UNIVERSIDADE ESTADUAL DE CAMPINAS
FACULDADE DE CIÊNCIAS MÉDICAS

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CAUSAS INDIRETAS DE MORBIDADE MATERNA GRAVE NO BRASIL:

RESULTADOS DE UM ESTUDO MULTICÊNTRICO NACIONAL DE VIGILÂNCIA

INDIRECT CAUSES OF SEVERE MATERNAL MORBIDITY IN BRAZIL: RESULTS OF A NATIONAL MULTICENTER SURVEILLANCE STUDY

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Dissertação apresentada ao Programa de Pós-Graduação em Tocoginecologia da Faculdade de Ciências Médicas da Universidade Estadual de Campinas, como parte dos requisitos exigidos para a obtenção do título de Mestra em Ciências da Saúde na área de concentração Saúde Materna e Perinatal.

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Dedico este trabalho...

No atual momento político e social em que o pais se encontra, me sinto no dever de dedicar este trabalho as minorias que desde sempre sofrem apenas por existirem como tal. Sendo as mulheres, mães, grande parcela dessa opressão indiscriminada.

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RESUMO

Introdução: A mortalidade e morbidade maternas podem ser classificadas segundo suas causas como direta, indireta e acidental (incidentais). As causas indiretas são condições pré-existentes, não causadas por condições obstétricas, 27% das mortes maternas são atribuídas às causas indiretas. Há uma dicotomia ao analisar as causas indiretas em países de alta renda e países de baixa e média renda. Em países de alta renda as causas indiretas de mortalidade materna são causas de difícil redução como cardiopatias e doenças cerebrovasculares e nos países de baixa e média renda refletem condições de saúde precárias na população. **Objetivo:** Identificar a prevalência, principais diagnósticos, resultados perinatais e fatores associados as causas indiretas de morbidade materna grave (MMG) na Rede Brasileira de Vigilância da Morbidade Materna Grave. **Métodos:** Análise secundária de Estudo de corte transversal, multicêntrico, implantado em 27 hospitais do país. Foram incluídas gestantes com MMG. Foram criados 2 grupos para comparação dos dados: causas indiretas exclusivas (CI) e alguma causa direta envolvida. Variáveis sóciodemográficas, obstétricas, condições clinicas e de manejo, tipo de parto e resultados perinatais foram avaliadas. Análise bivariada foi realizada para identificar fatores preditores, estimar razões de prevalência (RP) e seus respectivos intervalos de confiança a 95%, ajustados por efeito cluster e análise de regressão múltipla de Poisson. Foram identificados todos os casos de morte materna por CI. Os softwares utilizados foram SPSS versão 17 (SPSS, Chicago, IL, EUA) e Stata versão 7.0 (StataCorp, College Station, TX, EUA). Foi considerado nível significância $p<0,05$. **Resultados:** Entre 82388 mulheres incluídas, 9555 apresentaram morbidade materna grave, destas 9,9% associadas às CI, sendo que 75,5% eram condições potencialmente ameaçadoras à vida, 18% Near Miss e 6,3% Morte Materna. Para cada 2,9 casos de Near Miss materno ocorreu 1 morte por CI versus 7,4:1 nas demais causas. As mulheres com CI apresentaram maio risco de parto prematuro < 28 semanas (RP 1.49 [1.16 – 1.91]); apgar <7 no quinto minuto (RP 1.49 [1.01 – 2.21]); intubação não relacionada a anestesia (RP 3.88 [3.06 –4.93]); admissão em UTI (RP 2.46 [1.54–3.93]) e hospitalização >7dias (RP 2.57 [1.74 – 3.81]). 37,8% das mulheres com causas indiretas permaneceram grávidas RP (95%CI) 7.93

[6.0410.41]. Obesidade foi fator protetor para CI RP (95%CI) 0.45 [0.29 – 0.69] enquanto baixo peso como fator de risco RP (95%CI) 3.23 [1.70 – 6.14]. Número de consultas de pré-natal menor que 6 e seguro saúde privado foram fatores de risco, respectivamente, RP (95%CI) 1.68 [1.36 – 2.06] e RP (95%CI) 2.04 [1.35 – 3.08]. As CI mais associadas à morte materna foram H1N1, Sepsis, Câncer e Cardiopatia. **Conclusão:** A gravidade das CI se evidencia nos indicadores de saúde, com 2,9:1 casos de Near Miss/morte. Mulheres com baixo peso, menor número de consultas de PN e PN fora do SUS apresentaram maior prevalência de MMG por CI. Nos desfechos, permanecer gestante após uma internação por MMG e apgar de 5º minuto <7 foram mais prevalentes entre a MMG por CI. As principais causas de morte materna entre as CI foram infecção pelo vírus H1N1, sepsis, câncer e cardiopatia.

Palavras-chave: Mortalidade materna; Morbidade materna grave; Causas indiretas; Near miss.

Abstract

Background: Maternal mortality and morbidity can be classified according to their causes as direct, indirect and accidental (incidental). Indirect causes are defined as pre-existing conditions, and are not caused by obstetric conditions. About 27% of maternal deaths can be attributed to indirect causes. There is a dichotomy when we try to analyze the indirect causes in developed and developing countries. In developed countries the indirect causes of maternal mortality are difficult to reduce causes such as heart disease and cerebrovascular diseases. In underdeveloped countries they reflect poor health conditions in the general population. **Objective:** To identify the prevalence, main diagnoses, perinatal outcomes and factors associated with the indirect causes of severe maternal morbidity (SMM) in the Brazilian Network for Surveillance of Severe Maternal Morbidity. Methods: Secondary analysis of a crosssectional, multicenter study, implanted in 27 hospitals. Pregnant women with severe maternal morbidity were included. Two groups were created to compare the data: exclusive indirect causes (IC) and some direct cause involved. Sociodemographic, obstetric, clinical and management, perinatal outcomes and type of delivery variables were defined. Bivariate analysis was performed to identify associated predictor factors, estimate prevalence ratios (PR) and their respective 95% confidence intervals (CI), adjusted for cluster effect. Multiple Poisson regression analysis was performed. All cases of maternal death from indirect causes were identified. The software used for the analysis was SPSS version 17 (SPSS, Chicago, IL, USA) and Stata version 7.0 (StataCorp, College Station, TX, USA). Significance level p <0.05 was considered. **Results**: 82388 women were included, 9555 presented SMM, 9.9% were associated with IC and 75.5% with potentially life threatening conditions, 18% Near Miss and 6.3% Maternal Death. For each 2.9 cases of Near Miss there was 1 death among IC versus 7.4:1 cases for other causes. Women with IC had higher risk of preterm birth <28 weeks (OR 1.49 [1.16 - 1.91]); Apgar <7 at the fifth minute (RP 1.49 [1.01 -2.21]); Intubation not related to anesthesia (OR 3.88 [3.06 - 4.93]); Admission to the ICU (PR 2.46 [1.54 - 3.93]) and hospitalization> 7 days (RP 2.57 [1.74 - 3.81]). 37.8% of the women with IC remained pregnant, presenting a PR (95% CI) 7.93 [6.04-10.41]. Obesity appeared as a protective factor for IC PR (95% CI) 0.45 [0.29 - 0.69] while underweight as a risk

factor PR (95% CI) 3.23 [1.70 - 6.14]. Number of PN consultations <6 and private health insurance presented as a risk factor, respectively, PR (95% CI) 1.68 [1.36 - 2.06], PR (95% CI) 2.04 [1.35 - 3.08]. The most prevalent IC associated with maternal death were H1N1, Sepsis, Cancer and Cardiovascular Disease. **Conclusion:** The severity of exclusive indirect causes is evident in the health indicators, with 2.9:1 cases of Near Miss/death. Women with low weight, private PN care and PN visits <6 showed higher prevalence of MMG due to IC. Remaining pregnant after admission and five minute Apgar <7 were more prevalent among IC. The main causes of death among IC of were H1N1 infection, sepsis, cancer and heart disease.

Keywords: Maternal Morbidity, Maternal Near-miss, Maternal Death, Indirect Causes, Reproductive Health.

Lista de Símbolos, Siglas e Abreviaturas

CAISM – Centro de Atenção Integral à Saúde da Mulher

CEP- Comitê de Ética em Pesquisa

CNPq – Conselho Nacional de Desenvolvimento Científico e Tecnológico

CNS – Conselho Nacional de Saúde

CPAV – Condições potencialmente ameaçadoras de vida

CI- Causas Indiretas

ICU – Intensive Care Unit

IC- Indirect Causes

MDG – Millenium Development Goals

MeSH – Medical Subject Heading

MM – Mortalidade Materna

MMG – Morbidade Materna Grave

MNM – Maternal Near Miss

NMM – Near Miss Materno

OMS – Organização Mundial da Saúde

PLTC – Potential Life-Threatening Conditions

RNVMMG- Rede Nacional de Vigilância de Morbidade Materna Grave

SMM – Severe maternal morbidity

SMO- Severe Maternal Outcomes

SOFA- Sequential Organ Failure Assessment

UNICAMP – Universidade Estadual de Campinas

UTI – Unidade de terapia intensiva

WHO – *World Health Organization*

Sumário

1. Introdução

Mortalidade materna (MM) é definida como a morte de uma mulher durante a gravidez ou até 42 dias após o parto de qualquer causa relacionada ou agravada pela gravidez. Altas taxas de mortalidade materna estão diretamente ligadas à inadequada prestação de serviços de saúde a esse grupo específico. Essa assistência falha se dá desde o planejamento familiar e atenção pré-natal, até o parto e puerpério (Laurenti, 2004).

Quanto as causas, a mortalidade materna pode ser classificada como direta, indireta e acidental. Mortes resultantes de complicações obstétricas na gravidez, parto e puerpério são classificadas como causas diretas de morte materna (Laurenti, 2004). Entre as causas obstétricas diretas, as mais incidentes são hemorragias, infecções, doenças hipertensivas e o aborto (Lumbiganon, 2014).

As causas indiretas são definidas como condições pré-existentes ou recentemente adquiridas durante a gravidez, e que não são causadas por condições obstétricas. Um estudo feito pela OMS, em 2014, mostrou que 27% das mortes maternas no mundo são de causas indiretas. Além disso, mulheres com causas indiretas subjacentes possuem um aumento significante de complicações obstétricas e morbidades perinatais (Lumbiganon, 2014). E ascausas acidentais são referentes as mortes maternas não obstétricas, não relacionadas à gravidez, como por exemplo, acidente de trânsito ou infarto (Royston & Armstrong, 1989)

A mortalidade materna é um evento de extrema importância e alta magnitude, pois relaciona-se com o grau de desenvolvimento do país ou região onde ocorre, porém é um evento relativamente raro. Assim para ampliar a possibilidade de estudos na área e de prevenção da morte materna, a

morbidade materna grave (MMG =MM+NM) passou a ser o enfoque dos estudos, para um melhor entendimento dos processos que levam ao óbito, uma vez que com frequência estão relacionadas (Cecatti et al, 2009; Pattinson & Hall,2003). Dessa maneira, ampliando a vigilância sobre os casos de MMG +MM, pode se avaliar e analisar tais situações, para o desenvolvimento de políticas de saúde e qualificação da assistência, construindo uma rede hospitalar cada vez mais segura e próxima aos números ideais (Pattison, 2009; Say, 2004; Tunçalp, 2012).

A MMG tem um continuo referente à gravidade: os casos graves, onde existe uma condição potencialmente ameaçadora à vida (CPAV) porém ainda sob controle, o Near Miss (NM) e, por fim, a morte materna (MM).

Assim, existe um grupo de mulheres que possui condições de morbidade que são potencialmente ameaçadoras à vida. Estas são complicações graves que se não diagnosticadas e tratadas a tempo podem evoluir para o Near Miss (WHO,2009).

Near Miss é o termo utilizado para caracterizar uma mulher que quase morreu, mas sobreviveu, durante a gestação, o parto e os 42 dias de pós-parto. O conhecimento da prevalência e das causas de NM passou a ser uma nova forma de avaliação do cuidado obstétrico (Cecatti et al, 2007). O Near miss materno é um ótimo marcador de cuidados obstétricos uma vez que procede e compartilha diversas características com a mortalidade materna, mesmo sendo mais comum que esta última. É com base nele que podemos entender determinantes da mortalidade materna (WHO, 2009; Souza et al, 2007; WHO 2011).

A Organização Mundial da Saúde (OMS) em 2009 definiu conceitos e padronizou critérios identificadores de NM, tendo como base a identificação de disfunções e/ou falência orgânica (Pattinson et al.,2009). Previamente os critérios foram validados por um grupo de trabalho a partir dos marcadores de

disfunção e falência orgânica (*sequential organ failure assessment*- SOFA), aplicado em uma população obstétrica (Cecatti et al., 2011). SOFA foi tido como padrão ouro para comparação que se mostrou com alto desempenho na identificação de gravidade de casos de morbidade materna grave (Oliveira-Neto et al., 2012).

Os critérios estabelecidos pela OMS, após análise, se mostraram com sensibilidade de 99,2% e especificidade de 86% no que se referem a identificação de falência orgânica (Cecatti et al., 2011).

Muitos estudos discutem sobre o Near Miss materno e suas diferenças em diversos locais do mundo. Em 2009 um estudo realizado em países de alta e média-baixa renda revelou alguns fatos importantes. A prevalência do Near Miss nos países de alta renda varia de 3,8 a 12 por 1000 partos, e a hemorragia e a pré-eclâmpsia correspondem a mais da metade dos casos de Near Miss. (Van Roosmalen & Zwart,2009). Já nos países de média e baixa renda não é fácil estimar os valores de near miss. Estima-se que a prevalência de Near Miss para essa população seja de 14,2 por 1000 nascidos vivos, porém esses valores podem ser muito maiores a depender da situação socioeconômica. Assim, quanto mais pobre a população, maior a prevalência do *Near Miss* (Ronsmans, 2009).

Em termos de complexidade os casos de NM e MM muito se assemelham. Desse modo, pela possibilidade de entrevistar as mulheres após o evento, os casos de NM são de extrema importância para avaliações futuras e melhora da qualidade do serviço (Say, 2009; Souza, 2007; Maine, 2007).

Segundo levantamento da OMS (2014) feito em 29 países, são importantes causas indireta de MM: infecções de causas não obstétricas, incluindo pielonefrite, septicemia e outras infecções sistêmicas, distúrbios hipertensivos (hipertensão arterial crônica a qual é definida como pressão arterial > 140/90 mmHg antes de 20 semanas de gestação) ; e (Pattinson &

Hall, 2003) outras complicações ou doenças , incluindo o HIV , AIDS, anemia grave definida como hemoglobina < 7 g/dl % , a malária / dengue, câncer, doença cardíaca , doença pulmonar, doença renal e doença hepática (Lumbiganon, 2014).

Há uma dicotomia quando tentamos analisar as causas indiretas em países de alta e media-baixa renda. Em países de alta renda as causas indiretas de mortalidade materna são causas de difícil redução, provavelmente não evitáveis como cardiopatias, doenças cerebrovasculares e tromboembolismo, levando e consideração um aumento considerável da obesidade nesses países. Já em países de media-baixa renda refletem condições de saúde precárias na população geral, como as doenças infecto-contagiosas: diarreia, malária e AIDS (Lumbiganon, 2014; Bodker, 2009). Evidenciando a dificuldade de acesso e qualidade dos serviços de saúde nestes países.

