

## Study protocol

### **Brazilian network for the surveillance of severe maternal morbidity and maternal near-miss and a multidimensional evaluation of their long term consequences**

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## **Abstract**

**Background:** Over recent years, women who survive severe complications of pregnancy (near-miss) have begun to attract the attention of investigators and healthcare administrators. It has been suggested that the study of maternal near-miss may represent a practical alternative to surveillance of maternal morbidity/mortality since the number of cases is higher and the woman herself is able to provide information on the difficulties she faced and the long-term repercussions of the event. These repercussions, which may include sexual dysfunction, postpartum depression and posttraumatic stress disorder, may persist for prolonged periods of time, affecting women's quality of life and resulting in adverse effects to them and their babies. **Objective:** The aims of the present study are to form a nationwide network of scientific cooperation to carry out surveillance and estimate the frequency of maternal near-miss cases, to perform a multicenter investigation into the quality of care of women with severe complications of pregnancy, and to carry out a multidimensional long-term evaluation of these women. **Methods/Design:** This project has two components: a multicenter, cross-sectional study to be implemented in 27 referral obstetric units in different geographical regions of Brazil, and a concurrent cohort study of multidimensional analysis. Over 12 months, investigators will perform prospective surveillance to identify maternal near-miss and non-near-miss severe maternal morbidity. The population of the cross-sectional component will consist of all women with organ dysfunction (near-miss), one of the diagnoses defined as non-near-miss maternal morbidity, and those who died or were transferred to other healthcare services. Data analysis will be performed in case subgroups according to the moment of occurrence and determining cause. Frequencies of near-miss and non-near-miss severe maternal morbidity and the association between organ dysfunction and maternal death will be estimated. A proportion of cases identified in the cross-sectional study will comprise the cohort of women for the multidimensional analysis. Different aspects of quality of life of women who suffered severe maternal morbidity will be evaluated 3 and 6 months after the event and compared to a group of women who suffered no severe complications in pregnancy. Evaluation will include reproductive function, posttraumatic stress disorder, functional capacity, quality of life, sexual function, postpartum depression and infant development.

**Key words:** Maternal near-miss; severe acute maternal morbidity; maternal mortality; mothers; pregnancy complications; multidimensional evaluation.

## Background

Currently, more than half a million avoidable maternal deaths occur annually worldwide. Although an extremely rare event in developed countries, maternal mortality is higher in less developed countries. Better social conditions, better medical care in cases of severe complication, and family planning are factors that contribute to reducing maternal mortality [1].

Nevertheless, quantifying maternal mortality in Brazil is a complex task. The Ministry of Health estimates the maternal death ratio in the country at 75 maternal deaths per 100,000 liveborn infants [2]. Reflecting the complexity of this estimate, other agencies, using different methods, have calculated maternal death ratios twice or even four times higher than the official figures [3,4].

Notwithstanding, the recorded cases of maternal mortality constitute a tiny proportion of the whole problem. Cases of maternal death conceal millions of cases of severe maternal morbidity and the precise size of this specific population currently remains unknown. For this reason, women who have survived severe complications of pregnancy have in recent years sparked the attention of investigators and healthcare administrators. The World Health Organization coined the phrase *maternal near-miss* to describe these cases, defined as a woman who almost died as the result of a complication of pregnancy, during pregnancy, delivery or in the first 42 days following childbirth [5].

Therefore, the study of near-miss severe maternal morbidity has been suggested as a practical alternative to the surveillance of maternal morbidity and mortality, mainly in view of the larger number of cases and because the woman herself is able to provide information on the event and on the difficulties she had to face. It is believed that auditing near-miss cases would enable even smaller services to evaluate how the determinants of severe maternal morbidity (and consequently the determinants of maternal death) affect their users and services [6-8].

In addition, little is known on the long-term repercussions of a maternal near-miss, although there are indications that a variety of events may occur during this period, mainly in women submitted to surgical procedures [9,10]. The repercussions of these events may lead to adverse effects in the women and their children, may negatively affect their quality of life and may persist for extended periods of time after the event [11,12].

