Maternal near miss and maternal death in the World Health Organization's 2005 global survey on maternal and perinatal health

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Objective To develop an indicator of maternal near miss as a proxy for maternal death and to study its association with maternal factors and perinatal outcomes.

Methods In a multicenter cross-sectional study, we collected maternal and perinatal data from the hospital records of a sample of women admitted for delivery over a period of two to three months in 120 hospitals located in eight Latin American countries. We followed a stratified multistage cluster random design. We assessed the intra-hospital occurrence of severe maternal morbidity and the latter's association with maternal characteristics and perinatal outcomes.

Findings Of the 97 095 women studied, 2964 (34 per 1000) were at higher risk of dying in association with one or more of the following: being admitted to the intensive care unit (ICU), undergoing a hysterectomy, receiving a blood transfusion, suffering a cardiac or renal complication, or having eclampsia. Being older than 35 years, not having a partner, being a primipara or para > 3, and having had a Caesarean section in the previous pregnancy were factors independently associated with the occurrence of severe maternal morbidity. They were also positively associated with an increased occurrence of low and very low birth weight, stillbirth, early neonatal death, admission to the neonatal ICU, a prolonged maternal postpartum hospital stay and Caesarean section.

Conclusion Women who survive the serious conditions described could be pragmatically considered cases of maternal near miss. Interventions to reduce maternal and perinatal mortality should target women in these high-risk categories.

Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

Introduction

Approximately 15 000 women die every year in Latin America and the Caribbean of causes related to pregnancy. The maternal mortality ratio (MMR) for the region, which is around 130 maternal deaths per 100 000 live births, lies somewhere between the MMRs observed in developed and underdeveloped countries.[1]

When maternal deaths are infrequent, the information they provide is not generalizable and they become poor sources of information on which to base measures to improve maternal health. Thus, in this situation severe maternal morbidity, which continues to be a public health problem in Latin America, has been proposed as a proxy for maternal death.[2,3]

Women who survive severe complications during pregnancy, childbirth and the postpartum period could serve as surrogates to help us gain a better understanding of the set of conditions and preventable factors that together contribute to a maternal death.[2] This is known as the concept of maternal near miss [4] recently defined by the World Health Organization (WHO), after some controversy,[5] as the near death of a woman from a complication during pregnancy, childbirth or within 42 days after the termination of pregnancy.[6]

Assessing maternal near misses for their values as proxies may be especially useful in Latin America, where MMRs are moderately low. In this paper we describe the occurrence of severe maternal morbidity in large hospitals in Latin America and test the usefulness of a pragmatic definition of maternal near miss for predicting maternal deaths. We also checked for associations between a maternal near miss on the one hand, and maternal factors and perinatal outcomes on the other.

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Table 1. Performance of various indicators of maternal morbidity as predictors of maternal death before hospital discharge, eight Latin American countries, 2005

Indicator[a]	No.	No. per 1000 deliveries	No. of maternal deaths	Ratio of no. to deaths	Sensitivity (95% CI)	Specificity (95% CI)	Likelihood ratio[b] (95% CI)
Hysterectomy	151	1.56	7	22:1	28.0 (27.7–28.3)	99.9 (99.8–99.9)	249.7 (105.8–589.2)
ICU	1 102	11.35	12	92:1	48.0 (47.7–48.3)	98.9 (98.8–98.9)	80.4 (36.8–175.9)
Transfusion	1 340	13.80	9	149:1	36.0 (35.7–36.3)	98.6 (98.6–98.7)	40.2 (17.8–90.8)
Cardiac/renal complications	483	4.97	3	161:1	12.5 (12.3–12.7)	99.5 (99.4-99.6)	27.3 (8.2–90.8)
Eclampsia	253	2.61	1	253:1	4.0 (3.9–4.1)	99.7 (99.7–99.8)	15.9 (2.2–117.5)
Respiratory complication	593	6.11	1	593:1	4.2 (4.0–4.3)	99.4 (99.3–99.4)	6.8 (0.9–50.1)
Diabetes	742	7.64	1	742:1	4.0 (3.9–4.1)	99.2 (99.2–99.3)	5.4 (0.7–39.9)
Vaginal bleeding	2 134	21.98	2	1 067:1	8.0 (7.8–8.2)	97.8 (97.7–97.9)	3.9 (0.9–16.4)
Uterotonics	21 431	220.72	12	1 786:1	48.0 (47.7–48.3)	77.9 (77.6–78.1)	3.3 (1.5–7.1)
Hypertension	9 415	96.97	4	2 354:1	16.0 (15.8–16.2)	90.3 (90.1–90.5)	1.8 (0.6–5.2)
Referral	33 504	345.06	11	3 046:1	44.0 (43.7–44.3)	65.5 (65.2–65.8)	1.5 (0.7–3.3)
Pyelonephritis or any UTI	14 443	148.75	2	7 221:1	8.0 (7.8–8.2)	85.0 (84.8–85.2)	0.5 (0.1–2.1)

