Maternal mortality due to hemorrhage in Brazil

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Objective: to analyze the rates of maternal mortality due to hemorrhage identified in Brazil from 1997 to 2009. Methods: the time series and population data from the Brazilian Health Ministry, Mortality Information System and Live Birth Information System were examined. From the Mortality Information System, we initially selected all reported deaths of women between 10 and 49 years old, which occurred from January 1, 1997 to December 31, 2009 in Brazil, recorded as a "maternal death". Results: during the research period, 22,281 maternal deaths were identified, among which 3,179 were due to hemorrhage, accounting for 14.26% of the total deaths. The highest rates of maternal mortality were found in the North and Northeast areas of Brazil. Conclusions: the Brazilian scenario shows regional inequalities regarding maternal mortality. It presents hemorrhaging as a symptom and not as a cause of death.

Descriptors: Maternal Mortality; Postpartum Hemorrhage; Cause of Death.

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Introduction

Maternal Mortality (MM) is defined as the death of a woman during pregnancy or within a period of 42 days after termination of pregnancy, regardless of duration or site of the pregnancy, from any cause related to or aggravated by pregnancy or its management, but not due to accidental or incidental causes. Obstetric Maternal Mortality, more specifically, is related to obstetric complications during pregnancy, childbirth or the puerperium, due to interventions, omissions and incorrect treatment, or chains of events arising from any such causes. These correspond to deaths that in Brazil are coded CID-10 as: O00.0 - O08.9, O11 - O23.9, O24.4 - O26, 92.7, E23.0, F53 and M83.0[1-4].

In general, MM suggests a death that occurs prematurely, with causes considered to be avoidable, reflecting not only on the living conditions of women, but also on the level of organization and quality of care provided[4-5].

There are many issues related to Maternal Mortality based on both empirical and theoretical information. However, despite the number of published papers on the subject, MM, which is preventable, continues to occur at high rates, a reality that needs to be transformed urgently[4-7].

Hemorrhage is a major cause of avoidable maternal death worldwide and it includes ante-partum, intra-partum and postpartum hemorrhaging[8]. In developing countries, the main cause of MM is postpartum hemorrhage, which affects about 1% of pregnant women, with overall MM rates ranging from 290-450[1]. In more developed countries, such as France, the MM rate is lower, but has remained around 10 per 100,000 births, and hemorrhage is still one of the main causes observed[8-10]. In the United States, recent MM rates are reported at 13.3 - 24 per 100,000 live births, with an increasing trend in deaths related to postpartum hemorrhage[1,11].

In Brazil, MM has been reported from 52 to 75 per 100,000 live births; published data from 2007 suggest that 23% of maternal deaths were due to hypertensive diseases and 8% due to hemorrhage[12-13].

Among the principal causes of bleeding were: abortion, abruptio placentae, placenta previa, ruptured uterus, trauma, coagulopathy, and postpartum hemorrhage. The last is considered preventable with adequate obstetrical support[13].

The objective of this study is to analyze the Maternal Mortality Ratio (MMR) by hemorrhage, in Brazil, during the period 1997 to 2009. The measurement of MMR as the result of hemorrhage provides information to health managers in planning actions aimed at reducing it. Thus, without this information it would be impossible to meet the Millennium development goals to which Brazil is a signatory[14].

Method

This is a descriptive study of a retrospective record review, population-based series, from data provided by the Ministry of Health of Brazil, the Mortality Information System (SIM) and the Live Birth Information System (SINASC). From the SIM we initially selected all reported deaths of women between 10 and 49 years old, which occurred from January 1st of 1997 to December 31st of 2009 in Brazil and recorded as a "maternal death," whose root cause was a maternal condition related to hemorrhage. Thus, for the study sample, this included all cases reported in the following categories of CID-10:2: 000 – ectopic pregnancy; O20 – early pregnancy bleeding; O43 –malformations of the placenta; O44 – placenta previa; O45 – abruptio placentae; O46 – antepartum hemorrhage; NCOP, O67 – complicated labor intra-partum hemorrhage; and NCOP, O72 – postpartum hemorrhage[3]. Exclusion criteria included maternal deaths related to hemorrhage due to abortion, because the records contained in the SIM do not permit us to evaluate if this death is associated with a hemorrhagic event, infection, or other cause. We also excluded cases coded as O96 and O97 - late maternal death (deaths that occur 43-365 days postpartum) resulting from obstetric causes.

