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Declared maternal death and the linkage between health information systems

ABSTRACT

OBJECTIVE: To describe the characteristics of maternal mortality according to the Mortality Information System in relation to the data corresponding to these records that are in other systems.

METHODS: This was a descriptive study using two information systems on vital data and another on the hospital system, for the 26 state capitals and the Federal District of Brazil, in 2002. Initially, the maternal mortality ratios were calculated and information on declared maternal deaths were obtained. From these data, the Mortality Information System was probabilistically linked with the Live Birth Information System and the Hospital Information System, using the "Reclink II" software, with a multiple-step blocking strategy. For paired records, the diagnoses and hospital procedures brought together by the best-known criteria for severe maternal morbidity were detailed.

RESULTS: A total of 339 maternal deaths were recorded in 2002. The official and adjusted maternal mortality ratios were, respectively, 46.4 and 64.9 (deaths per 100,000 live births). By correlating with data from the live birth system, 46.5% of the maternal deaths could be located; and from the hospital information, 55.2%. The most frequent admission diagnosis was infection (13.9%) and the most frequent procedure was intensive care unit admission (39.0%).

CONCLUSIONS: There were low percentage linkages between the records from the three sources studied. However, the possible failures and/or impossibilities in the linkages indicated may separately or jointly explain these low percentages.

KEYWORDS: Mortality registries. Maternal mortality. Cause of death. Vital statistics. Information systems. Data analysis.

INTRODUCTION

Maternal mortality is difficult to measure, even in developed countries with good systems for recording vital statistics, despite the low rate of underreporting deaths. Errors in attributing the cause of death may occur, thus leading to underreporting of maternal mortality.[1,12] It is even more complicated to obtain reliable estimates in developing countries, where the vital records generally have low coverage and there are also high rates of underreporting of specific causes of death.[1]

The maternal mortality indicator that is most used today is the maternal mortality ratio (MMR), which is obtained as the quotient between the number of maternal deaths and the number of live births over a given period, multiplied by 100,000.[1] The number of live births (LB) is given by vital record systems and is used as an approximation for the number of pregnant women,[12] which ideally should be used in the denominator so that a true rate or coefficient

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can be created. The main problem in calculating the MMR is the difficulty in identifying a maternal cause as a clearly recognized and recorded cause of death, especially in places where the vital record system does not exist or is faulty.

There are various methods for estimating maternal mortality. Among these are the Reproductive Age Mortality Survey (RAMOS) and the Sisterhood method.[8] In a publication on maternal mortality estimates in 2000,[1] the adjusted MMR figures for 110 countries were presented. These were divided into five blocks relating to the quality (in decreasing order) of the data sources or the methods used for obtaining the official MMR: a vital register containing good attribution of the cause of death, poor attribution of the cause of death, the direct Sisterhood method, RAMOS, and home surveys using direct or census-based estimates.

Several international conferences have given emphasis to and proposed targets for reducing maternal mortality, with periods of some years within which to reach these targets.[17] Thus, there is a need to periodically measure maternal mortality in order to monitor it over the course of time, despite the difficulty involved in this process. Recently, interest has arisen in studying severe maternal morbidity, called "near miss" situations, although there is not yet any consensual definition regarding such events.[11,16]

In Brazil, according to the National Demographic Health Survey (PNDS) in 1996, the MMR was estimated as 160 per 100,000 LB, using the modified Sisterhood method that was adopted for the PNDS.* For the year 2000, this value was adjusted to the order of 260 per 100,000 LB.[1] These figures contrast sharply with the official MMR, which in 1998 was approximately 65 deaths per 100,000 LB.**