CI, confidence interval; ICU, intensive care unit; UTI, urinary tract infection.

[a] No deaths were identified in women with severe anaemia, malaria or sickle cell disease.

[b] A likelihood ratio > 10 denotes a strong association.

Methods

The WHO Global Survey on Maternal and Perinatal Health, whose methods have been described in detail elsewhere,[7,8] is a multicountry and multicentre study designed by WHO in 2004 to explore the relationship between rates of Caesarean delivery and maternal and perinatal outcomes in selected medical institutions. It has also been used to gather information on severe maternal complications in Africa, Asia and Latin America. Briefly, the WHO Global Survey was implemented through a worldwide network of health institutions that were selected by means of a stratified multistage cluster sampling design. The present study is a secondary analysis, performed in 2005, of the Latin American database. Anonymous maternal and perinatal data were collected from the hospital records of all women admitted for delivery over a period of two to three months to 120 randomly selected hospitals located in eight randomly selected Latin American countries. In each hospital data were collected over two to three months and entered in a MedSciNet AB (Stockholm, Sweden) online data system.

Definitions and outcomes

In 2005, WHO criteria for maternal near miss had not yet been defined. Nonetheless, we used the information available in the database to establish the predictive value of five factors with respect to maternal death during pregnancy, childbirth and the first week postpartum. The five factors were admission to the intensive care

Table 2. Maternal near misses[a] and various indicators of severe maternal morbidity, per 1000 deliveries, in selected health facilities in eight Latin American countries, 2005

Country	Population (× 10⁵)	Maternal near miss	ICU[b] admission	Hysterectomy[b]	Blood transfusion[b]	Cardiac/renal complication[b]	Eclampsia[b]
Argentina	36.2	21.96	11.8	1.9	9.2	4.2	0.9
Brazil	169.8	40.67	21.4	1.1	9.6	7.5	4.7
Cuba	11.2	44.22	16.0	2.3	23.0	6.8	1.3
Ecuador	12.1	25.78	9.5	1.2	11.5	1.9	3.0
Mexico	97.5	32.60	7.7	1.9	16.6	6.6	3.2
Nicaragua	5.3	22.71	3.0	0.5	15.6	3.0	1.8
Paraguay	5.5	14.75	4.3	2.6	6.3	1.2	2.3
Peru	26.7	23.07	8.7	1.1	13.0	3.7	2.1
Total[c]	**364.4**	**34.31**	**14.7**	**1.5**	**12.2**	**6.2**	**3.5**

ICU, intensive care unit.

[a] Women who survived after admission to the ICU, or a hysterectomy, or a blood transfusion, or a cardiac or renal complication, or eclampsia during pregnancy, childbirth and the first seven days postpartum.

[b] Number per 1000 deliveries.

[c] The total estimates are proportional to the population size.

unit (ICU), blood transfusion, hysterectomy, eclampsia, or cardiac and renal complications. We assumed that a combination of factors indicative of severe maternal morbidity would identify those women who, having narrowly escaped maternal death, could be considered maternal near misses.

