Clinical and Evolutionary Characteristics of Pregnant and Postpartum Women with COVID-19 Admitted to a Hospital in the Central Region of Brazil

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Abstract

Objective: To describe the demographic and evolutionary characteristics of pregnant and postpartum women with coronavirus disease 2019 (COVID-19) admitted to a hospital in the Central Region of Brazil. Method: This is a descriptive and retrospective study, collected from medical records, from March 2020 to October 2021 in a hospital located in Cuiabá (MT). Results: Pregnant and puerperal women with COVID-19 who needed hospitalization were mixed-race, from the metropolitan area, and carriers of moderate and severe forms of the disease. The primary risk condition found was overweight/obesity, and pre-gestational diabetes, hypertension, asthma, and autoimmune disease were the most prevalent comorbidities in the group. Elevated lactate dehydrogenase (LDH), c-reactive protein (CRP), and D-dimer were relevant laboratory findings in this group of patients. The most frequent maternal outcomes were respiratory failure, invasive ventilatory support, thromboembolic phenomena, sepsis, and preterm labor. Maternal death occurred in 6.4% of pregnant women. Most maternal deaths were of women who lived in the interior of the state, and the minority arrived on adequate ventilatory support. Prematurity and the need for neonatal intensive care unit (NICU) were significant complications for neonates. Stillbirth/neonatal mortality occurred in 11.0%. Conclusion: The clinical conditions at hospitalization were associated with worse living conditions and lack of access to health care, resulting in increased chances of severity and worsening outcomes in this group of women and neonates.
Keywords
Analysis of Consequences, Coagulation Disorders, Coronavirus Disease 2019, Intensive Care, Maternal Mortality, Neonatal Outcomes, Pregnancy, SARS-CoV-2

1. Introduction
The first published studies related to coronavirus disease 2019 (COVID-19) showed no increased risk of morbidity and mortality in the obstetric population [1] [2]. However, more recent studies indicate that COVID-19 infection may have more adverse effects in pregnant women compared to nonpregnant women, increasing the maternal mortality rate and significant neonatal complications [3] [4].

Critical meta-analysis studies have identified that pregnant women with COVID-19 are more asymptomatic than nonpregnant women of the same age group with COVID-19. However, these pregnant women with COVID-19 indicated a higher likelihood of fatal complications associated with the disease, resulting in a high mortality rate [4] [5].

In addition to the increased risk of maternal morbidity and mortality, perinatal and neonatal outcomes in children born to pregnant women with COVID-19 are also significantly worse, such as a three-fold increase in neonatal intensive care unit (NICU) admissions [6] [7].

The Pan American Health Organization (PAHO) reported that in 2020 there was a significant increase in cases of infected pregnant and postpartum women and deaths maternal deaths from COVID-19 in 12 countries. Brazil had the highest number of deaths and an alarming maternal mortality rate of 7.2%, more than double the current mortality rate of the country’s general population, which is 2.8% [8].

The Brazilian Obstetric Observatory COVID-19 pointed out that COVID-19-induced SARS in January 2022 reached 18,881 cases in pregnant and postpartum women, with a fatality rate higher than that reported by PAHO in 2021 (11.5%), and the mortality was higher in the third trimester (37.8%) and the puerperal period (32.8%). Notably, 20.1% of pregnant or puerperal women who died had no access to an intensive care unit (ICU), and 32.3% had no access to invasive ventilatory support [9].

This study describes the demographic, clinical, laboratory, and evolutionary characteristics of pregnant and postpartum women with COVID-19 admitted to a medium-sized hospital in the Central Region of Brazil in the period 2020-2021.

2. Patients and Methods
This is a descriptive and retrospective study of the clinical characteristics and evolution of pregnant and postpartum women hospitalized for COVID-19 from
March 2020 to October 2021 in a university hospital located in Cuiabá (MT). All pregnant and postpartum women who were admitted to the Hospital Universitário Júlio Müller (HUJM) after the reverse transcription-polymerase chain reaction (RT-PCR) test for COVID-19 or computerized tomography (CT) scan for chest were included in the analysis. The admission criterion was the severity of the clinical conditions, according to the WHO guidelines classification, performed by an attending physician [10].