O Brasil por sua diversidade sóciodemográfica e grande extensão territorial, está em um status intermediário de uma forma geral, o qual contempla características das duas situações, mas que ainda não são conhecidas. Pouco se sabe sobre as causas indiretas de mortalidade materna no país. O desconhecimento dessas causas não permite que se criem estratégias de saúde pública para minimizar suas consequências.

É clara a associação entre MM e características socioeconômicas. Nos países com pior Índice de Desenvolvimento Humano (IDH) o risco de uma mulher morrer durante o ciclo gravídico puerperal é de um em seis. Sabe-se que mesmo antes de se realizar melhoras externas precisamos trilhar um caminho no sentido de melhorar a atuação da equipe do serviço de saúde, que assiste a gravida e a puérpera.

Conhecer a prevalência das diversas causas indiretas e seu impacto no continuo de gravidade desde a ocorrência de condições potencialmente

ameaçadoras da vida, Near Miss e óbito é importante para a criação de estratégias específicas para uma abordagem de risco durante o período perinatal (Lumbiganon, 2014). Em 2009, pelo período de um ano, foi realizado um estudo multicêntrico de corte transversal em 27 maternidades de referência divididas entre as cinco regiões do Brasil. Estudo intitulado Rede Nacional de Vigilância de Morbidade Materna Grave (RNVMMG) (Haddad et al., 2011).

Nesse estudo em específico foram analisados os casos de morbidade materna grave por causas indiretas e suas possíveis repercussões no decorrer da gestação e resultados perinatais. O resultado desta análise contribuiu para o maior conhecimento das causas indiretas da MMG no Brasil e dessa forma, para futuro planejamento assistencial, visando redução dos desfechos desfavoráveis.

2. Objetivos

2.1. Objetivo geral

Conhecer a prevalência das causas indiretas da Rede Brasileira de Vigilância da Morbidade Materna Grave e dos principais indicadores, diagnósticos, antecedentes e resultados perinatais associados.

2.2. Objetivos Específicos

2.2.1 Conhecer os indicadores de morbidade materna grave entre as causas indiretas exclusivas e compará-los com as demais

2.2.2 Identificar características sociodemográficas, comorbidades, hábitos e antecedentes obstétricos associados à morbidade materna grave por causas indiretas

2.2.3 Conhecer resultados perinatais associados à morbidade materna grave por causas indiretas

2.2.4 Conhecer os critérios de diagnóstico e manejo do Near Miss mais prevalentes entre causas indiretas de morbidade materna grave.

2.2.5 Identificar as principais causas de morte materna entre os casos de morbidade materna grave por causas indiret

3. Metodologia

3.1 Desenho do Estudo

Esta é uma análise secundária dos dados gerados pela Rede Nacional de Vigilância da Morbidade Materna Grave, estudo multicêntrico de corte transversal, realizado em 27 maternidades de referência das cinco macrorregiões brasileiras, durante um ano, 2009 a 2010 (Haddad, et al, 2011). Neste estudo foram comparadas as causas indiretas exclusivas de MMG com as outras causas.

3.2 Tamanho Amostral

O estudo original contou com um cálculo amostral de aproximadamente 75.000 partos, para assim obter 750 casos e NM e 100 MM. O tamanho amostral se baseou numa prevalência de 10 casos de NM para cada 1000 nascidos vivos (14), uma razão de morte materna de 140 para cada 100.000 nascidos vivos.

A RNMMG contou com uma avaliação de 82.388 partos. A amostra foi constituída por 942 casos de Morbidade materna grave relacionados a causa

indireta, subdivididos em Condição Potencialmente Ameaçadora à Vida, Near Miss e Morte Materna.

3.3 Definições e conceitos

3.3.1 Causas Indiretas Exclusivas de Morbidade Materna Grave

São aquelas resultantes de doenças existentes antes da gravidez ou de doenças que se desenvolveram durante a gravidez não devidas a causas obstétricas diretas, mas que foram agravadas pelos efeitos fisiológicos da gravidez.

Para este estudo foram avaliadas as causas indiretas exclusivas, ou seja, situações em que causas obstétricas não estavam presentes, mesmo que associadas à comorbidades maternas.

3.3.2 Outras Causas de MMG (Causas Diretas exclusivas ou Associações de Causas Diretas + Indiretas)

Para este estudo foram consideradas outras causas as causas diretas exclusivas ou associadas as causas indiretas, ou seja, todas que não foram incluídas nos critérios acima citados por apresentarem alguma complicação obstétrica

As causas diretas são aquelas resultantes de complicações obstétricas na gravidez, parto ou puerpério devidas a intervenções, omissões, tratamento incorreto ou a uma cadeia de eventos resultantes de quaisquer das causas acima mencionadas.

3.3.3. Critérios de Near miss Materno (OMS)

A presença de 1 ou mais critérios clínicos e/ou laboratoriais e/ou de manejo definem um caso de Near Miss.

 Critérios Clínicos

– *Gasping*: padrão respiratório terminal e com respiração ruidosa.

– Cianose.

– Frequência respiratória> 40 ou < 6 imp.

– Choque: hipotensão grave persistente (PA sistólica < 90 mmHg por ≥60 minutos com FC ≥ 120 bpm) apesar de reposição volêmica agressiva (> 2 litros). Oligúria não responsiva a fluídos e diuréticos: débito urinário < 30 ml/h durante 4 horas ou < 400 ml/24h.

– Distúrbios de coagulação: teste de coagulação à beira do leito segundo instruções: (1) Coletado 2ml de sangue venoso em um tubo seco de vidro (cerca de 10 mm x 75 mm); (2) segura-se o tubo para mantê-lo aquecido (+ 37 ° C), (3) Após 4 minutos, inclina-se o tubo lentamente para ver se há formação de coágulo. Novamente inclina-se o tubo a cada minuto até que o sangue coagule e o tubo possa ser girado de cabeça para baixo; (4) A não formação de um coágulo após 7 minutos ou a formação de um coágulo frágil, que se rompe facilmente, sugere coagulopatia, ou ausência de coagulação de acessos venosos após 7-10 minutos.

– Perda de consciência: profunda alteração do estado mental que envolve a completa ou quase completa falta de resposta a estímulos externos. Definida como uma Escala de Coma Glasgow <10 (coma moderado ou grave) ≥ 12 horas.

– AVC: déficit neurológico de causa vascular cerebral que persiste após 24 horas ou é interrompido pela morte dentro de 24 horas.

– Perda de consciência e ausência de pulso/batimento cardíaco.

- Convulsão não-controlada: Condição na qual o cérebro está em um estado de permanente convulsão. Equivalente ao *status epilepticus*, normalmente definido como uma convulsão contínua e ininterrupta que dura mais de 30 minutos, ou crises recorrentes sem recuperação da consciência entre as convulsões por mais de 30 minutos. Refratária, convulsão persistente.
- Icterícia na presença de P.E. ou eclâmpsia: amarelamento da pele, das escleras e de outros tecidos causado pelo excesso de bilirrubina circulante.

 Critérios Laboratoriais

- Saturação de O_2 <90% por ≥ 60 minutos.
- Relação PaO_2/FiO_2< 200: Relação entre a saturação arterial de oxigênio (PaO_2) e a fração inspirada de oxigênio (FiO_2). A saturação arterial de oxigênio foi determinada pela realização da gasometria arterial. A fração inspirada de oxigênio pode variar de acordo com o paciente e foi gravada no momento da coleta de sangue para a gasometria. Podendo ser precisa (por exemplo, durante a ventilação mecânica, 0,21 -1,00) ou estimada: sem suplementação de oxigênio, 0,21; cateter nasal de oxigênio, 0,25; máscara facial de oxigênio, 0,25-1,0.
- Creatinina ≥ 300 µmol/l ou ≥ 3,5mg/dl.
- Bilirrubina≥ 100µmol/l ou >6 mg/dl.
- pH<7,1
- lactato>5

– plaquetas< 50.000

– Perda de consciência e presença de glicose e corpos cetônicos na urina.

 Critérios de Manejo

– Uso contínuo de droga vasoativa: O uso contínuo de qualquer dose de dopamina, adrenalina e noradrenalina. No contexto da infusão de drogas vasoativas, refere-se à infusão contínua e ininterrupta de uma solução contendo um fármaco vasoativo. Ela opõe-se à injeção em bolus ou intermitente de um fármaco vasoativo.

– Histerectomia por infecção ou hemorragia.

– Transfusão de ≥5 unidades de concentrado de hemácias.

– Ventilação mecânica invasiva ≥ 60 minutos, não relacionada à anestesia.

– Diálise para falência renal aguda.

– Ressuscitação cardiopulmonar: procedimento de emergência médica para atendimento de parada cardíaca, incluindo compressões do tórax e ventilação pulmonar.

3.4. Variáveis

3.4.1. Variáveis dependentes

- Condição potencialmente ameaçadora a vida: ocorre na presença de complicações maternas, incluindo distúrbios hemorrágicos e hipertensivos, além de indicadores de manejo de gravidade e outras complicações:

- Near Miss materno: Mulheres que sobrevivem às complicações durante a gestação, parto e puerpério após terem apresentado qualquer critério ou marcador clínico, laboratorial ou de manejo, que identifiquem falência/ disfunção orgânica.

- Morte materna: Morte de uma mulher durante a gestação, parto ou até 42 dias após parto ou aborto. No presente estudo foi considerado o óbito acontecido somente durante a internação:

3.4.2. Variáveis independentes

Características maternas, sociodemográficas, reprodutivas, antecedentes clínicos, qualidade do acesso aos serviços de saúde:

– Idade (anos completos): categorizada para análise bivariada em ≤ 19, de 20 a 34 ou ≥35.

– Cor da pele: (conjunto de características socioculturais e fenotípicas, identificadas pela observação ou declaração da própria mulher): categorizadas em branca (mulher de cor de pele branca ou parda de origem latino-americana) e outras (Negra: mulher de cor de pele preta ou parda de origem africana; Amarela: mulher de origem oriental-leste e sudeste asiático; Indígena: mulher com características da população nativa do país).

– Estado Marital (condição de convívio conjugal). Categorizada: com companheiro e sem companheiro.

– Escolaridade (anos de estudo declarados pela mulher). Categorizada:

ensino fundamental completo e ensino maior que fundamental.

– Número de gestações (número total de gestações da mulher, inclusive gestações que terminaram em aborto, prenhez ectópica ou gestação molar, incluindo a gestação atual). Categorizada em: uma / duas ou mais.

– Internação em UTI (admissão em unidade de terapia intensiva durante o período de internação): categorizada em sim ou não.

– Utilização de Sulfato de Magnésio (não discriminado o momento da utilização): categorizada em sim ou não.

3.4.3. Variáveis de Controle

– Idade gestacional no parto: idade gestacional, em semanas, no momento do parto. Categorizada em prematuridade extrema22-33 + 6 dias,ou prematuridade tardia 34- 36 + 6 dias, e termo > 37 semanas.

– Tipo de parto: como foi ultimada a gestação. Categorizada em parto vaginal ou cesárea. Excluindo casos de aborto.

– Condição ao nascimento: condição do RN durante o período de internação. Categorizada em natimorto ou vivo.

– Peso ao nascer: peso do RN, em gramas, no momento do nascimento. Excluídos os casos de óbito fetal ou intraparto.
  Categorizados em <2500 ou >2500gr.

  Desfecho neonatal: Categorizados em permanência em UTI neonatal(internados e transferidos), óbito neonatal ou alta hospitalar. Excluídos os casos de óbito fetal ou intraparto.

– Apgar ao 5^{o} minuto: avaliação da vitalidade neonatal ao momento do nascimento, segundo a escala de Apgar, no quinto minuto de vida. Excluídos os casos de óbito fetal ou intraparto. Categorizado (para análise bivariada) em >7, <7.

3.5. Seleção dos Sujeitos

Foram incluídas no estudo original todas as mulheres admitidas nos 27 centros de estudo que apresentaram CPAV, NM ou MM, segundo avaliação dos prontuários após alta.

Os desfechos maternos foram definidos usando os critérios estabelecidos pela OMS para desfecho materno grave (near miss e morte).

O estudo original não previa a classificação da morbidade materna grave em causas indiretas, diretas ou mistas, assim para o presente estudo foram criados filtros que excluíram as causas indiretas exclusivas todos os casos que apresenta-sem: complicações hemorrágicas e hipertensivas, endometrite pósparto ou pós-aborto, uso de sulfato de magnésio, histerectomia/laparotomia ou histerectomia por infecção ou hemorragia.

3.6. Coleta de Dados

Assistentes locais de pesquisa, em cada Centro, denominados coordenador e investigador, realizavam a revisão diária dos prontuários das mulheres que tiveram alta ou morreram, separando as de interesse para o estudo e transcrevendo os dados para o formulário de coleta manual (Anexo 1). Os dados coletados manualmente foram em seguida digitados em formulários eletrônicos abrigados na plataforma eletrônica *OpenClinica*®. O link para o site esteve disponível em www.caism.unicamp.br.

3.7. Controle de qualidade

Primeiramente os dados passavam por um controle de qualidade referente a coleta de dados realizada pelos investigadores locais, antes e durante a digitação eletrônica das fichas, para assim identificar rapidamente possíveis incongruências.

Outra forma de controle de qualidade foram visitas realizadas as instituições participantes do estudo por um pesquisador principal da Rede.Devido ao grande número de casos, de forma aleatória selecionaram alguns casos para tal análise.

Foi criado um manual de informações que padronizava os itens como uso da internet, preenchimento de formulários (manual e eletrônico), acesso ao banco de dados particular de cada centro, padronização das definições diagnósticas, entre outras.

Por fim, os pesquisadores principais realizaram o terceiro controle de qualidade, aplicação de consistência lógica e revisão do banco de dados.

3.8. Processamento e Análise de dados

Os dados coletados foram analisados como frequências para descrever as causas indiretas e demais variáveis socio-demograficas, obstétricas e perinatais. Ainda, as mulheres classificadas no grupo de causas indiretas foram classificadas segundo o desfecho em condições potencialmente ameaçadoras da vida (CPAV), near miss materno (NMM) e morte materna (MM), de acordo com os critérios de disfunção/falência orgânica estabelecidos pela OMS, além de dados sobre a resolução da gestação e resultados perinatais.

Adotou-se o nível de significância de 0,05%, em análise bivariada pelo cálculo das razões de prevalência (RP) e seus respectivos intervalos de confiança (IC) de 95%, ajustados pelo efeito conglomerado e análise múltipla por regressão de Poisson. Os softwares utilizados foram SPSS® versão 17 (SPSS, Chicago, IL, USA) e Stata® versão 7.0 (StataCorp, College Station, TX, USA).

3.9. Considerações éticas

Todos os dados obtidos foram através do banco de dados do estudo principal, uma vez que o mesmo é uma análise secundária da “Rede Nacional de Vigilância de Morbidade Materna Grave” (RNVMMG).

A pesquisa da RNVMMG baseou-se nos princípios que regulamentam as pesquisas em seres humanos definidos pelo Conselho Nacional de Saúde (Resolução 196/96). Não foi feito uso de Termo de Consentimento Informado, visto que os dados foram colhidos em prontuários na pós-alta hospitalar e nenhum contato ter sido realizado com os sujeitos de pesquisa. O estudo foi aprovado pelos Comitês de Ética locais e pelo Comitê Nacional de Ética em pesquisa em seres Humanos- CEP: nº 097/2009 (Anexo 1).