We also examined the association between maternal near miss and certain maternal and institutional characteristics, namely age, marital status, years of schooling, parity, number of antenatal visits, obesity, Caesarean section in the previous pregnancy, and type of health facility in which the delivery took place (public, social security or private). We also looked at the following perinatal outcomes: length of maternal postpartum stay, low and very low birth weight, admission of neonate to ICU, stillbirth, early neonatal death and mode of delivery.
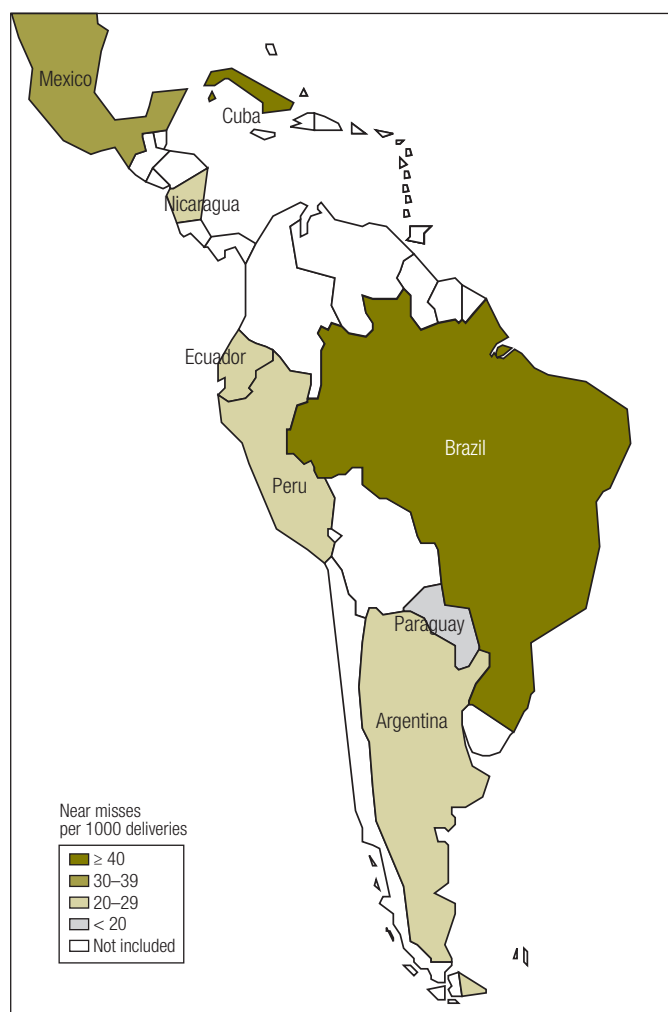
Analysis

We first tested the usefulness of clinical diagnosis and management indicators for predicting maternal death by calculating, for each indicator, its sensitivity, specificity, likelihood ratio and its 95% confidence intervals (CIs), and the ratio of cases to deaths. The association between maternal death and each indicator was considered strong if the likelihood ratio was greater than 10.[9] The ratio of cases to deaths was calculated as the number of cases of a particular maternal morbid indicator for every maternal death in a woman who had the indicator, from the date of hospital admission to the seventh day postpartum. Once we had identified the indicators most strongly associated with maternal death, we combined them into a single indicator of severe maternal morbidity when at least one of them was present.

We studied the occurrence of maternal near misses in each country and derived summary estimates proportional to each country's population size. By using simple and multiple logistic regression, we calculated crude and adjusted odds ratios (ORs) to assess the association between maternal and institutional characteristics and maternal near miss. Maternal body mass index was excluded from the analysis due to missing data.

Finally, we used a cohort approach – with maternal near miss as an exposure and maternal and perinatal outcomes as effects – to examine the crude association between maternal near miss and perinatal outcomes, expressed as risk ratios (RRs) and their 95% CIs. A logistic regression model that included all possible predictors was then developed for each outcome. We excluded 61 women for whom there was no information on life status at discharge. The mode of delivery was included in the model only as an outcome. Statistical analyses were carried out with SAS, version 9.1.3 (SAS Institute Inc., Cary, NC, USA).

The WHO Global Survey research project was approved by the national ethics committee of each country studied as well as the WHO Scientific and Ethical Review Group and the Ethics Review Committee. Some large hospitals in Mexico and Argentina and all hospitals in Brazil independently approved the protocol.