The data concerning the total live births during the study period were collected from SINASC.

Descriptive analysis was used to determine the distribution and frequency of cases of MM collected from the SIM data, in accord with the aforementioned inclusion and exclusion criteria. Then we calculated Maternal Mortality Ratio (MMR) corrected according to adjustment factors[15] comparing the calculation of MMR with and without correction[15] for each region of the country during the study period. Standardized adjustment factors are used to take into account potential underestimations and misclassifications of maternal deaths in registered reports and based on a literature review of previously

published reports. The MMR is defined as the relationship between the maternal deaths divided by the total of live births, multiplied by 100,000:

$$MMR = \frac{\text{Total of maternal deaths}}{\text{Total of live birth}} \times 100{,}000$$

We used the World Health Organization definition of live birth (i.e., those that were born live, at whatever gestational age, and breathes or show any sign of life such as, heartbeat, pulsation in the umbilical cord or voluntary movements, regardless of whether the umbilical cord or placenta are intact)[3].

The study was developed as part of a larger project, "Catarinas: birth, life, and death," approved by the Ethics Committee of the Federal University of Santa Catarina (CEPSH-UFSC), protocol number 209/2008, in observance of resolution number 196/1996, of the Ministry of Health of Brazil.

Results

During the study period the SIM identified 22,281 deaths of women of childbearing age (10 to 49 years) due to complications in pregnancy, childbirth or the post-partum period (i.e., maternal deaths). Out of this total, 3,179 (14.2%) were associated with hemorrhage. Table 1 shows the number of cases, for each year of the period, as it appears on the SIM, and the total number of cases, after applying the correction factor[15], which brings the total to 3,609.

It was also noted that postpartum hemorrhage (CID O72), and abruptio placentae (CID O45) were the two leading cause of maternal death due to hemorrhage, accounting for 41 and 30 percent of the total, respectively (Figure 1).
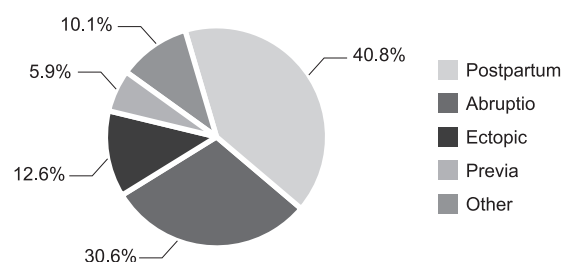

Figure 1 - Maternal Mortality due to hemorrhage according to category CID 10. Brazil, 1997–2009

Table 1 - Maternal Mortality due to hemorrhage according to category CID-10. Brazil, 1997-2009

Category CID-10	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total	%
O00 Ectopic pregnancy	26	23	30	27	25	22	36	28	39	30	40	31	44	401	12.6
O20 Early pregnancy bleeding	1	1	0	0	-	-	1	2	2	1	1	3	-	12	0.38
O43 Malformations of the placenta	2	3	1	1	2	1	1	1	-	-	3	2	4	21	0.66
O44 Placenta previa	17	12	20	18	12	10	14	15	16	14	12	9	19	188	5.91
O45 Abruptio placentae	96	77	96	82	99	78	70	66	59	71	64	57	58	973	30.6
O46 Antepartum hemorrhage	10	14	14	17	15	11	13	13	14	12	12	17	17	179	5.63
O67 Intrapartum hemorrhage	4	9	8	10	7	10	11	5	6	10	10	9	10	109	3.43
O72 Postpartum hemorrhage	107	97	124	92	83	117	91	105	105	101	109	76	89	1,296	40.8
Total (original number)	263	236	293	247	243	249	237	235	241	239	251	204	241	3,179	100
Applied correction factor*	313	281	349	294	289	296	282	280	287	284	299	243	287	3,784	-
MMR/correction factor*	10.34	8.92	10.71	9.17	9.28	9.68	9.28	9.25	9.46	9.64	10.34	8.28	9.96	-	-

* Correction Factor[15].

