

**Factors associated to maternal near miss on a university hospital****Fatores associados ao *near miss* materno em um hospital universitário****Factores asociados con el *near miss* materno en un hospital universitario****Received: 13/11/2019****Approved: 28/04/2020****Published: 01/07/2020****Brenda Magalhães Arantes<sup>1</sup>****Efigênia Aparecida Maciel de Freitas<sup>2</sup>****Karen Magalhães Arantes<sup>3</sup>****Jean Ezequiel Limongi<sup>4</sup>**

“Maternal near miss” means the near death of mothers during pregnancy, childbirth or puerperium. This study aims to analyze the epidemiological profile of women who go through maternal near miss in relation to their characteristics and perinatal outcome in a regional reference hospital, where there are no data record on this topic. This is a cross-sectional, quantitative-exploratory, analytical study, and it was carried out with through surveys of medical records of pregnant and postpartum women who were hospitalized between January and December of 2017. The analysis indicates a reason of maternal near miss of 18.8/1,000 live births, the largest proportion between 20-34 years of age, 75% were black or pardas. 32.7% had hemorrhages, 28.6% had hypertensive diseases, 66.7% premature births. Criteria associated with death were coagulation disorders, loss of consciousness and absence of pulse, massive transfusion, use of vasoactive drugs and orotracheal intubation unrelated to anesthesia. The high ratio of maternal near miss shows the magnitude of this problem at the local level.

**Descriptors:** Near miss, healthcare; Maternal mortality; Pregnancy, high-risk; Obstetric nursing

Near miss materno refere-se à quase morte materna no período de gestação, parto e puerpério. Este estudo teve como objetivo analisar o perfil epidemiológico de mulheres com *near miss* materno em relação às suas características e o desfecho perinatal em um hospital de referência regional, onde não há registro de dados sobre esse tema. Estudo analítico, transversal, quantitativo-exploratório, realizado por levantamento de prontuários de gestantes e puérperas internadas entre janeiro a dezembro de 2017. A análise apontou razão de *near miss* materno de 18,8/1000 nascidos vivos, maior proporção entre 20-34 anos de idade, 75% pretas ou pardas. 32,7% tiveram hemorragias, 28,6% doenças hipertensivas, 66,7% partos prematuros. Critérios de distúrbios da coagulação, perda da consciência e ausência de pulso, transfusão maciça, uso de drogas vasoativas e intubação orotraqueal não relacionado à anestesia foram associados ao óbito. A alta razão de *near miss* materno demonstra a magnitude desta problemática em nível local.

**Descritores:** Near miss; Mortalidade materna; Gravidez de alto risco; Enfermagem obstétrica.

Near miss materno se refiere a la casi muerte de la madre en el embarazo, el parto y el puerperio. El objetivo de este estudio fue analizar el perfil epidemiológico de las mujeres con *near miss* materno en relación con sus características y el resultado perinatal en un hospital de referencia regional, donde no existe ningún registro de datos sobre este tema. Estudio analítico, transversal, cuantitativo y exploratorio, realizado mediante una encuesta de los registros médicos de las mujeres embarazadas y puérperas que fueron internadas entre enero y diciembre de 2017. El análisis apuntó a una tasa de *near miss* materno cercana a 18,8/1000 nascidos vivos, mayor proporción entre los 20 y 34 años de edad, 75% negras o pardas. El 32,7% tuvo hemorragias, el 28,6% enfermedades hipertensivas, el 66,7% partos prematuros. Los criterios de los trastornos de la coagulación, la pérdida de conciencia y la ausencia de pulsación, la transfusión masiva, el uso de drogas vasoactivas y la intubación orotraqueal no relacionada con la anestesia se asociaron a la muerte. La elevada tasa de *near miss* materno demuestra la magnitud de este problema a nivel local.

**Descriptorios:** Near miss salud; Mortalidad materna; Embarazo de alto riesgo; Enfermería obstétrica.

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## INTRODUCTION

**F**or obstetrics, maternal near miss (NMM) refers to a situation of near maternal death (MD), that is, it refers to a woman who survived a serious complication that happened during pregnancy, childbirth or up to 42 days after the resolution of pregnancy<sup>1</sup>.

