases: Latin American and Caribbean Literature in Health Sciences (LILACS), on the Medical Literature Analysis and Retrieval System Online (MEDLINE) portal via the National Library of Medicine (PUBMED). The search in the selected databases/portal was carried out with the descriptors selected individually using the Boolean operator AND/OR, using terms indexed in the structured vocabulary of the Health Sciences Descriptors (DeCS) of the Virtual Health Library (VHL) and Medical Subject Headings (MeSH terms) using the terms: COVID-19 AND (Gestantes OR Pregnant Women OR Grávidas OR Mulher Grávida OR Mulheres Grávidas) AND (Período Pós-parto OR Cuidado Pós-Natal) AND (Unidades de Terapia Intensiva OR Intensive Care Units OR Unidades de Cuidados Intensivos OR Unidade de Terapia Intensiva OR Unidade de Terapia Intensiva Especializada OR Unidades de Terapia Intensiva UTI OR Hospitalização OR Hospitalization OR Internação Hospitalar) AND (Morte OR Death OR Experiência de Quase Morte OR Falecimento OR Fim da Vida OR Final da Vida OR Óbito).

After searching each database, studies were managed in EndNote X7, where duplicate studies were removed. The articles were reviewed using the Rayyan web application and studies that met the inclusion criteria were selected. Titles and abstracts were subsequently read to assess whether they met the eligibility criteria for this study. In the second stage, two reviewers read the articles independently and blindly, selecting the articles based on their criteria.

If there was disagreement between reviewers, a third reviewer could resolve the disagreement.

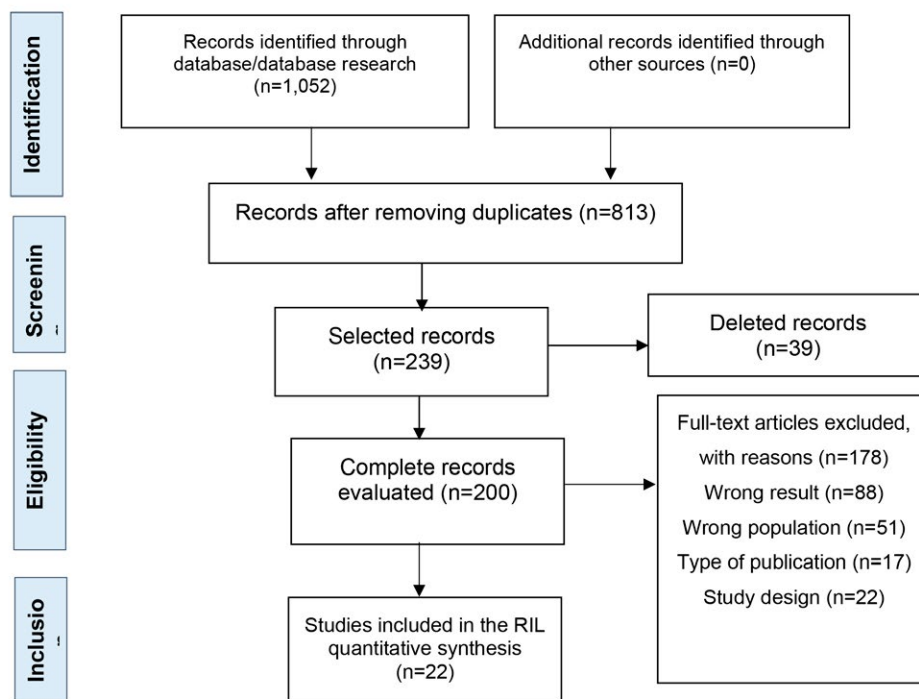
The search in the selected databases involved the individual application of the selected descriptors; to improve the results, all combinations between these descriptors were performed. Initially, crossings were made two by two and, when necessary to reduce to facilitate selection, additional descriptors were gradually included, thus making the search more precise.