Among the possible repercussions, studies have been carried out to evaluate the psychological impact and occurrence of posttraumatic stress disorder (PTSD), postpartum depression and sexual problems following delivery [10,13-17]. Considering that other factors such as mode of delivery, medical interventions and obstetrical complications [9,18,19] negatively affect women's quality of life in the post partum period, it is probable that in dramatic situations such as near-misses such repercussions would be even more evident. However evaluation of the state of health, quality of life and sexual function in patients who suffered severe complications is poorer in the postpartum period [15,20-23].

Nevertheless, doubts remain with respect to the long-term functional status of women who suffer severe acute maternal morbidity and near-miss. Investigation of various aspects related to mental health and quality of life may offer a valuable perspective on the effect of maternal morbidity on the life of these women.

Studying the occurrence of severe complications in pregnancy and the factors associated with this event will result in a greater understanding of the process that occurs in these women taking them from a state of health to one of sickness. Further knowledge on this issue may collaborate towards improving public policies and the healthcare provided to women who develop severe acute maternal morbidity.

Therefore, the objective of the present project is to evaluate this issue using clear goals to differentiate it from previous studies. These goals include estimating the frequency of maternal near-miss using a uniform set of criteria, carrying out a multicenter investigation into the quality of care provided to women with severe complications of pregnancy and performing a longitudinal evaluation of the quality of life of these women following the event.

### **Objectives and Hypothesis**

The general objective is to develop a nationwide network of scientific cooperation for the surveillance of severe maternal morbidity and maternal near-miss and their consequences.

#### *Specific objectives*

- To determine the frequency of maternal near-miss in healthcare facilities of different levels of complexity situated in different regions of Brazil, using the World Health Organization (WHO)'s new set of criteria for near-miss [5];
- To determine the frequency of non-near-miss severe maternal morbidity in these facilities using specifically defined potentially life threatening conditions;
- To evaluate the association between the indicators of organ dysfunction used to define maternal near-miss and the risk of maternal death;
- To determine the frequency of near-miss and non-near-miss severe maternal morbidity according to age-group and specific causes;
- To examine the occurrence of avoidable factors and other factors associated with maternal near-miss;
- To investigate the repercussions of severe maternal morbidity and near-miss on the quality of life of survivors up to six months after the event;
- To investigate the presence of sexual dysfunction, posttraumatic stress disorder and postpartum depression, as well as the perception of the women with respect to their functional status in routine activities in the six months following an occurrence of severe maternal morbidity.
- To investigate the immediate perinatal outcome and subsequent neuromotor and weight-height development in the children born from the pregnancy associated with the episode of severe maternal morbidity.

### *Main hypotheses*

In survivors of severe acute maternal morbidity:

- health and quality of life would be poorer;
- posttraumatic stress would be more prevalent

- postpartum depression would be more common;
- sexual function would have deteriorated and the time to return to sexual activity would be greater;
- woman's perception of her functional status in routine activities would be poorer.

In the children born from a pregnancy associated with severe maternal morbidity:

- immediate perinatal outcome would be poorer;
- the occurrence of impaired neuromotor and weight-height development would be significantly greater.

## **Methods / Design**

This study is composed of two components: a multicenter cross-sectional study and a concurrent cohort study.

The cross-sectional study will be implemented in 27 referral obstetric units in different geographical regions of Brazil, which have already been joined for building a national network for studies on maternal and reproductive health. Over a 12-month period, the principal and local investigators will carry out prospective surveillance and will collect data for the identification of maternal near-misses and non-near-miss severe maternal morbidity (potentially life threatening conditions). To determine the number of collaborating centers to be included in the present study, calculation of sample size took into consideration the number of deliveries that would have to be monitored to identify cases of near-miss. Previous studies have estimated an incidence of approximately 8 cases per 1000 deliveries [24]. Therefore, adopting a safety index of 25% (due to the

fact that this definition of near-miss has not yet been tested), a total of approximately 75,000 deliveries would have to be monitored. This number is believed to be sufficient to evaluate the use of the new criteria for near-miss established by the World Health Organization in 2009 [5].

The study population will consist of all the women admitted to the participating hospitals during the study period in whom organ dysfunction is registered (maternal near-miss, Table 1), in whom one of the diagnoses defined as non-near-miss severe maternal morbidity is present (Table 2), and those who died or were transferred to another healthcare service.