For this study, a specific database was prepared to record demographic, clinical, and laboratory data and maternal and fetal outcomes of all pregnant and postpartum women hospitalized for COVID-19 during the study period. Such data were obtained from reviewing all electronic and physical records available in the institution’s electronic system.

Data were described in their proportions, if using qualitative variables, or in their means and standard deviations, if using quantitative data. Information on the prior existence of comorbidities and the incidence of complications during the patient’s’ hospitalization was based on identifying these events in the medical records. The severity of COVID-19 was measured based on the WHO guidelines [10]. Invasive respiratory support was defined by the patient’s need for mechanical ventilation, either by orotracheal tube or tracheostomy tube [11]. Pulmonary and cardiac impairment were defined by recording compatible alterations on chest tomography and echocardiography, respectively. Obstetric evolution, maternal outcome, and fetal outcome followed the ICD-10 international classifications for diseases [12].

Further, it was approved by the Ethics and Research Committee of the Hospital Universitário Júlio Müller/Universidade Federal do Mato Grosso, with Opinion number: 4.622.295 and CAAE number: 44693621.0.0000.5541.

3. Results

From March 2020 to October 2021, 126 pregnant and postpartum women with COVID-19 confirmed by RT-PCR at hospitalization were admitted to the HUJM. None of them had received immunization against COVID-19 by vaccination. Women were predominantly mixed-race (89.7%) and married (41.3%) or in a stable union (26.2%). The place of origin of these patients was equally distributed between the metropolitan area (50.8%) and the interior of the state (49.2%). Only 51 (40.5%) had no comorbidities. Among the others, diabetes mellitus (19%) and arterial hypertension (17.5%) were predominant conditions. Overweight and obesity were diagnosed in 20.2% and 44.4% of patients. The mean (SD) age was 29.7 (6.1) years (Table 1).

On admission, laboratory tests showed anemia, with mean (SD) hemoglobin = 10.7 (1.6) g/dL and mild leukocytosis, with mean (SD) count = 11,738 (5546) cells/µL. There was an evident elevation of markers of acute inflammation, such as c-reactive protein (CRP) with a mean (SD) = 45.9 (66.0) mg/dL and lactate dehydrogenase (LDH) with mean (SD) = 440.8 (850.0) U/L. More than half of
Table 1. Demographic, clinical, and laboratory characteristics at admission of 126 pregnant and postpartum women with COVID-19 admitted to a medium-sized hospital in the central region of Brazil, 2020-2021.

| Variable                  | n (%)                      |
|---------------------------|----------------------------|
| Color                     |                            |
| White                     | 13 (10.3)                  |
| Mixed-race                | 113 (89.7)                 |
| Marital Status            |                            |
| Married                   | 52 (41.3)                  |
| Stable Union              | 33 (26.2)                  |
| Single                    | 40 (31.7)                  |
| Widow                     | 1 (0.8)                    |
| Source                    |                            |
| Cuiabá metropolitan area  | 64 (50.8)                  |
| Interior                  | 62 (49.2)                  |
| Comorbidities             |                            |
| No                        | 51 (40.5)                  |
| Diabetes                  | 24 (19.0)                  |
| Hypertension              | 22 (17.5)                  |
| Asthma                    | 6 (4.8)                    |
| Autoimmune disease        | 5 (4.0)                    |
| Heart Disease             | 3 (2.4)                    |
| Hypothyroidism            | 3 (2.4)                    |
| Other                     | 12 (9.4)                   |
| Nutritional status        |                            |
| Low weight                | 7 (7.1)                    |
| Appropriate weight        | 28 (28.3)                  |
| Overweight                | 20 (20.2)                  |
| Obesity                   | 44 (44.4)                  |
| O₂ saturation             |                            |
| <95%                      | 57.2                       |
| >95%                      | 42.8                       |