Fig. 1. **Estimates of maternal near misses per 1000 deliveries in referral hospitals in a study of eight Latin American countries, 2005**

Results

A total of 120 institutions from eight Latin American countries contributed to the 97 095 deliveries included in this study, of which 96 026 culminated in a live births. There were 25 maternal deaths in hospital, from admission to the seventh day postpartum. Table 1 shows some of the indicators used to develop a pragmatic definition of maternal near miss. Hysterectomy, ICU admission, blood transfusion, cardiac or renal complication and eclampsia yielded the highest likelihood ratios. In our sample this high-risk group, which comprised 2964 women with any of these conditions, had a combined likelihood ratio of 21.1 (95% CI: 15.7–28.4). In other words, for a woman who had died, the likelihood of having had any of these conditions was about 21 times higher than for a woman who had survived. On the

Table 3. Characteristics of women who experienced a maternal near miss[a] (crude and adjusted estimates)[b] in a study of eight Latin American countries, 2005

Characteristic	Near miss		Not near miss	Crude OR (95% CI)	Adjusted OR (95% CI)
	%	No.	No.		
Age, in years					
10–19	2.99	530	17 178	1.03 (0.93–1.14)	0.99 (0.88–1.10)
20–34	2.91	2 003	66 860	1	1
> 35	4.00	417	9 997	1.39 (1.25–1.55)	1.40 (1.20–1.64)
Missing		2	48		
Marital status					
No partner	3.36	697	20 072	1.15 (1.05–1.25)	1.21 (1.10–1.64)
With partner	2.94	2 233	73 662	1	1
Missing		22	349		
Schooling, no. of years					
< 7	2.76	662	23 345	0.72 (0.63–0.82)	0.70 (0.62–0.80)
7–12	3.07	1 769	55 877	0.80 (0.72–0.90)	0.82 (0.73–0.92)
> 12	3.79	395	10 024	1	1
Missing		126	4 837		
Parity					
Primipara	3.18	1 062	32 344	1.17 (1.08–1.27)	1.37 (1.24–1.51)
2–3 deliveries	2.73	1 225	43 606	1	1
> 3 deliveries	3.54	663	18 077	1.31 (1.19–1.44)	1.28 (1.15–1.42)
Missing		2	56		
No. of antenatal visits					
0–3	3.15	506	15 546	1.03 (0.93–1.14)	1.05 (0.94–1.16)
> 3	3.06	2 356	74 612	1	1
Missing		90	3 925		
Obesity (BMI > 30 kg/m²)[c]					
Yes	2.98	1 059	34 510	1.08 (0.99–1.17)	
No	2.77	1 199	42 052	1	
Missing		694	17 521		
Caesarean section in previous pregnancy					
Yes	4.09	538	12 628	1.46 (1.33–1.61)	1.63 (1.47–1.81)
No	2.84	2 362	80 881	1	1
Missing		52	574		
Type of health facility					
Public	3.65	2 147	68 712	1	1
Social security	3.65	720	19 022	1.21 (1.11–1.32)	1.24 (1.13–1.36)
Private	1.32	85	6 349	0.43 (0.34–0.53)	0.29 (0.21–0.42)
Total[d]		**2 952**	**94 083**		

BMI, body mass index; CI, confidence interval; OR, odds ratio.

[a] Women who survived after admission to the ICU, or a hysterectomy, or a blood transfusion, or a cardiac or renal complication, or eclampsia during pregnancy, childbirth and the first seven days postpartum.

[b] Simple and multiple logistic regression model (including all variables except BMI).

[c] BMI was not used in multiple analyses due to the high number of missing data.

[d] Excluded from the analysis were 61 women with no information on maternal death.

other hand, of 25 women who had died, 16 had presented at least one of these conditions, and the ratio of cases to deaths was thus 2964:16, or 185:1. According to our pragmatic definition, women who survived these conditions during pregnancy or childbirth were classified as maternal near misses.

Table 2 shows estimates of maternal near misses and its components, as defined, in the Latin American coun-

tries selected. Near misses were more frequent in Brazil and Cuba and less frequent in Paraguay. Admission to the ICU during pregnancy was more common in Brazil and rare in Nicaragua and Paraguay. Blood transfusions were more frequently administered in Cuba and Mexico. For all eight countries in the sample, the mean proportional ratio of near misses was around 34 per 1000 deliveries (Fig. 1).