The assessment of the methodological quality of the studies was carried out through the level of evidence, taking into account Melnyk & Fineout-Overholt (2005), thus, it was considered as level 1: studies that come from systematic reviews, relevant randomized controlled clinical studies, or clinical guidelines based on systematic reviews of randomized controlled clinical studies; level 2: randomized controlled clinical studies; level 3: clinical studies without randomization; level 4: cohort and case-control studies; level 5: originating from a review of descriptive and/or qualitative studies; level 6: descriptive or qualitative study; level 7: research originating from the opinion of authorities and reports from expert committees.²³ At this stage, two reviewers carried out the assessment of methodological quality independently and in cases of disagreement, a third reviewer participated in order to resolve the differences, which was not necessary in this study.

During the critical review phase, it was decided to evaluate the methodological quality of the primary studies included in the sample using a tool recommended by Johns Hopkins Nursing Practice. Study data were collected in Excel, containing the following information: study, year of publication, objectives, methodological characteristics (study design) and main results. The methodological quality of the primary studies was assessed using tools developed by the Joanna Briggs Institute (JBI), composed of questions, each of which was answered by the evaluator using the questions to assess the internal validity and risk of bias of the studies.

It is noteworthy that data extraction was also carried out by two independent reviewers and divergences were resolved by a third reviewer, and presented in the flowchart (Figure 1).

Figure 1. Flowchart of searches and the process of including studies in the databases/data portal adapted from Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)



Source: Prepared by the authors adapted from the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA). São Paulo – SP, Brazil. 2023.

Data analysis and synthesis were carried out in a descriptive manner and are founding the summary table (Table 1). It should be noted that it was not necessary to submit the study to the Research Ethics Committee (CEP), as the research does not directly involve human beings, being a RIL.²⁴ The steps defined for the development and the procedures carried out to approach the object and operationalization of the RIL are registered in Figshare (<https://figshare.com/>) under the identification of the Digital Object Identifier (DOI) accessible at: <http://dx.doi.org/10.6084/m9.figshare.23804793>.

3. Results

The RIL sample comprised twenty-two articles, with the publications analyzed originating from observational studies, published in journals indexed in LILACS (n=2), PUBMED/MEDLINE (n=20). Four articles were published in 2020, fourteen in 2021 and three in 2022. Regarding the research design, cross-sectional (n=11), cohort (n=7), case-control (n=2), descriptive (n=1) and descriptive qualitative (n=1), developed in the following countries: South Africa (n=1), Brazil (n=15), United States of America (n=2), France (n=1), Iran (n=2) and Switzerland (n=1). The summary table of the studies is presented below.

Table 1. Summary table containing title, authors, type of study and main results (to be continued)

ID	Title	Authors Year	Kind of study	Results
A1	Maternal Deaths from COVID-19 in Brazil: Increase during the Second Wave of the Pandemic	Scheler CA, Discacciati MG, Vale DB, Lajos GJ, Surita FG, Teixeira JC ²⁵ / 2022	Cross-sectional study	They identified that there were 377 maternal deaths in 2020 and 804 in 2021. The mortality rate increased 2.0 times for the obstetric groups
A2	Clinical characteristics and risk factors for maternal deaths due to COVID-19 in Brazil: a nationwide population-based cohort study	Siqueira TS, de Souza EKG, Martins-Filho PR, Silva JRS, Gurgel RQ, Cuevas LE, Santos VS ²⁶ / 2022	Cross-sectional study	There were 1,858 deaths (12.3%) for a maternal mortality rate per 1,000 patient-days. Black and brown skin color had a higher risk of death than white women
A3	Progression of COVID-19 Among Black Pregnant Women: Population-Based Study	Dos Santos GG, de Andrade LH, de Sordi MAP, Nunes HRC, Parada CMGL ²⁷ / 2022	Cross-sectional study	Black pregnant women had a risk of death approximately five times higher compared to white and mixed-race women
A4	Maternal mortality associated with COVID-19 in Brazil in 2020 and 2021: Comparison with non-pregnant women and men	Gonçalves BMM, Franco RPV, Rodrigues AS ²⁸ / 2021	Cross-sectional study	The maternal population had a higher risk of death, suggesting that pregnancy and postpartum may be an important risk factor associated with severe COVID-19
A5	Obstetrical outcomes and maternal morbidities associated with COVID-19 in pregnant women in France: A national retrospective cohort study	Epelboin S, De Labrosse J, Mouzon J, Fauque P, Gervoise-Boyer MJ, Levy R, et al ²⁹ /2021	Cohort study	An increase in the frequency of pregnant women with maternal morbidities and diagnosis of COVID-19 was observed compared to pregnant women without COVID-19
A6	COVID-19 outcomes in hospitalized puerperal, pregnant, and neither pregnant nor puerperal women	Serra FE, Francisco RPV, de Lourdes RP, Brizot ML, Rodrigues AS ³⁰ / 2021	Cohort study	Pregnant women had a higher frequency of anosmia and ageusia than the others. Postpartum women had a worse prognosis than pregnant women in relation to ICU admission, invasive ventilatory support and death

