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Risk factors for maternal near miss: an integrative review

Fatores de risco para near miss materno: revisão integrativa

Factores de riesgo para near miss materno: revisión integrativa

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ABSTRACT

Objective: to summarize the main risk factors for maternal near miss. **Method:** this integrative literature review was performed on March 21, 2021, in the following databases: the National Library of Medicine – Medline via PubMed, the Cumulative Index to Nursing and Allied Health Literature, Science Direct, Elsevier's Scopus, Web of Science, and the Virtual Health Library portal. Articles were evaluated with the Hierarchy of Evidence for Intervention Studies. **Results:** the 12 articles reviewed all used quantitative methods and were in English. As risks for maternal near miss, evidence highlighted hypertensive disorders, bleeding complications, and puerperal sepsis. Other findings related to the domicile's distance from, and difficulty in accessing, health services, as well as low level of education. **Conclusions:** risk factors for maternal near miss relate to inadequate prenatal care resulting from geographic issues and lack of access to services, plus economic, educational, and social issues.
Descriptors: Nursing; Pregnancy Complications; Morbidity; Maternal Mortality; Near Miss, Healthcare.

RESUMO

Objetivo: sumarizar os principais fatores de risco relacionados ao *near miss materno*. **Método:** revisão integrativa da literatura. A busca foi efetuada em 21 de março de 2021, nas bases de dados: *NationalLibrary of Medicine - Medline via PubMed; Current Index to Nursing and Allied Health Literature; Science Direct*, Elservier's Scopus, *Web of Science* e no portal da Biblioteca Virtual de Saúde. Os estudos foram avaliados com a *Hierarchy of Evidence for Intervention Studies.* **Resultados:** 12 artigos compuseram a revisão, todos de método quantitativo e idioma inglês. As evidências destacaram como risco para *near miss materno:* distúrbios hipertensivos, complicações hemorrágicas e a sepse puerperal. Demais achados relacionam-se à distância da moradia e dificuldade de acesso aos serviços de saúde além da baixa escolaridade. **Conclusões:** os fatores de risco para *near miss materno* se relacionam com pré-natal inadequado, decorrente de questões geográficas e falta de acesso aos serviços, questões econômicas, educacionais e sociais.
Descritores: Enfermagem; Complicações na Gravidez; Morbidade; Mortalidade Materna; Near Miss.

RESUMEN

Objetivo: resumir los principales factores de riesgo relacionados con el *near miss* materno. **Método:** revisión integrativa de la literatura. La investigación se realizó el 21 de marzo de 2021, en las siguientes bases de datos: *NationalLibrary of Medicine - Medline via PubMed; Current Index to Nursing and Allied Health Literature; Science Direct, Elservier's Scopus, Web of Science* y en el portal de la Biblioteca Visrtual de Salud. Los artículos fueron evaluados con la *Hierarchy of Evidence for Intervention Studies*. **Resultados:** 12 artículos conformaron la revisión, todos tenían método cuantitativo y estaban en inglés. Se destacaron como riesgos de *near miss* materno: trastornos hipertensivos, complicaciones hemorrágicas y sepsis puerperal. Otros hallazgos están relacionados con la distancia del hogar y la dificultad para acceder a los servicios de salud, además de la baja escolaridad. **Conclusiones:** Los factores de riesgo para el *near miss* materno están relacionados con la atención prenatal inadecuada, como resultado de cuestiones geográficas y la falta de acceso a los servicios, y a cuestiones económicas, educativas y sociales.
Descriptores: Enfermería; Complicaciones del Embarazo; Morbosidad; Mortalidad Materna; Near Miss Salud.

INTRODUCTION

Despite advances in reducing maternal deaths, nearly 810 women die daily due to preventable causes related to pregnancy and delivery at the global level. Between 2000 and 2017, there was a 38% reduction in the maternal mortality rate, although it is still around 211 deaths per 100,000 live births[1].

Due to the quantitative and qualitative deficiencies of the data on maternal mortality, the study of cases of women who survived severe gestational complications is an important strategy for surveying diverse information. It is observed that, for each case of maternal death, more women survive severe complications and may show permanent sequelae[2].

