ORIGINAL ARTICLE

https://doi.org/10.1590/1806-9282.20230048

Maternal near miss: before and during the coronavirus disease 2019 pandemic

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SUMMARY

OBJECTIVE: The aim of this study was to evaluate and compare Maternal Near Miss prevalence and outcomes before and during the coronavirus disease 2019 pandemic.

METHODS: This retrospective study was carried out in a university maternity hospital of high complexity. The population was divided into two groups: G1, 1 year before the coronavirus disease 2019 pandemic period (August 2018–July 2019) and G2, 1 year during the pandemic period (August 2020–July 2021). All pregnant/postpartum women hospitalized up to 42 days after the end of pregnancy/childbirth were included, and pregnant women who were admitted with coronavirus disease 2019/flu symptoms were excluded. The association of variables with "Maternal Near Miss" was estimated using logistic regression.

RESULTS: A total of 568 women from G1 and 349 women from G2 fulfilled the Maternal Near Miss criteria. The prevalence of Maternal Near Miss in pre-pandemic was 144.1/1,000 live births and during the pandemic was 78.5/1,000 live births. In the analysis adjusted for G1, the factors of days of hospitalization (PR: 1.02, CI: 1.0–1.0, p<0.05), pre-eclampsia (PR: 0.41, CI: 1.4–2.2, p<0.05), and sepsis/severe systemic infection (PR: 1.79, CI: 0.3–0.4, p<0.05) were crucial for women with the Maternal Near Miss condition to have a greater chance of being admitted to the intensive care unit. In G2, low education (PR: 0.45, CI: 0.2–0.9, p<0.05), eclampsia (PR: 5.28, CI: 3.6–7.6, p<0.05), and use of blood products (PR: 6.48, CI: 4.7–8.8, p<0.05) increased the risk of admission to the intensive care unit.

CONCLUSION: During the pandemic, there was a lower prevalence of Maternal Near Miss in high-risk pregnancies, fewer hospitalizations, and more deaths compared to the non-pandemic period.

KEYWORDS: Pregnancy complications. Near miss, healthcare. COVID-19 pandemic.

INTRODUCTION

The COVID-19 pandemic contributed to increased morbidity and mortality among pregnant women. COVID-19 positive pregnant women are more likely to develop hypertension/pre-eclampsia and eclampsia. Notably, 1 in every 68 affected women require intensive care and has 22 times higher risk of mortality[1,2].

Worldwide, governments and public health surveillance leaders emphasized the need for people to visit hospitals only when necessary to mitigate the risk of exposure to COVID-19 infection and to avoid overcrowding of health facilities[3]. Current studies suggest that social isolation adopted as a security measure against the pandemic could have contributed to pregnant women not seeking regular health services[4,5].

There was a sharp reduction in reporting of non-COVID-19 cases[3,6], as well as in obstetric emergency services[5]. This restriction on access to healthcare may be associated with significant clinical implications for pregnant or postpartum women, such as the Maternal Near Miss (MNM)[7]. Additionally, there were uncertainties related to the outcome of COVID-19 infection during pregnancy.

Therefore, relevant public agencies and health institutions were concerned, as many high-acuity patients, who needed emergency care, did not attend services due to the fear of contamination. Recent studies show that delays in timely care for pregnant women have increased maternal morbidity and mortality[4,7,8].

Studies indicate that COVID-19 positive pregnant women have similar outcomes as non-pregnant women[8,9], but show higher mortality in the infected group. However, there is still no measurement of the actual impact of the SARS-CoV-2 pandemic on pregnant women's social and health aspects or puerperium. Thus, this study aims to evaluate and compare MNM prevalence and outcomes before and during the COVID-19 pandemic.

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Conflicts of interest: the authors declare there is no conflicts of interest. Funding: none.
Received on June 27, 2023. Accepted on July 09, 2023.

METHODS

This hospital-based study was performed following the guidelines and checklist of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[10]. This study was carried out in a university maternity hospital of high complexity that attends high-risk pregnant women in Brazil, with an annual cesarean delivery rate of approximately 62%.

The population was selected by review of medical records during two periods: the first one from August 2018 to July 2019 (before the COVID-19 pandemic: G1) and the second period comprised the interval from August 2020 to July 2021 (during the pandemic period: G2). In both periods, the same months were chosen before and during the pandemic to reduce the seasonal effects of other pathologies and provide greater similarity between the periods.