4.Resultados

ORIGINAL RESEARCH

Indirect causes of severe maternal morbidity in Brazil: results from a national cross-sectional multicenter study

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Conflict of interest

The authors have stated explicitly that there are no conflict of interest in connection with this article

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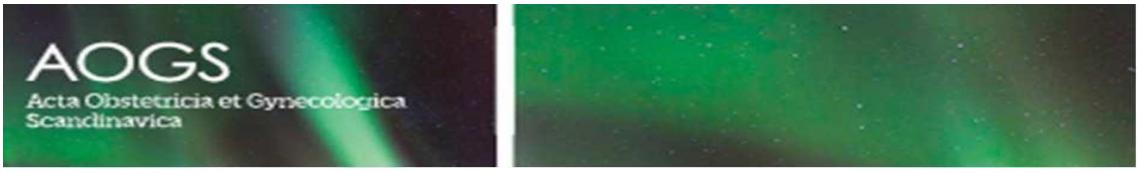

Indirect causes of severe maternal morbidity in Brazil: results from a national cross-sectional multicenter study

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Abstract

Introduction: Severe maternal morbidity causes can be classified as direct, indirect and incidental. Indirect causes are defined as preexisting conditions or recently started during pregnancy but not caused by obstetric conditions. In high-income countries (HIC), indirect causes are mainly heart diseases and thromboembolism. On the other hand, in low and middle-income countries (LMIC), indirect causes reflect poor health conditions for the population in general, mainly due to infectious diseases such as diarrhea and malaria. To evaluate the burden of indirect causes of maternal morbidity/mortality in Brazil, within the Brazilian Network for Surveillance of Severe Maternal Morbidity. **Material and methods:** Secondary analysis of a multicenter

cross-sectional study conducted in 27 referral obstetric units in Brazil. Cases were identified through prospective surveillance by using the WHO standardized criteria for potentially life-threatening conditions (PLTC), maternal near miss (MNM) and maternal death (MD). Two groups were considered concerning underlying causes of morbidity as direct (any direct cause involved) or indirect causes (exclusive indirect causes) and compared considering socio-demographic and obstetric characteristics, maternal and perinatal outcomes and severity of morbidity. Factors independently associated with severe maternal outcomes (SMO=MNM+MD) among indirect causes of maternal morbidity were also assessed. **Results:** 82,388 women were surveilled, 9,555 were included with severe maternal morbidity, 942 (9.9%) of them with exclusive indirect causes of morbidity. There was an increased risk of higher severity among the exclusive indirect causes, which presented 7.56 times increased risk of MD (PR 7.56 [4.99-11.45]). They also had a higher risk of preterm birth < 28 weeks (PR 1.49 [1.16 – 1.91]); Apgar<7 at the fifth minute (PR 1.49 [1.01 –2.21]); maternal intubation non-related to anesthesia (PR 3.88 [3.06 – 4.93]); admission to the ICU (RP 2.46 [1.54 – 3.93]) and hospitalization> 7 days (RP 2.57 [1.74 – 3.81]). 37.8% of these women still remained pregnant after the acute condition was managed. The main indirect causes of maternal deaths were H1N1 influenza, sepsis, cancer and cardiovascular disease. **Conclusions:** Indirect causes of maternal morbidity/mortality were responsible for an increased risk of higher severity and were responsible for less than 10% of the overall cases, however, they represented over 40% of maternal deaths in the current study. There was an association of indirect causes and worse maternal and adverse perinatal outcomes.

Keywords: Maternal Morbidity, Maternal Near-miss, Maternal Death, Indirect Causes, Reproductive Health.

Abbreviations: PLTC, potentially life-threatening conditions; MNM, maternal near miss; MD, maternal death; SMO, severe maternal outcomes; SMM, severe maternal morbidity.

Introduction

Recent Sustainable Development Goals were stablished by the United Nations (2015-2030), including the broad goal of "good health and wellbeing" for all. Based on the goals for the previous period (2000-2015) , there was an improvement in maternal health worldwide. However, the goal of significant reduction in maternal mortality was not yet reached, especially among low and middle income countries (1). This inequity represents a gender issue as well, regarding most of the socially, psychologically and physically vulnerable populations from poor settings.

Maternal morbidity became a relevant outcome for understanding maternal health in the past decade, defined as a continuum of severity complicating a normal pregnancy (2, 3, 4). According to specific criteria, women can experience a potentially life threatening condition that can evolve to a state of organ dysfunction and/or failure (3, 5).

In 2009, the WHO standardized the definitions for potentially life-threatening conditions (PLTC) and maternal near miss (MNM). PLTC is defined as severe maternal complications that include hemorrhage (e.g. abruption placenta, ruptured uterus, atony and others), hypertensive disorders (e.g. severe preeclampsia, eclampsia, HELLP syndrome), management indicators of severity (e.g. blood transfusion, intubation, intensive care unit admission) and other complications (e.g. pulmonary edema, cardiac disease and sepsis). MNM is when a woman has almost died, but survived a given complication during pregnancy, childbirth or the first 42 days post-partum (4). These women should present an organ dysfunction or failure with at least one of these criteria: clinical (e.g. shock or clotting disorder), laboratory (e.g. lactate>5, $PaO_2/FiO_2 < 200$ mmHg) or management (e.g. hysterectomy due to infection or hemorrhage and blood transfusion ≥ 5 units of packed red blood cells) (4).

Evaluating maternal near miss cases might enable the understanding of maternal death determinants in severely ill women, since the outcome is their only difference (2; 4). MNM and Maternal Death (MD) characterize severe maternal outcomes (SMO) (4),

while altogether, including PLTC, we consider as Severe Maternal Morbidity (SMM) (1).

The causes of maternal mortality and morbidity are classically divided in direct, indirect or non-related to pregnancy (6). Direct obstetric causes are those occurring with direct relationship to pregnancy and are mostly on the spot because they are, by definition, avoidable. Causes such as bleedings, sepsis, hypertensive syndromes and abortion are the most frequent (7). Indirect obstetric causes, defined as preexisting disorders or even those aggravated by pregnancy, such as cardiac disease, kidney disease or infection due to urinary or pulmonary foci, have a very high cause/mortality rate, even though they happen in fewer cases among maternal deaths (MD) (8).

A way to consider maternal mortality and morbidity in different settings is to use the concept of "obstetric transition". This concept refers to the global trend in which a high rate of maternal morbidity/mortality with mostly direct obstetric causes of mortality is being gradually replaced by lower rates with a growing proportion of indirect causes, institutionalization and medicalization of labor and childbirth and an increase in obstetric intervention rates (9). High-income countries have started their transition over a century ago, whereas middle and low-income countries have only started recently and are still on earlier stages of the process (9). There are five stages (I-V) in this obstetric transition and different settings are in different moments of the phenomenon. Brazil is ranked in an intermediate position for population development and currently on stage III of this transition (9).

The aim of the current study is to identify the burden of indirect causes of maternal morbidity/mortality in comparison to direct causes and factors associated with severe maternal outcomes.

Material and methods

This is a secondary analysis focused on indirect causes of severe maternal morbidity within the Brazilian Network for Surveillance of Severe Maternal Morbidity,

a multicenter cross-sectional study implemented in 27 referral obstetric units in all Brazilian regions, between 2009 and 2010, based on the WHO standardized criteria for severe maternal morbidity (5, 10). Through a prospective surveillance, data were collected to identify cases of potentially life-threatening conditions (PLTC), maternal near-miss (MNM) and maternal death (MD). Detailed information on the study methods has been previously published (1).

Briefly, sample size was calculated considering that 75,000 deliveries should be surveyed to identify around 750 near-miss cases, using an approximate theoretical incidence of 10 near miss cases per 1000 deliveries as a basis for calculation (11, 12). Data collection was performed by a trained research team, considering all women admitted during pregnancy, childbirth or the post-partum period with any of the criteria for severity conditions defined by the WHO. Information retrieved from medical charts were transferred into the OpenClinica® electronic platform (version 2.5.5, Waltham, MA, USA) by the local coordinator from each participating center.

For data quality control, there was a strict personnel training for adequate data collection, chart review, and feeding the database, with the implementation of an operation manual and site visits for monitoring data control. Detailed typing and consistency checking by local and central coordinators were also performed (11, 12).

Data analysis for the current study approach consisted of a comparison of maternal and perinatal outcomes among women defined according to the underlying cause of morbidity as indirect or direct. The first group considered exclusive indirect obstetric causes of maternal morbidity, and the second one with any situation involving exclusive or associated direct obstetric causes of maternal morbidity or mortality.

Initially, the prevalence of PLTC, MNM and MD was calculated and compared between the two groups. We then considered health indicators among both groups: the maternal near miss incidence ratio (MNM incidence ratio), severe maternal outcome ratio (SMOR = MNM + MD), maternal near miss to maternal death ratio (MNM:MD ratio), mortality index (MI) and maternal mortality ratio (MMR), according to the WHO recommendations (5). We further assessed socio demographic variables, previous

morbid conditions, prenatal care and obstetric complications, comparing direct and indirect causes of maternal morbidity. Data on pregnancy outcomes and perinatal results were also described, comparing both groups.

Finally, Poisson multiple regression analysis was used to identify the factors that were independently and significantly associated with Severe Maternal Outcomes (MD or MNM), compared to PLTC among indirect causes of maternal morbidity. The prevalence ratio adjusted for the cluster design effect and for the remaining model variables as possible predictors, with their respective confidence interval (PR_{adj} [95% CI]) were presented. Statistical analysis was carried out with softwares SPSS® version 17.0 (SPSS, Chicago, IL, USA) and Stata version 7.0 (StataCorp, College Station, Tx, USA). The descriptive level was presented at 5% (95% confidence level) adjusted by the cluster design effect.

Ethical Considerations

This study is a secondary analysis with data obtained from the database of the main study. All the principles regulating research on human beings defined by the Brazilian Health Council, as well as the Declaration of Helsinki were respected. Individual Informed Consent Form was waived, since data were collected from medical records post–discharge or post-mortem and no contact occurred with the research subjects. Local IRBs and the National Committee of Ethics in Research approved the study, under the letter of approval 097/2009.

Results

During the12-month period of study, 82,388 women from 27 obstetric units were monitored, resulting in 82,144 live births (LB). Among these women, 9,555 met the criteria for severe maternal morbidity (either PLTC, MNM or MD). In this group, 942 had an exclusive indirect cause of maternal morbidity, 713 defined as PLTC (75.7%), 170 as MNM (18.0%) and 59 MD (6.3%) (Figure 1). Comparing the occurrence of severe outcomes between indirect and direct causes, there was an increased risk of

higher severity among the exclusive indirect causes, which presented 7.56 times increased risk of MD (PR 7.56 [4.99-11.45]).

Considering health indicators (Table 1), the MD ratio (MNM: MD) for indirect causes of maternal morbidity, there is one death for every 2.79 cases of near miss, while for direct causes there is one death for every 8.29 cases. The mortality rate – Mortality index = MD/(MNM + MD) – was 25.8% among cases of exclusive indirect causes of maternal morbidity, significantly higher when compared to the direct underlying causes of morbidity, which have a 11.9% mortality rate.

When evaluating sociodemographic data and obstetric characteristics comparing exclusive indirect causes and direct causes of maternal morbidity, there were very few significant differences among groups, with increased risk among indirect causes of morbidity of low weight (PR 3.23 [1.70 – 6.14]), fewer prenatal visits (PR 1.68 [1.36 – 2.06]) and private health care (PRP 2.04 [1.35 – 3.08]) (Table 2).

Data on pregnancy characteristics and perinatal results for women with SMM due to indirect causes of maternal morbidity presented a higher risk of terminating pregnancy before 28 weeks of gestation (PR 1.49 [1.16 – 1.91]), abortion (PR 1.72 [1.11 – 2.64]) and Apgar scores below 7 at the fifth minute (PR 1.49 [1.01 –2.21]), when compared to direct causes of maternal morbidity (Table 3).

A significant proportion of cases admitted due to indirect causes of maternal morbidity had severe complications through pregnancy that did not lead to pregnancy resolution (37.8%) and were discharged still pregnant. In contrast, among cases of direct causes of morbidity, only 3.8% remained pregnant after a SMM event. Among the ones that delivered, most were through C-sections in both groups.

Looking into the standard criteria used for identifying MNM: laboratory, clinical or management, 36.2% of women with underlying indirect causes of maternal morbidity presented the combination of all three criteria, versus 24.1% in group with direct causes (p=0.004) (Data not show). Among the procedures used as management criteria, intubation not related to anesthesia (PR 3.88 [3.06 – 4.93]), venous central access (PR

4.24 [3.23 – 5.56]), admission to ICU (PR 2.46 [1.54 – 3.93]) and hospitalization > 7 days (PR 2.57 [1.74 – 3.81]) were significantly associated to indirect causes of maternal morbidity, when compared to cases of direct underlying causes of morbidity (Table 4).

The risk of SMO for indirect obstetric causes according to previous maternal conditions, showed increased risk among drug users (PR 1.56 [1.05 – 2.032]) and decreased risk of severity among women with history of cardiac disease (PR 0.40 [0.20 – 0.81]) (Table 5). A specific analysis of all identified cases of MD due to indirect causes presented an impressive incidence of Influenza-H1N1 (30.5%), sepsis (20.3%), cancer (10.1%) and heart disease (10.1%). The remaining cases were other causes or nonidentified causes of mortality (Table 6).

The multivariate analysis showed that exclusive indirect cause, preexisting conditions, other financial coverage (nonpublic), diabetes, neoplasia, kidney disease and drug addiction were risk factors for a severe maternal outcome. Obesity, not having a partner and higher education were protective factors for severe maternal outcome (Table 7).

Discussion

Our results provide the burden of indirect causes of maternal morbidity/mortality among cases of severe morbidity in a Brazilian population. In our settings, indirect causes were responsible for only around 10% of the total cases of severe morbidity, however, represented 40% of the deaths occurred, with a high mortality index (MI=25.8%). The MI correlates with quality of care, indicating substandard care when above 20% (13).

Worldwide, indirect causes of mortality are responsible for one quarter of all maternal deaths (8). Gradual changes towards a decrease in avoidable causes of maternal mortality (mostly direct causes of mortality) are now understood as a phenomenon called
"obstetric transition" (9). Such changes are happening at different countries, and are strongly connected to the governmental and the society's improvements in

implementing public policies that promote social development and health awareness (9). Brazil is currently on stage III of this obstetric transition with a maternal mortality ratio (MMR) between 299-50 MD / 100,000 LB (9).

Very recently a systematic analysis was published with the intent of better understanding worldwide causes of mortality, aiming to improve quality of life and to achieve more longevity among populations. Data of mortality and its trends according to the sociodemographic measures of 195 countries between 1980 and 2015 were presented and among the 249 studied causes of morbidity, there was a subgroup concerning maternal morbidity. The data confirm the decrease in the absolute number of maternal deaths (7),with hemorrhage still as the main cause of maternal mortality in the world .

In the current analysis, it is important to consider that data was collected during the influenza pandemic season (H1N1pdm09) (14;15). The (H1N1)pdm09 began in Mexico in March, 2009 (16), and turned out to be the viral infection with higher morbidity and mortality among pregnant and postpartum women in the last decades.

Maternal Mortality related to sepsis is still high globally. It is estimated that 62,000 maternal deaths occur worldwide every year with sepsis as the main cause (17). In HIC, the absolute risk of maternal death is relatively low (0.60 per 100,000 LB), but the risk of morbidity is substantially higher (20.9 per 100,000 LB) (1). When analyzing LMIC, these numbers become even more relevant, with the proportion of maternal mortality ratio due to sepsis of 11.6% (17). There is little knowledge about the disease epidemiology in Brazil when related to pregnancy and postpartum. In the current study, sepsis represented a total of 20.3% of maternal mortality due to exclusive indirect causes.

