Severe Maternal Morbidity and Near Misses in a Regional Reference Hospital

Morbidade Materna Grave e Near Misses em Hospital de Referência Regional

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Abstract

Objective: To investigate severe maternal morbidity/near misses in a tertiary public maternity in the state of Rio de Janeiro, using different identification criteria. **Methods:** This is a cross-sectional study, performed in a regional reference hospital between June and October 2009, on severe maternal morbidity/near miss cases identified from the log books of the maternity hospital and review of medical records. This study focused on women who, during pregnancy, delivery, or the postpartum period, showed no clinical symptoms compatible with the defining criteria for severe maternal morbidity/near miss of Waterstone *et al*, Mantel *et al.* and the World Health Organization (WHO). **Results:** Among the 1,544 admissions during the period studied, 89 women with severe maternal morbidity were identified, considering all criteria. The occurrence of severe maternal morbidity/near misses ranged from 81.4 to 9.4 per 1,000 live births (LB), depending on the criterion used. The mortality rate was 3.2%, reaching 23% in the WHO criteria. Only 40% of these women had more than six prenatal visits and 10% did not have any visit at all. The most common markers found were severe preeclampsia, followed by severe hemorrhage, ICU admissions, HELLP syndrome, and eclampsia. There were three maternal deaths with a MMR = 280/100.000 LB and one late death. The WHO criterion showed greater specificity, identifying more severe cases, while the Waterstone criterion was more sensitive. **Conclusions:** The study of severe maternal morbidity/near misses in a regional reference hospital can contribute to the knowledge of this event's magnitude, as well as to identify its most frequent characteristics and clinical conditions, being essential for dealing with maternal morbidity and mortality.

Keywords: *Near miss.* Severe maternal morbidity. Maternal mortality. Maternal Death. Defining criteria. Brazil.

Resumo

Objetivo: Analisar perfil epidemiológico da morbidade materna grave/*near miss* em uma maternidade pública de referência regional, utilizando diferentes critérios identificadores. **Métodos:** Trata-se de um estudo descritivo de corte transversal dos casos de morbidade materna grave/*near miss* realizado em Hospital de referência regional entre junho e outubro de 2009, identificados a partir dos livros de registro de internação da maternidade e análise dos prontuários clínicos. Foram estudadas mulheres que, durante a gestação, parto ou puerpério, apresentaram qualquer quadro clínico compatível com os critérios definidores de morbidade materna grave/*near miss* de Waterstone et al., Mantel et al. e Organização Mundial de Saúde. **Resultados:** Entre as 1.544 internações foram identificadas 89 mulheres com morbidade materna grave, considerando os critérios adotados. As razões de morbidade materna grave/*near miss* variaram entre 81,4 a 9,4 por 1.000 NV, dependendo do critério utilizado. O índice de Mortalidade foi de 3,2%, chegando a 23% no critério da OMS. Das 89 mulheres, apenas 40% fizeram mais de seis consultas de pré-natal e 10% não realizaram qualquer consulta. Os marcadores mais encontrados foram a pré-eclâmpsia grave seguida de hemorragia grave, internação em UTI, Síndrome HELLP e eclâmpsia. Ocorreram três mortes maternas por causas obstétricas com RMM de 280/100.000 NV e uma morte tardia. O critério da OMS se mostrou mais específico, identificando os casos mais graves, enquanto o de Waterstone foi mais sensível. **Conclusão:** O estudo da morbidade materna grave/*near miss* em um hospital de referência regional pode contribuir para o conhecimento da magnitude deste evento, como também identificar suas características e condições clínicas mais frequentes, sendo extremamente importante para o enfrentamento da morbi-mortalidade materna.

Palavras-chave: *Near miss*. Morbidade materna grave. Mortalidade materna. Óbito materno. Critérios definidores. Brasil.

Introduction

The World Health Organization (WHO) estimated that there were more than 500,000 maternal deaths worldwide in 2005.[1] Maternal mortality ratios (MMR) ranged from 1 per 100,000 live births in Ireland to 2,100 per 100,000 live births in Sierra Leone. Of all deaths, 95% occurred in developing countries,[1] revealing major political, economic and social differences between countries and regional differences, especially regarding women's health.