For the multidimensional analysis of the consequences of severe maternal morbidity, a concurrent cohort of specific population study will be carried out. The main exposure factor will be the occurrence of severe maternal morbidity. During the second half of the cross-sectional study, a sample of the women identified as having severe maternal morbidity will be selected and invited to participate in the longitudinal evaluation. There will be a comparison group composed of women who did not suffer severe maternal morbidity. These women will be selected externally in a proportion of 1:1 from postpartum women in the rooming-in wards of the same maternity hospitals as the cases. Controls will be selected at random and balanced according to mode of delivery, maternal age and gestational age at the time of delivery.

**Main outcomes:**

***Maternal near-miss:*** A woman who fulfills one of the clinical, laboratory or management criteria representing severity as defined by the World Health Organization

[5] and who survives a complication occurring during pregnancy, childbirth or within 42 days postpartum.

***Non-near-miss severe maternal morbidity:*** A condition of severe morbidity found in women during pregnancy, childbirth or in the puerperium, classified as potentially life threatening conditions, including hemorrhagic or hypertensive disorders, other systemic disorders, and indicators of severe management (Table 2).

***Abortion:*** Finalization of pregnancy prior to the 22<sup>nd</sup> week after the date of last menstrual period or the expulsion of a conceptus of less than 500 grams in weight.

***Maternal death:*** Death of a woman during pregnancy or within a 42-day period following the end of pregnancy irrespective of the duration or localization of the pregnancy, resulting from any cause related to or aggravated by the pregnancy or by measures taken with respect to it; however, not from accidental or incidental causes.

***Conditions at birth:*** Vital status of the newborn infant as recorded on the medical chart, dichotomized into live or intrauterine death.

***Vitality of the newborn infant:*** Evaluation of the life conditions of the newborn infant according to 1<sup>st</sup> and 5<sup>th</sup> minute Apgar scores as shown on the medical chart, classified from 0 to 10.

***Neonatal outcome:*** Condition of the newborn infant at the time of data collection, identified from a review of the medical charts and classified as: discharged from hospital together with the mother, early neonatal death (<7 days) or late neonatal death (7-28 days).

***Quality of life:*** The woman's perception of her position in life within the cultural context and value system in which she lives and in relation to her goals, expectations, health, standards and concerns (WHO); identified by the investigators using the standard SF-36 form.

***Posttraumatic stress:*** Symptoms of intrusion, avoidance and arousal following the occurrence of a pregnancy with severe complications; identified by the investigator using a standard questionnaire (PTSD – Checklist CV).

***Ideal number of children:*** Number of children that the woman considered ideal prior to and following the index pregnancy.

***Return to sexual activity:*** Time taken by the woman to resume sexual activity after delivery and reason given for not recommencing sexual activity.

***Sexual function:*** Sexual function and response; identified by the investigator using a standard questionnaire (*Female Sexual Function Index - FSFI*).

***Postpartum depression:*** Depressive symptoms following the occurrence of a pregnancy with severe complications; identified by the investigator using a standard questionnaire (Edinburgh Postnatal Depression Scale – EPDS).

***Functional status:*** Perception of woman with respect to her functional status in six items related to her routine activities (understanding and communicating, getting around, self-care, getting along with people, life activities in the home/at work and participation in society), classified from 0 to 100 (from best to worst) [25].

***Neuromotor development in the child born from the index pregnancy:*** Process of changes in motor behavior that involve both maturation of the central nervous system and interaction with the environment and stimuli given during the child's development; identified by the investigator using the Denver II – Revised Denver Developmental Screening Test [26].

***Weight-height development of the child born from the index pregnancy:*** Process of weight and height increment during the child's development, weight measured in grams and height in centimeters, using scales and anthropometer, classified as adequate or inadequate for age, according to the standards of the World Health Organization [27].

***Control variables:*** maternal age, marital status, place of residence, number of previous pregnancies, parity, previous abortions, previous Cesarean sections, number of children, mode of delivery, gestational age, birthweight, gender of neonate, condition of neonate at discharge, condition of mother at discharge.