In 2009, the World Health Organization (WHO) published standardized criteria for defining NMM, which allows collection of uniform data and the possibility of better comparisons between studies in different locations<sup>2</sup>. Thus, the operational definition of NMM cases by the WHO enables the uniformity of studies of severe maternal morbidity and contributes to a better understanding of the chain of events determining these cases<sup>3</sup>.

The criteria proposed by the WHO for the identification of NMM reflect the failure or dysfunction of any of the vital organ systems, as it means that these women were survivors of life-threatening conditions. There were 25 criteria identified, and they were arranged in three groups: clinical, laboratory and management criteria. The clinical criteria can identify severe cases through the use of clinical judgment. They are: acute cyanosis, gasping, respiratory rate above 40 or less than six incursions per minute, shock, oliguria with no response to hydration or diuretics, coagulation disorders, loss of consciousness for more than 12 hours, lack of consciousness and absence of pulse or heartbeat, stroke, total paralysis or uncontrolled repeated seizure, jaundice in the presence of pre-eclampsia<sup>1,2,4</sup>.

Meanwhile, the group of laboratory criteria refers to laboratory changes. So, for the identification of these, it is necessary that assistance resource are available. The criteria are: oxygen saturation less than 90% for more than 60 minutes, ratio between blood pressure of oxygen and inspired oxygen fraction less than 200mmHg, Creatinine  $\geq 3.5$  mg/dl or 300  $\mu\text{mol/l}$ , bilirubin  $> 100$   $\mu\text{mol/l}$  or 6 mg/dl, pH  $< 7$ , lactate  $> 5$ , acute thrombocytopenia (platelets  $< 50,000/\text{mm}^3$ ), loss of consciousness and presence of glucose and ketones in urine. In addition to those, six criteria belong to the management group and refer to actions taken when there is failure of vital organs. They are: continuous use of vasoactive drugs, puerperal hysterectomy for infection or hemorrhage, transfusion of more than five red blood cell concentrated units, intubation and mechanical ventilation unrelated to anesthesia for  $\geq 60$  minutes, dialysis for acute renal failure and cardiopulmonary resuscitation<sup>1,2,4</sup>.

The MD indicator is a significant predictor of global health inequities. Once it was considered that that, for each case of death there are a number of women who have suffered serious complications, the use of the NMM criteria as an indicator for serious complications during pregnancy, childbirth and up to 42 days after delivery, it presents a possibility of expanding the analysis of these cases, since studying this group of women brings valuable information, as it is a more frequent event, consequently a more sensitive indicator to assess the situation of health of a population<sup>5</sup>. The surveillance of NMM cases allows health services to have a design of the main causes of severity at a local level and to know the performance of their health services when they address these serious diseases<sup>1</sup>.

In a review of NMM around the world, it was possible to observe that developed countries already have low MD rates, so they started to focus their strategies on the surveillance of serious maternal morbidities. Among low and middle income countries, NMM indicators are more expressive, especially in Sub-Saharan Africa, where there is a ratio of 198 cases of NMM for every 1,000 live births<sup>6</sup>. In Brazil a multicenter study was carried out in 27 university hospitals with the help of the Severe Maternal Morbidity Surveillance Network. This study found 9.37 cases of NMM for every 1,000 live births<sup>7</sup>. Local surveys have varying ratios<sup>8,9</sup>. A survey conducted in Teresina, in the state of Piauí, found a ratio of 9.6 NMM for every 1,000 live births<sup>8</sup>, while in Campinas, in the state of São Paulo, the ratio was 7.4 NMM for every 1,000 live births<sup>9</sup>.

Thus, this study aims to analyze the epidemiological profile of women with NMM in regards to its characteristics and the perinatal outcome in a regional reference hospital, where there is no record of data on this topic.