| Reference intervals       | Mean (SD)                  |
|---------------------------|----------------------------|
| Age (years)               | 29.7 (6.1)                 |
| Hemoglobin (g/dL)         | 13.5 - 17.5                |
| 10.7 (1.6)                |
| Leukocytes (cells/µL)     | 4.000 - 11.000             |
| 11.738 (5.546)            |
| Lymphocytes (cells/µL)    | 855 - 5.280                |
| 1.322 (743)               |
| C-reactive protein (mg/L) | 0 - 0.5                    |
| 45.9 (66.0)               |
| Lactate dehydrogenase (U/L)| 135.0 - 214.0            |
| 440.8 (850.0)             |
| Platelets (cells/µL)      | 140.000 - 400.000          |
| 237.296 (93.813)          |
| D-dimer-                  | <0.5 mg/L                  |
| 3224.5 (8.5678)           |
Continued

|                  |            |            |
|------------------|------------|------------|
| **pH**           | 7.35 - 7.45| 7.37 (0.10)|
| **pCO₂ (mmHg)**  | 35 - 45    | 38.0 (12.7)|
| **HCO₃⁻ (mEq/L)**| 21 - 26    | 21.8 (5.8)|

SPO₂—peripheral oxygen saturation; pH—blood hydrogen potential; pCO₂—partial pressure of carbon dioxide; HCO₃⁻—bicarbonate.

The women (57.2%) had peripheral oxygen saturation below 95%. The high elevation of serum D-dimer was striking, with a mean (SD) of 3224 (8568) mg/L (Table 1).

Pregnant and postpartum women in this study were classified according to the severity of COVID-19 during admission as mild (28.6%), moderate (31%), and severe (40.5%). ICU admission and invasive ventilatory support were necessary for 86 (68.3%) and 55 (43.6%) women, respectively. It was possible to perform chest tomography of 90 patients, whose analysis revealed pulmonary involvement in 100% of them. Likewise, alterations were observed in 78.6% of the exams for the twenty-eight patients who underwent echocardiography. During the entire period of hospitalization, the following complications were identified: respiratory failure associated with stroke, pulmonary edema, thromboembolic phenomena, and sepsis in 46% of patients (Table 2).

Among the main obstetric complications recorded after the diagnosis of COVID-19, premature labor (19.0%) was the one that most affected the sample analyzed. However, after hospitalization, 44 (34.9%) patients kept their pregnancies ongoing and were discharged from the hospital while still pregnant. Preterm births during hospitalization occurred for 57 (45.2%) pregnant women with COVID-19, and only 23 (18.3%) pregnant women reached term delivery. Abortion was recorded for two cases alone (Table 2). After a mean (SD) hospitalization period of 20 (15.9) days, 118 (93.6%) patients were discharged from the hospital, and 8 (6.4%) died. The immediate causes of death were septic shock, hypovolemic shock, acute renal failure, acute myocarditis, and severe acute respiratory syndrome. Details on the clinical and laboratory characteristics at admission of the eight women who died are presented in (Table 3).

Analysis of fetal outcomes of pregnant and postpartum women in this study revealed 67 (81.7%) cesarean deliveries and 15 (18.3%) vaginal deliveries. The mean (SD) of 5’ Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) of the conceptuses of these deliveries was 6.9 (3.1), and the mean (SD) birth weight was 2280 (830) grams. As a fetal outcome, 40 (48.8%) neonates were discharged immediately from the hospital, 33 (40.2%) were admitted to NICU and nine (11%) were classified as Stillbirth/neonatal mortality. The results of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) ribonucleic acid (RNA) research in gastric aspirates of newborns were negative in 85.7% and positive in 14.3% of them (Table 4).
Table 2. Evolutionary characteristics of pregnant and postpartum women with COVID-19 admitted to a medium-sized hospital in the central region of Brazil, 2020-2021.