In this context, in 2009, the World Health Organization standardized diagnostic criteria for maternal near miss to be adopted as a tool for monitoring the quality of obstetric care[3]. The reduction of maternal deaths, the identification of *near miss* cases and the investigation of these episodes are useful to review the care path, in order to provide subsidies for improving the services, from the perspectives of quality and safety in health[1,3].

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Coming from the aeronautical industry, which evaluates accidents that did not occur to better understand the factors of almost error or potential adverse event, *near miss* is defined as an incident intercepted before causing harms[4]. As for maternal *near miss*, the condition is the same and can be elucidated from the understanding that women can have severe acute morbidities anywhere in the puerperal pregnancy cycle due to pathological or circumstantial factors; and that some women die and others die. Thus, the cases of severe outcomes of women who barely survived are the *near misses* that should be elucidated and analyzed in favor of the interception of new failures[3].

The classification of maternal *near miss* in the puerperal pregnancy cycle is the first step in the analysis of factors that can differentiate survival from death in the morbidity-to-mortality continuum[5]. In this sense, evidence-based knowledge and practice by professionals who assist women in the pregnancy-puerperium cycle at all health care levels become relevant.

The importance of Nursing, especially obstetric nurses, is also highlighted in this scenario, as members of the multiprofessional team. This is because, in addition to actions to classify gestational risk in prenatal care, they contribute with their competencies for comprehensive care, which provide qualification of the health services in the care of women and the improvement of maternal and neonatal health care indicators[6].

With a view to improving knowledge, as a first and fundamental step towards planning actions aimed at reducing maternal mortality and the occurrence of severe maternal morbidity, this integrative review aims at summarizing the main risk factors associated with the global incidence of maternal *near miss* in pregnant women admitted to health services.

METHOD

This is an integrative literature review study with the following sequence of steps: identification of the problem, literature search, evaluation of the studies included, analysis of the studies included and presentation of the review[7].

It is common to use the PICO acronym as a search strategy (P: Participants, I: Intervention, C: Control, O: Outcome) in studies of effectiveness or efficacy of interventions, although it is a strategy that does not always fit well for observational studies due to the absence of an intervention or control that fits better in systematic reviews and meta-analyses[8].

Based on this, the review question was structured based on the PVO, acronym, where P: Pregnant women; V: Hospitalization in health services for maternal care; and O: maternal *near miss*. The PVO Strategy was proposed by BIREME (Latin American Center for Health Sciences Information) in 2011, with the objective of facilitating the diagnosis of the various needs inherent to research questions, optimizing the response time in the retrieval of documents[9]. Thus, the following review question was elaborated: Which are the risk factors related to the occurrence of maternal *near miss* in women hospitalized in health services?

To compose the strategy to search for the studies, the controlled descriptors indexed in the Medical Subject Headings (MeSH) and their respective synonyms with Boolean operators (AND and OR) were used in a single association (Figure 1).

Identification	Descriptors	Crossing
1 #	*"Near miss, healthcare" ("Healthcare Near miss" OR "Healthcare Near misses" OR "Near misses, Healthcare" OR "Close Call, Healthcare" OR "Close Call, Healthcare" OR "Close Calls, Healthcare" OR "Healthcare Close Call" OR "Healthcare Close Calls")*	A = 1# AND 3# AND 4# B = 2# AND 3# AND 4# C = 5# AND 4# D = 6# AND 4# E = 7# AND 4# F = 8# AND 4# G = 9# AND 4#
2 #	*"Morbidity"("Morbidities")*	
3 #	*"Maternal Health" ("Health, Maternal")*	
4 #	*"Risk Factors" ("Factor, Risk" OR "Factors, Risk" OR "Risk Factor")*	
5 #	*"Near miss maternal mortality"*	
6 #	*"Near miss maternal morbidity"*	
7 #	*"Near miss obstetric"*	
8 #	*"Severe maternal morbidity"*	
9 #	*"Severe obstetric morbidity"*	

FIGURE 1: Developed search strategy. Campo Grande, MS, Brazil, 2021.