## METHOD

The study was carried out at the Hospital de Clínicas de Uberlândia (HCU), located in the city of Uberlândia, southeastern Brazil. It is a university hospital of reference in medium and high complexity cases for 86 municipalities in the macro and micro regions of Triângulo Mineiro, in the state of Minas Gerais. It has 520 hospital beds for hospitalization, being 18 beds for collective accommodations and 19 for hospitalizations for high-risk prenatal care. It also has an Emergency Room for Gynecology and Obstetrics, a high and low risk Prenatal Clinic, Obstetric Center, Adult and Neonatal Intensive Care Unit. The high-risk prenatal outpatient service serves a region of 18 municipalities.

HCU provides care to a significant number of women during pregnancy and postpartum, especially those who are classified as high risk. This scenario is important for identifying a situational diagnosis to guide the planning of actions that can be carried out not only at the HCU, but throughout delivery and birth care network in this region.

This is an analytical and cross-sectional study, with an exploratory quantitative approach. Data collection was carried out through the survey of medical records with the HCU Medical and Statistical Archive Service (*Serviço de Arquivo Médico e Estatístico do HCU - SAME-HCU*). Medical records of patients admitted during pregnancy, childbirth or puerperium period were collected between January 1<sup>st</sup> to December 31<sup>st</sup>.

Cases that met the criteria for NMM completed the Data Collection Instrument, which was specifically designed for this investigation and which contained sociodemographic data, personal and obstetric background, data of current pregnancy, criteria for NMM, maternal and perinatal outcome. The criteria for NMM used in this study are those proposed by the WHO and described in Say et al<sup>2</sup>. Reading and data collection of medical records happened from August of 2018 to July of 2019.

For data analysis, the database was built with the help of Epi Info 7.2.2 program. Frequency, significance and association measures were also calculated with this program. The analysis followed these steps: distribution of frequency of variables collected from researched population and consistency of data. First, the frequency of all variables surveyed was distributed, characterizing the population studied according to demographic and socioeconomic aspects, obstetric history and data on current pregnancy and its relationship with the incidence of NMM.

Subsequently, a bivariate analysis was performed. Fisher's Exact Test ( $\alpha = 5\%$ ) was used for comparisons for two proportions. To quantify the association between possible associated factors, were used Odds Ratio (OR) with a 95% confidence interval.

Finally, the following indicators were calculated: incidence of women with life-threatening conditions; NMM ratio; serious maternal outcome ratio; mortality rate of NMM; maternal mortality index.

The identification of the participants was numeric, in order to guarantee data privacy and the confidentiality of personal information. In line with Resolution 466/2012 and Resolution 510/2016 of the National Health Council, which regulates research with human beings, this research started only after approval of the project by the UFU Research Ethics Committee, no. 2,762,326/2018.

## RESULTS

3,121 medical records, with 49 cases of NMM and two maternal deaths (MD) were analyzed. The average age was  $28.8 \pm 6.71$ , with the most frequent age group between 20 and 34 years old (69.4%). Half of the women with data about their educational level (50%) had between 8 and 11 years of education, the majority were brown (*pardas*) or black (75%) and 64.6% were married or on civil union. The use of alcohol during pregnancy was the most reported life habit (8.2%) (Table 1).

The average time hospitalization was  $14.89 \pm 15.10$  days, in which the main reason for hospitalization was clinical-obstetric complications (81.6%). As for parity, 40.8% of women had gone through previous cesarean section, 30.6% had at least one previous miscarriage, as well as a considerable portion of them were nulliparous (40.8%). Among the 38 medical records with information on the beginning of prenatal care, they started in the first trimester of pregnancy in most cases (92.1%), with an average number of medical appointments at  $7.11 \pm 3.55$ . However, for 40 % women, the number of medical appointments was less than six (Table 1).

Among the serious complications investigated during pregnancy/puerperium, the most frequent were severe hemorrhage (32.7%) and hypertensive syndromes (28.6%). Among the cases of NMM, one (2%) happened in miscarriage, two (4%) in ectopic pregnancy, one (2%) in molar pregnancy and in one case there was no information on the outcome of the pregnancy. Therefore, among the 44 cases in which deliveries were performed, cesarean surgery was the most common type (84%), in which most of them had not gone through labor (72.9%) (Table 1).