During the study period, the overall MMRH ranged from 10.34 in 1997 to 9.96 in 2009. We observed that the Maternal Mortality Ratio by Hemorrhage (MMRH) in the north ranged from 7.18 to 12.73/100,000 live births, while in the Northeast it was 8.42 to 13.07, in the South, from 6.49 to 11.64 and in the Mid-west, from 5.71 to 11.05 (Figures 2 and 3, Table 2).
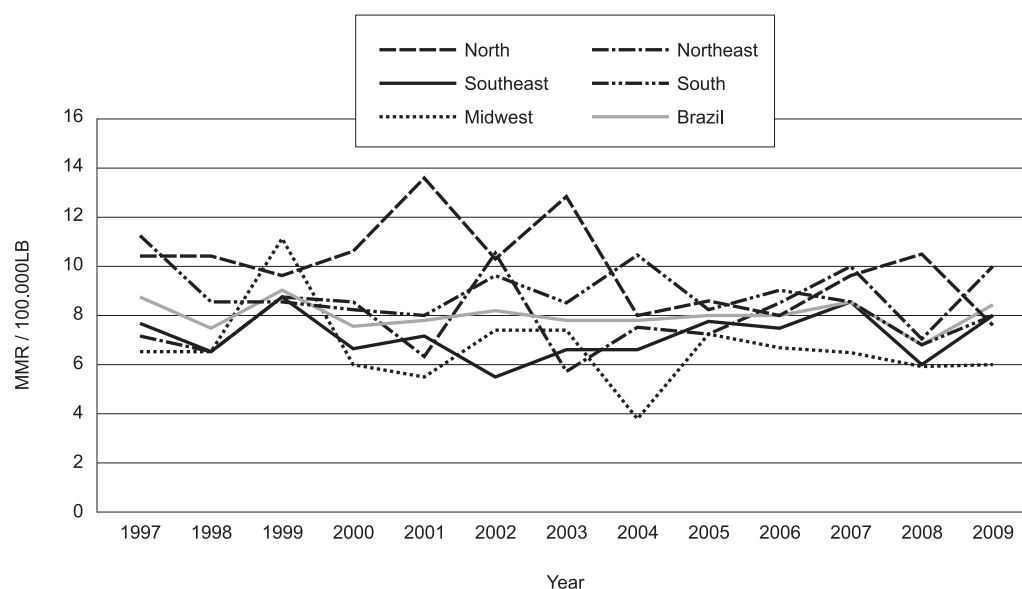
Figure 2 - Maternal mortality due to hemorrhage, original values. Brazil, 1997-2009
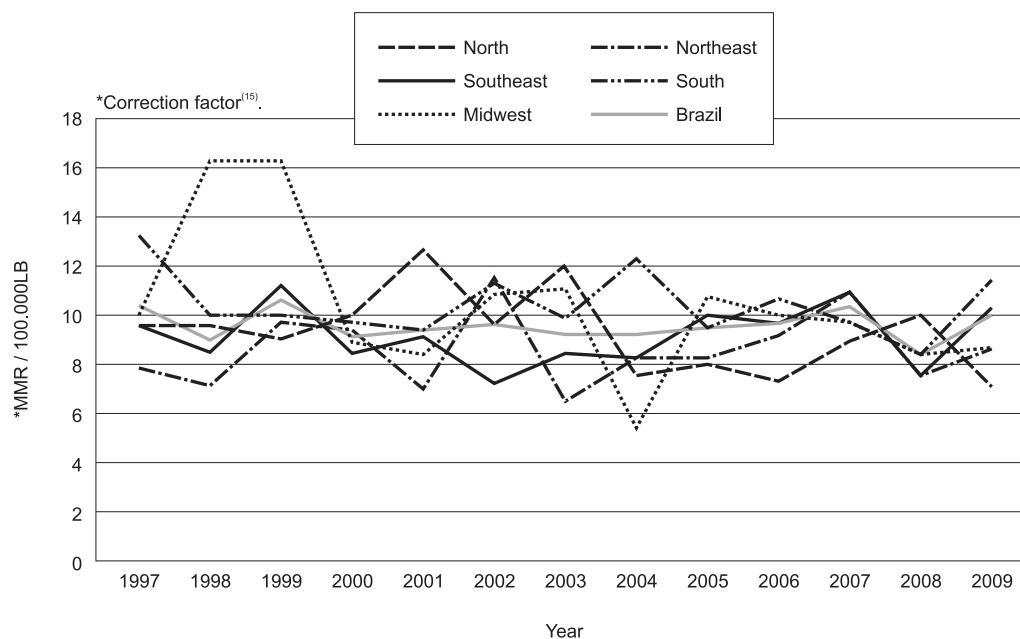