In Brazil, maternal death is a public health concern. According to the Brazilian Ministry of Health, the estimated MMR in 2006 was 77.2 per 100,000 live births.[2] The North and Northeast were the Brazilian regions with the highest MMRs, while the South and Southeast had the lowest ones. Direct obstetric causes account for 75% of maternal deaths, and the main causes are hypertensive diseases, followed by hemorrhage and puerperal infections.[2, 3, 4]

In a global scenario, maternal death is used as a parameter to assess the quality of health services provided by identifying situations of inequality and contributing to the assessment of levels of health and socioeconomic development of a population.[4]

The magnitude of maternal mortality is not yet well established in part because of inaccurate databases. The underestimation of the number of maternal deaths is a concern in both developed countries that have approximately 100% coverage of death records, and developing ones,[5,6] hindering the analysis of determinants of maternal mortality and the development of targeted public policies.

In view of inadequate quantitative and qualitative data on maternal mortality, and decreasing maternal mortality rates in developed countries, new indicators have been developed to more effectively evaluate maternal health issues. Severe maternal morbidity/near miss is a newly described condition that has been investigated for the last 20 years. Near misses are defined as pregnant women with severe life-threa-

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tening conditions who nearly die but, with good luck or good care, survive. [7,8,9,10]

Severe maternal morbidity/near miss can be a more valuable indicator in the analysis of obstetric care than maternal mortality as this condition has greater incidence rates and offers a good opportunity for data collection as the woman herself can be a source of information. WHO estimated in 2004 that 20 million women had complications during pregnancy, childbirth or the postpartum period with varying degrees of sequelae.[9] Therefore, the study of severe maternal morbidity/near miss is key to advance knowledge about risk factors during pregnancy, and it can be a valuable tool for monitoring the delivery of obstetric care.[8,11]

Severe acute maternal morbidity/near miss is a relatively recent concept and there has been no consensus about the most appropriate defining criteria. The lack of consensus can be in part attributed to a broad spectrum of clinical severity: it is difficult to set the point that characterizes severe maternal morbidity/near miss somewhere between a healthy pregnancy and maternal death.[8,12]

Three approaches based on different indicators have been proposed to identify severe maternal morbidity/near miss: 1) organ dysfunction;[13] 2) presence of conditions or complications[14,15] such as pre-eclampsia, uterine rupture or severe sepsis; and 3) level of care complexity such as blood transfusion or intensive care unit (ICU) admission.[16,17]

The WHO Working Group on Maternal Mortality and Morbidity has recently developed a uniform set of criteria for case identification based on three established approaches with clinical, laboratory and management markers.[18,19] This event is most commonly known as "severe maternal morbidity," "severe acute maternal morbidity" or "near miss." WHO[18,19] argues that "maternal near miss" is the term that better reflects the notion of "nearly dying but surviving" and recommends its use.

There have been several studies on maternal morbidity both in developing and developed countries and the spectrum of its causes overlaps to that of maternal mortality, especially hypertensive conditions and hemorrhage.[8,20,21]

Although it is a highly relevant issue regarding care during pregnancy, childbirth and the postpartum period, severe maternal morbidity or near miss has been scarcely investigated in Brazil. Most studies have used Mantel[13] and Waterstone[14] classifications as they have been published prior to the proposed WHO classification.[18]

Souza et al.[21] used Mantel[13] and Waterstone[14] criteria to assess severe maternal morbidity/near miss in a tertiary care hospital in the city of Campinas, southeast Brazil, in 2003–2004. They then applied Geller[22] score to explore factors associated with disease severity.[23,24] Luz et al.[25] used Mantel and Waterstone criteria to evaluate care at another tertiary hospital in the city of Campinas in 2005–2006. Amorim et al.,[26,27] using the same criteria, analyzed obstetric ICU admissions in a hospital in the city of Recife, northeastern Brazil.

Two population-based studies assessed severe maternal morbidity in Brazilian regions. The first study[28] used information from the National Mortality Database (SIM), Hospital Admissions Database (SIH), and Live Births Database (Sinasc). The second one[29] used data from the 1996 Demographic and Health Survey.

The present study aimed to describe the epidemiological profile of severe maternal morbidity/near miss and its maternal characteristics and perinatal outcomes in a regional public referral maternity hospital. The study was conducted in the state of Rio de Janeiro where there are no data available on this condition. In addition to the existing criteria, the new proposed WHO classification of severe maternal morbidity/near miss was used in the study to evaluate the frequency and accuracy of the most commonly used criteria.