During the period of data collection, there were 2,603 live births. Thus, the NMM Ratio was 18.8/1,000 LB, as there were two maternal deaths, 51 women fit the indicator of Women with Life-threatening Conditions (Table 2).

NMM happened mainly during pregnancy (53.1%) or during immediate delivery/postpartum (32.7%). Among women identified as NMM, the majority had one (49%) or two (20.4%) WHO diagnostic criteria. Clinical criteria (71.4%) were the most frequent, while laboratory (42.8%) and management criteria (38.8%) had similar frequencies (Table 3).

Among clinical criteria, shock (42.8%), oliguria with no response to hydration or diuretics (30.6%) and changes in respiratory rate (14.3%) were the most common. Among laboratory criteria, the most common were oxygen saturation below 90% for more than 12 hours (18.4%), change between arterial oxygen pressure and inspired oxygen fraction (14.3%) and acute thrombocytopenia (14.3%). Among management criteria, continuous use of vasoactive drugs (20.4%) and puerperal hysterectomy due to infection or hemorrhage (20.4%) were the most recorded (Table 3).

MM cases presented multiple criteria for NMM. Table 4 shows the bivariate analysis between NMM criteria and death in pregnancy. The presence of more than three criteria was significantly associated with clinical worsening. The groups of laboratory and management criteria were more associated with death, while the types most related to death were: coagulation disorders, loss of consciousness and absence of pulse, transfusion of more than five red blood cell concentrated units, use of vasoactive drugs and intubation orotracheal unrelated to anesthesia for more than 60 minutes (Table 4).

As for perinatal outcome, among 42 medical records in which there were information on birth conditions, it was found that that 92.9% were live births. The average birth weight in kilograms was  $2,108.75 \pm 1,056.18$ , with a low birth prevalence of 41.46%. The mean gestational age at birth was  $33.66 \pm 5.05$  weeks. The first minute Apgar was below seven in 43.5% of cases, while the fifth minute Apgar above seven occurred in 89.7%. There were five neonatal deaths recorded (Table 5).

**Table 1.** Cases of maternal near miss, by maternal characteristics, Uberlândia, 2017.

Characteristics	N	Percentage
<b>Maternal age (years) (N=49)</b>		
12- 19	5	10.2
20- 34	34	69.4
>35	10	20.4
<b>Educational level (years) (N=38)</b>		
0	0	0.0
0-3	0	0.0
4-7	11	28.9
8-11	19	50.0
>12	8	21.1
<b>Skin color (N=48)</b>		
White	12	25.0
Brown ( <i>pardas</i> ) or black	36	75.0
<b>Marital status (N=48)</b>		
Married/Civil union	31	64.6
Single	17	35.4
<b>Health habits (N=49)</b>		
Smoking	2	4.1
Drug use	4	8.2
Illegal drug use	1	2.4
<b>Nuliparous (N=49)</b>	20	40.8
<b>Previous Cesarean sections (N=49)</b>		
0	29	59.2
1	10	20.4
2 or more	10	20.4
<b>Previous miscarriages (N=49)</b>		
0	34	69.4
1	12	24.5
2 or more	3	6.1
<b>Prenatal appointments (N=35)</b>		
0- 6	14	40.0
6 or more	21	60.0
<b>Comorbidities (N=49)</b>		
Chronic arterial hypertension	11	22.4
Diabetes mellitus 1	4	8.2
Diabetes mellitus 2	-	-
Cardiopatias	2	4.1
Kidney diseases	2	4.1
<b>Pregnancy comorbidities (N=49)</b>		
Gestacional arterial hypertension	11	22.5
Gestacional diabetes	4	8.2
<b>Miscarriage in current pregnant (N=49)</b>	1	2.0
<b>Molar pregnancy (N=49)</b>	1	2.0
<b>Ectopic pregnancy (N=49)</b>	2	4.0
<b>Type of childbirth in current pregnancy (N=44)</b>		
Vaginal	7	14.3
Cesarian section in labor	10	20.4
Cesarian section without labor	27	55.1
<b>Serious intercurrenties (N=49)</b>		
Hemorrhage	16	32.7
Hipertensive syndrome	14	28.6
Sepsis	10	20.4
Uterine rupture	1	2.4