The search and selection process of the articles was carried out independently by two researchers on March 21st, 2021, in the following electronic databases: National Library of Medicine (Medline via PubMed); Elservier's Scopus (SCOPUS); Current Index to Nursing and Allied Health Literature (CINAHL); Science Direct, Web of Science and in the Virtual Health Library (*Biblioteca Virtual de Saúde*, BVS) portal, through federated access.

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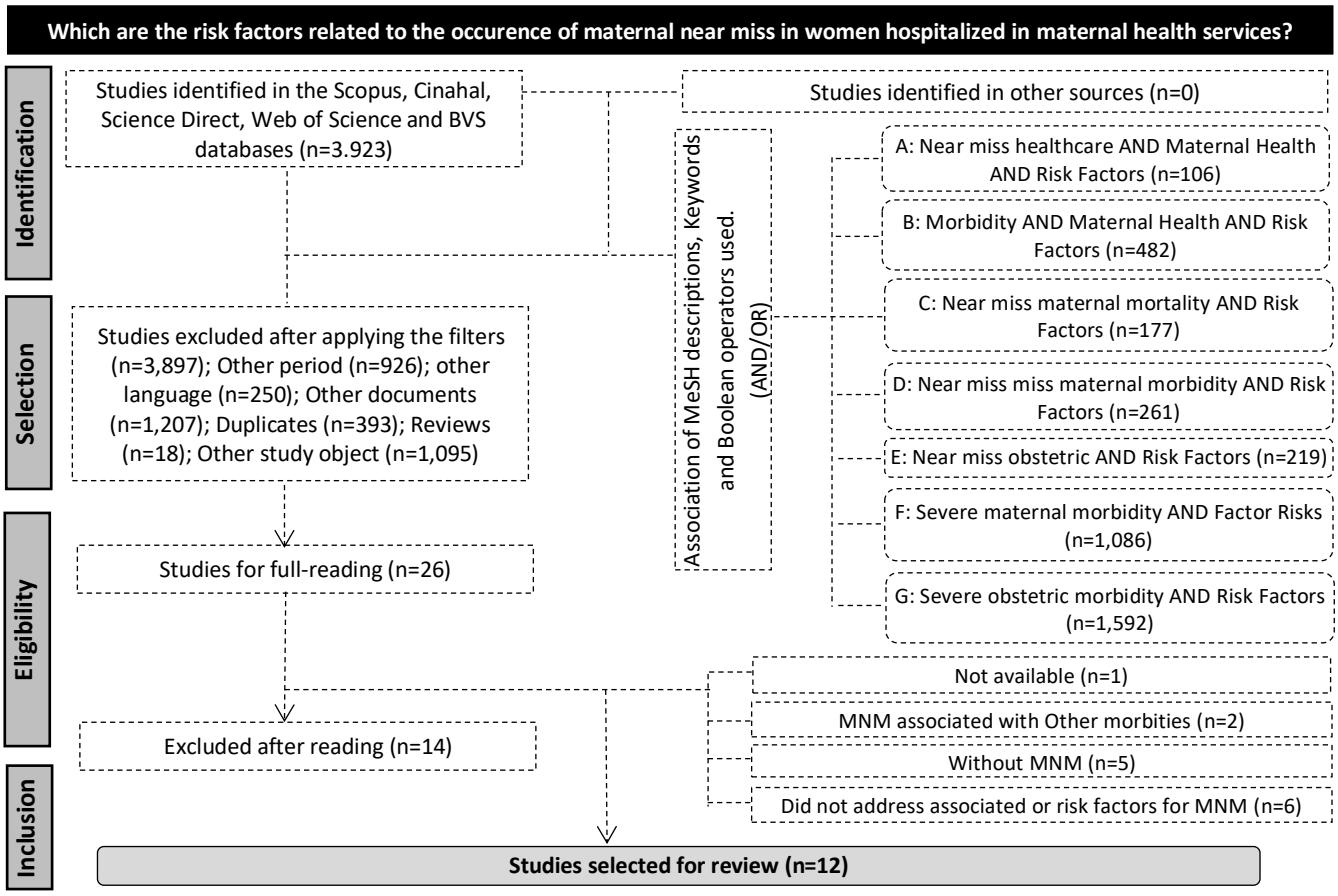
The inclusion criteria were the articles published in full from 2011 to 2020, as this time frame is related to clinical prerogatives and care guidelines aimed at identifying risks and preventing maternal *near misses*, which began to be implemented in 2011[3]. The accepted languages were the following: English, Portuguese and Spanish publications that addressed the risk factors for the occurrence of maternal *near miss* in women hospitalized in health services.