## **Data Collection and Procedures**

### ***Cross-sectional component***

Research assistants, referred to as local coordinators, will review the charts of hospitalized patients on a daily basis in search of cases with one of the conditions identifying severity (Table 2). In cases found with these diagnoses, the relevant charts will be referred for review and data collection following release of the patient from hospital, her death or transfer to another healthcare institute. Data unavailable on the chart but of interest to the study will be obtained from the attending medical team. For each case included, data will be collected on the demographic and obstetric characteristics of the patient, the primary determinant of maternal near-miss (the first complication to occur in the chain of events leading to severe maternal morbidity), the duration of hospitalization (prior to delivery, following delivery and total time), the occurrence of indicators of maternal near-miss at any time during hospitalization, indicators of perinatal outcome and conditions of the woman at discharge from hospital.

These data will be collected on a previously coded form developed specifically for this purpose. A central database will be constructed and the data will be included by the local investigators themselves using electronic forms. The manually completed forms will be filed and made available at technical visits for the purpose of quality control.

For the electronic inclusion of data, each center will have its own restricted area on the study website where password-protected access will be granted only to cases included at that center. An overview of all the cases included in the network will be provided in the form of monthly graphs and tables containing the number of cases included by each center. In addition, the reported diagnoses will be provided by the coordinating center on the main page of the website.

In all cases identified as having any potentially life threatening condition or of near-miss, data will be collected on avoidable factors responsible for their occurrence (delays). These factors will be classified into those related to infrastructure, the patient or the healthcare professionals. Avoidable factors related to infrastructure include cases in which difficulties in obtaining supplies or medication, transportation, communication, blood components or monitoring and treatment may have led to less than ideal care. Factors related to the patient include those generated by the patient herself or her family, either by delaying seeking professional care or by refusing treatment. Factors related to the healthcare team include delays in defining the correct diagnosis and/or inappropriate management.

The degree of complexity at each hospital will be evaluated using an adapted version of the hospital complexity index developed for the World Health Organization's "Global Survey" project [28]. Participating institutions will provide information on a monthly basis via the website on the total number of deliveries, live births and maternal deaths that occurred the previous month. These data will be confirmed by the principal local investigator after data collection is finished.

To minimize the number of uncertainties that research assistants may face during data collection, a manual of operation was produced containing all the necessary information on how to use the internet, how to complete the written and electronic forms and how to access the database of each individual center, as well as information regarding the standardization of diagnostic definitions, etc.

In addition to the manual of operation, a meeting was held with the investigators and local coordinators of each center (two individuals from each center) at the study coordinating center immediately preceding initiation of data collection in order to provide adequate training and clarify any queries regarding the data collection process and use of the website. Sometime after the initiation of data collection, a meeting of the study's Steering Committee will also be held. A second meeting will take place involving only the local investigators after data collection has finished to discuss facts related to the previous process, disclosure of partial results, scheduling of the preliminary and final analyses, agreement on papers to be written on the results and assignment of responsibility regarding execution of each item in this process.

***Longitudinal component:***

As in the cross-sectional component, women with one of the conditions indicative of severity will be selected as potential subjects for longitudinal evaluation. Once identified, research assistants who are not involved in the cross-sectional component of the study will invite candidates while they are still in hospital to participate in the longitudinal evaluation of the study. Women who agree to take part will be asked to sign an informed consent form and two CATI (computer assisted telephone interview)

will be scheduled for 3 and 6 months postpartum plus a medical visit with the woman and the newborn infant six months following delivery.

For the control group, all the women admitted to hospital for obstetric care in the same facility on the same day on which a case has been identified and who have none of the conditions indicating severity will be chosen. Following a process of randomized selection balanced according to mode of delivery, maternal age and gestational age at the time of delivery, the women in the control group will be invited to participate in the study by the research assistants in the same way as candidates to the study group. Three months after delivery, the study call center will contact the women to carry out the first step in data collection. At the time of this contact, the interviewers will again go over the objectives of the study and will proceed standard questionnaires designed to investigate quality of life and postpartum depression.

At six months postpartum, the study call center will contact the women again to carry out the second step in data collection. At this contact, the interviewers will go over the study objectives once again and apply the same standard questionnaires on quality of life and postpartum depression. In the case of women who do not have a telephone, a reminder letter will be sent asking them to make a collect call to the study call center at the sixth month postpartum to enable the interview to take place.