Early identification and proper treatment are key to reduce death rates due to infectious causes. Maternal mortality by sepsis is directly related to the time involved to recognize the severity of the disease (18). On this note, there is a worldwide campaign towards awareness on timely and adequate diagnosis of sepsis (17,18). Besides sepsis, other relevant indirect causes of maternal mortality presented were cancer and cardiovascular diseases, which meet the current finding worldwide. A possible

hypothesis for the increase on these diseases among young women is the worsening eating habits, increasingly sedentary lifestyle, stress and life conditions that do not prioritize health (19).

The number of women in reproductive age with previous heart diseases has greatly increased over the past years, due to the improvement in surgery, anesthesiology and clinical management of cardiac conditions (20, 21). As a result, congenital heart defects currently represent about 30% to 50% of all heart diseases during pregnancies (20, 21). The current numbers in Germany show 120,000 sick women, with an annual increase of around 5,000 (21). The evaluation of prevalence of cases at different ages, comparing indirect and direct causes of maternal morbidity presented no significant difference among both groups, with predominance in 20-29 years old women. A more in depth analysis within age groups, looking into severity has already been performed in the same database, showing the impact of extremes of reproductive age on severe outcomes, with increased maternal near miss and maternal mortality ratios with higher age and also among adolescents (10).

Our findings also show a higher prevalence of fewer pre-natal visits and increased private health care among cases of indirect causes of maternal morbidity. This might reflect that complications in these women determine early hospital admission and for that reason impact on the total number of visits. Our numbers for private care were very low to draw any conclusions, however, most likely women with previous conditions are the ones concerned with their health and more prone to have private health insurance.

A paradoxical finding in our study was that obesity appears as a protective factor for indirect causes. We have a trend of considering obesity as associated with indirect causes, perhaps due to chronic hypertension and diabetes. However, these are not the most severe cases. At the same time, low weight was associated with indirect causes of maternal morbidity, what can certainly represent the impact of serious illnesses such as lupus, cancer and anemia.

Comparing markers of clinical severity, it is possible to point out that women who were ill due to indirect causes of maternal morbidity were more often submitted to intubation not related to anesthesia, again highlighting the severity of respiratory diseases by Influenza virus H1N1 and severe clinical complications with the need of invasive respiratory support (15). Furthermore, the group of indirect causes of maternal morbidity had more central venous access, ICU admission and were hospitalized for periods longer than seven days, which also indicates higher clinical severity.

In the group of indirect causes, more women have continued pregnant, even after treatment of the severe acute event that triggered hospitalization, when comparing to the direct causes of maternal morbidity group. This reflects that many times, clinical complications early in pregnancy can be adequately controlled without interrupting gestation, what might enhance the chances of a better perinatal result for such cases. However, the decision to maintain pregnancy is not always simple or straight-forward and depends on individual response to treatment.

The use of magnesium sulfate has been kept on the results presented because it is one of the near miss management criteria. However, it shows as zero in our study, because its utilization was a criterion of exclusion for indirect causes of maternal morbidity, since all cases used this medication to treat or prevent eclampsia.

There are a few limitations in our study. Unfortunately, it is impossible to define all complications as dichotomous direct versus indirect causes of morbidity and this must be pointed out. We decided to consider pure indirect cases (named indirect causes exclusive) of morbidity versus cases of mixed morbidity (direct or direct + indirect), thus enabling a better understanding of this scenario.

To the best of our knowledge, there is only one other surveillance study from 2014, that analyzed indirect causes of maternal morbidity/mortality in the context of MNM and MD criteria; it is a secondary analysis of a WHO multicenter study (8). Other studies simply point out the associations between indirect causes and MD, like a recently published study from India which included 39,704 live births and 120 MD,

27.5% of them due to indirect causes, mostly anemia (22). A review from Ghana with 30,269 live births and 322 MD pinpointed that 22.4% were due to indirect causes, with infection as the main one (23). In Morocco, the maternal death surveillance system (MDSS) has 313 registries, in which 13.5% were classified as indirect causes of maternal death, with heart disease as the main cause of maternal mortality (24). In a systematic review of 12 studies from 1980 to 2007, with 9,750 MD, in high income countries, 28.6% of them were due to indirect causes, cardiovascular diseases presented as the main contributor cause (25).

The analysis regarding indirect causes published by the WHO in 2014 reports that anemia is the most common cause for SMO in low income countries (8;26;27) and heart disease was the main indirect cause for MD in high income countries. It also shows that women with any SMO related to an indirect cause have a higher risk for obstetric complications, MNM and MD, as well as worse perinatal outcomes (8). This information matches the findings of our study.

Indirect causes of maternal morbidity and mortality will certainly increase among low and middle income settings. In order to improve maternal and perinatal outcomes among these cases, there is a pressing need to strengthen health services and to implement strategies to ascertain adequate diagnosis and care of previous diseases among young women, with adequate family planning and referral centers trained and qualified on emergency obstetric care (8).

Indirect causes of maternal morbidity/mortality were responsible for less than 10% of the overall number of severe maternal morbidity cases, however, represented over 40% of maternal deaths. The main indirect causes of mortality were Influenza H1N1, sepsis, cancer and heart diseases. These women presented more adverse perinatal outcomes. In order to promote better care for these women, a proper maternal health policy is necessary, with specific and timely interventions aiming to decrease the impact of indirect causes of morbidity among women with severe maternal morbidity.

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Contribution to authorship

The idea for the study and this specific analytical approach arose in a group discussion among all the authors. Analyses were planned by JFC, FGS, MHS and JGC. The first version of the manuscript was drafted by JFC, FGS and MLC. Subsequently, all remaining authors complemented with suggestions. All authors contributed to the development of the study protocol and approved the final version of the manuscript.

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References

1. Cecatti JG, Costa ML, Haddad SM, Parpinelli MA, Souza JP, Sousa MH, Surita FG, Pinto E Silva JL, Pacagnella RC, Passini R, Network for Surveillance of Severe Maternal Morbidity: a powerful national collaboration generating data on maternal outcomes and care. BJOG 2016; 123:946-953.
2. WHO. Global Health Observatory: Brazil Profile. Geneva: WHO, 2011c. Available at http://www.who.int/gho/countries/bra.pdfç
3. Geller SE, Rosenberg D, Cox SM, et al. A Scoring System to Identify Near-miss Maternal Morbidity. J Clin Epidemiol 2004b; 57(7):716-20.
4. Say L, Souza JP, Pattinson RC; WHO working group on Maternal Mortality and Morbidity classifications. Maternal near miss--towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynaecol 2009; 23(3):287-96.
5. Cochet L, Pattinson RC, MacDonald AP. Severe acute maternal morbidity and maternal death audit - a rapid diagnostic tool for evaluating maternal care. S Afr Med J 2003; 93(9):700-2.
6. Khan K, Wojdyla D, Say L, Gulmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. Lancet 2006; 367:1066- 74.
7. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Global Health 2014; 2(6): e323 - e33.

8. Lumbiganon P, Laopaiboon M, Intarut N, Vogel JP, Souza JP, Gulmezoglu AM, Mori R, on behalf of the WHO Multicountry Survey on Maternal and Newborn Health Research Network. Indirect causes of severe adverse maternal outcomes: a secondary analysis of the WHO Multicountry Survey on Maternal and Newborn Health. BJOG 2014; 121 (Suppl. 1): 32–39.
9. Souza JP, Tunçalp Ö, Vogel JP, Bohren M, Widmer M, Oladapo OT, Say L, Gülmezoglu AM,Temmerman M. Obstetric transition: the pathway towards ending preventable maternal deaths. BJOG 2014; 121(Suppl. 1):1–4.
10. Oliveira FC, Jr, Surita FG, Pinto e Silva JL, Cecatti JG, Parpinelli MA, Haddad SM, et al. Severe maternal morbidity and maternal near miss in the extremes of reproductive age: results from a national cross-sectional multicenter study. BMC Pregnancy Childbirth. 2014; 14:77.
11. Haddad SM, Cecatti JG, Parpinelli MA, Souza JP, Costa ML, Sousa MH *et al.* From planning to practice: building the national network for the Surveillance of Severe Maternal Morbidity. BMC Public Health 2011; 11:283.
12. Haddad SM, Sousa MH, Cecatti JG, Parpinelli MA, Costa ML, Souza JP, et al. Intraclass correlation coefficients in the Brazilian network for surveillance of severe maternal morbidity study. BMC Pregnancy Childbirth 2012; 12(1):101.
13. Waterstone M, Bewley S, Wolfe C. Incidence and predictors of severe obstetric morbidity: case control study. BMJ 2001; 322:1089–1093.
14. Pfitscher LC, Cecatti JG, Haddad SM, Parpinelli MA, Souza JP et al for the Brazilian Network for Surveillance of Severe Maternal Morbidity study group. The role of infection and sepsis in the Brazilian Network for Surveillance of Severe Maternal Morbidity. Trop Med & Int Health 2016; 21(2):183-93.
15. Pfitscher LC, Cecatti JG, Pacagnella RC, Haddad SM, Parpinelli MA, Souza JP, Quintana SM, Surita FG, Sousa MH, Costa ML; Brazilian Network for Surveillance of Severe Maternal Morbidity Group.Severe maternal morbidity due to respiratory disease and impact of 2009 H1N1 influenza A pandemic in Brazil: results from a national multicenter cross-sectional study. BMC Infect Dis. 2016

16. Creanga AA, Johnson TF, Graitcer SB, Hartman LK, Al-Samarrai T, Schwarz AG, et al. Severity of 2009 pandemic influenza A (H1N1) virus infection in pregnant women. Obstet Gynecol. 2010; 115(4):717–26.
17. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. Crit Care Med. 2013; 41(2):580–637.
18. Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus
Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016; 315(8):801-810.
19. Abastado J, et al. World Cancer Report 2014. Geneva. WHO.2014 54-58p
20. Regitz-Zagrosek V, Gohlke-Bärwolf C, Geibel-Zehender A, Haass M, Kaemmerer H, Kruck I, Nienaber C: Heart diseases in pregnancy. Clin Res Cardiol 2008; 97: 630–65.
21. Regitz-Zagrosek V, Seeland U, Geibel-Zehender A, Gohlke-Bärwolf C, Kruck I, Schaefer C: Cardiovascular diseases in pregnancy. Dtsch Arztebl Int 2011; 108(16): 267–73.
22. Murthy BK, Murthy MB, Prabhu PM. Maternal mortality in a tertiary care hospital: a 10-year review. Int J Prev Med 2013; 4:105–9.
23. Lee QY, Odoi AT, Opare-Addo H, Dassah ET. Maternal mortality in Ghana: a hospital-based review. Acta Obstet Gynecol Scand 2012; 91:87–92.
24. Abouchadi S, Belghiti Alaoui A, Meski FZ, De Brouwere V. Implementing a maternal mortality surveillance system in Morocco - challenges and opportunities.
Trop Med Int Health 2013; 18:357–65.
25. Rossi CA, Mullin P. The etiology of maternal mortality in developed countries: a systematic review of literature. Arch Gynecol Obstet 2012; 285:1499–503.
26. Sullivan EA, Ford JB, Chambers G, Slaytor EK. Maternal mortality in Australia, 1973-1996. Aust N Z J Obstet Gynaecol 2004; 44:452–7; discussion 377.
27. Souza JP. Maternal mortality and development: the obstetric transition in Brazil. Rev Bras Ginecol Obstet. 2013; 35(12):533-5.

28. Vogel JP, Souza JP, Mori R, Morisaki N, Lumbiganon P, Laopaiboon M, et al. Maternal complications and perinatal mortality: findings of the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG. 2014; 121 Suppl 1:766-88.

29. Al-Tawfiq JA, Zumla A, Gautret P, Gray GC, Hui DS, Al-Rabeeah AA, et al. Surveillance for emerging respiratory viruses. Lancet Infect Dis. 2014; 3099(14):1–9.

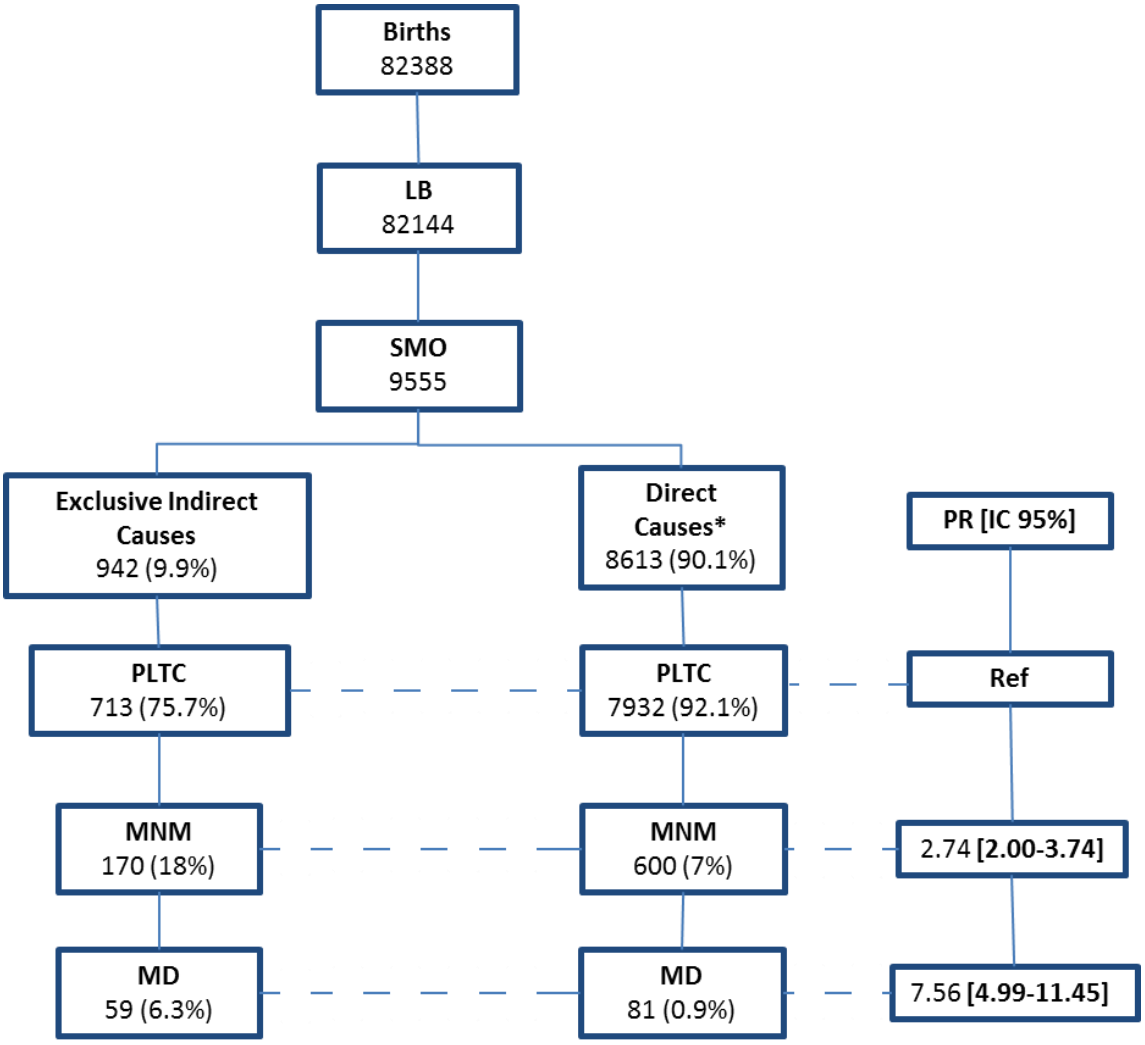

Figure 1. Flowchart of women according SMM in the study

Table 1. Indicators of severe maternal morbidity according to the WHO for only Indirect Obstetric Causes and Direct 46 Obstetric Causes

Causes	PLTC	MNM	MD	Total	Health indicators				
					MNMR /1000LB	SMOR /1000LB	MNM:MD ratio	Mortality index %	MMR /100000LB
Indirect Obstetric Causes	713 (75.7%)	170 (18.0%)	59 (6.3%)	942	2.07	2.79	2.9	25.8%	71.8
Direct Obstetric Causes	7932 (92.1%)	600 (7.0%)	81 (0.9%)	8613	7.30	8.29	7.4	11.9%	98.6

LB: live births; PLTC: potentially life-threatening condition; MNM: maternal near miss; MD: maternal death; MNMR: maternal near miss ratio; SMOR: severe maternal outcome ratio = (MNM + MD)/LB X 1000; MNM:MD ratio = MNM:1MD; Mortality index = MD/(MNM + MD); MMR: maternal mortality ratio = MD/LB X100.000
Mortality Index is the proportion of women with near miss who died.
Severe Maternal Outcome Ratio (SMOR) is the proportion of all women delivering an alive newborn who had a maternal near miss or died.