Duplicate articles or those that did not address the study theme were excluded, as well as editorials, letters to the editor, abstracts, experts' opinions, reviews, correspondence, reviews, book chapters, theses and dissertations. In addition to that, articles that exclusively addressed a maternal *near miss* criterion such as postpartum hemorrhage, postpartum hysterectomy, preeclampsia, HELLP syndrome and sepsis, were also disregarded.

The divergences or inconsistencies were discussed among the researchers at later moment, for consensus. In the first selection phase, the titles and abstracts were read, with subsequent full-text reading and selection of the studies for the final sample.

After these stages, the data were extracted through a structured instrument developed by the researchers, with the following items: author, year, country where the study was developed, language, name of the journal, method employed, approach category, level of evidence, total of the participating population, prevalence of *near miss*, main causes, risk factors for the occurrence of *near miss* of the study and conclusion.

To assess the level of evidence of the studies, the *Hierarchy of Evidence for Intervention Studies* was used, which proposes an analysis with seven levels of evidence: Level I-Systematic review of meta-analyses; Level II-Randomized controlled trials; Level III-Controlled trials without randomization; Level IV-Case-control or Cohort study; Level V-Systematic review of qualitative and descriptive studies; Level VI-qualitative and descriptive study; and Level VII-Experts' opinion or consensus[10]. To systematize the process to include articles, it was decided to use the Prisma[11] methodology through a flowchart (Figure 2).



Cinahl: Current Index to Nursing and Allied Health Literature; BVS: *Biblioteca Virtual em Saúde*.
FIGURE 2: Flowchart corresponding to selection of the articles. Campo Grande, MS, Brazil, 2021.

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The articles that comprised the review were incorporated into spreadsheets structured in the Microsoft Excel 2010® and the data were synthesized and analyzed descriptively, using synoptic tables. The ethical aspects of this study were preserved and all authors of the articles analyzed were adequately referenced and their content presented in a reliable manner, according to Copyright Law No 9,610/1998.

RESULTS

The search resulted in 3,923 studies, of which 3,897 were excluded after applying the inclusion and exclusion criteria. Therefore, 26 articles were retrieved for full evaluation. Eventually, 12 articles comprised this review, as 14 were excluded, of which: six did not address risk factors for maternal *near miss* (MNM); five did not address the specificities of MNM, two associated MNM with severe maternal mortality (SMM); and one was not available online.

Regarding characterization of the studies, there was no significant variation between the years of publication, most of them were developed in countries of the African continent (66.6%), used quantitative methods (100%) and were published in English (100%). The levels of evidence found according to the *Hierarchy of Evidence for Intervention Studies*[10] indicate that all studies analyzed are considered Level IV (Figure 3).