All pregnant or postpartum women admitted to the high-risk ward of the health institution up to 42 days after the end of pregnancy or childbirth were included, regardless of gestational age. MNM was identified using the criteria of the World Health Organization (WHO). Patients who have entered COVID-19 or flu symptoms were excluded. This exclusion is justified by the fact that pregnant women undergoing treatment for COVID-19 used medications (e.g., corticosteroids) that could interfere with hemodynamic balance, thus causing accuracies in the diagnosis of MNM.

Data collection was performed by two research assistants trained to use the tool mentioned above and an established form to collect sociodemographic information, obstetric history, and current obstetric conditions presented at the time of the woman's admission to the institution.

Statistical analysis was performed using the Stata software, version 14, with a significance level of 5% assigned to all statistical tests ($p<0.05$). To calculate the MNM prevalence ratio (PR) in both periods, we used the total number of MNM cases; in the denominator, we used the number of live births (LB) during the research period with a 95% confidence interval (CI). The chi-square test (χ^2) was used to compare the groups, before and during the pandemic. Mann-Whitney test was performed for intergroup comparisons. The logistic regression was performed after the bivariate analysis, and the "adjrr" command from the Stata software, version 14, was used to transform the odds ratios into PRs. A final regression analysis was performed with the variables that presented a p-value<0.05 in the bivariate analysis that served to perform the adjusted PR and respective CI of the women in both groups who were admitted to the intensive care unit (ICU).

Ethics

The research was approved by the Research Ethics Committee of the Federal University of Rio Grande do Norte CAAE: 16946919.7.0000.529. This study was conducted in accordance with the Declaration of Helsinki and its modifications.

RESULTS

One year before the pandemic, 2,740 high-risk obstetric hospitalizations were identified, and during the pandemic, it was 1723. Regarding MNM, we selected all women who presented at least one MNM criteria listed by the WHO: 568 women in the period corresponding to 1 year before the pandemic and 349 women during the pandemic (Figure 1).

Prevalence of maternal near miss

The results show an MNM prevalence of 144.1/1000 LB 1 year before the pandemic and 78.5/1000 LB during the pandemic. A total of 3939 cases were identified in the year before the pandemic and 4445 during the pandemic.

Sociodemographic and obstetrics determinants

Significant differences between the groups were identified for the variables of age (28.7 vs. 30.3; p=0.01), race/color (p=0.02), and stable union (p=<0.01). This indicated that women hospitalized in G2 had greater age, most considered themselves of mixed race, and they declared a stable union compared to those hospitalized in G1 (Table 1).

Regarding obstetric aspects, differences between groups were observed in terms of the number of pregnancies (2.3 CI=2.2–2.5 vs. 2.7, CI=2.6–3.0) and mode of delivery cesarean (85.2 vs. 70.5% p=<0.01). The data indicate a lower frequency of cesarean delivery during the pandemic compared to the previous year. Additionally, the average gestational age of the pandemic group was lower (36 vs. 35 gestational weeks).

Moreover, there was a difference in the period of hospitalization, indicating that G2 had a shorter hospital stay than G1 (8 days vs. 9 days, p=<0.01). We also identified that in G1, 80.3% of the women underwent prenatal care compared to 77.3% in G2. However, 85% of the population studied took up to six prenatal consultations in both groups.

Identification of maternal near miss

Regarding the identification conditions of MNM to the symptoms criterion, a relevant frequency of women diagnosed with pre-eclampsia in both groups is perceived (G1=67.7% vs. G2=95.7%). In terms of the clinical interventions item,