Table 2. Some socio demographic and obstetric characteristics of women associated with an indirect obstetric cause of SMM

Characteristics	Indirect Obstetric Cause		Direct Obstetric Cause		PR (95%CI)
	n	%	n	%	
Age (years)					
10-19	172	18.3	1541	17.9	0.95 [0.79 – 1.15]
20-29	480	51.0	4076	47.3	Ref.
30-39	256	27.2	2561	29.7	0.86 [0.69 – 1.08]
40-49	34	3.6	435	5.1	0.69 [0.46 – 1.03]
Marital status [a]					
With partner	446	58.8	3827	52.6	Ref.
Without partner	312	41.2	3454	47.4	0.79 [0.58 – 1.09]
Schooling [b]					
Primary	277	45.2	2939	46.6	0.77 [0.54 – 1.11]
High school	292	47.6	3020	47.9	0.79 [0.54 – 1.15]
University	44	7.2	351	5.6	Ref.
Ethnicity [c]					
White	386	51.1	2645	41.4	Ref.
Non white	370	48.9	3738	58.6	0.71 [0.49 – 1.03]

Obesity [d]						
Yes	107		12.5	1882	25.5	**0.45 [0.29 – 0.69]**
No	749		87.5	5503	74.5	Ref.
Low weight [d]						
Yes	9		1.1	18	0.2	**3.23 [1.70 – 6.14]**
No	847		98.9	7367	99.8	Ref.
Parity [e]						
0	399	42.6	4177	48.8	1.17 [0.98 – 1.38]	
1	241	25.7	2129	24.9	Ref.	
≥2	296		31.6	2251	26.3	1.14 [0.94 – 1.38]
Abortions [f]						
0	709		75.7	6659	77.8	Ref.
≥1	227		24.3	1896	22.2	1.11 [0.93 – 1.32]
Number PN visits [g]						
0-5	387		59.3	3076	45.2	**1.68 [1.36 – 2.06]**
≥ 6	266		40.7	3728	54.8	Ref.
Health care [h]						
Public	918		97.8	8522	99.0	Ref.
Private + SS	21		2.2	85	1.0	**2.04 [1.35 – 3.08]**

*adjusted for the cluster design effect

Missing information for: a: 1516; b: 2632; c: 2416; d: 1314; e: 62; f: 64; g: 2098; h: 9

Table 3. Some perinatal characteristics of termination of pregnancy and perinatal outcomes associated with an indirect obstetric cause of SMM

Perinatal outcomes	Indirect Obstetric Cause		Direct Obstetric Cause		PR (95%CI)
	n	%	n	%	
GA at delivery (weeks) [a]					
<28	57	6.5	552	6.8	**1.49 [1.16 – 1.91]**
28-33	88	10.0	1336	16.4	0.98 [0.67 – 1.44]
34-36	98	11.2	1682	20.7	0.88 [0.63 – 1.23]
>37	284	32.3	4238	52.1	Ref.
Still pregnant	351	40.0	324	4.0	-
Termination of pregnancy [b]					
Vaginal birth	128	13.8	2010	23.4	Ref.
Cesarean section	394	42.4	5760	67.1	1.07 [0.76 –1.50]
Abortion	56	6.0	489	5.7	**1.72 [1.11 – 2.64]**
**Still pregnant	351	37.8	326	3.8	**7.93 [6.04-10.41]**
Low birthweight (g) [c]					
< 2500	171	35.8	2978	40.0	0.85 [0.66 –1.09]
≥ 2500	306	64.2	4468	60.0	Ref.

Apgar score at 5 min [d]					
< 7	26	5.7	270	3.8	**1.49 [1.01 –2.21]**
≥ 7	431	94.3	6898	96.2	Ref.
Vital condition at birth [e]					
Alive	474	95.0	7259	95.2	Ref.
Stillbirth	25	5.0	363	4.8	1.05 [0.69 –1.61]
Neonatal outcome [f]					
Discharged	365	78.2	5258	75.3	Ref.
Admitted/transferred	88	18.8	1542	22.1	0.83 [0.64 –1.08]
Neonatal death	14	3.0	179	2.6	1.12 [0.72 –1.74]

*adjusted for the cluster design effect

Missing information for: a: 545; b: 41; c: 1632; d: 1930; e: 1434; f: 2109

** still pregnant *versus* other grouped categories.

Table 4. Procedures used for the management of severity according to the type of cause of morbidity

Procedures	Indirect Obstetric Cause		Direct Obstetric Cause		PR [95% CI]
	n	%	n	%	
Use of Magnesium sulfate	0	0	4617	53.6	-
Return to operating room	36	3.8	280	3.3	1.16 [0.76 – 1.77]
Hysterectomy-laparotomy	68	7.2	521	6.0	1.18 [0.77 – 1.83]
Intubation not related to anesthesia	104	11.0	192	2.2	**3.88 [3.06 – 4.93]**
Venous central access	135	14.3	228	2.6	**4.24 [3.23 – 5.56]**
Transfusion of blood derivatives	207	22.0	1359	15.8	1.44 [0.98 – 2.11]
Admission to ICU	388	41.2	1727	20.1	**2.46 [1.54 – 3.93]**
Hospitalization > 7 days	494	52.4	2374	27.6	**2.57 [1.74 – 3.81]**

Multivariate analysis

Outcome: SMO. Predictors: sociodemographic and obstetric characteristics (table 2) + GA at delivery and mode of termination of pregnancy (table 3) + previous maternal conditions (table 6) + Cause indirect/direct.

Table 5. Estimated risk of SMO for indirect obstetric causes according to previous maternal conditions

Previous maternal conditions	Indirect Obstetric Causes		
	SMO	**PLTC**	**PR [95% CI]**
Cardiac diseases	14 (6.8)	119 (18.3)	**0.40 [0.20 – 0.81]**
Other	33 (16.1)	89 (13.7)	1.15 [0.80 – 1.66]
Obesity	22 (10.7)	85 (13.1)	0.84 [0.52 – 1.35]
Smoking	17 (8.3)	54 (8.3)	1.00 [0.72 – 1.38]
Respiratory diseases	19 (9.3)	45 (6.9)	1.26 [0.73 – 2.20]
Chronic hypertension	10 (4.9)	46 (7.1)	0.73 [0.42 – 1.29]
Drug addiction	11 (5.4)	19 (2.9)	**1.56 [1.05 – 2.032]**
Sickle cell disease – Thalassemia	9 (4.4)	30 (4.6)	0.96 [0.63 – 1.48]
Diabetes Mellitus	8 (3.9)	27 (4.1)	0.95 [0.55 – 1.64]
Neurologic diseases	3 (1.5)	31 (4.8)	0.36 [0.10 – 1.32]
HIV- AIDS	9 (4.4)	18 (2.8)	1.41 [0.78 – 2.54]
Thyroid diseases	6 (2.9)	18 (2.8)	1.05 [0.59 – 1.84]
Renal diseases	8 (3.9)	13 (2.0)	1.61 [0.65 – 4.03]
Neoplasia	7 (3.4)	11 (1.7)	1.65 [0.90 – 3.02]
Collagenoses	4 (1.9)	12 (1.8)	1.04 [0.33 – 3.29]
Low weight	3 (1.5)	6 (0.9)	1.40 [0.46 – 4.22]

Total	**229**	**713**	**806**

Table 6- Indirect Causes of Maternal Death among women with indirect causes of Severe Maternal Morbidity **Causes**

	MD	
	n	**%**
Influenza- H1N1	18	30.5
Sepsis	12	20.3
Pulmonary	6	10.1
Urinary	3	5.0
Abdominal	3	5.0
Cancer	6	10.1
Heart disease	6	10.1
AIDS	2	3.3
Sickle cell disease	2	3.3
Thromboembolic disease	2	3.3
Erythematous systemic lupus	1	1.6
Bone marrow aplasia	1	1.6
Interstitial Pneumonia	1	1.6
Not identified	8	13.5
TOTAL	59	100

Table 7. Variables associated to SMO (Multiple regression analysis of a Poisson process*) [n = 5.608]

Variable	PR	95% CI	p
- Other preexisting conditions	2,48	1,91–3,21	<0,001
- Cause (Exclusive indirect)	2,61	1,77–3,86	<0,001
- Financial coverage for hospitalization (Other)	2,52	1,70–3,74	<0,001
- Obesity	0,58	0,45–0,75	<0,001
- Education (HS or higher)	0,68	0,57–0,82	<0,001
- Gestational age on the outcome (weeks)	0,96	0,94–0,98	<0,002
- Marital status (No partner)	0,52	0,35–0,77	0,002
- Diabetes	1,90	1,24–2,90	0,005
- Neoplasia	1,98	1,25–3,14	0,005
- Kidney diseases	1,99	1,14–3,49	0,018
- Sickle cell anemia	2,50	1,16–5,41	0,022
- Drug addiction	1,98	1,03–3,80	0,042

* Analysis considering cluster design (center) **Multiple regression analysis of a Poisson process** Dependent variable: SMO (NM+MM): 1/ CPAV: 0; Independent variable: "**Cause**": (Exclusive indirect: 1/ Direct: 0), Age (years), Marital Status (Partner: 0/ No partner: 1), Education (Up to elementary: 0/ HS or higher: 1), Skin color (White: 0/ Number of deliveries (0/ ≥1: 1), Number of abortions (0/ ≥1: 1), Number of prenatal visits (< 6: 0/ ≥6: 1), Financial coverage for Other: 1), hospitalization (Public: 0/ Other: 1), Gestational age on the outcome (weeks), How pregnancy ended (Vaginal delivery: 1/ Cesarean section; abortion; ectopic: 0),Chronic Hypertension (Yes: 1/ No: 0), Obesity (Yes: 1/ No: 0), Low weight (Yes: 1/ No: 0),Diabetes (Yes: 1/ No: 0), Smoking (Yes: 1/ No: 0), Heart diseases (Yes: 1/ No: 0), Respiratory diseases (Yes: 1/ No: 0), Kidney diseases (Yes: 1/ No: 0), Sickle cell anemia (Yes: 1/ No: 0), HIV/Aids (Yes: 1/ No: 0), Thyroid diseases (Yes: 1/ No: 0), Neurological diseases/ epilepsy (Yes: 1/ No: 0), Collagenose (Yes: 1/ No: 0), Neoplasia (Yes: 1/ No: 0)

5. Discussão Geral

Ao refletir as condições de vida das mulheres, o nível de desenvolvimento da população e a qualidade e nível da organização do sistema de saúde de um pais, a taxa de mortalidade materna (maternal mortality ratio (MMR) se caracteriza como um forte indicador social em nivel global (UNFPA, 2012).

Essa analise global se da de forma extremamente heterogena, com a MMR variando de 1000 a cada 100 000 nascidos vivos (NV) em alguns países em desenvolvimento, para menos de 10 por 100 000 NV em outros. Em paises de baixa renda o risco de uma mulher morrer durante o ciclo gravidico-puerperal é de 1 a cada 52 NV, enquanto em paises de alta renda esse numero é de 1 a cada 3400 (WHO,2015).

Mudanças graduais para uma diminuição das causas maternas evitáveis estão sendo aplicadas em todo o mundo, apresentando um cenário da então chamada "transição obstétrica" (Souza, 2013; Souza, 2014). Tais mudanças, que acontecem em ritmos diferentes em cada país, estao diretamente ligadas à presenca e eficiência dos esforços do governo e da sociedade para implementar políticas públicas que promovam o desenvolvimento social e a melhoria da saúde (Souza, 2014).

Os padrões passam por mudanças: as causas de morte predominantemente por causa direta diminuem e há um aumento e maior visibilidade das causas indiretas; das mortes por doenças contagiosas às mortes causadas por doenças não transmissíveis; de uma população materna mais jovem para uma mais velha (Souza, 2013).

Em outubro de 2016 uma revisão sistemática foi publicada, com o intuito de um melhor entendimento referente as causas de morte, visando uma melhora na qualidade de sobrevivência e longevidade da população mundial, abrangendo dados de mortalidade e suas tendências de acordo com as medidas sociodemográficas de 195 países entre 1980 e 2015. Dentre as 249

causas de morte estudadas, houve um subgrupo referente as mortes maternas. Seus achados relatam uma diminuição do número absoluto de mortes (GBD,2016).

Sendo a principal causa de morte materna mundial a hemorragia

No Brasil, apesar dos esforços implementados para a redução das mortes relacionadas a causas diretas, a fim de reduzir a razão de mortalidade materna global para menos de 70 mortes por 100 mil nascidos vivos – um dos Objetivos de Desenvolvimento do Milênio (ODM) –, a principal causa de mortalidade materna ainda é a hipertensão (GBD,2016).

Em um contexto no qual o país busca atingir os objetivos estipulados pelas Nações Unidas e o fenômeno da mortalidade materna passa a ser compreendido de modo a contemplar seus determinantes sociais, ocorre uma diminuição das mortes por causas diretas. Tal diminuição se dá a partir da implementação de estratégias para detecção, prevenção e enfrentamento de complicações obstétricas, materializadas em políticas que têm como base o aumento da cobertura da atenção pré-natal e da atenção obstétrica oferecida em instituições de saúde por profissionais treinados. Nesse sentido, enquanto as mortes por causas diretas diminuem, as causas indiretas passam a emergir como problema significativo no cenário brasileiro de modo geral, valendo ressaltar sua grande extensão territorial e cultural.

Atualmente o Brasil se encontra no estágio III de transição obstétrica, apresentando uma razão de mortalidade materna (MMR) de 299-50 óbitos maternos / 100 000 nascidos vivos (LB). É uma fase complexa, onde grande parte da população não possui acesso aos serviços de saúde, a população que possui acesso encontra um serviço sobrecarregado, com assistencia insatisfatoria (Souza, 2013; Souza, 2014).

Para uma mudança nos resultados de saúde materna há necessidade de prevenção primária, secundária e terciária, ou seja, melhora na atenção na saúde reprodutiva de uma forma geral, abrangendo contracepção efetiva, planejamento familiar, , assistencia ao pré-natal, parto e puerpério qualificadas e manejo adequado das complicações em qualquer dessas etapas (Souza, 2014).