Author and year	Country	Method and studied population	Objective	Level of evidence
Mekango *et al.*; 2017[12]	Ethiopia	Case-control 308 women	To identify determinants of maternal *near miss* in a small female population.	IV
Souza *et al.*; 2015[2]	Brazil	Cohort 492 women	To evaluate the determinants of morbidity and mortality in the obstetric intensive care unit of a university hospital.	IV
Assarag *et al.*; 2015[13]	(Brown)	Case-control 299 women	To determine the incidence of Maternal *Near Miss* in 3 reference hospitals and to identify preventable factors that cause obstetric complications that lead to *Maternal Near Miss*.	IV
Liyew et al.; 2018[14]	Ethiopia	Case-control 854 women	To identify the factors associated with *Maternal Near Miss* in public hospitals.	IV
Naderi *et al.*; 2015[15]	Iran	Cohort 9,908 women	To establish a profile of severe maternal morbidities and the relationship with other underlying factors.	IV
Madeiro *et al.*; 2015[16]	Brazil	Cohort 399 women	To investigate the incidence and determinants for severe maternal morbidity and *Maternal Near Miss* in a public maternity hospital.	IV
Oppong *et al.*; 2019[17]	Ghana	Cohort 804 women	To explore the incidence and factors associated with *Maternal Near Miss*.	IV
Adeoye, Onayade, Fatusi; 2013[18]	Nigeria	Case-control 375 women	To determine the incidence, characteristics, determinants and perinatal outcomes of *Maternal Near Miss* in a tertiary-level hospital.	IV
Yemane, Tiruneh; 2020[19]	Ethiopia	Cohort 845 women	To evaluate the incidence-proportion of *Maternal Near Miss* and its risk factors.	IV
Donati, Senatore, Ronconi; 2012[5]	Italy	Cohort 1,259 women	To detect *Maternal Near Miss* cases among women admitted to the Intensive Care Unit or Coronary Unit, as well as to analyze associated causes and calculate morbidity rates.	IV
Kasahun e Wako; 2018[20]	Ethiopia	Case-control 229 women	To identify predictors of *Maternal Near Miss* among women admitted to hospitals.	IV
Galvão *et al.*; 2014[21]	Brazil	Case-control 16,242 women	To investigate the prevalence of Severe Maternal Morbidity and *Maternal Near Miss* cases and the associated the risk factors in two reference maternity hospitals.	IV

FIGURE 3: Categorization of the studies selected regarding the risk factors associated with *near miss* in pregnant women hospitalized in health services (n=12). Campo Grande, MS, Brazil, 2021.

The prevalence of MNM was found in half of the studies analyzed, with a minimum variation of 2 per 1,000 live births in Italy and a maximum of 37.9 per 1,000 live births in Ethiopia.

In relation to the characterization of the participants, the pregnant women were aged between 20 and 29 years old in 50% of the studies analyzed[2,12,13,17,18,20]; had low schooling levels, recorded in 66.6% of the studies[2,12-15,18,20] and low-income reports in 41.6% of the studies[2,12-14,20].

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In the 12 studies that comprised the review, factors associated with the occurrence of MNM were identified, namely: sociodemographic, involving lower schooling levels[2.5, 12-15], living in the inland or in rural areas[2,14,20], having low incomes[2,12-14,21] and being extremely old or young[5,12,15,21]; and obstetric, especially previous cesarean section[9,18,19] or during the pregnancy analyzed [2,5,16,18,21], previous miscarriage[13,21], primiparity[15,19] and failures in prenatal care[2,13,18,19,21].

As clinical and obstetric factors related to the occurrence of maternal *near miss*, the following obstetric complications stand out: hypertensive disorders, which appear in 10 of the 12 studies in this review[2,5,12,13,15-19,21]; hemorrhagic complications in nine studies[2,5,12,13,15-20]; sepsis, mentioned in five studies[2,12,17-19]; and gestational history of anemia, reported in four articles[12,14,18,20]. Chronic diseases such as hypertension[14,18] were evidenced among the pre-existing maternal clinical factors.

In addition to these, the delay in the commute time of to access care[12,13,18-20], the referral to another service[17,20] and low birth weight[17,18,21] also appear as factors related to the maternal *near miss* cases.

DISCUSSION

In the analysis of the studies that comprised this review, the importance of the maternal *near miss* theme is evident, as understanding of the different factors that exert an impact on women's morbidity in the puerperal-pregnancy cycle can subsidize improvements in the care practices, predict assertive management measures and reduce health expenses[11,12].

The prevalence of MNM was variable, with a minimum of 2 per 1,000 live births in Italy and a maximum of 37.9 per 1,000 live births in Ethiopia. Nearly 94% of the maternal deaths occur in low- and middle-income countries, of which 86% are in sub-Saharan Africa and South Asia[1]. A study conducted in Ribeirão Preto presented a prevalence of 5.4 *near miss* cases for every 1,000 live births in the population studied, the main criteria being shock and transfusion ≥ 5 units of packed red blood cells (1.7 case per 1,000 live births)[22].