At the end of the 6-month telephone interview, the interviewer will confirm the date, time and place of the visit that was previously scheduled when the women were still in

hospital. The women will be reminded that they should take the baby born from this index pregnancy to the visit. Even if they do not authorize the participation of their infants in the study, the women will be invited to return to the hospital and answer the quality of life questionnaires. The interview with the woman will be carried out by a trained female interviewer, who will apply standard questionnaires to evaluate posttraumatic stress disorder, sexual function and the woman's perception of her functional status in routine activities. After the women have answered the questionnaires, the weight, height and neuro-psychomotor development of the infants will be evaluated by a specially trained pediatrician. Finally, the women will receive a token cash payment as a contribution towards their transportation and food costs while attending this visit.

The following instruments will be used for data collection:

***Posttraumatic Stress Disorder (PTSD) Checklist - Civilian Version (PCL-CV)***: This questionnaire has been validated in Brazil to screen for the diagnosis of posttraumatic stress disorder. It contains 17 items in which the woman will indicate to what extent she has been disturbed by symptoms over the past month on a scale of 1-5 (ranging from not at all to a lot). A score  $\geq 3$  (a medium score) for any one of the items is considered indicative of a clinically significant symptom.

***Medical Outcomes Study 36-Item Short-Form Health Survey (SF36)***: This is a generic questionnaire for evaluating quality of life that has been validated for use in Brazil. It is multidimensional with 36 items in 8 scales: physical functioning, role-physical, bodily

pain, general health, vitality, social functioning, role-emotional and mental health. Final scores vary from 0 to 100 (poorest to best).

***Female Sexual Function Index:*** A multidimensional questionnaire used to evaluate female sexual function consisting of 19 questions in 6 domains: desire, arousal, lubrication, orgasm, satisfaction and pain. Final scores vary from 2 to 36, a cut-off point  $< 26$  having been proposed as determinant of sexual dysfunction. This questionnaire has been culturally adapted for use in Brazil.

***Edinburgh Postnatal Depression Scale (EPDS):*** A questionnaire used to screen for symptoms of depression and anxiety in the postpartum period, composed of 10 questions that may be self-administered. A final score  $\geq 10$  has been defined as the cut-off point of greatest sensitivity in screening. The tool has been validated for use in Brazil.

***The World Health Organization Disability Assessment Schedule II (WHODAS II):*** A 36-item questionnaire used to evaluate the individual's perception of herself and her functional status, consisting of six activity domains related to the woman's routine activities (understanding and communicating, getting around, self-care, getting along with people, life activities in the home/at work and participation in society), on a 6-level scale varying from (1) no difficulty to (6) extreme difficulty/cannot do. Final score varies from 0 to 100 (from best to worst) [25].

***Neuro-psychomotor development of the child:*** The Denver Developmental Screening Test II consists of 125 tasks or items organized in the form of tests of 4 general

functions: personal-social, fine motor-adaptive, language and gross motor. At the end, a behavior test is applied that helps the examiner subjectively observe the overall behavior of the child and obtain an impression on how the child uses his/her skills.

### **Quality control**

Quality control procedures will be adopted and include techniques such as reviewing completed forms, checking data entry, repeating data collection for selected medical charts and the use of a detailed manual of operation. Initial quality control of data collection will be performed by the local investigator prior to and during electronic data entry of the forms in order to identify any possible inconsistencies in the data.

A second quality control measure will be carried out by one of the principal investigators, who will visit the participating centers. At this visit, consistency will be verified between the manual records on file and the data contained in the electronic forms. In addition, a random evaluation will be made of patient medical charts.

For the quality control of the longitudinal component, 10% of the records at each participating center will be randomly selected at the end of individual data collection and contact will once again be made with the patient in order to verify the data obtained at the first interview. The local investigators will maintain a record of any problems occurring during the study and any queries will be raised with the country coordinator of the project.