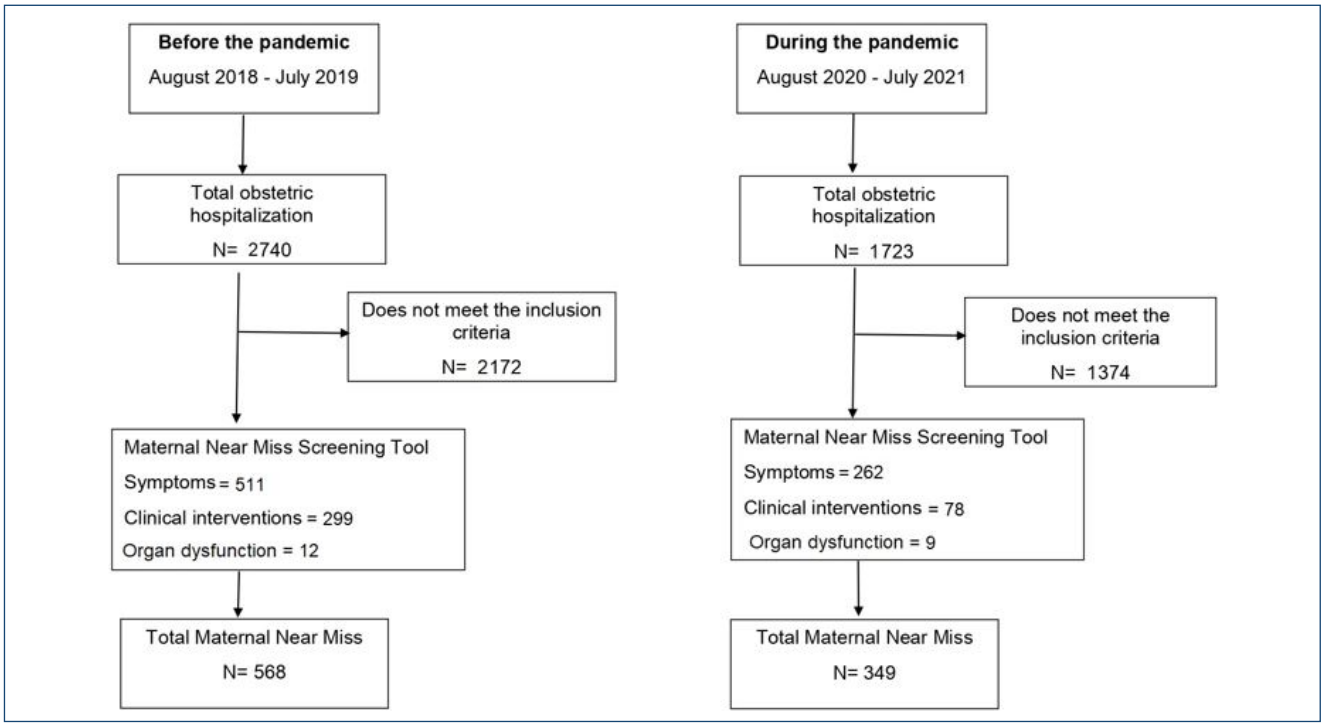

Figure 1. Sample selection flowchart.

the use of blood products was higher in G1 (12.3 vs. 4.3%). However, uterine complications were more frequent in G2 (1.2 vs. 0.9%) (Table 1).

In the adjusted analysis, the factors such as days of hospitalization (PR: 1.0201, 95%CI=1.0099, 1.0304), pre-eclampsia (PR: 0.4125, 95%CI=0.3453, 0.4928), and sepsis/severe systemic infection (PR: 1.7940, 95%CI: 1.4222, 2.2630) were decisive for women with the MNM condition to be more likely to be admitted to the ICU in G1. In G2, low schooling (incomplete high school) (PR: 0.4560, 95%CI=0.2202, 0.9446), eclampsia (PR=5.2814, CI 95%=3.6225, 7.6999), and use of blood products (PR: 6.4856, CI 95%=4.7687, 8.8205) increased the risk of ICU admission (Table 2).

DISCUSSION

This study identified a lower number of obstetric hospitalizations and prevalence of MNM during the COVID-19 outbreak compared to the same period of the previous year.

Women hospitalized during this pandemic had a mean gestational age of 35 weeks at admission, had fewer prenatal consultations, remained hospitalized for a shorter time, and had higher mortality rate (>150%, i.e., 20.5 times higher). Additionally, both groups presented the most frequent cesarean delivery and the diagnosis of eclampsia as a criterion for symptoms of MNM.

Uncertainties about the virus, maternal and neonatal outcomes, and constant changes in COVID-19 guidelines may have resulted in fewer visits to the emergency room and reduced MNM prevalence compared to the previous year[4,5,11,12]. Despite that, there were no recommendations to stop the care or monitoring of pregnant and postpartum women in the guidelines issued by health institutions of many countries[13].

Our data agree with a study by Kugelman et al. in an obstetric emergency room in Israel, which showed that fewer patients visited the obstetric emergency room. The most frequent diagnosis was "active labor"[4]. Another study by Abdollahpour et al. showed that the prevalence of MNM globally was 18.67/1000 LB based on the WHO criteria. According to our result (78.0/1000 LB), the prevalence was reduced during the pandemic. However, comparing global and local values, we identified a need to improve care for pregnant women[14].