Regarding the factors related to maternal *near miss*, it was interesting to note that a study conducted in Ghana did not identify correlations between sociodemographic characteristics and occurrence of this event[17]. At the same time, of the four studies conducted in Ethiopia[12,14,19,20], only one cites the prevalence of *near miss* and living in remote areas as its main determinant. On the other hand, the other research studies found a strong relationship with low schooling and monthly income, as well as with pregnancy in girls under the age of 16, revealing that social vulnerability is a public health problem in many places around the world, showing itself as a focus priority of public policies aimed at reducing maternal deaths and severe perinatal outcomes[2,13,21] .

It is noted that the maternal *near miss* rate varies according to the population studied, the diagnostic criterion chosen and the way in which the study was conducted[15]. In this sense, a study carried out in Italy reinforces that, despite its findings being similar to studies carried out in high-income countries, the inclusion criterion based only on admission to an intensive care unit (ICU) may underestimate the real *near miss* rate, as not all women with severe maternal morbidity are able to be transferred to an ICU[5]. Therefore, the use of clinical, laboratory and management criteria is the best tool for the diagnostic approach, as it allows for the early identification and detection of *near miss* cases, as indicated by the WHO[3].

Low schooling was related to the occurrence of maternal *near miss* in practically half of the studies analyzed[5,12,13,15], suggesting a possible association between information deficit and timely demand for health care, both in the scope of prenatal assistance and in emergency care. Education is a social determinant of health, as higher schooling levels are directly related to higher levels of information offered by the services. However, low schooling among pregnant women is related to severe perinatal outcomes, including maternal death and *near miss*es, especially in countries with low a Human Development Index[21].

Living in inland areas that are difficult to access tends to increase the delay seeking care or the commute time to the health service, which has been elucidated in different ways in five studies[2,13,19]. It is observed that a gestational complication with a prognosis of severe evolution, when identified in a timely manner, improves the chances of a favorable perinatal outcome[6].

Another sociodemographic factor that increases the risk of developing *near miss* is maternal age below 16 years old or above 35 years old, a fact that is more frequent in older age groups[4,15]. This condition is due to the fact that pregnant adolescents may have preeclampsia, anemia, intrauterine growth restriction and prematurity, while pregnant women over 35 years of age are prone to chromosomal disorders and chronic diseases, especially hypertension and diabetes[23].

Among the main obstetric factors, five studies showed the association of cesarean section as a negative predictor[2,4,16,18,21] for the occurrence of *near miss*. A number of Brazilian studies show that cesarean section is associated with a 31-fold higher relative risk for increased severe maternal morbidity or *near miss*[2] and that 75% of the women

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characterized as MNM underwent cesarean sections[28]. As found in this review, this surgical procedure increases the risk of infection, hemorrhage, intra- and post-partum complications, as well as it can result in adverse perinatal outcomes and, consequently, in an increase in intensive care admissions and neonatal mortality rates.

Considered a risk factor for severe maternal morbidity in two studies of this review[12,21], a miscarriage history can trigger obstetric complications, such as abnormal placentation, prematurity and habitual abortions, which is a relevant finding, as 15% to 20% of all normal pregnancies can lead to spontaneous miscarriage up to the 13th gestational week[23].

Failures in prenatal care are directly linked to the occurrence of severe maternal morbidity and can result from difficulties accessing the services, inadequate number of consultations and low care quality, due to weaknesses in the recommended procedures[2,13,19,21]. Added to this scenario are structural problems such as lack of organization of the services and shortage of qualified human resources and materials[6]. It is noted that, in high-income countries, in 2015, practically all women had at least four prenatal consultations, while in low-income countries only 40% of the women attended the recommended number of consultations[1].

As part of the clinical and obstetric factors, a number of studies confirm the association of hypertensive disorders, hemorrhages and sepsis with the development of *near miss*, with gestational hypertensive syndromes as the most prevalent in this scenario[2,28]. Hypertensive disorders in pregnancy are directly related to sociodemographic factors, access to health care, late onset of prenatal care and age-related extremes. Thus, it becomes necessary to strengthen assistance to women through multiprofessional training from primary- to tertiary-level care so that they are able to identify, prevent and manage maternal *near miss* cases, favoring the reduction of severe maternal outcomes[24].