Os achados do presente trabalho nos mostraram uma maior prevalência de MMG associada às causas indiretas exclusivas entre casos da assistência prestada pelo serviço privado de saúde, juntamente com um número menor de consultas de pré-natal.

O Sistema Único de Saúde contempla três quartos da população brasileira, o restante está sob a assistência do setor de seguros/privado.

Uma possível estratégia para a redução da SMO por causas indiretas é o fortalecimento do Sistema Único de Saúde com pré-natal realizado em atenção terciaria especializada, promover a qualificação continua dos profissionais de saúde para cuidados obstétricos de emergência juntamente com instalações adequadas que contemplem os cuidados.

Um dado paradoxal presente no estudo é de que obesidade aparece como fator protetor para as causas indiretas de MMG, muito provavelmente por sua forte ligação a causas diretas como hipertensão. Em concomitante, Baixo Peso se associa as causas indiretas, concordando com a relação de que são doenças graves como lúpus, câncer e anemia e outras doenças consuptivas.

De forma a afirmar a importância e gravidade das causas indiretas de MMG, o término da gestação com menos de 28 semanas se apresenta com risco elevado. Mostrando-se desta forma um problema que vai além dos maus resultados maternos e uma causa importante de prematuridade extrema por indicação materna de interrupção precoce da gestação.

As atuais evidências sugerem que as causas indiretas são responsáveis por um quarto de todas as mortes maternas no mundo (Lumbiganon,2014), neste contexto a análise do presente artigo foi realizada com o intuito de identificar a prevalência, principais diagnósticos, resultados perinatais e fatores associados as causas indiretas de morbidade materna grave no cenário brasileiro.

A análise referente as causas indiretas publicadas pela WHO em 2014 relata a anemia sendo a causa mais comum para SMO em países de media e baixa renda (Lee,2012; Igwegbe,2012; Mohammed,2011) e a doença cardíaca foi a principal causa indireta de MD em países de alta renda(Engin-ustun,2012;

Abouchadi,2013; Sullivan,2014). Tal analise ainda relata que as mulheres com alguma SMO relacionada a causa indireta apresentam um risco aumentado para complicações obstétricas, MNM e MD, bem como os resultados perinatais (Lumbiganon,2014) Dado esse que esta de concordância com os achados no presente estudo.

Uma revisão sistemática de 12 artigos de países desenvolvidos entre 1980 e 2007 com 9750 MDs mostrou que 28,6% eram de causas indiretas, com a doença cardiovascular como a principal causa (Rossi,2012). Uma revisão hospitalar da mortalidade materna em Gana de 30 269 nascidos vivos e 322 médicos indicou que 22,4% eram de causas indiretas e que a infecção e a doença falciforme representaram 61,1% das causas indiretas (Lee,2012). O sistema de vigilância da morte materna (MDSS) em Marrocos, incluindo 313 registos analisados, revelou que 13,5% foram classificados como causa indirecta e que a doença cardíaca foi a principal causa indirecta de morte (Abouchadi,2013). Um relatório muito recente da Índia, incluindo 39 704 nascidos vivos e 120 MDs mostrou que 27,5% dos MDs foram o resultado de causas indiretas, com anemia e icterícia sendo as duas causas mais comuns (Murthy,2013).

A analise da WHO (2014) comparando todos os trabalhos acima nos mostrou que as MMG por causas indiretas se mostram entre 13,5-29,7% das MM, em nossa analise atual, um pais estagio III na transição obstétrica, apresentou 6,3% de MMs por causa indireta (WHO,2014).

Sendo a primeira causa de morte materna H1N1, o que nos mostra o peso que uma epidemia possui em frente as morbidades, em especial para as gestantes, um grupo particulamente vulneravel e cheio de especificidades.

Estamos no meio das categorias da transição obstetrica, dado esse explicito em nosso trabalho, onde as causas de morte materna se assemelham com os paises desenvolvidos- sepsis,cancer e doenças do coração, porem há presenças de epidemia, como o caso da H1N1.

Neste sentido, os dados apresentados na pesquisa referendam e corroboram ao fato de que as idas ao pré-natal e o acompanhamento médico

durante todas as fases da gravidez é essencial para a descoberta e o tratamento das causas que podem, diretamente ou indiretamente, estabelecer o desenvolvimento da ocorrência da SMO.

Com o intuito de melhorar a assistência prestada as mulheres no ciclo gravídico puerperal, se faz necessário a conscientização referente as condições maternas subjacentes. Em termos de cuidado e melhores resultados puerperais essas mulheres devem ser detectadas e tratadas precocemente, antes de engravidarem. No período gestacional fornecer cuidado apropriado e especifico a sua causa subjacente. É preciso que mais pesquisas sejam conduzidas nessa linha, para redução do impacto das causas indiretas.

6. Conclusões

- A MMG por causas indiretas exclusivas ocorreu em cerca de 10% dos casos e a MM foi 7x maior nesse grupo de mulheres. Para cada 2.9 casos de NMM ocorreu 1 morte entre as causas indiretas exclusivas versus 7.4 casos de NMM para cada MM entre as demais causas.

- Mulheres com baixo peso, menor número de consultas de PN e PN fora do SUS apresentaram maior prevalência de MMG por causas indiretas exclusivas. O Uso de drogas ilícitas aumentou o risco de quadros mais graves (NM+MM) entre as mulheres com MMG por causas indiretas exclusivas.

-Permanecer gestante após uma internação por MMG e apgar de 5º minuto menor que 7 foram mais prevalentes entre as MMG por causas indiretas exclusivas.

-36.2% dos casos de MMG por causas indiretas exclusivas apresentavam os 3 critérios de NM (clinico, laboratorial e manejo); intubação orotraqueal, acesso venoso central internação em UTI e tempo de internação maior que 7 dias foram mais prevalentes entre os casos de morbidade materna grave por causa indireta exclusiva.

-As principais causas de MM entre as CI exclusivas de MMG foram infecção pelo vírus H1N1, sepsis, câncer e doença cardíaca.

7.Referências

Abouchadi S, Belghiti Alaoui A, Meski FZ, De Brouwere V. Implementing a maternal mortality surveillance system in Morocco - challenges and opportunities. *Trop Med Int Health* 2013;**18**:357–65.

Bodker B, Hvidman L, Weber T, Moller M, Aarre A, et al. Maternal deaths in denmark 2002–2006. Acta Obstet Gynecol Scand 2009; 88: 556–62.

Cecatti JG, Souza JP, Prapinelli MA, Haddad SM, Camargo RS, Pacagnella RC et al. Brazilian network for the surveillance of maternal potentially life threatening morbidity and maternal near-miss and a multidimensional evaluation of their long term consequences. Reprod Health 2009; 6: 15-25.

Cecatti JG, Souza JP, Prapinelli MA, Souza MH, Amaral E. Research on severe maternal morbidities and near-misses in Brazil: what we have learned. Reprod Health Matters. 2007; 15(30): 125-33.

Cecatti JG, Souza JP, Oliveira Neto AF, Parpinelli MA, Sousa MH, Say L et al. Pre-validation of the WHO organ dysfuntion based criteria for identification of maternal near miss. Reprod Health. 2011;8:22-43.

Conde-Agudelo A, Belizán JM, Lammers C. Maternal-perinatal morbidity and mortality associated with adolescent pregnancy in Latin America: Crosssectional study. Am J Obstet Gynecol 2005;192(2):342-9.

Engin-Ustun Y, Celen S, Ozcan A, Sanisoglu S, Karaahmetoglu S, Gul R, et al. Maternal mortality from cardiac disease in Turkey: a population-based study. *J Matern Fetal Neonatal Med* 2012;**25**:2451–3.

Gorman SE. A new approach to maternal mortality: the role of HIV in pregnancy. *Int J Womens Health* 2013;**5**:271–4.

Haddad SM, Cecatti JG, Parpinelli MA, Souza JP, Costa ML, Sousa MH, Surita FG, Pinto e Silva JL, Pacagnella RC, Camargo RS, Bahamondes MV, Zotareli V, Gurgel LT, Say L, Pattinson RC; National Network for the

Surveillance of Severe Maternal Morbidity Group. From planning to practice: building the national network for the surveillance of severe maternal morbidity. BMC Public Health 2011; 11:283.

Haddad SM, Cecatti JG, Parpinelli MA, Souza JP, Costa ML, Sousa MH, et al. From planning to practice: building the national network for the Surveillance of Severe Maternal Morbidity. BMC Public Health. 2011; 11:283.

Ham P, Allen C. Adolescent health screening and counseling. Am Fam Physician.
2012; 86(12):1109-16.

Igwegbe AO, Eleje GU, Ugboaja JO, Ofiaeli RO. Improving maternal mortality at a university teaching hospital in Nnewi, Nigeria. *Int J Gynaecol Obstet* 2012;**116**:197–200.

Khan K, Wojdyla D, Say L, Gulmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. Lancet 2006; 367: 1066- 74.

Laurenti R , Gotlieb SLD. A mortalidade materna nas capitais brasileiras: algumas características e estimativa de um fator de ajuste. Rev. bras. epidemiol 2004; 7(4): 449-60.

Lee QY, Odoi AT, Opare-Addo H, Dassah ET. Maternal mortality in Ghana: a hospital-based review. *Acta Obstet Gynecol Scand*2012;**91**:87–92.

Lumbiganon P, Laopaiboon M, Intarut N, Vogel JP, Souza JP, Gulmezoglu AM, Mori R, on behalf of the WHO Multicountry Survey on Maternal and Newborn Health Research Network. Indirect causes of severe adverse maternal outcomes: a secondary analysis of the WHO Multicountry Survey on Maternal and Newborn Health. BJOG 2014; 121 (Suppl. 1): 32–9.

Maine D. Detours and shortcuts on the road to maternal mortality reduction. Lancet 2007; 370(9595):1380-2.

Mohammed AA, Elnour MH, Mohammed EE, Ahmed SA, Abdelfattah AI. Maternal mortality in Kassala State - Eastern Sudan: community-based study using reproductive age mortality survey (RAMOS). BMC Pregnancy Childbirth 2011;11:102.

Moodley J, Pattinson RC, Baxter C, Sibeko S, Abdool Karim Q. Strengthening HIV services for pregnant women: an opportunity to reduce maternal mortality rates in Southern Africa/sub-Saharan Africa. *BJOG* 2011;**118**:219–25.

Moran NF, Moodley J. The effect of HIV infection on maternal health and mortality. *Int J Gynaecol Obstet* 2012;**119**(Suppl. 1):S26–9.

Morikawa M, Cho K, Yamada T, Yamada T, Sato S, Minakami H. Risk factors for eclampsia in Japan between 2005 and 2009. Int J Gynaecol Obstet. 2012; 117(1):66-8.

Murthy BK, Murthy MB, Prabhu PM. Maternal mortality in a tertiary care hospital: a 10-year review. Int J Prev Med 2013;4:105–9.

Oliveira Neto AF, Parpinelli MA, Cecatti JG, Souza JP, Sousa MH. Sequential organ failure assessment score for evaluating organ failure and outcome of severe maternal morbidity in obstetric intensive care. Scientific World Journal 2012: 172145.

Pattinson RC, Hall M. Near misses: a useful adjunct to maternal death enquiries.
Br Med Bull. 2003; 67:231-43.

Pattinson R, Say L, Souza JP, Broek Nv, Rooney C; WHO Working Group on Maternal Mortality and Morbidity Classifications. WHO maternal death and nearmiss classifications. Bull World Health Organ. 2009;87(10):734.

Ronsmans C. Severe acute maternal morbidity in low-income countries. Best Pract Res Clin Obstet Gynecol 2009; 23:305-16.

Rossi CA, Mullin P. The etiology of maternal mortality in developed countries: a systematic review of literature. Arch Gynecol Obstet 2012;285:1499–503.

Royston E, Armstrong S: Preventing maternal deaths. World Health Organization,Geneva, 1989.

Say L, Pattinson RC, Gülmezoglu AM. WHO systematic review of maternal morbidity and mortality: the prevalence of severe acute maternal morbidity (near miss). Reprod Health 2004; 1(1):3.

Say L, Souza JP, Pattinson RC, WHO working group on Maternal Mortality and Morbidity classifications. Maternal near miss-towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynecol 2009; 23:287-96.

Souza JP. Mortalidade materna e desenvolvimento: a transição obstétrica no Brasil; Maternal mortality and development: the obstetric transition in Brazil. Rev Bras Ginecol Obstet. 2013;35(12):533-5.

Souza JP, Cecatti JG, Haddad SM, Parpinelli MA, Katz L, Say L, Brazilian Network for Surveillance of Severe Maternal Morbidity. The WHO Maternal Near-Miss Approach and the Maternal Severity Index Model (MSI): Tools for Assessing the Management of Severe Maternal Morbidity. PLosOne 2012; 7(8):e44129.

Souza JP, Cecatti JG, Parpinelli MA, Serruya SJ, Amaral E. Appropriate criteria for identification of near-miss maternal morbidity tertiary care facilities: a cross sectional study. BMC Pregnancy Childbirth 2007; 7:20-48.

Sullivan EA, Ford JB, Chambers G, Slaytor EK. Maternal mortality in Australia, 1973-1996. *Aust N Z J Obstet Gynaecol*2004;**44**:452–7; discussion 377.

Tunçalp O, Hindin MJ, Souza JP, Chou D, Say L. The prevalence of maternal near miss: a systematic review. BJOG 2012; 119(6):653-61.

United Nations Population Fund. Rich mother, poor mother: the social determinants of maternal death and disability. New York: UNFPA; 2012. Available from: www.unfpa. org/webdav/site/global/shared/factsheets/ srh/ENSRH%20fact%20sheet-Poormother. pdf Accessed on 12 June 2014.

Van Roosmalen J, Zwart J. Severe acute maternal morbidity in high-income countries. Best Pract Res Clin Obstet Gynecol 2009; 23:297-304

Waterstone M, Bewley S, Wolfe C. Incidence and predictors of severe obstetric morbidity: case-control study. BMJ. 2001; 322(7294):1089-93; discussion 93-4.