Table 1. Summary table containing title, authors, type of study and main results (continuation)

ID	Title	Authors Year	Kind of study	Results
A7	Maternal characteristics and pregnancy outcomes of hospitalized pregnant women with SARS-CoV-2 infection in South Africa: An International Network of Obstetric Survey Systems-based cohort study	Budhram S, Vannevel V, Botha T, Chauke L, Bhoora S, Balie GM et al ³¹ / 2021	Cohort study	There were 39 deaths in women hospitalized for COVID-19, compared to women hospitalized for other indications, where 106 required intensive care
A8	Factors associated with death in postpartum women with COVID-19: a Brazilian population-based study	Bonatti AT, Miller NC, Leite MAB, Jensen R, Parada CMGL ³² / 2021	Cross-sectional study	The proportion of deaths was 20.2% in the first period and 11.2% in the second. The probability of death increased in both periods due to dyspnea, respiratory discomfort and low saturation
A9	COVID-19 prevalence, symptoms, and sociodemographic disparities in infection among insured pregnant women in Northern California	Ames JL, Ferrara A, Avalos LA, Badon SE, Greenberg MB, Hedderson MM, et al ³³ / 2021	Qualitative and descriptive study	Loss of smell was a unique and common symptom reported, of women with symptomatic COVID-19, approximately 2% were hospitalized, 71% had a telehealth visit, and 75% were quarantined at home
A10	The tragedy of COVID-19 in Brazil: 124 maternal deaths and counting	Takemoto MLS, Menezes MO, Andreucci CB, Nakamura-Pereira M, Amorim MMR, Katz L, Knobel R ³⁴ / 2020	Cross-sectional study	Of the 978 positive cases, 207 (21.2%) were admitted to the ICU (134 recovered cases and 73 fatal cases). No ventilatory support was offered to 14.6% of all fatal cases, while the remaining 21.4% received non-invasive ventilation only.
A11	Mortality in pregnancy and the postpartum period in women with severe acute respiratory distress syndrome related to COVID-19 in Brazil, 2020	Scheler CA, Discacciati MG, Vale DB, Lajos GJ, Surita F, Teixeira JC ³⁵ / 2021	Cross-sectional study	The COVID-19-related mortality rate in the obstetric group was 7.8%. Deaths from COVID-19 were 4.4 times higher than SARS due to other etiologies and twice as high in black women
A12	Pregnancy outcomes among SARS-CoV-2-infected pregnant women with and without underlying diseases: a case-control study	Ghelichkhani S, Jenabi E, Jalili E, Alishirzad A, Shahbazi F ³⁶ / 2021	Case-control study	The results revealed that preterm labor, preeclampsia and eclampsia were higher in women with COVID-19 and underlying illnesses than those without pathologies.
A13	COVID-19-related deaths among women of reproductive age in Brazil: The burden of postpartum	Knobel R, Takemoto MLS, Nakamura-Pereira M, Menezes MO, Borges VK, Katz L et al ³⁷ / 2021	Cross-sectional study	Pregnant women with cancer, diabetes mellitus, obesity and rheumatologically diseases were at risk of death. In the postpartum period, age over 35 years and diabetes mellitus were associated with a greater chance of death
A14	Maternal outcomes and risk factors for COVID-19 severity among pregnant women	Vouga M, Favre G, Martinez-Perez O, Pomar L, Acebal LF, Abascal-Saiz A et al ³⁸ / 2021	Case-control study	Women who had pulmonary comorbidities, hypertensive disorders and diabetes were at greater risk of cesarean section and premature birth
A15	Disproportionate Impact of Coronavirus Disease 2019 (COVID-19) Among Pregnant and Postpartum Black Women in Brazil Through Structural Racism Lens	de Souza DS, de Oliveira M, Andreucci CB, Nakamura-Pereira M, Knobel R, Katz L, Salgado HO, et al ³⁹ / 2021	Cross-sectional, exploratory, population-based study	There was a similar mean age and morbidity profile between black and white women, but black women were hospitalized in worse conditions, had higher rates of ICU admission, mechanical ventilation and death.