**Table 2.** Indicatives of maternal mortality. Uberlândia, 2017.

Indicatives	n	Values
Live births	2603	-
Women who go through NMM	49	-
Maternal deaths	2	-
Ratio of NMM <sup>a</sup>	-	18.82/ 1000 NV
Ratio of maternal death <sup>b</sup>	-	76.83/ 100.000 NV
Ratio of serious maternal outcome <sup>c</sup>	-	19.6/ 1000 NV
NMM: MD	-	24.5:1
Maternal death index <sup>d</sup>	-	3.9%

<sup>a</sup>Ratio of NMM: number of NMM cases/number of live births x 1000

<sup>b</sup>Ratio of maternal death: number of cases of MD/ number of live births x 100.000

<sup>c</sup>Ratio of serious maternal outcome: number of life threatening conditions (NMM+MD)/number of live births x 1000

<sup>d</sup>Maternal death index: MD/ MD+ NMM x100

**Tabela 3.** Incidence and proportional distribution of maternal near miss cases according to criteria defined by the World Health Organization, Uberlândia, 2017.

Number of criteria	Incidence by 1,000 live births	%
1	9.2	49.0
2	3.8	20.4
3	1.9	10.2
4 or +	3.8	20.4
<b>Clinical criteria</b>	13.4	71.4
Respiratory rate greater than 40 or less than six breaths per minute	2.7	14.3
Coagulation disorder	1.5	8.2
Acute cyanosis	1.2	6.1
Shock	8.0	42.9
Oliguria with no response to hydration and medication	5.8	30.6
Repeated seizures/total paralysis	1.9	10.2
Jaundice in the presence of pre-eclampsia	0.38	2.0
Loss of conscience for over 12 hours	0.77	4.1
Agonal respiration	-	-
Loss of conscience + Absence of pulse	-	-
Stroke	0.77	4.1
<b>Laboratory criteria</b>	8.1	42.8
Acute thrombocytopenia (platelet count below 50,000)	2.69	14.3
pH <7.1	0.38	2.0
Creatinine greater than or equal to 3.5mg/dL	1.1	6.1
Bilirubin greater than 6mg/dL	0.77	4.1
PaO <sub>2</sub> /FiO <sub>2</sub> less than 200mmHg	2.69	14.3
Loss of consciousness associated with presence of glucose in urine and ketoacidosis	-	-
O <sub>2</sub> saturation less than 90% for more than 60 minutes of more	3.4	18.4
Lactate greater than 5	1.1	6.1
<b>Management criteria</b>	7.3	38.8
Transfusion of 5 or more red blood cell units	3.4	18.4
Port-infection hysterectomy or hemorrhage	3.84	20.4
Continuous use of vasoactive drugs	3.84	20.4
Intubation and mechanical ventilation unrelated to anesthesia for 60 minutes or more	2.69	14.3
Dialysis for acute renal failure	1.5	8.1
Cardiopulmonary resuscitation	-	-