### **Data analysis**

Data analysis will be performed in sub-groups according to the time of occurrence of the near-miss or severe maternal morbidity (in adolescence, older ages or at another time in the woman's reproductive life) and determining cause (hypertension, hemorrhage, abortion or other causes). The rates of maternal near-miss will be calculated for each collaborating center using the new criteria defined by the World Health Organization [5], and frequencies of non-near-miss severe maternal morbidity (potentially life threatening conditions) will be calculated using specific defined diagnoses. General estimates will be calculated together with their respective 95% confidence intervals. The association between organ dysfunction and maternal death will be estimated using odds ratios, likelihood ratio test and their respective 95% confidence intervals. In addition, risks will be calculated for sexual dysfunction, postpartum depression, posttraumatic stress disorder, deterioration in quality of life, deterioration in the woman's perception of her own functional status in routine activities, risk of adverse perinatal outcome and risk of impaired neuromotor and weight-height development in the children born from the pregnancy associated with severe maternal morbidity.

### **Results obtained from the preliminary project**

Initially, a meeting was held during a national congress of Gynecology and Obstetrics in November, 2007, attended by representatives of 35 healthcare institutions in Brazil. At this meeting, the main points featured in the initial concept of the project were

presented and an invitation was made to institutions interested in participating in a Brazilian network on the topic. Those present who were interested in participating filled out a registration form with the addresses and characteristics of their respective healthcare institutions. In December, an electronic form was sent to them to be completed with specific information. In accordance with the data received, 27 of these candidate healthcare institutions were selected to participate in the network, taking regional characteristics, geographic distribution, level of complexity and the number of deliveries performed at each one into consideration.

A meeting with representatives from all the centers was held at the coordinating center in Campinas August 2008. At this meeting, the preliminary proposal was presented and discussed in detail, and suggestions were incorporated into the final version of the protocol. Participating center representatives were identified, the operational issues involved in implementing the study and the theoretical concepts were discussed, and the final version of the research project was defined. Concurrently, a signed commitment was undertaken by each representative to participate in the Brazilian Network for the Surveillance of Severe Maternal Morbidity and to institute a National Network of Studies in Reproductive and Perinatal Health. A Steering Committee was also designated for the study. After a sponsorship for the network surveillance was obtained, another pre initiation meeting was held in April 2009 for training for the cross sectional component of the study.

### **Technical and scientific contributions expected from the project**

The results of the present study will permit a prospective evaluation of the cases of death and severe maternal morbidity nationwide through the participation of healthcare institutions with different regional characteristics. No multicenter collaborative studies of this dimension are currently being carried out in healthcare institutions in Brazil, nor at any other country at the best of our knowledge, and no data thus obtained are currently available. There is only one research protocol published to be implemented in Nigeria, Africa, focusing on a national data system on near miss and maternal death to be prospectively carried out [29]. In addition to the specific study of maternal health hazards, the organizational structure required by this project will guarantee continuity of the investigation into various conditions of interest to public health beyond the period in which this study will be conducted. The implementation of a network through which structured electronic data will be obtained and stored in a specific database, and the commitment of healthcare institutions that are respected and renowned within the global scientific environment, are essential in a country of the continental dimensions of Brazil. The participation of three international individuals in the Steering Committee (JP Souza and L Say of the World Health Organization, Switzerland, and R Pattinson of Pretoria, South Africa), all with vast experience and an extensive scientific production in this area of interest, will undoubtedly contribute towards guaranteeing the quality of this study and to the prospective validation that will be made for the first time of the World Health Organization criteria for severe maternal morbidity and maternal near-miss recently issued [5].

Certainly, the availability of resources for the implementation and development of the Brazilian Network for the Surveillance of Severe Maternal Morbidity will lead to new scientific findings pertinent both in Brazil and internationally. Concomitantly, this will

permit the construction of an innovative technological base from which health data may be obtained on a continuous basis, providing the evidence required to institute a real and effective improvement in the quality of life and health of the population. This network, which has already been formed and is committed to participating in future initiatives in the form of collaborative studies in the areas of perinatal and women's healthcare, will permit the implementation of a series of multicenter studies in this area in a way never before achieved in this country. This fact gives greater power to the results, which will therefore be representative of the entire country, a particularly interesting achievement bearing in mind the wide ethnic, cultural and social diversity of the Brazilian population.