Regarding MNM, our data showed that pre-eclampsia frequently occurred in both periods. This result was expected as the research was conducted in a high-risk maternity hospital.

These findings align with the results obtained from a multinational cohort study involving 2130 pregnant women in 18 countries. The results showed higher rates of adverse outcomes, including eclampsia and preterm birth, in pregnant women during the pandemic[1]. Additionally, we can infer that the period of social isolation could have influenced the prevalence of hypertensive disorders because pregnant women

Table 1. Comparisons of sociodemographic, obstetrics, and Maternal Near Miss criteria between groups: 1 year before the pandemic (G1) and during the pandemic (G2).

Variables	Group 1 (568)		Group 2 (349)		p-value
	N	%	N	%	
Average age	28.7		30.3		0.01
Education					
1st degree incomplete	196	36.2%	128	38.2%	0,31
1st degree complete	31	5.7%	22	6.6%	
2nd degree incomplete	64	11.8%	41	12.2%	
2nd degree complete	191	35.3%	116	34.6%	
Incomplete higher	20	3.7%	6	1.8%	
Graduated	39	7.2%	22	6.6%	
Race/color					
White	28	4.9%	6	1.7%	0.02
Black/Brown	539	95%	342	98%	
Yellow	0	0.0%	1	0.3%	
Marital status					
Not married	184	34.8%	104	29.8%	<0.01
Married	168	31.8%	93	26.6%	
Separated	2	0.4%	2	0.6%	
Stable union/Others	175	33.1%	150	43%	
Mean number of pregnancies	2		2		0.01
Abortion	132	23.3%	88	25.9%	0.38
Average Gestational Age	36		35		0.67
Prenatal	416	80.3%	262	77.3%	0.30
Six prenatal consultations	445	80.3%	289	85.2%	0.79
Average days of hospitalization	9		8		<0.01
Way of delivery					
Vaginal	46	8.1%	31	8.9%	<0.01
Cesarean	483	85.2%	246	70.5%	
Did not give birth	38	6.7%	68	19.5%	
IUFD[a]	0	0.0%	2	0.6%	
Stillborn[b]	0	0.0%	2	0.6%	
Maternal death	2	0.3%	5	1.4%	0.05
Symptom-based MNM criteria					
Eclampsia	63	11.1%	20	5.7%	0.01
Pre-eclampsia	384	67.7%	286	81.9%	<0.01
Sepsis/severe systemic infection	37	6.5%	15	4.3%	0.19
Hemorrhage	25	4.4%	27	7.7%	0.04
Uterine rupture	1	0.2%	1	0.3%	0.99
Intervention-based MNM criteria					
Used Hemoderivatives	70	12.3%	15	4.3%	<0.01
Laparotomy	14	2.5%	3	0.9%	0.12
ICU[c] admission	284	50.1%	60	17.2%	<0.01
Organ dysfunction based MNM criteria*					
Cardiovascular	1	0.2%	2	0.6%	0.56
Respiratory	1	0.2%	2	0.6%	0.56
Renal	2	0.4%	2	0.6%	0.99
Neurological	1	0.2%	0	0.0%	0.99
Uterine[d]	7	1.2%	3	0.9%	0.75

[a]IUFD: intrauterine fetal death; [b]Stillborn: death of a fetus in utero after 20 weeks of gestation. [c]ICU: Intensive care unit; [d]Uterine: Characterized by hemorrhage, (postpartum vaginal bleeding of 1000 ml or more in volume) or uterine infection leading to hysterectomy. Missing data in Group 1 (Education=27; Race/color=1; Marital status 39; Abortion=2; and Prenatal=6). Missing data in Group 2 (Education=14; Abortion=4; and Prenatal=6). *There were no cases of Hematological and Hepatic in both groups.

Table 2. Analysis logistic regression of determinants for intensive care unit admission of women in groups: 1 year before the pandemic (G1) and during the pandemic (G2).