**Table 4.** Bivariate analysis between maternal near miss criteria and pregnancy outcome, Uberlândia, 2017 (n = 51).

Criteria for near miss	Survival	Death	Bivariate analysis	
			OR (CI95%)	Value of p <sup>a</sup>
<b>Number of criteria</b>				
Up to 3	39 (100)	0	-	0.05
Greater than 3	10 (83.3)	2 (16.7)		
<b>Clinical criteria</b>	35 (94.6)	2 (5.4)	-	1
Respiratory rate greater than 40 or less than six breaths per minute	7 (100)	0		1
Coagulation disorder	4 (66.7)	2 (33.3)	-	0.01
Acute cyanosis	3 (75.0)	1 (25.0)	0.07 (0.0008-6.81)	0.15
Shock	21 (91.3)	2 (8.7)	-	0.19
Oliguria with no response to hydration and medication	15 (100)	0	-	1
Repeated seizures/total paralysis	5 (100)	0	-	1
Jaundice in the presence of pre-eclampsia	1 (100)	0	-	1
Loss of conscience for over 12 hours	2 (66.7)	1 (33.3)	0.05 (0.001-2.46)	0.11
Agonal respiration	-	-	-	-
Loss of conscience + Absence of pulse	0	2 (100)	-	< 0.001
Stroke	2 (66.7)	1 (33.3)	0.05 (0.001-2.46)	0.11
<b>Laboratory criteria</b>	21 (91.3)	2 (8.7)	-	0.19
Acute thrombocytopenia (platelet count below 50,000)	7 (87.5)	1 (12.5)	0.17 (0.004-7.40)	0.29
pH < 7.1	1 (100)	0	-	1
Creatinine greater than or equal to 3.5mg/dL	3 (100)	0	-	1
Bilirubin greater than 6mg/dL	2 (100)	0	-	1
PaO <sub>2</sub> /FiO <sub>2</sub> less than 200mmHg	7 (87.5)	1 (12.5)	0.17 (0.004-7.40)	0.29
Loss of consciousness associated with presence of glucose in urine and ketoacidosis	-	-	-	-
O <sub>2</sub> saturation less than 90% for more than 60 minutes of more	9 (100)	0	-	1
Lactate greater than 5	3 (100)	0	-	1
<b>Management criteria</b>	19 (90.5)	2 (9.5)	-	0.16
Transfusion of 5 or more red blood cell units	9 (81.8)	2 (18.2)	-	0.04
Port-infection hysterectomy or hemorrhage	10 (100)	0	-	1
Continuous use of vasoactive drugs	10 (83.3)	2 (16.7)	-	0.05
Intubation and mechanical ventilation unrelated to anesthesia for 60 minutes or more	7 (77.8)	2 (22.2)	-	0.03
Dialysis for acute renal failure	4 (100)	0	-	1
Cardiopulmonary resuscitation	-	-	-	-

<sup>a</sup>Fisher's exact test; OR: Odds ratio; CI: confidence interval.

**Tabela 5.** Características do desfecho perinatal para os casos de *near miss* materno, Uberlândia, 2017.

	N	Percentage (%)
<b>Conditions of birth</b>		
Live birth	39	92.9
Stillbirth	3	3.1
<b>Birth weight (N=41)</b>		
< 2500g	17	41.46
>2500g	24	58.54
<b>Apgar 1<sup>st</sup> minute (N=39)</b>		
≤ 7	17	43.5
>7	22	56.4
<b>Apgar 5<sup>th</sup> minute (N=39)</b>		
≤ 7	4	10.26
>7	35	89.7
<b>Gestational age (N=36)</b>		
≤ 37 weeks	24	66.7
>37 weeks	12	33.3
<b>Medical discharge conditions</b>		
Discharge	33	86.4
Death	5	13.1

## DISCUSSION

The sociodemographic characteristics of women with NMM corresponds to the usual profile of the population cared for at the HCU, with a majority of black or *pardo* women and with a high school educational level. Most were between 20-39 years old, this being also the age group in which the highest number of obstetric admissions occurs. In other studies, there was a tendency of increase in serious conditions with advancing age<sup>10-12</sup>.

There was no significant index of NMM in women who drank alcohol, smoked or were drug addicts. When assessing prenatal care through the number of medical appointments, most performed it satisfactorily, but with a possible weaknesses for detecting changes.

Cesarean section was present in the previous medical history of 40% of patients. Other investigations show that the existence of risk factors in pregnancies when there is a history of cesarean section surgeries is not uncommon<sup>13-16</sup>. Monitoring cesarean rates, as well as making efforts to reduce them, is a strategy to reduce the incidence of serious complications in the future. Previous cesarean section is associated with an increased risk for anomalous placental fixation, hemorrhages, hysterectomies and blood transfusions<sup>17</sup>.