Among the prevalent bleeding disorders are postpartum hemorrhage (PPH), premature placental displacement (PPD), placenta previa, placenta accreta, uterine rupture and ectopic pregnancy[2,5,12-13,15-20]. There is an association between severe bleeding and unfavorable maternal and neonatal outcomes, such as fetal death, prematurity and low birth weight[28]. PPH and PPD are among the main causes of maternal mortality, which are associated with weaknesses in prenatal care, difficulties in access, availability of information, social factors and absence of standardized protocols for the management of obstetric emergencies. It is worth considering that access to health care during the puerperal-gestational cycle involves identification and management of anemia, interpartum interval, recurrence of cesarean sections and comorbidities, as actions that are part of a sensitive anamnesis and qualified maternal health care[25].

Another important clinical obstetric complication is puerperal sepsis, considered one of the main causes of maternal mortality and *near miss*, as well as hemorrhagic and hypertensive disorders[16,17,19]. At the global level, the puerperal infection rate varies between 3% and 20%, with cesarean section, labor induction and frequent vaginal examinations as the main risk factors. A study carried out in Amazonas with 351 puerperal women found that 96% of the women who underwent cesarean sections developed puerperal infections, with predominance of surgical site and urinary tract infections[26].

The anemia history in pregnant women has also shown to be one of the predictors of *near miss* episodes[12,14,18,20]. In addition to iron deficiency, anemia can be related to nutritional deficiencies, infectious and parasitic diseases and hereditary genetics, in addition to clinical and social factors, which must be monitored to minimize unfavorable maternal outcomes[27].

The occurrence of low birth weight appears in three studies in this review[17,18], correlating it with factors associated with irregular prenatal care and inadequate management of pregnancy complications[18]. It is also worth noting that children of women with *near misses* are at a higher risk of prematurity and are more likely to have low birth weight[28].

In addition to the factors already presented, there is also the delay in the commute to the care locus[12,13,18-20] and the referrals made to other health services[17,20], as situations that can result in a *near miss*. Some studies classify the delay in the final resolution of adverse events related to pregnancy as first, second and third, with the "First delay" being considered as the time taken for decision-making to seek health care since, in nearly 60% of the *near miss* cases, the women waited more than an hour to decide to seek the health service[18,20]. The "Second and Third Delays" are associated with the commute time to the health service and to the treatment time after admission to the final destination[18,20]. These conditions may result from lack of available transportation, insufficient knowledge about the warning signs related to pregnancy and absence of well-equipped units to accommodate obstetric emergencies[18], thus increasing the probability of risks and adverse events[12].

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Study limitations

Among the main potentialities of this review is the organization and methodological sequence, which elucidates an important condition to be worked on in health services. The following stand out as limitations: non-standardization of the criteria for identifying maternal *near miss* factors in the studies found and the variability in the numbers of the reported population.

CONCLUSION

In summarizing the risk factors for the occurrence of maternal *near miss*, sociodemographic, obstetric and clinical characteristics are made evident. The absence or inadequacies in prenatal care may result from geographic, economic, educational and social issues, which interfere with women's access to the health services, especially primary care, which is a privileged space for health promotion and maternal risk prevention.

Causes such as these imply, for example, late diagnosis and management of hypertensive and hemorrhagic disorders, among others that may be a risk factor for maternal *near miss*.

Knowledge of the factors associated with the occurrence of maternal *near miss* supports the construction of situational diagnoses and the assessment of the quality of obstetric care for a given population, substantiating the development of public policies aimed at identifying maternal *near miss* and reducing severe maternal outcomes.

In addition, the importance of the articulation between all health care levels and permanent education is highlighted as essential tools for effective intersectoral communication, for comprehensiveness and qualification of obstetric care and for the timely management of complications in order to mitigate social and health determinations related to maternal *near miss*.

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