Table 1. Summary table containing title, authors, type of study and main results (conclusion)

ID	Title	Authors Year	Kind of study	Results
A16	Maternal and Neonatal Outcomes of SARS-CoV-2 Infection in a Cohort of Pregnant Women with Comorbid Disorders	Teixeira MLB, Costa FJ, João E, Fuller T, Silva EJS, Mendes-Silva W et al ⁴⁰ / 2021	Cohort study	The proportion of SARS-CoV-2 infection was 28.7%. The obesity rate was 60.9%, vascular hypertension 40.0% and HIV 21.7%. The most common clinical presentations were ageusia (21.2%), anosmia (18.2%) and fever (18.2%)
A17	The risk of clinical complications and death among pregnant women with COVID-19 in the Cerner COVID-19 cohort: a retrospective analysis	Qeadan F, Mensah NA, Tingey B, Stanford JB ⁴¹ /2021	Retrospective cohort study	The results indicate that pregnant women, compared to non-pregnant women, had higher hospitalization rates, but there were no significant differences in the rates of invasive ventilation or death.
A18	The impact of the COVID-19 pandemic on maternal mortality in Brazil: 523 maternal deaths by acute respiratory distress syndrome potentially associated with SARS-CoV-2	Nakamura-Pereira M, Knobel R, Menezes MO, Andreucci CB, Takemoto MLS ⁴² / 2021	Retrospective cohort study	The peak of COVID-19 cases and deaths occurred between epidemiological weeks 17 and 30, while indeterminate cases peaked from weeks 11 to 34. Postpartum deaths represented 41.6% (151/363) and 47.5% (76/160)
A19	Maternal mortality by COVID-19 in Brazil	Souza ASR, Amorim MMR ⁴³ / 2021	Descriptive study	When comparing the frequency of patients with SARS without and with COVID-19, a mortality rate for COVID-19 (8.4%) is observed, which is higher than for SARS, due to other or undetermined causes (3.7%)
A20	Clinical characteristics and risk factors for mortality in obstetric patients with severe COVID-19 in Brazil: a surveillance database analysis	Takemoto M, Menezes MO, Andreucci CB, Knobel R, Sousa L, Katz L, Fonseca EB, et al ⁴⁴ / 2020	Cross-sectional, exploratory, population-based study	124 maternal deaths, with 58.9% admitted to the ICU, 53.2% on invasive ventilation and 29.0% without respiratory support
A21	Maternal and neonatal outcomes in COVID-19 infected pregnancies: a prospective cohort study	Pirjani R, Hosseini R, Soori T, Rabiei M, Hosseini L, Abiri A, Moini A et al ⁴⁵ / 2020	Cohort study	The percentage of patients (4/66, 6.06%) admitted to the ICU was significantly higher than the control group
A22	Risk factors for adverse outcomes among pregnant and postpartum women with acute respiratory distress syndrome due to COVID-19 in Brazil	Menezes MO, Takemoto MLS, Nakamura-Pereira M, Katz L, Amorim MMR, Salgado HO, et al ⁴⁶ / 2020	Cross-sectional, exploratory, population-based study	There were 2,475 cases, among the deaths, 5.9% were not hospitalized, 39.7% were not admitted to the ICU, 42.6% did not receive mechanical ventilation and 25.5% did not have access to respiratory support

Source: Prepared by the authors adapted from the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA). São Paulo – SP, Brazil. 2023.

4. Discussion

When analyzing the studies, in order to answer the research question, the following categories emerged: "Risk factors, vulnerability and characteristics of COVID-19 in pregnant and postpartum women" and "Serious outcomes of COVID-19 in pregnant and postpartum women".