WHO. World Healthy Organization . Evaluating the quality of care for severe pregnancy complications. The WHO near-miss approach for maternal health. Geneva: World Health Organization, 2011. Disponível em: http://whqlibdoc.who.int/publications/2011/9789241502221_eng.pdf. Acessado em 19/03/2015

World Health Organization. Trends in maternal mortality: 1990 to 2013: estimates by WHO, UNICEF, UNFPA, the World Bank, and the United Nations Population Division: executive summary, 2014. Available from: http://apps.who.int/iris/bit stream/10665/112697/1/WHO_RHR_14.13_ eng.pdf?ua=1

8. Anexos

8.1. Anexo 1. Ficha identificadora de casos

Rede Nacional de Vigilância de Morbidade Materna Grave

Nome:_____ HC:_____Data da alta:_____

- Anexar este formulário aos prontuários de todas as pacientes obstétricas (gestantes ou puérperas) internadas no serviço.
- Identificar durante a internação ou na alta hospitalar se houve o diagnóstico de alguma das condições abaixo descritas.
- Para as que apresentarem qualquer uma das condições abaixo ("SIM"), o prontuário será separado para revisão antes do seu arquivamento.
- Para as que NÃO tiverem nenhum das condições, esta ficha deverá ser arquivada em pasta específica e o prontuário pode ser liberado para arquivamento pelo SAME

Complicações hemorrágicas	**Sim**	**Não**
Descolamento prematuro de placenta		
Placenta prévia / acreta/increta/percreta		
Prenhez ectópica		
Rotura uterina		
Hemorragia grave por aborto		
Hemorragia pós-parto		
a) atonia		
b) retenção placentária		
c) lacerações de trajeto		
d) coagulopatia		
e) inversão uterina		
Complicações hipertensivas	**Sim**	**Não**
Pré-eclampsia grave		
Eclâmpsia		
Hipertensão grave		
HELLP síndrome		
Fígado Gorduroso		
Outras complicações	**Sim**	**Não**
Edema pulmonar		
Convulsões		
Sepse grave		
Trombocitopenia < 100 mil		
Crise tireotóxica		
Choque		
Insuficiência respiratória aguda		
Acidose		
Cardiopatia		
AVC		
Distúrbios de coagulação		
Tromboembolismo		
Cetoacidose diabética		
Icterícia / disfunção hepática		
Meningite		
Insuficiência Renal Aguda		
Indicadores de manejo de gravidade	**Sim**	**Não**
Transfusão de hemoderivados		
Acesso venoso central		
Admissão em UTI		
Hospitalização prolongada (>7dias)		
Intubação não relacionada à anestesia		
Retorno à sala cirúrgica		
Intervenção cirúrgica maior (histerectomia, laparotomia)		
Uso de sulfato de magnésio		

RESUMO ☐ SIM ☐ NÃO

Resp. pelo preenchimento: _____

8.2. Anexo 2. Ficha para coleta manual de dados

Rede Nacional de Vigilância de Morbidade Materna Grave - FORMULÁRIO DE COLETA MANUAL

IDENTIFICAÇÃO

1. Centro do Estudo*: ☐☐
2. Subject ID*: _____
3. Person ID*: _____

Data de nascimento*: ☐☐ ☐☐ ☐☐

DADOS PESSOAIS

4. Idade em anos completos*: ☐☐
5. Cor: [ ] 1 negra [ ] 2 branca [ ] 3 indígena [ ] 4 amarela [ ] 5 outro [ ] 8 não consta
6. Escolaridade: [ ] 1 analfabeta [ ] 2 Fundamental incompleto [ ] 3 Fundamental [ ] 4 Médio incompleto [ ] 5 Médio [ ] 6 Superior incompleto [ ] 7 Superior [ ] 8 não consta
7. Estado civil: [ ] 1 casada/amasiada [ ] 2 solteira [ ] 3 separada/divorciada [ ] 4 viúva [ ] 8 não consta
8. Peso em kg: _____
9. Altura em m: _____
10. Data da internação no centro*: ☐☐ ☐☐ ☐☐
11. A paciente fazia pré-natal no serviço?* [ ] 1 sim [ ] 2 não [ ] 3 sem pré-natal [ ] 8 não consta
12. Como foi o acesso da mulher ao centro?* [ ] 1 procura espontânea [ ] 6 encaminhamento da própria instituição [ ] 2 transferência por serviço de resgate/emergência [ ] 8 não consta [ ] 3 transferência inter hospitalar programada [ ] 4 transferência inter hospitalar não programada [ ] 5 encaminhamento de outro serviço
13. Qual cobertura financeira majoritária do pré-natal? [ ] 1 público [ ] 2 privado [ ] 3 seguro saúde/convênio [ ] 4 sem pré-natal [ ] 8 não consta
14. Qual cobertura financeira majoritária da internação?* [ ] 1 público [ ] 2 privado [ ] 3 seguro saúde/convênio [ ] 8 não consta

DADOS OBSTÉTRICOS

15. Número de gestações*: ☐☐
16. Número de partos*: ☐☐
17. Número de abortos*: ☐☐
18. Número de cesáreas prévias*: ☐☐
19. Número de nascidos vivos*: ☐☐
20. Anos desde o último parto: ☐☐
21. A mulher possui cirurgia uterina prévia? (excluindo cesárea seg. transv) [ ] 1 sim [ ] 2 não [ ] 8 não consta
22. Número de consultas de pré-natal*: ☐☐
23. A mulher estava grávida quando foi admitida?* [ ] 1 sim [ ] 2 não [ ] 8 não consta
24. Idade gestacional na internação*: ☐☐
25. Forma de início do trabalho de parto*: [ ] 1 espontâneo [ ] 2 induzido [ ] 3 sem trabalho de parto [ ] 4 aborto [ ] 5 continua grávida [ ] 8 não consta
26. Data da resolução da gestação: ☐☐ ☐☐ ☐☐
27. Idade gestacional na resolução*: ☐☐
28. Como foi ultimada a gestação?

[ ] 1 parto vaginal
[ ] 2 parto vaginal operatório
[ ] 3 parto cesárea antes do início do trabalho de parto
[ ] 4 parto cesárea após o início do trabalho de parto
[ ] 5 aborto
[ ] 6 prenhez ectópica
[ ] 7 continua grávida
[ ] 8 não consta

ABORTO

29. Como se iniciou o aborto? [ ] 1 espontâneo [ ] 2 induzido [ ] 8 não consta
30. O aborto foi mais provavelmente seguro ou inseguro? [ ] 1 seguro [ ] 2 inseguro [ ] 8 não consta
31. Quais procedimentos foram realizados? [ ] 1 dilatação e/ou curetagem [ ] 2 ocitocina [ ] 3 vácuo aspiração [ ] 4 prostaglandinas [ ] 5 outros [ ] 6 nenhum [ ] 8 não consta
32. Se outro procedimento, especifique: _____

DADOS DO RN

33. Número total de nascidos: ☐☐
34. Qual era a apresentação fetal ao nascimento? [ ] 1 cefálico [ ] 2 pélvico [ ] 3 outro [ ] 8 não consta
35. Sexo: [ ] 1 feminino [ ] 2 masculino [ ] 3 indeterminado [ ] 8 não consta
36. Condição do nascimento: [ ] 1 vivo [ ] 3 natimorto anteparto [ ] 2 natimorto intra-parto [ ] 8 não consta
37. Qual foi o Apgar de 1°. Minuto? ☐☐
38. Qual foi o Apgar de 5°. Minuto? ☐☐
39. Peso em gramas: ☐☐☐☐
40. Desfecho neonatal: [ ] 1 alta [ ] 2 internado [ ] 3 óbito neonatal precoce (<7dias) [ ] 4 óbito neonatal tardio (8-28 dias) [ ] 5 transferido [ ] 8 não consta
41. Se gemelar, informe os dados dos outros RN: _____

_____

CONDIÇÕES MATERNAS PRÉ-EXISTENTES

42. A mulher apresentava alguma condição patológica/ de risco prévios à gestação?* [ ] 1 sim [ ] 2 não [ ] 8 não consta
43. Quais condições estavam presentes?

[ ] 1 hipertensão arterial crônica
[ ] 2 obesidade
[ ] 3 baixo peso
[ ] 4 diabetes mellitus
[ ] 5 tabagismo
[ ] 6 doenças cardíacas
[ ] 7 doenças respiratórias
[ ] 8 doenças renais
[ ] 9 anemia falciforme-talassemia
[ ] 10 HIV/AIDS
[ ] 11 tireoidopatias
[ ] 12 doenças neurológicas / epilepsia
[ ] 13 colagenoses
[ ] 14 neoplasias
[ ] 15 outro
[ ] 16 drogadição

44. Se outra condição patológica, especifique: _____

CONDIÇÕES POTENCIALMENTE AMEAÇADORAS DA VIDA

45. Houve alguma complicação hemorrágica?* [ ] 1 sim [ ] 2 não [ ] 8 não consta
46. Qual complicação hemorrágica ocorreu no período?*

[ ] 1 descolamento prematuro de placenta
[ ] 2 placenta prévia/acreta/increta/percreta
[ ] 3 prenhez ectópica complicada
[ ] 4 rotura uterina
[ ] 5 hemorragia grave por aborto
[ ] 6 hemorragia pós parto
[ ] 7 outra hemorragia grave
[ ] 8 não houve/não consta

47. Se HEMORRAGIA PÓS- PARTO, especifique: [ ] 1 atonia [ ] 2 retenção placentária [ ] 3 lacerações de trajeto [ ] 4 coagulopatia [ ] 5 inversão uterina [ ] 6 outra causa obstétrica

48. Houve alguma complicação hipertensiva?* [ ] 1 sim [ ] 2 não [ ] 8 não consta

49. Qual complicação hipertensiva ocorreu no período?*

[ ] 1 pré-eclâmpsia grave [ ] 2 eclâmpsia [ ] 3 hipertensão grave
[ ] 4 HELLP síndrome [ ] 5 fígado gorduroso [ ] 8 não houve / não consta

50. Houve alguma outra complicação?* [ ] 1 sim [ ] 2 não [ ] 8 não consta

51. Quais complicações?*

[ ] 1 edema pulmonar [ ] 2 convulsões [ ] 3 trombocitopenia < 100 mil
[ ] 4 crise tireotoxica [ ] 5 choque [ ] 6 insuf. respiratória aguda
[ ] 7 acidose [ ] 8 cardiopatia [ ] 9 AVC
[ ] 10 dist. de coagulação [ ] 11 CIVD [ ] 12 tromboembolismo
[ ] 13 cetoacidose diabética [ ] 14 icterícia/disf hepática [ ] 15 meningite
[ ] 16 sepse grave [ ] 17 IRA [ ] 88 não houve / não consta
[ ] 18 complicação associada à suspeita ou confirmação de Influenza A (H1N1)

52. Se SEPSE GRAVE, especifique o foco:

[ ] 1 endometrite pós-parto [ ] 2 endometrite pós aborto [ ] 3 foco pulmonar
[ ] 4 foco urinário [ ] 5 outro [ ] 8 não consta [ ] 9 ignorado

53. Se outro foco, especifique:_____

54. A mulher apresentou alguma das condições de manejo de gravidade?* [ ] 1 sim [ ] 2 não [ ] 8 não consta

55. Quais condições estavam presentes?*

[ ] 1 transfusão de hemoderivados [ ] 6 retorno à sala cirúrgica
[ ] 2 acesso venoso central [ ] 7 histerectomia/laparotomia
[ ] 3 admissão em UTI [ ] 8 uso de sulfato de magnésio
[ ] 4 hospitalização prolongada (>7 dias) [ ] 9 outro proc. cirúrgico maior
[ ] 5 intubação não relacionada à anestesia [ ] 88 não houve/não consta

CRITÉRIOS DE NEAR MISS MATERNO

56. A mulher apresentou algum dos critérios clínicos de near miss?* [ ] 1 sim [ ] 2 não [ ] 8 não consta

57. Se SIM, indique quais*:

[ ] 1 cianose [ ] 9 acidente vascular cerebral
[ ] 2 gasping [ ] 10 convulsão não controlada – paralisia total
[ ] 3 FR > 40 ou < 6 [ ] 11 icterícia na presença de pré-eclâmpsia
[ ] 4 choque [ ] 88 não houve / não consta
[ ] 5 oligúria não responsiva a fluidos ou diuréticos
[ ] 6 distúrbios de coagulação
[ ] 7 perda da consciência durante 12 h ou mais
[ ] 8 ausência de consciência E ausência de pulso-batimento cardíaco

58. A mulher apresentou algum dos critérios laboratoriais de near miss?* [ ] 1 sim [ ] 2 não [ ] 8 não consta

59. Se SIM, indique quais*:

[ ] 1 saturação de O_2 < 90% por > 60 min.
[ ] 2 PaO_2/FiO_2 < 200
[ ] 3 creatinina ≥300mmol/l ou ≥ 3,5 mg/dl
[ ] 4 bilirrubina ≥ 100 mmol/l ou ≥ 6 mg/dl
[ ] 5 pH < 7,1
[ ] 6 lactato > 5
[ ] 7 plaquetas < 50 mil
[ ] 8 ausência de consciência e presença de glicose e cetoácidos na urina
[ ] 88 não houve / não consta

60. A mulher apresentou algum dos critérios de manejo?* [ ] 1 sim [ ] 2 não [ ] 8 não consta

61. Se SIM, indique quais*:

[ ] 1 uso de droga vasoativa contínua [ ] 6 R. Cardiopulm. (RCP)
[ ] 2 histerectomia por infecção ou hemorragia [ ] 88 não houve / não consta
[ ] 3 transfusão de ≥ 5 U de hemácias
[ ] 4 intubação e ventilação por ≥ 60 minutos não relacionada com anestesia
[ ] 5 diálise para insuficiência renal aguda

62. Alguma dessas condições já estava presente na admissão do sujeito? [ ] 1 sim [ ] 2 não [ ] 3 não se aplica [ ] 8 não consta

DESFECHO MATERNO

63. Data da alta, transferência ou óbito*: [ ][ ] [ ][ ] [ ][ ]

64. Qual foi a condição de alta da mulher?*

[ ] 1 alta médica [ ] 2 alta a pedido [ ] 3 transferência [ ] 4 óbito [ ] 5 evasão

65. Comentários ou observações referentes a dados incluídos e dados relativos à transferência do sujeito: _____

_____

PESQUISA DE DEMORAS NO ATENDIMENTO

66. Durante o atendimento do caso, houve alguma demora relacionada ao serviço e/ou sistema de saúde?* [ ] 1 sim [ ] 2 não [ ] 9 ignorado

Se houve demora, especifique: (se NÃO houve, deixe em branco)
1 nível primário 2 nível secundário 3 nível terciário

67. Falta de medicação (sulfato, ATB, DVA, uterotônicos): [ ]
68. Dificuldade ou problemas com transporte municipal / hospitalar): [ ]
69. Dificuldade na comunicação (hospitalar/central reguladora): [ ]
70. Ausência de hemoderivados: [ ]
71. Dificuldade para monitorização (unidade de cuidados intensivos): [ ]
72. Falta de pessoal treinado: [ ]
73. Dificuldade de acesso ao pré-natal: [ ]

74. Houve alguma demora relacionada ao paciente e/ou seus familiares?* [ ] 1 sim [ ] 2 não [ ] 9 ignorado

75. Se resposta SIM, especifique quais:

[ ] 1 demora na procura ao Serv. Saúde
[ ] 2 dificuldade geográfica ao acesso ao Serv. Saúde
[ ] 3 recusa ao tratamento
[ ] 4 Pré-natal ausente ou inadequado
[ ] 5 Aborto inseguro

76. Houve alguma demora na assistência relacionada aos profissionais de saúde?* [ ] 1 sim [ ] 2 não [ ] 9 ignorado

Se houve demora, especifique: (se NÃO houve, deixe em branco)
1 nível primário 2 nível secundário 3 nível terciário

77. Demora no diagnóstico: [ ]
78. Demora no início do tratamento: [ ]
79. Manejo inadequado do caso: [ ]
80. Demora na referência ou transferência do caso: [ ]

8.3. Anexo 3. Artigo referente à Rede Brasileira de Vigilância de Morbidade Materna Grave

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Study protocol

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Brazilian network for the surveillance of maternal potentially life threatening morbidity and maternal near-miss and a multidimensional evaluation of their long term consequences

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Abstract

Background: It has been suggested that the study of women who survive life-threatening complications related to pregnancy (maternal near-miss cases) 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 create 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 for women with severe complications of pregnancy, and to carry out a multidimensional evaluation of these women up to six months.