Methods

A cross-sectional study was conducted at the Azevedo Lima State Hospital (HEAL)

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in the city of Niterói, State of Rio de Janeiro, between June 1st, 2009 and October 30, 2009. The HEAL is a 275-bed hospital affiliated to the State Department of Health and Civil Defense of Rio de Janeiro and includes a maternity ward and a surgery center, an adult ICU, a neonatal ICU (NICU) and an intermediate care unit.

The HEAL and the Antônio Pedro University Hospital at the Universidade Federal Fluminense (UFF) are tertiary referral hospitals that provide care to high-risk pregnant women in the metropolitan area II of the state of Rio de Janeiro with an estimated population of 1,931,063 inhabitants in 2009. According to demographic and obstetric data from Sinasc (2005–2006) and SIH (2007–2008), the women served by these hospitals included 28% adolescents and 21% over 30 years of age; 45% had incomplete elementary schooling; 11% had less than four pre-natal visits; and almost one quarter (23.4%) had low birth weight infants.

The study included women who during pregnancy, childbirth or within the first 42 days postpartum showed any clinical signs that met the defining criteria of severe maternal morbidity/near miss based on Mantel et al.,[13] Waterstone et al.,[14] and WHO classification[18] (Chart 1).

Data was prospectively collected from June to October 2009 by the principal investigator and trained students of the UFF Medical School. Suspected cases of severe maternal morbidity/near miss were identified during daily visits to the ICU and obstetrics ward, and review of hospital admissions records. Once they were identified, the patients were followed up by reviewing medical, nursing, and blood bank records and death certificates from the hospital administrative department to rule out or confirm suspected cases of severe maternal morbidity/near miss. Data of the confirmed cases were entered into a data collection form without direct contact or interview with the women.

The data collection instrument was based on Mantel, Waterstone and WHO criteria. It consisted of a semi-structured questionnaire with open and closed questions. All cases were reviewed to assess their classification based on the three different criteria.

After case confirmation, consistency and completeness of data were evaluated and then entered into a database using Microsoft Excel 2003.

The following variables were collected: age; city of residence; education level; prenatal visits; gestational age or postpartum time at admission; parity; type of delivery; markers used to identify severe maternal morbidity; and perinatal data.

A descriptive analysis was carried out, comparing the different criteria for maternal morbidity. Measures of central tendency were estimated for continuous variables and measures of frequency for categorical variables. For the assessment of indicators of maternal morbidity and mortality, the formulas recommended by WHO Department of Reproductive Health and Research were used.[18]

The study followed the recommendations of Resolution 196/96 and was approved by the Research Ethics Committee of the UFF Antônio Pedro University Hospital and authorized by Azevedo Lima State Hospital board. There were no conflicts of interest.

Results

During the study period 1,544 women were admitted to the HEAL maternity hospital, 1,097 (71.1%) for childbirth (50.4% cesarean sections), 15.4% for curettage and 13.5% for other procedures (laparotomy, ectopic pregnancy and inpatient care during pregnancy). There were three maternal deaths from obstetric causes with a MMR of 280 per 100,000 live births; and one late death that is still under investigation.

Of 1,069 live births, 17 died within the first six days of life with an early neonatal mortality rate of 16 per 1,000 live births. There were 28 fetal deaths, totaling 45 perinatal deaths with a perinatal mortality rate of 41 per 1,000 births.

Among the 112 women with suspected

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Chart 1 - Diagnostic criteria of severe maternal morbidity according to Waterstone et al.[14], Mantel et al.[13] and the WHO[18].
Quadro 1 - *Critérios diagnósticos de morbidade materna grave segundo Waterstone et al.[14], Mantel et al.[13] e OMS[18]*

WATERSTONE et al. CRITERIA [14]		

Severe pre-eclampsia
   BP = 170/110 mmHg twice, 4-hours apart or
   BP >170/110 associated with 24-hour proteinuria greater than 0.3 g or + + on a stick
Eclampsia
HELLP syndrome
Severe hemorrhage (blood loss >1,500 mL)
Severe sepsis
Uterine rupture		