There was a high incidence of cesarean sections in the current pregnancy, a fact that other findings corroborate<sup>7,10</sup>. A multicenter study used the Robson Group Classification to assess the indication of this procedure in patients with NMM. This study showed that high rates of cesarean section can worsen the maternal outcome and it the indication must be done with caution<sup>18</sup>. In another analysis, there was a five times association between the risk of NMM and cesarian sections, but it was considered a confounding variable since it involved a high-risk population and indicated for pregnancy termination<sup>19</sup>.

Prematurity was present in most cases, as well as the absence of labor in parturition process, that is, surgery was indicated as a form a treatment. Protocols can be performed to systematically establish the indication for cesarean section in women with severe conditions. Among all cases of NMM, miscarriages represent 2%. In a systematic review conducted with 70 surveys from 28 countries, it was possible to estimate that 9% of hospitalizations for miscarriage evolved to NMM and were more related to hemorrhage and severe infection<sup>20</sup>. The repercussion of this condition is percentage lower, but it represents preventable causes of complications and clinical protocols must be reviewed for its follow-up.

Hypertensive diseases had an important percentage in the occurrence of severe morbidities, a fact that corroborates findings in research conducted in other regions of the



country<sup>8,19,21,22</sup>. In a multicenter study, the incidence of severe hypertensive disease in women with NMM was 4.2/1000 LB, with a presence in 70% of all cases<sup>23</sup>. The progression between a healthy pregnancy and its worsening, when seen by this variable, allows for the perception of the avoidable nature of gestational complications. The analysis of this population by the health services makes it possible to identify possible delays in attendance and their due corrections.

Hemorrhage was the most common factor among NMM cases, as well as being one of the registered deaths. Among the criteria, a high proportion of puerperal hysterectomy, the use of vasoactive drugs, massive blood transfusion and shock were also found, which correspond to symptoms and treatment of hemorrhage. Studies carried out in similar services in Recife, in the state of Pernambuco, and Campinas, in the state of São Paulo, found bleeding rates of 53.7% and 64.5%, respectively<sup>9,24</sup>. Accordingly, a systematic review carried out with studies from 17 countries showed that NMM events due to hemorrhages occur more frequently in developing countries, with the global indicator found being 3.3/1000 NV<sup>25</sup>.

The percentage of hemorrhages is important in this analysis, as it is the only tertiary-level hospital with emergency care in the city. In addition, for cases admitted to secondary units or other locations in the region, which are referred through the regulation of hospital beds, there may be delays in handling and thus, the increase in severity. Accessibility to emergency services that avoid women's journeys between hospitals, as well as clinical protocols with trained staff is of paramount importance to prevent clinical worsening. This obstetric emergency requires rapid response and the necessary technological support for its timely assistance, as it is related to MD<sup>26</sup> rates.

The NMM ratio found in this analysis was 18.8/1000 LB. In two studies carried out across the national territory, there was an NMM ratio of 10.8 and 9.37/1000 NV<sup>7,10</sup>. Likewise, a study in Spanish-speaking countries in the American continent found an NMM ratio of 12.3/1000 NV<sup>27</sup>. The ratio between NMM:MD found in this analysis is higher than that of other studies<sup>8,15,22</sup>, but lower than that found by a national survey<sup>10,28</sup>, bigger reasons indicate a better capacity to deal with severe cases<sup>1</sup>.

Among the criteria proposed by WHO, clinical criteria were the most prevalent, as found in the survey *Nascer no Brasil*, in which postpartum women were evaluated in all Brazilian regions<sup>10</sup>. However, in the survey by the Severe Maternal Morbidity Surveillance Network (*Rede de Vigilância da Morbidade Materna Grave*), management criteria were the most prevalent, followed by clinical and laboratory criteria<sup>7</sup>. In another Brazilian study carried out in Campinas, in the state of São Paulo, the management criteria were also found to be the most prevalent<sup>9</sup>.