Characteristics	Group 1				Group 2			
	PR	(95%CI)	PR adjusted	(95%CI)	PR	(95%CI)	PR adjusted	(95%CI)
Gestational age	0.99	(0.9–0.9)*	0.99	(0.9–1.0)	1.01	(0.9–1.0)	0.99	(0.9–1.0)
Hospitalization days	1.03	(1.0–1.0)*	1.02	(1.0–1.0)*	1.03	(1.0–1.0)*	1.01	(0.9–1.0)
Education								
2nd degree incomplete	1.14	(0.9–1.4)	1.08	(0.8–1.3)	0.68	(0.2–1.6)	0.45	(0.2–0.9)*
Eclampsia	1.83	(1.5–2.1)*	0.96	(0.7–1.2)	5.48	(3.7–7.9)*	5.28	(3.6–7.6)*
Pre-eclampsia	0.37	(0.3–0.4)*	0.41	(0.3–0.4)*	0.49	(0.2–1.0)	1.15	(0.3–3.8)
Sepsis/severe systemic infection	2.01	(1.7–2.2)*	1.79	(1.4–2.2)*	2.47	(1.2–4.8)*	1.21	(0.4–2.9)
Hemorrhage	1.46	(1.1–1.9)*	0.87	(0.5–1.4)	2.98	(1.8–4.8)*	0.70	(0.2–2.0)
Used hemoderivatives	1.94	(1.7–2.2)*	1.26	(0.8–1.8)	6.15	(4.4–8.5)*	6.48	(4.7–8.8)*
Laparotomy	0.99	(0.5–1.6)	0.36	(0.1–0.7)	3.97	(1.7–9.1)*	0.12	(0.0–0.8)
Uterine	1.14	(0.5–2.1)	0.70	(0.3–1.5)	3.97	(1.7–9.1)*	1.16	(0.1–9.7)
Way of delivery								
Cesarean	0.81	(0.6–0.9)*	1.01	(0.8–1.2)	1.25	(0.7–2.1)	1.18	(0.7–1.8)
Did not give birth	1.52	(1.2–1.8)*	1.05	(0.7–1.5)	0.72	(0.3–1.4)	0.87	(0.5–1.4)

*p<0.05.

stayed at home longer, favoring extended periods of rest[15,16]. Thus, the uncertainties increased stress and anxiety. A few studies show that these factors substantially contribute to weight gain and changes in blood pressure levels[17,18].

Our data showed that women hospitalized during the pandemic had shorter hospital stays. There may have been a need to reduce hospitalization to release beds[19,20]. Studies report that health institutions have made structural adaptations to meet the high demand caused by the pandemic. An observational study in the United States also identified reduced hospitalization time during the COVID-19 pandemic, and there was no change in readmission rates[21]. Additionally, a systematic review and Cochrane meta-analysis showed that no evidence could support the higher/lower probability of adverse events in the case of early discharge, especially in the postpartum period[22].

The adjusted logistic regression showed that pre-eclampsia and eclampsia were among the determining factors in increasing the probability of women being admitted to the ICU during the pandemic.

This study shows that pregnant/puerperal women in G1 who presented with pre-eclampsia were four times more likely to require ICU. Another critical condition was sepsis/severe systemic infection, which represented twice the likelihood of ICU admission for this group. However, in G2, women with eclampsia were five times more likely to be in ICU and six times more likely to use blood components. Thus, eclampsia is responsible for increasing the rates of maternal deaths and requires more severe clinical interventions such as the replacement of blood products[1,23,24].

Thus, the maternal death numbers presented in this study support the assumption that during the global spread of SARS-CoV-2, pregnant/puerperal women needed critical care. The number of maternal deaths was almost three times higher than the period, not the pandemic, since the delay in seeking care caused the aggravation of the clinical condition.

Despite promising findings, this study has limitations, such as no follow-up with these women after they left the hospital environment, which may contribute to underestimating the magnitude of MNM and the impacts of COVID-19 in this population.

CONCLUSION

The prevalence of MNM in high-risk pregnancies was lower during the worldwide spread of COVID-19. However, these results can be attributed to the reduction in the search for assistance, motivated by fear of contamination. Additionally, this study identified that a few triggering factors for MNM such as hypertensive disorders are preventable and treatable. It remains a challenge to fathom the overall damage inflicted by this

pandemic, which, apart from infecting people, caused significant changes in the flow of care to various population groups. Thus, it is necessary to rethink future guidelines and measures in cases of similar outbreaks to mitigate the possible damage to these populations.

AUTHORS' CONTRIBUTIONS

CLF: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **ACS:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft. **KSM:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft. **AKG:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **MEML:** Formal Analysis, Software. **YHSS:** Formal Analysis, Software.

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