MANTEL et al. CRITERIA[13]		
Pulmonary edema Cardiopulmonary resuscitation Hypovolemia (requires 5 or more units of packed red blood cells) Admission to the Intensive Care Unit (ICU) for sepsis or other causes Emergency hysterectomy Ventilation for more than 60 minutes, except for general anesthesia O2 saturation below 90% for more than 60 minutes Alveolar pressure of oxygen/inspired fraction of oxygen (PaO2/FiO2) ratio >300 mmHg Diuresis less than 400 mL/24 hours, refractory to hydration, furosemide or dopamine Acute deterioration of BUN and creatinine (> 15 mol and >400 mol) Jaundice with pre-eclampsia Diabetic ketoacidosis Thyroid storm Acute thrombocytopenia requiring platelet transfusion Coma for more than 12 hours Subarachnoid or intraparenchymal hemorrhage Anesthetic accident: severe hypotension after-blockade and failed intubation		
WHO CRITERIA [18,19]		
Clinical criteria	Laboratory criteria	Management criteria
• Acute cyanosis • Gasping • AVC • Respiratory frequency > 40 or <6 • Shock • Oliguria not responsive to fluids or diuretics • Coagulation disorders • Total paralysis • Loss of consciousness for ≥12h • Jaundice with pre-eclampsia • Unconsciousness and no pulse/heartbeat	• Oxygen saturation <90% for ≥ 60 minutes • PaO2/FiO2 <200 mmHg • Creatinine ≥300 mmol/L or ≥ 3.5 mg/dL • Bilirubin >100 mmol/L or >6.0 mg/dL • pH <7.1 • Lactate >5 • Acute thrombocytopenia (<50 000 platelets) • Loss of consciousness and ketoacidosis and glucose in urine	• Continued use of vasoactive drugs • Hysterectomy for postpartum hemorrhage or infection • Transfusion of ≥5 units of PRBCs • Dialysis for acute renal failure • Intubation and ventilation for ≥60 minutes not related to anesthesia • Cardiopulmonary resuscitation (CPR)

PRBCs: packed red blood cells; ICU: intensive care unit

severe maternal morbidity/near miss, 89 were confirmed based on any of the three criteria. The other 23 patients were excluded from the analysis. Twenty of them were first suspected because they had some clinical conditions suggestive of severe maternal morbidity but they progressed with clinical improvement, not meeting any criterion of maternal morbidity. The remaining three patients were excluded due to death, although they met the three criteria. The fourth death, still under investigation, was not identified as a suspected case.

The maternal morbidity/near miss rate was 83.25 per 1,000 live births (Table 1). Eighty-seven women met Waterstone[14] (75

of them exclusively), 14 met Mantel[13] (two of them exclusively) and 10 met WHO criteria (none of them exclusively). Two women met both Mantel and Waterstone criteria at the same time and 10 met all three criteria.

Depending on the criteria used, the rate of severe maternal morbidity/near miss ranged from 81.4 to 9.4 per 1,000 live births (Table 1): Mantel criteria[13] – 13.09 cases per 1,000 live births; Waterstone criteria[14] – 81.38 cases per 1,000 live births; and WHO criteria[18] – 9.35 cases per 1,000 live births. The mortality rate ranged between 3.2% and 23%, when assessed by the WHO criteria[18] and the maternal near miss/mortality ratio was 29.6:1.

The characteristics of the women diagnosed with severe maternal morbidity/near miss are presented in Table 2. Their mean age was 26.4 years old; there were more cases in the age group 20–29 years, except when using the WHO criteria that identified more cases in the age group 30–39 years. Only one woman had less than three years of schooling and 40% had 8–11 years of schooling. Of all women, 33.7% were primiparous and 23.6% had previous abortions. Most entered the study with less than 36 weeks gestation (mean 34.6 weeks). Only one woman entered the study in the puerperium. Regarding prenatal care, 40% attended more than six visits; approximately 10% did not attend any visit accounting for 30% of cases identified by the WHO crite-

ria.[18] Of the 89 confirmed cases, 70 were admitted for delivery, of which 88% were cesarean sections (100% according to the WHO[18] and Mantel criteria[13]).

Among these 70 women, the perinatal outcomes (Table 3) were 68 live births (one twin pregnancy), three stillbirths and three early neonatal deaths, with a perinatal mortality rate of 84.5 per 1000 births. More than 50% of the newborns were low birth weight (<2,500 g) and preterm (gestational age <37 weeks). About 12% of newborns had a 5-minute Apgar score of less than 7. Twenty-five (36.8%) newborns of the women studied were admitted to the hospital's NICU. Of these, three died and 11 were transferred to other hospitals. The three newborns who died weighed less than 600 g at birth, had a 5-minute Apgar score of less than 7 and the causes of death reported were sepsis and prematurity. Their mothers were all characterized only by Waterstone criteria as they had severe preeclampsia. As for stillborn babies, two mothers had severe preeclampsia and met Waterstone criteria and one had severe hemorrhage following placental abruption and met all the three criteria.