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 all maternal complications. The population of the cross-sectional component will consist of all women surviving potentially life-threatening conditions (severe maternal complications) or life-threatening conditions (the maternal near miss criteria) and maternal deaths according to the new WHO definition and criteria. Data analysis will be performed in case subgroups according to the moment of occurrence and determining cause. Frequencies of near-miss and other 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. Various aspects of the lives of women surviving severe maternal complications will be evaluated 3 and 6 months after the event and compared to a group of women who suffered no severe complications in pregnancy. Previously validated questionnaires will be used in the interviews to assess reproductive function, posttraumatic stress, functional capacity, quality of life, sexual function, postpartum depression and infant development.

Background

Currently, more than half a million 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 at 75 maternal deaths per 100,000 live-born 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 deaths constitute a tiny proportion of the whole problem. Around the world, millions of women present severe maternal complications every year 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 (WHO) developed the maternal near-miss approach, a tool to uniformly identify near-miss cases and evaluate quality of care provided to women presenting severe complications. WHO defines a maternal near miss case as a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy [5].

Therefore, the study of maternal near-miss cases 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 [6,7].

In addition, little is known on the long-term repercussions of severe, life-threatening complications related to pregnancy. An acute stress disorder associated with the occurrence of severe maternal complications has been suggested, but further research is needed. [8]. 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 [9-12].

Among the possible repercussions, studies have been carried out to evaluate the psychological impact and occurrence of posttraumatic stress disorder (PTSD), postpartum depression and changes in sexual health 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, it is probable that in dramatic situations such as near-misses such repercussions would be even more evident. According to some authors, evaluation of the state of health, quality of life and sexual function of patients who suffered severe complications is poorer in the immediate postpartum period [15,20-23].

Nevertheless, doubts remain with respect to the long-term health 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 the occurrence 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 overall objective is to develop a nationwide network of scientific cooperation for the surveillance of severe maternal complications 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 women's perception of 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 children born from pregnancies associated with 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 common;
- postpartum depression would be more common;
- sexual function would have deteriorated and the woman's return to sexual activity would take longer;
- functional status in routine activities would be evaluated as 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 higher.

Methods/Design

This study has 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 joined the initiative 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-miss and non-near-miss cases, severe maternal morbidity (potentially life threatening conditions) and maternal deaths. 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 and maternal deaths. Previous studies have estimated a maternal near miss incidence of approximately 8 cases per 1000 deliveries [24] and a Brazilian maternal mortality ratio of 140 per 100,000 LB. Therefore, a total of approximately 75,000 deliveries would have to be monitored in order to identify around 100 maternal deaths and 600 maternal near miss cases. These numbers are believed to be sufficient to evaluate the use of the new criteria for near-miss established by the World Health Organization

in 2009 [5] and to perform analysis allowing for level of complexity of health facility, age group and specific cause.

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, Appendix 1), in whom one of the diagnoses defined as non-near-miss severe maternal morbidity is present (Appendix 2), and those who died or were transferred to another healthcare service because of their bad health condition.

For the multidimensional analysis of the repercussions of severe maternal morbidity, a concurrent cohort, specific population study will be carried out with an externally selected comparison group. The main exposure factor will be the occurrence of severe maternal morbidity (both maternal potentially life threatening or near miss conditions). During the second half of the cross-sectional study, a sample of 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 randomly 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 WHO [5] and who survives a complication occurring during pregnancy, childbirth or within 42 days postpartum.

Maternal potentially life threatening condition

A condition of severe morbidity found in women during pregnancy, childbirth or in the puerperium, classified as potentially life threatening conditions [5], including hemorrhagic or hypertensive disorders, other systemic disorders, and indicators of severe management (Appendix 2).

Main cause of complication/death

classification of the determinant main cause of the complication identified among cases and/or the main cause of death.

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 newborn infant according to 1st and 5th 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 a standard SF-36 form.

Posttraumatic stress

Symptoms of intrusion, avoidance and hyperarousal 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 recommence 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 the 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 (Appendix 2). In cases found with these diagnoses, the relevant hospital records will be reviewed for data collection following the women's hospital discharge, death or transfer to another healthcare facility. 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 cases 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 WHO 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.

A meeting will be 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 portion of the study will invite eligible women 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 women admitted to the 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 eligible. Following a process of randomized selection balanced according to mode of delivery, maternal age and gestational age at the time of delivery, 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 apply standard questionnaires designed to investigate quality of life and postpartum depression. This interview is estimated to last around 20 minutes.

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, lasting no more than 20 minutes. In the case of women who do not have a telephone, a reminder letter will be sent asking them to phone 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 bring the baby 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 questionnaires. The interview 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, taking no more than 35 minutes for each woman. After the mothers have answered the questionnaires, the weight, height and neuro-psychomotor development of the infants will be evaluated by a specially trained pediatrician, taking around 20 minutes. 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-C)

This questionnaire has been validated in Brazil to screen for the diagnosis of posttraumatic stress disorder. It contains 17 items in which women 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 ≥ 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, body 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, containing 10 questions that may be self-administered. A final score ≥ 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 procedure 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 hospital records.

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 WHO maternal near miss approach [5], and frequencies of non-near-miss severe maternal morbidity 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, relative 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 the Brazilian national congress of Gynecology and Obstetrics in November, 2007, and attended by representatives of 35 healthcare facilities 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 who were interested in participating filled out a registration form with the addresses and characteristics of their respective healthcare institutions. In December 2007, 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 into consideration.

In August 2008, a meeting with representatives from all the centers was held at the coordinating center in Campinas. At this meeting, the 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: the Brazilian Network of Studies in Reproductive and Perinatal Health was created. A Steering Committee was also designated for the study.

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.

Technical and scientific contributions expected from the project

Brazil is a country with very high proportion of births taking place in health facilities (around 97%). The results of the present study will permit a prospective evaluation of severe maternal morbidity and deaths nationwide through the participation of healthcare facilities with different regional characteristics. No multicenter collaborative studies of this dimension are currently being carried out in healthcare institutions in Brazil in the field of Reproductive Health, and no data thus obtained are currently available. 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 collaborative network is essential for expanding the production of substantive research in the field of maternal and perinatal health in Brazil.

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 relevant to Brazil and other countries. 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 is committed to participating in future collaborative studies in the areas of perinatal and women's healthcare. The implementation of a series of multicenter studies is anticipated in this area in a way never before achieved in this country. This fact gives greater power to the results, which will therefore be more representative of the country, a particularly interesting achievement bearing in mind the wide ethnic, cultural and social diversity of the Brazilian population.

We hope that this initiative contributes to the improvement of health care and for the reduction of maternal and perinatal morbidity and mortality.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

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.

Appendix 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.

Clinical Criteria

Acute cyanosis

Breathing rate > 40 or < 6

Oliguria unresponsive to fluids or diuretics

Loss of consciousness for ≥ 12 hours

Unconscious, no pulse/heartbeat

Jaundice concomitantly with preeclampsia

Gasping

Shock

Coagulation disorders

Cerebrovascular accident

Total paralysis

Laboratory Criteria

Oxygen saturation <90% for > 60 minutes

Acute thrombocytopenia (<50,000 platelets)

Creatinine ≥ 300 μmol/l or ≥ 3.5 mg/dL

Bilirubin >100 μmol/l or > 6.0 mg/dL

Unconscious, presence of glucose and ketoacidosis in urine.

Lactate > 5PaO2/FiO2 < 200

pH < 7.1

Management Criteria
Use of continuous vasoactive drug

Dialysis for treatment of acute kidney failure

Puerperal hysterectomy due to infection or hemorrhage

Cardiopulmonary resuscitation (CPR)

Transfusion ≥ 5 units of red blood cell concentrate

Intubation and ventilation for a period ≥ 60 minutes, unrelated to anesthesia*

Modified from [5]

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

Hemorrhagic disorders
Abruptio placentae

Placenta accreta/increta/percreta

Ectopic pregnancy

Antepartum hemorrhage

Postpartum hemorrhage

Ruptured uterus

Abortion with severe hemorrhage

Hypertensive disorders
Severe Preeclampsia

Eclampsia

Severe hypertension

Hypertensive encephalopathy

HELLP syndrome

Other systemic disorders
Endometritis

Pulmonary edema

Respiratory failure

Seizures

Sepsis

Thrombocytopenia <100,000

Thyroid crisis

Management indicators of severity
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

*Modified from [5]

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References

1. United Nations Department of Economic and Social Affairs (DESA): *The Millennium Development Goals Report. New York* 2007 [http://millenniumindicators.un.org/unsd/mdg/Resources/Static/Products/Progress2007/UNSD_MDG_Report_2007e.pdf]. Accessed on 03/17/2009
2. Brazil, Ministry of Health: *Indicators and basic data of Brazil 2007* [http://tabnet.datasus.gov.br/cgi/idb2007/c03.htm]. Accessed on 03/17/2009

3. BEMFAM/MACRO (Sociedade Civil Bem-Estar Familiar no Brasil, Macro International): **National Demographic and Health Survey - 1996.** . *Rio de Janeiro* 1997.
4. WHO (World Health Organization): **Maternal Mortality in 2000: Estimates developed by WHO, UNICEF, and UNFPA.** *Geneva* 2003.
5. Say L, Souza JP, Pattinson RC, WHO working group on Maternal Mortality and Morbidity classifications: **Maternal near miss - towards a standard tool for monitoring quality of maternal health care.** *Best Pract Res Clin Obstet Gynaecol* 2009, **23**:287-296.
6. Pattinson RC, Hall M: **Near misses: a useful adjunct to maternal death enquiries.** *Br Med Bull* 2003, **67**:231-243.
7. Filippi V, Brugha R, Browne E, Gohou V, Bacci A, De Browere V, Sahel A, Goufodji S, Alihonou E, Ronsmans C: **Obstetric audit in resource-poor settings: lessons from a multi-country project auditing 'near miss' obstetrical emergencies.** *Health Policy Plan* 2004, **19**:57-66.
8. Souza JP, Cecatti JG, Parpinelli MA, Krupa F, Osis MJ: **An emerging "maternal near-miss syndrome": narratives of women who almost died during pregnancy and childbirth.** *Birth* 2009, **36(2)**:149-58.
9. Lydon-Rochelle MT, Holt VL, Martin DP: **Delivery method and self-reported postpartum general health status among primiparous women.** *Paediatr Perinat Epidemiol* 2001, **15**:232-240.
10. Glazener CM, Abdalla M, Stroud P, Naji S, Templeton A, Russell IT: **Postnatal maternal morbidity: extent, causes, prevention and treatment.** *Br J Obstet Gynaecol* 1995, **102**:282-287.
11. Glangeaud-Freudenthal NM, Boyce P: **Postpartum depression: risk-factors and treatments - introduction.** *Arch Womens Ment Health* 2003, **6(Suppl 2)**:S31-32.
12. Seng JS, Oakley DJ, Sampselle CM, Killion C, Graham-Bermann S, Liberzon I: **Posttraumatic stress disorder and pregnancy complications.** *Obstet Gynecol* 2001, **97**:17-22.
13. Tham V, Christensson K, Ryding EL: **Sense of coherence and symptoms of post-traumatic stress after emergency caesarean section.** *Acta Obstet Gynecol Scand* 2007, **86**:1090-1096.
14. Olde E, Hart O van der, Kleber R, van Son M: **Posttraumatic stress following childbirth: a review.** *Clin Psychol Rev* 2006, **26**:1-16.
15. Ryding EL, Wijma K, Wijma B: **Psychological impact of emergency cesarean section in comparison with elective cesarean section, instrumental and normal vaginal delivery.** *J Psychosom Obstet Gynaecol* 1998, **19**:135-144.
16. Glazener CM: **Sexual function after childbirth: women's experiences, persistent morbidity and lack of professional recognition.** *Br J Obstet Gynaecol* 1997, **104**:330-335.
17. Boyce PM: **Risk factors for postnatal depression: a review and risk factors in Australian populations.** *Arch Womens Ment Health* 2003, **6(Suppl 2)**:S43-50.
18. de Tychey C, Briançon S, Lighezzolo J, Spitz E, Kabuth B, de Luigi V, Messembourg C, Girvan F, Rosati A, Thockler A, Vincent S: **Quality of life, postnatal depression and baby gender.** *J Clin Nurs* 2008, **17**:312-322.
19. Jansen AJ, Essink-Bot ML, Duvekot JJ, van Rhenen DJ: **Psychometric evaluation of health-related quality of life measures in women after different types of delivery.** *J Psychosom Res* 2007, **63**:275-281.
20. Waterstone M, Wolfe C, Hooper R, Bewley S: **Postnatal morbidity after childbirth and severe obstetric morbidity.** *BJOG* 2003, **110**:128-133.
21. Cohen MM, Ansara D, Schei B, Stuckless N, Stewart DE: **Posttraumatic stress disorder after pregnancy, labor, and delivery.** *J Womens Health* 2004, **13**:315-324.
22. van Pampus MG, Wolf H, Weijmar Schultz WC, Neeleman J, Aarnoudse JG: **Posttraumatic stress disorder following preeclampsia and HELLP syndrome.** *J Psychosom Obstet Gynaecol* 2004, **25**:183-187.
23. Engelhard IM, van Rij M, Boullart I, Ekhart TH, Spaanderman ME, Hout MA van den, Peeters LL: **Posttraumatic stress disorder after pre-eclampsia: an exploratory study.** *Gen Hosp Psychiatry* 2002, **24**:260-264.
24. Souza JP, Cecatti JG, Parpinelli MA, Serruya SJ, Amaral E: **Appropriate criteria for identification of near-miss maternal morbidity in tertiary care facilities: a cross sectional study.** *BMC Pregnancy Childbirth* 2007, **7**:20.
25. World Health Organization. WHODAS II: **World Health Organization Disability Assessment Schedule.** 2000 [http://www.who.int/icidh/whodas/index.html]. Accessed on 19/02/2009
26. Frankenburg WK, Dodds J, Archer P, Shapiro H, Bresnick B: **The Denver II: A Major Revision and Restandardization of the Denver Developmental Screening Test.** *Pediatrics* 1992, **89**:91-97.
27. De Onis M, Garza C, Onyango AW, Martorell R: **WHO Child Growth Standards.** *Acta Paediatr* 2006, **S450**:1-101.
28. Villar J, Valladares E, Wojdyla D, Zavaleta N, Carroli G, Velazco A, Shah A, Campodónico L, Bataglia V, Faundes A, Langer A, Narváez A, Donner A, Romero M, Reynoso S, de Pádua KS, Giordano D, Kublickas M, Acosta A, WHO 2005 global survey on maternal and perinatal health research group: **Caesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America.** *Lancet* 2006, **367**:1819-1829.

Anexo 4 – Indicadores do Cuidado Obstétrico

-Razão de Condições Potencialmente ameaçadoras da Vida (RCPAV) é calculada pelo número de mulheres com condições potencialmente ameaçadoras de vida, dividido por número de nascidos vivos por 1000.

-Razão de Morte Materna (RMM) é calculada pelo número de mortes maternas dividido pelo número de nascidos vivos por100. 000.

-Razão de Near Miss Materno (RNMM) é calculada pelo número de mulheres com Near Miss Materno dividido pelo número de nascidos vivos por 1000.

-Razão de Desfecho Materno Grave (RDMG) é calculada pelo número de mulheres que evoluíram para a morte somado ao número de mulheres com Near Miss, dividido pelo número de nascidos vivos por 1000.

-Razão de Near Miss Materno: Razão de Morte Materna (RNMM: RMM): referese à proporção entre RNMM e RMM, também conhecida pelo número de casos por fatalidade.

-Índice de Mortalidade (IM) é calculado pelo número de mortes maternas dividido pelo número de mortes maternas somado ao número de mulheres com Near Miss.