Table 3 compared the characteristics of maternal near miss cases with those of women who had no severe complications. Being > 35 years of age, not having a partner, and being a primipara or para > 3 were independently associated with the occurrence of a near miss. Social security institutions showed a stonger independent association with near misses than private institutions. Near misses were less frequent

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Table 4. Crude and adjusted RRs of maternal and perinatal outcomes among women who experienced maternal near misses[a,b] in a study of eight Latin American countries, 2005

Outcome	Near miss		Not near miss	Crude RR (95% CI)	Adjusted RR (95% CI)
	%	No.	No.		
Postpartum stay ≥ 7 days					
Yes	15.82	318	1 692	6.12 (5.46–6.86)	4.76 (4.20–5.40)
No	2.71	2 567	92 212	1	1
Missing		67	179		
Low birth weight (< 2500 g)					
Yes	8.13	694	7 843	2.83 (2.64–3.03)	2.38 (2.19–2.58)
No	2.54	2 247	86 066	1	1
Missing		11	174		
Very low birth weight (< 1500 g)					
Yes	14.21	209	1 262	5.29 (4.59–6.09)	4.36 (3.72–5.12)
No	2.86	2 732	92 647	1	1
Missing		11	174		
Admission to neonatal ICU					
Yes	7.70	797	9 552	2.73 (2.57–2.91)	2.11 (1.95–2.28)
No	2.39	2 044	83 553	1	1
Missing		111	978		
Stillbirth					
Yes	11.32	107	832	4.07 (3.34–4.96)	3.95 (3.17–4.94)
No	2.96	2 843	93 183	1	1
Missing		2	62		
Early neonatal death					
Yes	15.49	92	502	6.03 (4.84–7.50)	4.77 (3.74–6.07)
No	2.87	2 739	92 616	1	1
Missing		121	965		
Mode of delivery[c]					
Vaginal	1.90	1 191	61 497	1	1
Caesarean	5.12	1 756	32 515	1.72 (1.67–1.78)	1.57 (1.49–1.65)
Missing		5	71		
Total[d]		2 952	94 083		

BMI, body mass index; CI, confidence interval; ICU, intensive care unit; RR, risk ratio.

[a] Women surviving after admission to ICU or hysterectomy or blood transfusion or cardiac or renal complications or eclampsia during pregnancy, childbirth and the first seven postpartum days.

[b] Logistic regression model for cohort studies with adjustment for all predictors (age, marital status, years of schooling, parity, number of antenatal visits, Caesarean section in previous pregnancy and type of facility) except BMI.

[c] Mode of delivery was tested in the model only as an outcome.

[d] Excluded from the analysis were 61 women with no information on maternal death.

among women with less than 12 years of schooling.

Women who had undergone Caesarean section in their previous pregnancy were at increased risk of severe maternal morbidity, whether or not their current delivery was by Caesarean. The association between Caesarean section in the previous pregnancy and severe maternal morbidity remained statistically significant after adjustment for current mode of delivery (data not shown). Table 4 shows the crude and adjusted RRs for selected maternal and perinatal outcomes. In both analyses, the occurrence of a near miss was positively associated with low and very low birth weight, admission of the neonate to the ICU, stillbirth, early neonatal death and a prolonged maternal postpartum stay.

Discussion

In this study, a pregnant woman admitted to the ICU, or undergoing a hysterectomy, or receiving a blood transfusion, or presenting a cardiac or renal complication, or having eclampsia was found to be at increased risk of dying during pregnancy, childbirth or in the early postpartum period. Survivors of the above-mentioned conditions were then pragmatically labelled as near miss cases.

It is not surprising that age, marital status and parity, well known predictors of maternal death, were also found to be associated with the occurrence of maternal near miss. This finding supports the use of maternal near miss as a proxy or surrogate for maternal death in assessments of maternal health interventions. Maternal near miss could be used for auditing health facilities where maternal deaths rarely occur.

Low maternal education was found to be protective against the occurrence of a maternal near miss. Furthermore, a previous Caesarean section was independently and positively associated with the occurrence of a maternal near miss.

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Caesarean section has been reported to increase maternal morbidity in Latin America,[7,10] where women with lower education are known to undergo fewer Caesarean sections. The worldwide trend towards an increase in Caesarean section rates may be linked to iatrogenic maternal morbidity and maternal death.[7,10]

The association between maternal near miss and poor perinatal outcomes was expected and is very strong.[11] Babies delivered to women who are near misses are smaller, require intensive care more frequently and are at higher risk of dying in the first week of life. In addition, women who are near misses have more stillbirths.