Table 4 shows the most commonly used clinical and management criteria of maternal morbidity in 89 patients. Of the six criteria proposed by Waterstone,[14] all but one (uterine rupture) were used, while only 11 out of the 19 criteria proposed by Man-

Table 1 – Indicators proposed by the WHO[18] for Maternal Near Miss, according to the criteria utilized.
Tabela 1 – *Indicadores propostos pela OMS[18] para Near Miss Materna, segundo os critérios utilizados.*

WHO INDICATORS	GENERAL	WATERSTONE	MANTEL	WHO
Absolute number of near-miss cases*	89	87	14	10
Near miss rate***	83.25	81.38	13.09	9.35
Severe maternal outcome ratio (SMOR)#	86.06	84.19	15.9	12.16
Maternal near miss/mortality ratio ##	29.66	29	4.6	3.3
Maternal mortality rate ###	3.20%	3.33%	17.60%	23%

* Absolute number of near miss cases / *Nº absoluto de casos near-miss (NMM)*
** Incidence of near-miss cases refers to the number of maternal near misses by 1,000 live births / ** *Incidência NMM, se refere ao número de casos de near miss materna por 1.000 nascidos vivos*
# Severe maternal outcome ratio = number of women in life-threatening situations per 1,000 live births / # *Razão de Desfecho Materno Grave (RDMG) número de mulheres em condições de Risco de Vida por 1.000 nascidos vivos*
Maternal near miss/mortality ratio - ration between cases of maternal near miss and maternal deaths./ *Razão Near Miss Materna/mortalidade - proporção entre casos de near miss materna e mortes maternas.*
Mortality rate, number of maternal deaths by the number of women in life-threatening situations (percentage) / *Índice de Mortalidade, número de mortes maternas dividido pelo número de mulheres em condições de Risco de Vida (percentagem)*

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Table 2 – Socio-demographic and obstetric characteristics of the patients indentified as Severe Maternal Morbidity/Near Miss at Azevedo Lima State Hospital from June to October 2009, according to the criteria utilized.

Tabela 2 - Características sociodemográficas e obstétricas das pacientes identificadas como Morbidade Materna Grave/Near Miss no Hospital Estadual Azevedo Lima, de junho a outubro de 2009, segundo os critérios utilizados.

Characteristics	Total		Waterstone criteria		Mantel criteria		WHO criteria	
	n	%	N	%	n	%	n	%
Total cases	**89**	100	**87**	100	**14**	100	**10**	100
Age								
10–19	19	21.3	19	21.8	3	21.4	2	20
20–29	39	43.9	38	43.7	5	35.7	3	30
30–39	27	30.4	26	29.9	5	35.7	4	40
>40	4	4.4	4	4.6	1	7.2	1	10
Municipality of residence								
Niterói	33	37.1	33	37.9	4	28.6	3	30
São Gonçalo	48	53.9	46	52.9	8	57.1	6	60
Other	8	9	8	9.2	2	14.3	1	10
Education level (years of schooling)								
≤3	1	1.1	1	1.1	0	0	0	0
4–7	27	30.4	27		4	28.6	3	
8–11	38	42.8	38	43.7	3	21.4	3	30
≥ 12	4	4.4	4	4.6	0	0	0	0
Unknown	19	21.3	17	19.5	7	50	4	40
Type of procedure								
Childbirth	70	78.8	70	80.5	7	50	6	60
Curettage/abortion	4	4.4	4	4.6	2	14.3	2	20
Laparotomy Ectopic pregnancy	4	4.4	4	4.6	1	7.2	1	10
Other Procedures	11	12.4	9	10.3	4	28.6	1	10
Type of delivery								
Vaginal	8	11.4	8	11.4	0	0	0	0
Cesarean section	62	88.6	62	88.6	7	100	6	100
Number of pregnancies								
1	30	33.7	29	33.3	3	21.4	1	10
2–3	41	46.1	40	45.9	10	71.4	9	90
>3	13	14.6	13	14.9	0	0	0	0
Previous abortion								
0	68	76.4	67	77.1	12	85.6	10	100
>1	16	18	15	17.2	1	7.2	0	0
Gestational age								
<22 weeks	3	3.4	3	3.4	0	0	0	0
22–27 weeks	8	9	7	8	2	14.3	1	10
28–31 weeks	12	13.5	11	12.6	1	7.2	0	0
32–36 weeks	25	28.1	25	28.8	4	28.6	3	30
37–41 weeks	32	36	32	36.9	3	21.4	3	30
≥42 weeks	2	2.2	2	2.3	0	0	0	0
Puerperium	1	1.1	1	1.1	1	7.2	0	0
Unknown	6	6.7	6	6.9	3	21.4	3	30
Prenatal care visits								
None	9	10.1	9	10.3	3	21.4	3	30
1–3	13	14.6	12	13.8	2	14.3	0	0
4–6	21	23.6	21	24.2	1	7.2	1	10
> 6	35	39.3	35	40.2	5	35.7	5	50
Unknown	11	12.4	10	11.5	3	21.4	1	10