Figure 3 - Maternal mortality due to hemorrhage, adjusted by correction factor. Brazil, 1997-2009

Table 2 - Maternal Mortality Rates by Region, adjusted by correction factor. Brazil, 1997-2009

Year	Brazil	North	Northeast	Southeast	South	Midwest
1997	10.34	9.69	13.09	9.73	7.85	9.92
1998	8.92	9.76	10.02	8.50	7.18	16.23
1999	10.71	9.11	9.94	11.25	9.78	16.42
2000	9.17	9.97	9.72	8.42	9.53	9.02
2001	9.28	12.69	9.34	9.18	6.97	8.35
2002	9.68	9.63	11.29	7.28	11.57	11.00
2003	9.28	11.88	9.89	8.47	6.42	11.06
2004	9.25	7.44	12.19	8.23	8.28	5.66

(continue...)

Table 2 - (continuation)

Year	Brazil	North	Northeast	Southeast	South	Midwest
2005	9.46	7.94	9.62	10.07	8.16	10.81
2006	9.64	7.56	10.59	9.65	9.23	9.92
2007	10.34	8.98	9.90	11.04	11.02	9.75
2008	8.28	9.94	8.44	7.61	7.81	8.53
2009	9.96	7.08	11.67	10.18	8.73	8.63

Discussion

Maternal Mortality Rates due to hemorrhage, when calculated for each year of the series, proved to be identical between regions, common every year, and showed little improvement over time, especially in the North and Northeast regions. These findings suggest that managers and health professionals should invest additional attention in the problem of hemorrhaging in order to assess technologies and procedures that are being adopted, as well as to implement new management practices to improve the safety of patients, particularly in this areas[16-17].

Regional disparities

MM by hemorrhage was common in all Brazilian regions, though more prevalent in the North and Northeast, pointing also to the regional differences. In general, the level and trends of MM in Brazil may be related to socioeconomic differences and unequal access to health services between the less affluent regions (North and Northeast) and the most affluent regions (South and Southeast). Regional disparities in MM have also been noted in other countries. In the United States MM rates range from 1.2 in the state of Maine to 20.5 in the state of Georgia[10].

Exploring the underlying cause

It was considered important to explore the causes of hemorrhaging, because hemorrhaging is merely a symptom of a disease. Therefore, it is the underlying cause, such as uterine atony or abruptio placentae, which will present with hemorrhage, but each of these conditions has a unique etiology. The risk of hemorrhage is increased in cases of multiple pregnancies, polyhydramnios, macrosomia, precipitous labor or prolonged labor, chorioamionitis, or simply the inability to contract the uterine muscle, due to the use of tocolytics or general anesthesia[12-13].

We note the definition of the underlying cause as "disease or injury which initiated a chain of events which leads to death," which is the adopted terminology used in mortality statistics throughout the world[4,15]. This is also important because, in order to prevent, control, or intervene effectively in an obstetrical hemorrhage, it is necessary to know the underlying cause.

Thus in cases of MM, the underlying cause should be clearly recorded on the death certificate, and we recommend that bleeding not be listed as a "cause", but that the underlying causes that triggered the bleeding such as: abruptio placentae, uterine atony, and others shown in Table 1, as presented in the CID-10 be recorded.

Postpartum hemorrhage

One main cause of postpartum death found in this study was uterine atony resulting in postpartum hemorrhage, a result that is consistent with other studies[8-9,11]. These findings are similar to those of the World Health Organization, who also find that the main cause of maternal mortality, responsible for one quarter of all maternal deaths, is obstetric hemorrhage that usually occurs after delivery, and can lead to death if care and treatment are not implemented to control the immediate hemorrhage[1,6-9].