Limitations

Some study limitations should be addressed. The proposed pragmatic definition of near miss included both management indicators (admission to the ICU, blood transfusion, and hysterectomy) and clinical diagnoses. The application of management criteria is influenced by the availability and use of the corresponding resources. In addition, these findings are based mostly on the data recorded in medical charts, which may not have been fully standardized. Another limitation is the small number of maternal deaths on which we based our pragmatic definition of a near miss. All these maternal deaths occurred in hospital and some women may have died after being transferred or discharged and thus been omitted. This may explain the very low MMR observed.

Implications

Despite its limitations, this study is based on what is probably the world's largest data set to date of severe maternal complications, such as peripartum hysterectomy, blood transfusions and admission to the ICU during pregnancy and childbirth. Because most deliveries in Latin America and the Caribbean occur in health facilities, the survey results are likely to represent the state of care during childbirth in that region. In addition, the strength of the association between indicators of severe maternal morbidity and maternal death makes the concept of near miss even more relevant for efforts to improving maternal health. In the future, these findings can also be compared with those from Africa and Asia to try to gain an understanding of severe maternal morbidity and near miss worldwide.

Ideally, the definition of maternal near miss should be based on organ dysfunction.[5] However, a more pragmatic approach is needed to perform macroanalyses, which are often secondary analyses of large sets of data routinely collected from health systems. This study provides further evidence to support the use of selected conditions, such as hysterectomy, ICU admission and blood transfusion, to explore the concept of maternal near miss. Furthermore, the indicators currently reported or even the stricter, more precise criteria recently proposed by WHO could be applied in future epidemiologic studies or similar surveys on maternal and perinatal health.[6] ∎

Résumé

Décès maternels et décès maternels évités de justesse dans le cadre de l'enquête mondiale sur la santé maternelle et périnatale réalisée en 2005 par l'Organisation mondiale de la Santé

Objectif Mettre au point un indicateur pour les décès maternels évités de justesse en tant qu'indicateur indirect des décès maternels et étudier son association avec des facteurs maternels et des événements périnatals.

Méthodes Dans le cadre d'une étude transversale multicentrique, nous avons recueilli des données maternelles et périnatales à partir des dossiers hospitaliers d'un échantillon de femmes, constitué des parturientes admises pour accoucher dans 120 hôpitaux appartenant à huit villes d'Amérique latine sur une période de deux à trois mois. Nous avons appliqué une méthode de sondage aléatoire stratifié à plusieurs degrés et par grappe. Nous avons évalué l'occurrence en milieu hospitalier de la morbidité maternelle sévère et les associations de cette dernière avec les caractéristiques maternelles et les événements périnatals.

Résultats Sur les 97 095 femmes étudiées, 2964 (34 pour 1000) présentaient un risque important de décès en association avec une ou plusieurs des conditions suivantes : avoir été admise dans une unité de soins intensifs, avoir subi une hystérectomie, avoir reçu une transfusion sanguine, avoir souffert d'une complication cardiaque ou rénale ou encore d'une éclampsie. Par ailleurs, avoir plus de 35 ans, ne pas avoir de partenaire, être primipare ou quadripare et plus et avoir subi une césarienne lors de la précédente grossesse étaient des facteurs indépendamment associés à l'occurrence de la morbidité maternelle sévère. Ces facteurs étaient aussi positivement associés à une fréquence accrue des petits poids et des très petits poids de naissance, de la mortinatalité, des décès néonatals précoces, des admissions en soins intensifs néonatals, dés séjours hospitaliers prolongés des mères pendant le postpartum et des césariennes.

Conclusion Les femmes qui survivent aux situations graves précédemment décrites peuvent être considérées pratiquement comme des cas de décès maternel évité de justesse. Les interventions pour réduire la mortalité maternelle et périnatale doivent viser les femmes appartenant à ces catégories à haut risque.

Resumen

Cuasieventos maternos y mortalidad materna en la encuesta mundial 2005 de la Organización Mundial de la Salud sobre salud materna y perinatal

Objetivo Elaborar un indicador de los cuasieventos maternos como medición indirecta de las defunciones maternas y estudiar su relación con diversos factores maternos y con los resultados perinatales.