| Features | n (%) |
|----------|-------|
| **Clinical classification** |       |
| Light    | 36 (28.5) |
| Moderate | 39 (31.0) |
| Severe   | 51 (40.5) |
| **Need for intensive therapy** |       |
| No       | 40 (31.7) |
| Yes      | 86 (68.3) |
| **Ventilatory support** |       |
| No       | 33 (26.2) |
| Yes, non-invasive | 38 (30.2) |
| Yes, invasive | 55 (43.6) |
| **Pulmonary involvement** |       |
| (Computerized Tomography) |       |
| No       | 0 (0.0) |
| Yes      | 90 (100.0) |
| **Cardiac involvement** |       |
| (echocardiogram) |       |
| No       | 6 (21.4) |
| Yes      | 22 (78.6) |
| **Complications** |       |
| Respiratory insufficiency | 6 (4.8) |
| Respiratory failure + stroke | 1 (0.8) |
| Respiratory failure + Pulmonary Edema | 15 (11.9) |
| Respiratory failure + DVT/VTE | 12 (9.5) |
| Respiratory failure + Sepsis | 15 (11.9) |
| Respiratory failure + Surgical infection | 9 (7.1) |
| Obstetric complication |       |
| No       | 96 (76.2) |
| Premature labor | 24 (19.0) |
| Sub aponeurotic/intracavitary hematoma | 3 (2.4) |
| Postpartum hemorrhage | 2 (1.6) |
| Placental remains | 1 (0.8) |
| Obstetric evolution |       |
| Pre-term delivery | 57 (45.2) |
| Gestation in progress | 44 (34.9) |
| Full-term birth | 23 (18.3) |
| Abortion | 2 (1.6) |
| Maternal outcome |       |
| Death | 8 (6.3) |
| High | 118 (93.7) |

**Mean ± SD**

| Time of onset of symptoms (days) | 7.8 ± 4.5 |
| Hospitalization time (days) | 20 ± 15.9 |
### Table 3. Clinical and laboratory characteristics at the admission of pregnant women who died from COVID-19 in a medium-sized hospital in the central region of Brazil, 2020-2021.

| Case | Clinical conditions on admission | Laboratory tests on admission |
|------|---------------------------------|-------------------------------|
|      | Age (years)                     | Hemoglobin (g/dL)             |
| 1    | 37                              | 13                            |
| 2    | 38                              | 11.3                          |
| 3    | 36                              | 12.5                          |
| 4    | 28                              | 11.1                          |
| 5    | 20                              | 7.0                           |
| 6    | 27                              | 8.8                           |
| 7    | 26                              | 7.3                           |
| 8    | 25                              | 9.3                           |
|      | Color/ethnicity                  | Leukocytes—4000 to 11,000/µL |
|      | Mixed-race                       | 13.840                        |
|      | White                            | 25.170                        |
|      | Brown                            | 11.600                        |
|      | White                            | 18.970                        |
|      | Brown                            | 6.650                         |
|      | Brown                            | 16.620                        |
|      | Brown                            | 21.270                        |
|      | Brown                            | 10.120                        |
|      | Gestational age at admission     | CRP—<0.5 mg/L                 |
|      | 26s                              | 158.1                         |
|      | 32s                              | 239.0                         |
|      | 9s                               | 47.3                          |
|      | 26s                              | 18.14                         |
|      | 37s                              | 134.1                         |
|      | 38s                              | 167.4                         |
|      | 26s1                             | 191.4                         |
|      | 24s                              | 3.41                          |
|      | Comorbidities                    | LDH—135.0 to 214.0 U/L        |
|      | No                               | 790                           |
|      | No                               | 1510                          |
|      | Cardiopathy                      | 1516                          |
|      | No                               | 1138                          |
|      | SAH + PE                         | 1463                          |
|      | No                               | 1828                          |
|      | No                               | 1276                          |
|      | No                               | 1113                          |
|      | Gravity at admission             | Platelet—140,000 to 400,000/µL |
|      | Moderate                         | 241,000                       |
|      | Severe                           | 286,000                       |
|      | Severe                           | 230,000                       |
|      | Severe                           | 284,000                       |
|      | Severe                           | 397,000                       |
|      | Severe                           | 405,000                       |
|      | Severe                           | 116,000                       |
|      | Severe                           | 214,000                       |
|      | Time from onset of symptoms to hospitalization | D-dimer—<0.5 mg/L |
|      | 7 days                           | 0.1                           |
|      | 5 days                           | 7.9                           |
|      | 4 days                           | 2.3                           |
|      | 5 days                           | 5.7                           |
|      | 5 days                           | 10.0                          |
|      | 7 days                           | 0.9                           |
|      | SpO₂ on admission                | Induction of labor            |
|      | 93%                              | No                            |
|      | 82%                              | Induction of labor            |
|      | 97%                              | No                            |
|      | 90%                              | Induction of labor            |
|      | 96%                              | No                            |
|      | 83%                              | Induction of labor            |
|      | 90%                              | No                            |
|      | 86%                              | No                            |
|      | Respiratory rate at admission    | Cesarean section              |
|      | 35                               | Postpartum                    |
|      | 38                               | Postpartum                    |
|      | 34                               | Cesarean section              |
|      | 28                               | Cesarean section              |
|      | 24                               | Cesarean section              |
|      | 24                               | Cesarean section              |
|      | Respiratory on admission         | Indicator of obstetric intervention |
|      | Ambient air                      | Fetal death                   |
|      | Nasal catheter                   | Maternal IOT                  |
|      | Nasal catheter                   | -                             |
|      | MV                               | -                             |
|      | MV                               | -                             |
|      | MV                               | -                             |
|      | MV                               | -                             |
|      | Place of hospitalization on admission | Indication of obstetric intervention |
|      | Infirmary                        | Fetal death                   |
|      | Infirmary                        | Maternal IOT                  |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | ICU                              | -                             |
|      | Interval from admission to death  | Vaccination against SARS-CoV-2 |
|      | 16 days                          | NO                            |
|      | 5 days                           | NO                            |
|      | 3 days                           | NO                            |
|      | 14 days                          | NO                            |
|      | 12 days                          | NO                            |
|      | 18 days                          | NO                            |
|      | 37 days                          | NO                            |
|      | 15 days                          | NO                            |
|      | Obstetric intervention           | SARS-CoV-2                    |
|      | Induction of labor               | NO                            |
|      | Cesarean section                 | NO                            |
|      | No                               | NO                            |
|      | No                               | NO                            |
|      | No                               | NO                            |
|      | No                               | NO                            |
Table 4. Fetal outcomes of pregnant and postpartum women with COVID-19 admitted to a medium-sized hospital in the central region of Brazil, 2020-2021.