MM due to hemorrhage is, in general, associated with a type of monitoring during labor and the postpartum period, delayed response to loss of blood, and lack of a blood bank being located in maternity[10-13]. Most of these deaths occur within 24 hours and are greatly influenced by the non-recognition of potentially serious cases, as well as the inadequate structure of health services, for example, limited access to blood banks[18], in addition to other barriers to implementing a blood transfusion[19].

Implementation of protocols and standards

These cases would have a better prognosis if a standardized clinical protocol was adopted for the management of the third stage of labor (including appropriate cord clamping and administration of 10 units of oxytocin intramuscularly in the mother)[20-21]. Using a standardized clinical protocol in cases of post-partum

hemorrhage and additional training of multidisciplinary teams may improve maternal outcomes[20]. Increasing the availability of blood for transfusions and alternatives to transfusions, such as autologous transfusions before and during surgery or delivery, would also help reduce deaths[22].

Need for improved data collection/documentation

These regional differences may be related to the quality of information on death certificates, given that this is a well-recognized problem in most developing countries[1,12].

MM is the result of several determinants, and quantifying and analyzing it are affected by the inadequate filing and coding of death certificates. Thus, the data recorded in most developing countries should be analyzed for the possibility of underreporting and hidden information[2,9,23].

This may be related to technical inaccuracies in the medical certification of deaths and/or the poor quality of the institutional records (hospital charts and outpatient records), among other factors[4,9,15]. Furthermore, studies of MM have variable coverage, depending on the type of record and the country to which it refers. But there is recognition of the likelihood of underreporting of MM (estimated between 20 and 50%) in all countries, including those who have developed specific ways to improve records and data collection[9].

In Brazil, the installation of Maternal Mortality Committees in all 27 states has improved the detection and reporting of MM, however, the quality of such reports has varied according to location and time of occurrence, affecting the interpretation of temporal trends and rates by regions[12].

In Brazil, there have been several initiatives to improve the collection of data on maternal mortality; for example, there has been a multicenter study that, among their results, developed a correction factor for Brazilian state capitals[15]. Another initiative was the issuance of Resolution number 256, of the National Health Council, which requires that maternal death in states and municipalities be a notification event for epidemiological surveillance.

The average mortality rate in the first years of this study (starting in 1997) shows little significant change from the last years of this study (ending in 2007), which may be partially explained by improved reliability of data collection and better reporting, rather than an actual increase in incidence or lack of change. However, MM due to hemorrhage remains an avoidable crisis.

In summary, temporal trends in MMR show some improvement based on vital statistics, as well as providing evidence of a decline in the maternal mortality ratio in the last thirty years. However, the United Nations Millennium Development Goal Number 5 (calling for a 75% reduction in maternal mortality from 1990 to 2015), may well not be reached[12]. We must also be aware that the risk of a woman dying as a result of pregnancy or childbirth during her lifetime is about one in six in the poorest regions of the world, as compared to the rate of about one in 30,000 in Northern Europe. It is also important to reflect on the global commitment to reduce MM[24-25].

Mortality from hemorrhage, represented in the MMR, and verified in this study, is alarming and, due to the magnitude that it represents and also the vulnerability of otherwise healthy women and the implications for future generations, represents a significant public health problem. Simple measures such as the active management of the immediate postpartum period, early diagnosis, and better care for patients with hypertensive syndrome, can reduce mortality of this sort.

Conclusion

The Brazilian situation shows the regional inequalities regarding maternal mortality from hemorrhage, and this analysis reveals several opportunities to improve care for women in the perinatal period. Throughout the series (1997-2007), there was no significant reduction in MMR rates in any of the regions. The existence of technology to intervene in obstetric hemorrhaging has not led to the desired outcomes in Brazil. The results of this study demonstrate a need for change in clinical practice and in the management of postpartum hemorrhage and more attention to women's health, in general.

Improved record keeping, including documenting on the death certificate the underlying condition that triggered the bleeding would help facilitate root cause analysis. Questions emerged from this data, demonstrating the need for improved data reporting. It is difficult to track trends or fluctuations if the data is suspect. However, poor record keeping does not explain away the problem. Consider that most births in Brazil occur in a hospital, and that the protocols for the management of obstetrical hemorrhage are known, and thus prevention is in the domain of the professionals that provide care. Further research and clinical innovation is clearly needed to address the problem of maternal mortality in Brazil.

Acknowledgements

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