Métodos Mediante un estudio transversal multicéntrico, a lo largo de un periodo de dos a tres meses reunimos datos maternos y perinatales de los registros hospitalarios de una muestra de mujeres ingresadas para dar a luz en 120 hospitales de ocho países de América Latina. Aplicando un diseño aleatorio, polietápico, estratificado y por conglomerados, evaluamos los casos intrahospitalarios de morbilidad materna grave y la relación entre ésta y las características de la madre y los resultados perinatales.

Resultados De las 97 095 mujeres estudiadas, 2964 (34 por 1000) presentaron un mayor riesgo de morir asociado a alguno de los siguientes factores: ingreso en la unidad de cuidados intensivos, histerectomía, transfusión de sangre, complicación cardiaca o renal, y eclampsia. Tener más de 35 años, carecer de pareja, ser primípara o acumular un mínimo de tres partos anteriores y haber sido sometida a cesárea en el embarazo precedente fueron factores asociados independientemente a morbilidad materna grave. Se observó que estaban relacionados también positivamente con lo siguiente: un peso bajo o muy bajo al nacer, mortinatalidad, mortalidad neonatal precoz, ingreso en la UCI neonatal, estancia prolongada de la madre en el hospital tras el parto, y cesárea.

Conclusión Los casos de las mujeres que sobreviven a los graves problemas aquí descritos pueden conceptuarse en la práctica como cuasieventos maternos. Las intervenciones encaminadas a reducir la mortalidad materna y perinatal deberían focalizarse en las mujeres de esas categorías de riesgo.

ملخص

حالات الأمهات المقاربات على الوفاة ووفيات الأمهات في المسح العالمي لمنظمة الصحة العالمية لعام 2005 حول صحة الأمهات والولدان

الغرض: إعداد مؤشر لحالات الأمهات المقاربات على الوفاة كبديل لوفيات الأمهات ودراسة ارتباطه بعوامل الأمومة والنتائج الوليدية.

الطريقة: في دراسة مقطعية متعددة المراكز، حسب الباحثون بيانات الأمهات والولدان المقيدة في سجلات المستشفيات لعينة من الأمهات أدخلن المستشفى للولادة خلال فترة شهرين إلى ثلاثة شهور في 120 مستشفى في ثمانية بلدان في أمريكا اللاتينية. واتبع الباحثون تصميماً عشوائياً عنقودياً طباقياً متعدد المراحل. وقيّم الباحثون معدلات وقوع المراضة الوخيمة للأمهات في المستشفيات ثم الارتباط بين خصائص الأمومة والنتائج الوليدية.

الموجودات: من 97095 امرأة أجريت عليهن الدراسة، كان هناك 2964 امرأة (معدل 34 في الألف) معرضة لخطر عال للموت المتعلق بواحد أو أكثر من الأسباب التالية: النساء اللاتي أدخلن إلى وحدة الرعاية الصحية المركزة، أو أجري لهن استئصال الرحم، أو تلقين نقل الدم، أو كن يعانين من مضاعفات قلبية أو كلوية، أو كان لديهن ارتعاج. وتعتبر العوامل المستقلة المرتبطة بوقوع مراضة وخيمة للأمهات هي النساء أكبر من عمر 35 سنة، واللاتي ليس لديهن شريك، واللاتي حملن لأول مرة أو اللاتي حملن أكثر من ثلاث مرات، واللاتي سبق إجراء جراحة القيصرية لهن في الحمل السابق. وقد ارتبطت هذه العوامل إيجابياً بزيادة وقوع نقص الوزن ونقص الوزن الشديد للمواليد، وولادات الوليد الميت، وموت الولدان المبكر، والإدخال في وحدة الرعاية المركزة، وطول بقاء الأمهات في المستشفى، وإجراء الجراحة القيصرية.

الاستنتاج: النساء اللاتي بقين أحياء بعد الحالات المرضية الوخيمة المذكورة يمكن اعتبارهن عملياً حالات مرضية لأمهات مقاربات على الوفاة. ويجب أن تستهدف تدخلات الحد من وفيات الأمهات والولدان هؤلاء النساء في الفئات المعرضة لخطورة عالية.

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