This is a variable (criteria) that is difficult to compare, as it depends on the availability of complex resources for the identification of laboratory and management criteria. The finding in this study may be related to the fact that HCU receives women sent from other intermediary health services with very serious clinical conditions, making it possible for symptoms to appear compatible with the proposed clinical criteria. Delays in care are related to the increased severity of obstetric complications<sup>19,29</sup>.

Due to the reduced number of registered deaths, it was probably not possible to find significance in several criteria analyzed in relation to death. However, there was a positive relationship for the criteria: coagulation disorders, loss of consciousness and absence of pulse, transfusion of more than five red blood cell concentrated units, use of vasoactive drugs and orotracheal intubation unrelated to anesthesia for more than 60 minutes.

In other studies, all the criteria for NMM proposed by the WHO had a positive association in relation to death<sup>1,19,21</sup>. Equally, the increase in the presence of criteria is related to the patient's severity, since the criteria proposed by the WHO are associated with organ dysfunctions<sup>1,21</sup>. In an investigation, when analyzing the cases of NMM and MD in Fortaleza, in the state of Ceará, a more significant association was found between death and management criteria<sup>19</sup>, while in this analysis, the relationship with the worst outcome was increased for laboratory and management criteria.

Perinatal outcome, low birth weight, prematurity and Apgar scores lower than seven in the first minute had important percentages, a fact that corroborates with other research<sup>30</sup>. It is possible that assistance to the newborn in an adequate manner provided an improvement in Apgar scores after the fifth minute for most neonates, a relevant factor for reduction of neonatal morbidity. Maternal health has a direct relationship with birth conditions, since they can affect fetal development and promote early termination of pregnancy.

Knowing NMM criteria standardized by the WHO and its determinants is essential for the best execution of care. Furthermore, the work of nurses has a fundamental role in epidemiological surveillance and in the planning of actions for organizing health care network. During the obstetric care process, the professional nurse is involved in its entire continuum, from prenatal appointments, monitoring of exams, active search at the necessary times, as well as during the care related to birth and obstetric emergencies.

This was the first study on this topic carried out at HCU, where it was possible to know the epidemiological profile of NMM and maternal death in relation to characteristics of the patients and the perinatal outcome of this hospital. Carrying out surveillance of this population will allow systematic monitoring of related factors and formation of strategies for the improvement of the indicators.

## CONCLUSION

The NMM ratio of this study was high, a fact that shows the magnitude of this problem at a local level. A higher proportion of NMM was found in women aged between 20 and 34 years, black or *pardas*, with high school level education and married.

Previous cesarean section surgeries have a higher percentage in severe maternal morbidity, as well as the indication for this surgery in the current pregnancy. The most common factors were hemorrhages, followed by hypertensive diseases. For the studied population, clinical criteria were the most found, with the overlap of more than three criteria being associated with death. The adverse perinatal outcome was also common in neonates of women with NMM.

The present study presents the epidemiological characteristics of women with criteria for NMM admitted during the puerperal pregnancy cycle at the HCU, therefore, it is a local analysis and cannot reflect other realities.

This study has as limitations the impossibility of contact with the health professional involved in the care for patients, a time when doubts could be clarified, in addition to not allowing direct contact with the patient in order to provide more information regarding the pre-natal and urgent care care processes, as well as more information on sociodemographic aspects. However, the retrospective research, carried out through collection of data in medical records, allows for the inclusion of cases that happened during the period of time mentioned and provides clinical information necessary for characterization of patients. The time period chosen for data collection includes all possible seasonal interferences.

Given the above, it is suggested to encourage research and the exchange of experience of health professionals, managers and users to recognize the advances and challenges of public policies in reproductive health as a means of subsidizing improvements to current indicators. The effectiveness of health actions is intertwined with efforts and monitoring of maternal-fetal indicators, given the importance of involving epidemiological surveillance and assistance services with the proposition to transform the current scenario, which is still very permeated by poor outcomes.

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**Karen Magalhães Arantes** contributed with writing. **Efigênia Aparecida Maciel de Freitas** participated in the conception, writing and revision. **Jean Ezequiel Limongi** and **Brenda Magalhães Arantes** worked on the conception, collection and analysis of data, writing and revision.

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