| Outcomes                              | Mean (SD)   |
|---------------------------------------|-------------|
| APGAR Score 5'                        | 6.9 (3.1)   |
| Birth weight (g)                      | 2280.8 ± 830.7 |
| Mode of delivery                      |             |
| Vaginal                               | 15 (18.3)   |
| Cesarean section                      | 67 (81.7)   |
| Neonatal intensive care               | 33 (40.2)   |
| Fetal outcome                         |             |
| Stillbirth/neomortality               | 9 (11.0)    |
| Hospital Discharge                    | 40 (48.8)   |
| Viral RNA in gastric aspirate         |             |
| Positive                              | 6 (14.3)    |
| Negative                              | 36 (85.7)   |

4. Discussion

In this study, it was observed that the occurrence of COVID-19 in pregnant and postpartum women hospitalized in a medium-sized hospital in the state of Mato Grosso was predominant among mixed-race women, residents of the metropolitan area of the capital, obese or overweight women, and those with diabetes mellitus and arterial hypertension as the main comorbidities. Hospitalizations were mainly motivated by moderate and severe COVID-19, presenting elevated LDH, CRP, and D-dimer as main laboratory changes. Maternal death occurred in 6.4%...
of hospitalized women, and stillbirth/neonatal mortality in 11.0% of conceptuses.

The predominance of mixed-race women is consistent with national data from a widely disseminated study, which shows worse disease prognosis among Black women and women of color [13]. The authors attributed this finding to the effect of racism and sexism as structural determinants of worse living and working conditions (facilitating transmission) and the lack of access to health care (determining worse prognosis) of this group of women [13]. This is also seen in the United States, where 58.4% of patients were Black or Hispanic, while in the United Kingdom, 55% were Black, Asian, and other minority communities [14] [15].