tel[13] were used. Twelve out of the 25 criteria proposed by WHO[18] were used. The most common criteria were severe pre-eclampsia followed by severe bleeding. Other criteria were often used including ICU admission (9 cases); HELLP syndrome (5 cases); and eclampsia, blood transfusion and high creatinine (4 cases each). As for the clinical outcome, 83 women were discharged in good health, three with sequelae and three were transferred to the university hospital.

Discussion

The present study found a incidence rate of severe maternal morbidity/near miss ranging from 81.4 to 9.4 per 1,000 live births. These data are consistent with those reported in the literature, 0.7 to 101.7 cases per 1,000 births.[8,20,30] However, they are higher than those found in Campinas studies.[22,23] Souza et al.[21] found a severe maternal morbidity rate of 15 to 42 cases per 1,000 births, depending on the criteria used. Luz et al.[25] found a rate for severe morbidity and extremely severe morbidity of 44.9 and 6.8 cases per 1,000 live births, respectively. Sousa et al.[28] estimated the rate of near miss morbidity at 44.3 per 1,000 live births. It is worth noting that most of these studies used the number of births in the denominator of the maternal morbidity rate, whereas the

Table 3 – Perinatal characteristics of the conceptus of patients characterized as Severe Maternal Morbidity/Near Miss.
Tabela 3 - Características perinatais dos conceptos das pacientes caracterizadas como Morbidade Materna Grave/Near Miss.

Characteristics	Total		Waterstone criteria		Mantel criteria		WHO criteria	
	n	%	n	%	n	%	n	%
Birth status								
Live birth	68	90.6	68	90.6	6	66.7	5	62.5
Stillbirth	3	4.0	3	4.0	1	11.1	1	12.5
Abortion**	4	5.4	4	5.4	2	22.2	2	25
Weight at birth								
500–999 g	4	5.6	4	5.6	0	0	0	0
1000–1499 g	10	14.1	10	14.1	1	14.3	0	0
1500–2499 g	23	32.5	23	32.5	4	57.1	4	66.6
2500–2999 g	17	23.9	17	23.9	2	28.6	2	33.3
3000–3999 g	16	22.5	16	22.5	0	0	0	0
4000 g and more	1	1.4	1	1.4	0	0	0	0
5-min Apgar score								
≤7	8	11.8	8	11.8	1	16.7	1	20
8–10	60	88.2	60	88.2	5	83.3	4	80
Neonatal ICU								
YES	25	36.8	25	36.8	3	50	2	40
NO	43	63.2	43	63.2	3	50	3	60
Status at discharge								
Death	3	4.4	3	4.4	0	0	0	0
Transfer	11	16.2	11	16.2	2	33.3	2	40
Good health	54	79.4	54	79.4	4	66.6	3	60
Gestational age								
<22 weeks	4	5.3	4	5.3	2	22.2	2	25
22–27 weeks	2	2.6	2	2.6	0	0	0	0
28–31 weeks	9	12	9	12	0	0	0	0
32–36 weeks	26	34.8	26	34.8	4	44.4	3	37.5
37–41 weeks	31	41.3	31	41.3	3	33.4	3	37.5
≥42 weeks	3	4	3	4	0	0	0	0

PRBCs: packed red blood cells; ICU: intensive care unit

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Table 4 – Markers used for the identification of Severe Maternal Morbidity/Near Miss at Azevedo Lima State Hospital from June to October 2009, according to the criteria utilized.