4.1 Risk factors, vulnerability and characteristics of COVID-19 in pregnant and postpartum women

The risk and vulnerability factors of pregnant or postpartum women were: maternal age, skin color, obesity, clinical conditions, obstetric or not, concomitant with pregnancy (cancer, diabetes mellitus and rheumatologically diseases). There was a significant increase in COVID-19 in 2021 in almost all Brazilian states, however, this increase was more pronounced in the North of Brazil, the epicenter of the first wave of infections.²⁵

A retrospective study shows that pregnant women had a higher frequency of admission to the ICU, mortality eclampsia, gestational hypertension, postpartum hemorrhage, fetal distress and emergency cesarean section.²⁹ A multicenter study revealed a total of women with severe hypertension (94%) (6,315/6,706), while 349 cases had organ dysfunction or failure. The prevalence of chronic arterial hypertension was 22.9% and diabetes was 2.7% among all women with severe hypertension, with no significant association with the outcome. Present a history of heart disease, acute pulmonary edema, postpartum hemorrhage and early onset of the disease in relation to gestational age, or hypertension far from term, transfusion of blood products, ICU admission, invasive mechanical ventilation unrelated to anesthesia and longer periods of hospitalization were highlighted as significant management procedures associated with worse outcomes.¹³

Regarding the characteristics of COVID-19, pregnant women had a higher frequency of anosmia and ageusia than the others. Postpartum women had a worse prognosis than pregnant women regarding admission to the ICU. Loss of smell was a unique and common symptom reported by women with symptomatic COVID-19. Between February 2020 and September 2021, of the cases in pregnant and

postpartum women, the most frequent signs and symptoms were: cough, shortness of breath, fever, respiratory discomfort and hypoxemia. Overall, 8,936 patients had no comorbidities, 4,117 had one, 1,164 had two, and 388 had three or more comorbidities.²⁶ Smoking was reported at between 2.7% and 3.6% and maternal tuberculosis and HIV infection were associated with hospitalization. The maternal mortality rate was high among women admitted with SARS-CoV-2 infection and higher in women admitted primarily for COVID-19 with tuberculosis.³¹

Black and brown skin color presented a higher risk of death than white women.^{18,19,39} However, black pregnant women presented a risk of death approximately five times higher compared to white and brown women.²⁸ Even with the average age and profile of similar morbidity between black and white women, black women were hospitalized in worse conditions, had higher rates of ICU admission, mechanical ventilation and death. Age over 35 years and diabetes mellitus were associated with a greater chance of death in postpartum women.²⁸

Two studies carried out in Brazil, using the same database SIVEP-Gripe covering the entire population, identified a difference in the incidence of COVID-19 between pregnant and postpartum women of different ethnicities. Although similarities were observed in mean ages and disease profiles between the two groups, black women had a more severe disease outcome: greater number of hospitalizations for serious conditions, higher rates of ICU admission, use of mechanical ventilation and death.³⁹ In a multivariate analysis, black pregnant and postpartum women had a 50% higher risk of suffering adverse outcomes related to COVID-19, compared to white women. Consequently, in both studies carried out in Brazil, a more unfavorable outcome⁴⁶⁻⁴⁹ was found among black pregnant and postpartum women infected with COVID-19, compared to white women.^{39,46}

The social, environmental and structural effects in the United States of America (USA) include differences in the prevalence of underlying chronic conditions and the disproportionate impact of socioeconomic determinants of health related to the pandemic.