Although the patients in the study were equally from the interior of the state and the capital’s metropolitan area, most of the women who died were from the interior part. Because it is a reference hospital at the state level, pregnant or postpartum women with severe COVID-19 are systematically transferred to the state capital, including those living in municipalities more than 1000 km away. Our study represents one of the few published studies from low-income countries, as cited by Gupta et al (2021) in their cohort of pregnant women [16]. The most frequently found comorbidities were pregestational diabetes and hypertension, followed by obesity and asthma, although not associated with a higher risk of death. Metz et al. point out that pregnant women who evolved to a worse prognosis were carriers of asthma or chronic obstructive pulmonary disease, chronic hypertension, or pregestational diabetes [17]. In the UK, pregnant women with COVID-19 had associated comorbidities such as gestational diabetes, pregestational diabetes, hypertension, and asthma [15]. Mendez-Rodriguez et al. reported that while asthma and immunological impairment increased the propensity to develop pneumonia, obesity and diabetes increased the chances of hospital death [18]. In Iran, pregnant women with comorbidities such as hypothyroidism, diabetes mellitus, and hypertension were associated with worse outcomes [3]. Carrasco et al., in a Spanish multicenter study, showed that the most frequent comorbidities among pregnant women with COVID-19 were gestational hypothyroidism, obesity, gestational diabetes, hypertension, autoimmune diseases, and asthma [19]. Overweight and obesity were diagnosed in many patients, also found in Mexican, American, Turkish and English women [7] [18] [20] [21]. Engjon et al., when describing the outcomes of 214 pregnant women admitted to hospitals in Northern Europe with a positive test for SARS-CoV-2, found that 158 of them were discharged after delivery and only 56 required continued hospitalization due to COVID-19, of which 32.1% were due to complications attributed to obesity [22].

Among the laboratory alterations observed, discrete anemia and leukocytosis are expected for the gravid condition, and it is difficult to establish their relationship with COVID-19. However, the elevation of acute inflammation markers (LDH and CRP) and the anticoagulant marker d-Dimer were evident. Biguenet et al., in France, also reported a significant increase in LDH and CRP in the first
10 days of symptoms [23]. Similar results for serum D-dimer concentration were found in studies from Turkey, Spain, and China [20] [21] [24]. It is believed that these inflammatory and anticoagulant markers should be dynamically analyzed in the course of COVID-19 since they may be associated with the worsening of the patient’s clinical picture.

At the moment of hospital admission of pregnant women with COVID-19, moderate and severe clinical pictures of the disease were predominant. With a low average time between the onset of symptoms and admission, a significant portion of the pregnant and puerperal women still presented a moderate disease presentation. This demand profile is a consequence of the hospital’s condition as a reference service for pregnant women with COVID-19. Only a minority of patients were on mechanical ventilation upon admission. The precarious structural and technical conditions of intensive care services in the interior of Brazil justify this massive and early referral of patients with COVID-19. This is because higher lethality of patients with COVID-19 has already been observed when treatment is performed in hospitals and ICUs of interior cities [25].

During the entire period of hospitalization, the main complications identified were the need for intensive care for respiratory failure and invasive ventilatory support, thromboembolic phenomena, and sepsis. These findings were worse than those observed by Sentilhes et al. in France, who pointed out that 68.5% of the hospitalized pregnant women had mild to moderate severity forms. Further, only 9.3% required intensive care, with invasive ventilatory support in about 5.0% of them [26]. Studies in Chile and the United States and several countries of the European, American, Asian, and African continents have also classified the majority of pregnant women with COVID-19 as mild and moderate cases of the disease, with low need for intensive care and invasive ventilatory support, as well as low frequency of pulmonary impairment on tomography [2] [17] [27]. Notably, in the studies above, the motivation for hospitalization was labor [17] [21] [27]. Simultaneously, the women in this study experienced an unfavorable evolution of COVID-19, regardless of their gestational age. This is likely to explain the worse severity profile of the women studied here. It is consistent with the Center for Disease Control and Prevention report that pregnant women face three times more risk of ICU admission and mechanical ventilation and a 70% risk of death in pregnancy [17].