Tabela 4 - *Marcadores utilizados na identificação de Morbidade Materna Grave/Near Miss no Hospital Estadual Azevedo Lima, de junho a outubro de 2009, segundo os critérios utilizados.*

Marcadores	TOTAL		Critério Waterstone	Critério Mantel	Critério OMS
	n	%	n	n	n
Severe hemorrhage	17	19.1	17		
Severe sepsis	02	2.2	02		
HELLP syndrome	05	5.6	05		
Severe pre-eclampsia	61	68.5	61		
Eclampsia	04	4.4	04		
ICU	09	10.1		09	
Transfusion of 5 PRBCs	04	4.4		04	04
Creatinine >3.5	04	4.4			04
Oliguria	03	3.4		03	03
Acute thrombocytopenia	03	3.4		01	03
Creatinine >400 mmol	02	2.2		02	
Dialysis	02	2.2			02
Emergency hysterectomy	02	2.2		02	02
Total bilirubin >6.0 mg/dL	01	1.1			01
Coagulation disorder	01	1.1			01
Hemorrhagic stroke	01	1.1		01	01
Shock	01	1.1		01	01
Mechanical ventilation for ≥60 minutes not related to anesthesia	01	1.1		01	01
ICU for sepsis	01	1.1		01	
Jaundice with pre-eclampsia	01	1.1		01	01

PRBCs: packed red blood cells - ICU: intensive care unit

WHO recommends using live births instead.

The mortality rate and ratio of maternal near miss/mortality found in the study are corroborated with those from systematic reviews.[8,20] In their study, Mantel et al.[13] showed a maternal mortality rate of about 20% and case/fatality ratio of 4:1, which are consistent with data from our study using the same criteria. These data corroborate evidence reported in the literature:[8,20,21,25] criteria based on signs and symptoms, as they include less serious cases, have much lower mortality rate than the other ones.

With respect to sociodemographic characteristics of the women in the study, a comparison should be made with the usual profile of HEAL patients. As for age, a high proportion of the women studied were older than 30 (34.8%). According to data from SIH and SINASC databases women older than 30 usually account for no more than 20% of obstetric admissions to the maternity ward. Adolescents usually account for approximately 28% of admissions in the maternity ward compared to 21.3% in the present study. Therefore, severe maternal morbidity/near miss was more common among older patients, which is consistent with Souza et al.[21] and Waterstone et al. studies.[14]

The analysis of severe maternal morbidity/near miss in this study correlated the proposed WHO criteria with the existing ones. Since these criteria are based on different approaches, different sensitivities and specificities are also expected. The new WHO classification is remarkable for iden-

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tifying the most serious cases with higher risk of death. At the other end is Waterstone criteria; as it comprises a broader spectrum of severity it allows to identifying more patients than the other two.

In our study, Waterstone et al.[14] criteria allowed to identifying a much greater number of maternal near miss cases. Most of these women had hypertensive disorders of pregnancy. This is an easy-to-use approach with good sensitivity but low specificity. Each condition can be classified into varying degrees of severity, which increases the likelihood of false positives. However, other causes of maternal mortality, such as pulmonary[18] embolism, may be overlooked. It is worth mentioning that the mothers of the three neonatal deaths were only identified using Waterstone criteria.

Other Brazilian studies[21,23,25,27] also reported hypertensive syndromes as the most commonly associated causes with severe maternal morbidity/near miss, as much as 57% in Souza et al. study[21]. Adisasmita et al.[31], in Indonesia, also found that 57.3% of women had hypertension syndrome as a primary cause of maternal near miss. In our study it is noteworthy the fact that approximately 70% of cases identified had pre-eclampsia, HELLP syndrome and eclampsia. It points out that prevention and management of these conditions are necessary as the use of less strict criteria for near miss.

The Mantel[13] and WHO[18] classification were able to identify a comparatively similar proportion of cases. These criteria, especially the WHO[18] classification, showed a very high threshold for the detection of cases of maternal near miss, missing a significant proportion of women with highly relevant conditions such as pre-eclampsia and eclampsia. In Mantel[13] criteria these conditions are only taken into consideration when they include jaundice, renal failure or thrombocytopenia with platelet transfusion, which are not common clinical features of these diseases.[21,22,25]

Reichenheim et al.[32] reviewed the literature for indicators of near miss and found

ICU admission (54.9%), eclampsia and obstetric hemorrhage (52.9%) as the most commonly identified. Filippi et al.[33] in a study in Africa, identified hemorrhage and hypertensive disorders of pregnancy as the most common conditions associated to near miss, except in Benin and Ivory Coast, where anemia was the main cause.