Having chronic lung disease, diabetes, hypertension or obesity can contribute to increasing vulnerability to COVID-19.⁵⁰ When considering comorbidities, three epidemiological studies carried out in Brazil indicate that pregnant women had a 4.4 times higher frequency of death in the presence of comorbidities and 6.7 times higher in the absence of comorbidities compared to SARS due to other etiologies.^{18,19,35}

The majority of women with severe hypertension suffered some type of delay in care^{13,43,48} (55.6%) and these were the second type, that is, related to the health system and the third type, those related to health professionals.¹³

In relation to the number of cases in the Central-West and South regions of Brazil, the proportion of deaths was 20.2% in the first six months of the pandemic and 11.2% at the time of the second wave (six months later)²⁷, dyspnea was the most common respiratory symptom, followed by cough, fever, odynophagia, headache, runny nose, anosmia, diarrhea and myalgia.^{18,19,32,40,41,45} In a Brazilian retrospective analysis, pregnant women with cardiovascular or chronic kidney disease, asthma or diabetes, admitted to the ICU, with ventilatory support were less likely to die, and postpartum women were more likely to die than pregnant women when both had diabetes, ventilatory support or admission to the ICU.^{30,33} However, a series of reports of cases highlighted the clinical evolution and results of three pregnant women who acquired SARS-CoV-2 infection at the end of pregnancy, two of whom had a cesarean section in the third trimester and all patients had an uneventful perinatal course and successful and no baby was infected by vertical transmission or during birth.¹²

4.2 Serious outcomes of COVID-19 in pregnant and postpartum women

Pregnancy and the postpartum period can be an important risk factor associated with COVID-19. Pregnant and postpartum women had a higher risk of death and unfavorable obstetric outcomes. The results of the studies indicate that pregnant women, compared to non pregnant women, had higher hospitalization rates, although there was no marked

difference in the rates of invasive ventilation or death. The same can be observed in postpartum women. The results revealed that cases of preterm labor, preeclampsia and eclampsia were higher in women with COVID-19. Likewise, pregnant women with pulmonary comorbidities, hypertensive disorders and diabetes had a higher risk of cesarean section and preterm birth.¹²

The risk of death prevails in women over 35 years of age compared to women under 20 years of age, with black/brown skin color and residing in the Southeast, Northeast and North regions in relation to the South region of Brazil²⁶, with pregnant women with black skin color were approximately five times more likely to die.²⁷ The proportion of white and black pregnant and postpartum women was 3:1, respectively, with a worse evolution of COVID-19 among black women with a higher proportion of hospitalization in conditions of greater severity; higher rates of ICU admission, use of mechanical ventilation and death. Thus, indicating that processes originating outside the hospital can affect pregnant and postpartum women disproportionately, impacting the evolution of the disease, due to the intersection between gender, race and social class.³⁶⁻³⁹

It is also worth mentioning that postpartum women with COVID-19 had twice the risk of adverse effects, for example, admission to the ICU, need for mechanical ventilation and death, than pregnant women, the proportion of deaths among postpartum women was high, and was associated with death respiratory signs/symptoms, need for mechanical ventilation and intensive care.^{30,32,37} Lower gestational age at the time of hospital admission due to severe hypertensive disorders (early onset of the disease) and also postpartum admission were strongly associated to serious maternal outcomes. Furthermore, women with comorbidities had approximately twice the rate of elective cesarean sections.¹³ Also evaluating clinical, social and access to health services factors, it was concluded that being a black pregnant or postpartum woman constituted a risk factor independently associated with results adverse effects of COVID-19.⁴²⁻⁴⁴

A case series conducted in 2020 in China, all nine patients had a cesarean section in the third trimester, seven patients had fever, other symptoms including cough (in four of the nine patients), myalgia (in three), sore throat (in two) and malaise (in two) were also observed, none of the patients developed severe COVID-19 pneumonia or died.^{11,12}

A Brazilian study carried out in 2020 with 978 cases highlights that 22.6% of women who died were not admitted to the ICU and that only 64.0% had invasive ventilation. No ventilatory support was offered to 14.6% of all fatal cases, while the remaining 21.4% received only non-invasive ventilation.³⁴ Another survey showed that 553 pregnant and postpartum women died, with 354 lives lost to COVID-19, when comparing the frequency of SARS patients without and with COVID-19.²⁴ A maternal deaths had a lower risk of occurrence than deaths of women of childbearing age. Regarding social variables, the risks of maternal death were higher among black women, women living in rural areas and women receiving care outside their cities of origin. Regarding hospitalization, women who died during pregnancy and childbirth were more likely to have been admitted to the ICU and to have been subjected to invasive ventilatory support.⁵⁰