Preterm labor was one of the main obstetric complications recorded after the diagnosis of COVID-19 among the women studied. Maternal lethality by COVID-19 in this study was lower than those recorded for the state of Mato Grosso (8.4%), the Midwest Region (8.9%), and Brazil (11.5%) for the same period [9]. It is already known that Brazil has the highest fatality rate of COVID-19 globally, being followed by other developing countries, such as Mexico and Iran [3] [18]. It is essential to highlight that the high fatality observed here was not associated with comorbidities, corroborating findings also published by the United Kingdom Obstetric Surveillance System (UKOSS), which is the obstetric surveillance system of the United Kingdom [15].
Most preterm births and the cesarean delivery route of the pregnant women analyzed here were motivated by clinical complications of COVID-19, and anticipatory delivery was assumed. In the San José Maternity Hospital in Santiago de Chile, it was observed that 16% of pregnant women with COVID-19 kept their pregnancies ongoing, 23% of deliveries were preterm, 46.1% of deliveries were C-sections, and 6% of them miscarried [27]. In the GESNEO-COVID (ANO) study in Spain, it was identified that 20.6% of deliveries were preterm and 36.2% of deliveries were cesarean, all associated with a worsening maternal clinical picture; however, in this study, there were no maternal deaths [19]. Vizheh et al. reported that in Iranian pregnant women, 44.5% kept the pregnancy ongoing, 29.1% occurred prematurely, and 7.3% experienced spontaneous abortion; of the deliveries, 83.3% underwent cesarean section [3]. In the study conducted in Nordic countries, 25% of deliveries were premature, 14.28% of pregnancies kept their course, and 41.75% were cesarean sections, mostly (85%) emergency cases [22].

In the present study, among the main fetal and neonatal outcomes, admission to the neonatal care unit, fetal and neonatal death, and SARS-CoV-2 RNA positivity in gastric aspirates in the first 24 hours of life were the most frequent events. These findings were associated with the need for early delivery due to the clinical deterioration of the pregnant woman. A similar observation was made in a tertiary care hospital in Mexico. A total of 44% of newborns of mothers with COVID-19 were admitted to neonatal intensive care. Wherein 8% were stillborn, and 30% were positive for SARS-CoV-2 [20]. Similarly, Vizheh et al. described that in Iran, the neonatal outcomes were premature births in approximately 25%, neonatal ICU admissions in 29.3%, and 15.7% of neonates were positive for SARS-CoV-2 in the first 24 hours, with 3.9% neonatal mortality [3]. In a maternity hospital in Chile, 23% of deliveries were premature, only 13.6% required NICUs, 10% of newborns tested positive for SARS-CoV-2 in the first 24 hours, and fetal/neonatal mortality was 5.7% [27]. Other studies conducted in the United States, Spain, and the United Kingdom report similar fetal and neonatal outcomes [15] [17] [19].

This descriptive study showed that pregnant and postpartum women with COVID-19 who required hospitalization were primarily mixed-race, married, from the metropolitan area, and carriers of moderate and severe forms of the disease. The primary risk condition found was overweight/obesity, and pre-gestational diabetes, hypertension, asthma, and autoimmune disease were the most prevalent comorbidities in the group. Elevated LDH, CRP, and D-dimer were relevant laboratory findings in this group of patients. The most frequent maternal outcomes were respiratory failure, invasive ventilatory support, thromboembolic phenomena, sepsis, and preterm labor. Further, maternal death occurred in 6.4% of pregnant women. We verified that this group’s chances of severity and worsening outcomes are higher than in the general population. Prematurity and the need for NICU were significant complications for neonates. Stillbirth/neonatal mortality occurred in 11.0%.
This study has some possible limitations. For instance, the number of premature births, NICU admissions, and fetal/neonatal deaths happened due to increased iatrogenic deliveries by maternal indications. As for 14.3% of positive cases for SARS-CoV-2 for newborns, criteria determined at the beginning of the pandemic were used, which may be associated with premature delivery in the acute phase of infection or even during delivery.

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Conflicts of Interest

The authors declare no competing financial interests.

Contributors

Kubiszeski EH, Carmo MAMV, Carmo AV and Galera MF contributed to the conception and design of the study. Kubiszeski EH and Carmo MAMV performed the analysis and interpretation of the data. Kubiszeski EH and Galera MF contributed to the preliminary writing of the manuscript. Kubiszeski EH, Carmo MAMV, Carmo AV and Galera MF participated in the relevant critical review of the manuscript's intellectual content. All authors approve the final version of the manuscript and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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