In our study, severe hemorrhage occurred in 17 women (19%), all of them identified by Waterstone criteria;[14] only four of them were also identified by Mantel[13] and WHO[18] criteria as their threshold for severe hemorrhage is the transfusion of five or more packed red blood cells. Several authors[21,22,34] have argued this threshold is too high. Some authors[21,25] set it at 1,500 mL (equivalent to three or more packs) or even lower, as reported in studies in Ghana and Thailand (500 mL) and Jamaica (1000 mL).[34]

In our study nine women were admitted to the ICU, a marker only included in Mantel criteria.[13] Of these, seven patients had other conditions included in the other criteria studied. Our findings were quite inconsistent with those reported by Souza[21] and Cecatti,[35] in Campinas, where 112 out of 124 cases of severe maternal mortality were admitted to the ICU. As bed availability and ICU admission criteria are not the same, the use of this marker is questionable because it is affected by the level of complexity of care provided at a health setting and organization of obstetric care.[28,31]

We found in our study a high cesarean rate (almost 90%) with no significant variation by different criteria. This finding is consistent with the literature. Because of the severity of these patients' obstetric conditions their pregnancy usually requires urgent action. Although cesarean delivery is associated with high rates of maternal morbidity and mortality when compared with vaginal delivery, when it is clinically indicated, timely interruption of pregnancy can reduce the risk of fetal-maternal death.[33]

Regarding prenatal care, Amorim et al.[26] reported that 9.7% of the patients investigated did not attend any prenatal care visit and 21% six or more visits. In our study

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40% of the women had more than six visits, with small difference among the criteria analyzed. But using WHO[18] and Mantel[13] criteria about 30% and 21% of the women studied did not receive any prenatal care, respectively. Thus, we identified a significant quantitative lack of prenatal care. A qualitative assessment was not performed but it is alarming that although 40% had six or more visits, they progressed with severe conditions in their pregnancies.

It should be noted that the mothers studied had preterm and low birth weight infants and 36.8% of them required NICU admission with a perinatal mortality rate two times as high as that reported in the hospital during the same period. This finding can be explained by severe obstetric conditions of these women as well as the low number of prenatal visits.

One of the major limitations of this study is that it was conducted in a single ward with a small sample size. However, HEAL is a regional referral hospital that assists approximately 2,200 births every year and provides care to high-risk patients in a coverage area with almost 2 million inhabitants. Another limitation regards to data collection instrument, without patient interview, when and more information should have been collected, especially about the quality of prenatal care. Further studies and epidemiological surveillance of near miss should incorporate this approach. In addition, it should be stressed that the present study covered only a 5-month period and potential seasonal effects were not explored.

Despite its limitations, the present study showed that is feasible to investigate this new indicator of maternal health, in a routine context. It is critical to prospectively identify women at life-threatening conditions as they probably will develop severe maternal morbidity/near miss or even die. The reference list of potential life-threatening conditions developed by WHO[18,19] should be use for implementing more effective surveillance efforts and standard criteria.

With regard to the monitoring of severe maternal morbidity, some authors[21,25,34] suggest a dual surveillance strategy with early screening using a broader set of criteria as proposed by Waterstone and the use of more specific severity criteria for case confirmation. Filippi et al[33] suggest that near miss events should have two separate estimates: one including cases identified at hospital admission, that can be a good indicator of effective emergency referrals; and the other one including cases identified after admission that can be valuable tool for monitoring the performance of obstetric care services.

Final Considerations

Issues related to quality of prenatal and childbirth care, along with timely consistent implementation of highly complex procedures as needed are some of the determinants of both maternal mortality and severe maternal morbidity. The occurrence of complications during pregnancy is not only associated to the level of human development but also to differences in detection and management of obstetric complications. Prompt diagnosis and adequate management actually contribute to differences in maternal morbidity and mortality rates between countries and regions.[34]

Ongoing monitoring of events and systematic use of reliable information within an integrated system of epidemiological surveillance, databases and obstetric care can be implemented and be extremely helpful in the management of maternal morbidity and mortality.

This monitoring will enable a more effective assessment and can be incorporated into the work process of epidemiological surveillance units at hospital settings that based on serious adverse events could detect and analyze cases of severe maternal morbidity/near miss.

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