### **Ethical aspects**

The coordinating center has already obtained the approval of the local Institutional Review Board and of the National Council for Ethics in Research (CONEP) of the Brazilian Ministry of Health for both components of the project. The participation of the collaborating centers in this study will only be confirmed after the project has been approved by their respective Institutional Review Boards. Individual signed informed consent will not be requested from the women involved in the cross-sectional analysis, since this study does not involve any type of intervention that could adversely affect their treatment; the data of interest will be obtained retrospectively from the patient's charts and without identifying the woman. Therefore, a waiver of the requirement for signed informed consent was obtained. It is understood that there is no other way of obtaining concrete, reliable information on cases of severe maternal morbidity or death, since these patients are unable to give their consent. However, informed consent will be

obtained from the women involved in the longitudinal component of the study. All the principles regulating research in human beings will be respected.

Based on the questionnaires applied, women diagnosed with some type of pathological condition, who are not receiving medical care, will be referred to healthcare facilities equipped to provide them with follow-up care. Women who have already received a diagnosis of a pathological condition but are not being followed up by a physician will also be referred to an appropriate healthcare service.

### **Competing Interests**

The authors declare that they have no competing interests.

### **Authors' Contribution**

The idea for the study arose in a group discussion with all authors. The first version of the protocol was drafted by JPS and JGC, then complemented with the suggestions of the others. RCP and RSC were responsible for including the initial proposal for a multidimensional evaluation of consequences. SMH was responsible for the final, complete version of the protocol. JGC supervised the whole process. All authors contributed to the development of the study protocol and approved the final version of the manuscript.

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**Table 1: Criteria defining *Near-Miss* (WHO)\***

A woman who fulfills one of the following criteria and survives a complication during pregnancy, childbirth or in the 42 days postpartum should be considered a near-miss.

<b>Clinical Criteria</b>	
Acute cyanosis	Gasping
Breathing rate > 40 or < 6	Shock
Oliguria unresponsive to fluids or diuretics	Coagulation disorders
Loss of consciousness for $\geq 12$ hours	Cerebrovascular accident
Unconscious, no pulse/heartbeat	Total paralysis
Jaundice concomitantly with preeclampsia	
<b>Laboratory Criteria</b>	
Oxygen saturation <90% for > 60 minutes	Lactate > 5
Acute thrombocytopenia (<50,000 platelets)	PaO <sub>2</sub> /FiO <sub>2</sub> < 200
Creatinine $\geq 300$ $\mu\text{mol/l}$ or $\geq 3.5$ mg/dL	pH < 7.1
Bilirubin >100 $\mu\text{mol/l}$ or > 6.0 mg/dL	
Unconscious, presence of glucose and ketoacidosis in urine.	
<b>Management Criteria</b>	
Use of continuous vasoactive drug	
Dialysis for treatment of acute kidney failure	
Puerperal hysterectomy due to infection or hemorrhage	
Cardiopulmonary resuscitation (CPR)	
Transfusion $\geq 5$ units of red blood cell concentrate	
Intubation and ventilation for a period $\geq 60$ minutes, unrelated to anesthesia	

\*Modified from [5]

**Table 2: Indicators of non-near-miss severe maternal morbidity (potentially life-threatening conditions) \***

<b>Hemorrhagic disorders</b>
Abruptio placentae
Placenta previa, accreta/increta/percreta
Ectopic pregnancy
Antepartum hemorrhage (uterine atony, placental retention, laceration, coagulopathy)
Postpartum hemorrhage
Ruptured uterus
Abortion with severe hemorrhage
<b>Hypertensive disorders</b>
Severe Preeclampsia
Eclampsia
Severe hypertension
Hypertensive encephalopathy
HELLP syndrome
<b>Other systemic disorders</b>
Stroke
Shock
Pulmonary edema
Acute respiratory failure
Acute renal failure
Acidosis
Cardiopathy
Seizures
Meningitis
Sepsis (endometritis, post abortion, urinary focus, pulmonary focus)
Thrombocytopenia <100,000
Coagulation disturbance
Jaundice, hepatic dysfunction
Thyroid crisis
<b>Management indicators of severity</b>
Blood transfusion
Central venous access
Hysterectomy
ICU admission
Prolonged hospital stay (>7 postpartum days)
Intubation not related to anaesthetic procedure
Return to operating room
Major surgical intervention (laparotomy)
Use of magnesium sulphate

\*Modified from [5]