Studies reinforce that the morbidity and mortality of COVID-19 was correlated to the burden of chronic conditions and the low capacity of health services for testing and provision of hospital beds, a situation that is aggravated in countries or regions with high social inequality.⁴⁷⁻⁴⁹ The infection has caused numerous public health problems worldwide in the spheres: society, market, and civil society, with a major disastrous repercussion in the health sector, requiring immediate interventionist measures to mitigate mortality rates. At the beginning of the infection, scientific evidence did not point to pregnant and postpartum women as a risk group, due to the probable fact of low assistance in East Asia, specifically in China, the first country to be affected by the infection, thus reflecting in maternal deaths that were not were published.

As a limitation of the study, it is evident that all articles are characterized by a low level of evidence, on this subject they still present some weaknesses and gaps such as: single center, different comparison systems, small sample size and lack of randomization. On the

other hand, there is a time frame related to the fact that the pandemic is recent, and there is no time for more robust research. Despite the limitations, this study contributed significantly to the advancement of Obstetric Nursing and Public Health, to understand the impact of the pandemic on the obstetric population and health systems, encouraging studies to be carried out in the context before, during and after the COVID-19 pandemic. In summary, research on COVID-19 in the pregnancy puerperal cycle is essential to protect maternal and neonatal health, identify risk factors, optimize clinical management, ensure the safety of interventions and prevent vertical transmission of the virus, thus contributing to a more effective response to the pandemic.

The implication of this study arises from gaps still present, there is a need to continue studies in the maternal and child group, when considering that the scientific literature does not present concrete bases to enable in-depth knowledge of the impact of COVID-19 on the pregnancy puerperal cycle, especially in terms of skin color, which is essential knowledge for planning and managing strategies. Finally, it is suggested that studies be carried out with more robust methodological designs and analyzes that can measure the questions that need to be answered about women's health during the pandemic, to better understand the maternal, fetal and neonatal clinical outcomes of COVID-19.

5. Conclusion

It is evident from this review that several Brazilian studies, as well as international studies, report a higher risk of death among black pregnant and postpartum women, compared to white and brown women. Improving the quality of health care implies the elimination of racial inequities, as racial disparities in the pregnancy-puerperal cycle process contribute to disparities in final health indicators. It must be considered that there will be other consequences of the crisis caused by the pandemic, by impacting the quality of care and generating, among other problems, greater exposure and increased rates of cesarean sections performed without clinical indication, an increase in gender and obstetric violence, racism, between others. It is considered that poor, black, peripheral, Indigenous women,

those living in prison or on the streets, among other conditions that constitute barriers to accessing health services, should also be prioritized in Brazilian public health policies.

Therefore, there is still a need for continued studies in the obstetric population, aiming to better understand the risks and outcomes of COVID-19 during the pregnancy-puerperal cycle to enable in-depth knowledge of the impact of the disease on the pregnancy-puerperal cycle, especially depending on the color of the skin, with this knowledge being essential for planning and managing strategies for promoting, preventing, rehabilitating and maintaining health.

Amid this search for knowledge, it is essential that public health policies and clinical practices are based on solid evidence, thus ensuring the best possible care for this vulnerable population. For example, as specific vaccines for COVID-19 are developed and implemented, it is crucial to understand how these interventions affect pregnant and postpartum women, as well as the safety and effectiveness of these measures to protect both women and babies during the pregnancy and postpartum cycle.

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Author contributions

dos Santos GG, de Andrade LH, Ferro TA and Cardoso AMR, participated in the conception of the research question, methodological design, search and statistical analysis of research data, interpretation of results and writing of the scientific article. dos Santos GG, de Andrade LH, da Silva ACL, Nascimento ES worked on data collection and interpretation, participated in the design of the research question, methodological design and statistical analysis of research data. dos Santos GG, da Silva ACL, Nascimento ES participated in the interpretation of the results of the scientific article, dos Santos GG and Cardoso AMR carried out the review of the final version. All authors reviewed the final version and are in agreement with its publication.

Conflicts of interest

No financial, legal, or political conflicts involving third parties (government, private corporations and foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and financing, advisory board participation, study design, preparation manuscript, statistical analysis, etc.).

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