The Brazilian Ministry of Health makes data available from its various computerized health systems. Among these are the Mortality Information System (SIM), Live Birth Information System (SINASC) and Hospital Information System (SIH). Information from SIM is available in digital form from the year 1979 onwards, SINASC from 1991 onwards, and SIH from 1992 onwards for the compiled data and from 1994 onwards for monthly data.*** The Ministry has also, since 1997, been publishing a variety of basic indicators calculated from these different sources, in print and on the Internet. With regard to maternal mortality, the MMR is presented only for the States in the Southeastern region (not Minas Gerais), Southern region and Midwestern region (not Mato Grosso), because these States have coverage of greater than or equal to 90% for SIM and SINASC.****

In addition to the fact that these systems do not cover the whole country, the lack of complete counting and the low trustworthiness of the causes of death limit the continuous monitoring of maternal mortality.[8]

Another problem is that these routine systems do not directly communicate with each other, which makes it impossible to integrate partial information originating from each system into a single file. This limitation on integration between the different health databases has been overcome using a procedure of probabilistic linkage to identify the same subjects in these different information sources.[7] Thus, the objective of the present study was to describe the characteristics of maternal mortality according to the mortality information system, in relation to data corresponding to these records in other systems.

METHODS

This was a descriptive ecological study with a calculated sample of 6,932 LB per state capital in order to obtain the MMR. The estimated MMR considered was 65/100,000 LB, with an absolute difference of 60/100,000 LB and type I error of 5%. The sample size was recalculated because four state capitals did not reach the minimum number of live births. Thus, the smallest number of live births, which was 3,942 in Palmas (TO), implied an absolute difference of 80/100,000 LB.

The data from SIM, SINASC and SIH for the state capitals and the Federal District for 2002 were specifically obtained for this study, including information that allowed the women to be identified. SIH-2002 coming from DATASUS in Rio de Janeiro was received in 2004, while the other two were supplied in 2005, by the Department of Health Surveillance (SVS) of the Ministry of Health, in Brasília (DF).

The variables considered, in accordance with the data source, were:

- SIM: age, race/color, schooling, marital status and place where death occurred;

* Sociedade Civil Bem-Estar Familiar no Brasil, Macro International. Pesquisa Nacional sobre Demografia e Saúde - 1996. Rio de Janeiro: BEMFAM; 1997.
** Ministério da Saúde. Manual dos comitês de mortalidade materna. 2. ed. Brasília: Secretaria de Políticas de Saúde, Área Técnica de Saúde da Mulher; 2002. p.7-17
*** Fundação Nacional de Saúde/ Departamento de Informática do SUS. Diretório de bases de dados. Available at URL: <http://www.datasus.gov.br/dirbd/estrut.htm> [Accessed on May 16, 2003].
**** Rede Interagencial de Informações para a Saúde. Indicadores básicos para a saúde no Brasil: conceitos e aplicações. Brasília: Organização Pan-Americana da Saúde, 2005. Available at: http://tabnet.datasus.gov.br/cgi/idb2005/c03.htm [Accessed on Jan 17, 2007]

- SINASC: place where birth took place, number of live children, type of delivery, number of prenatal visits, child's birth weight, Apgar score and time elapsed between childbirth and mother's death (the latter using SINASC and SIM sources);

- SIH: main and secondary diagnoses, procedure requested and performed during hospitalization and total number of days spent in the intensive care unit.

From SIM, all the records of women in the age group from 10 to 49 years whose basic cause of death was in category "O" (chapter XV of ICD-10) were initially selected. Categories "O96" and "O97" were excluded: these refer, respectively, to "death due to any obstetric cause occurring between 42 days and one year after the delivery" (late) and "death due to sequelae of direct obstetric causes". From SINASC, all the records of live births were considered, while from SIH there was an initial selection of women between 10 and 49 years of age. Following this, the data from the 26 state capitals and the Federal District were separated out.

The principal fields utilized for linking the SIM and SINASC data were the mother's name and age. Other fields utilized in manual selection for confirming the match were the data of death in SIM versus the date of birth in SINASC (the date in SIM should be the same as or subsequent to the date in SINASC) and the address when available. For matching between SIM and SIH data, the principal fields were the name and date of birth and the auxiliary fields were the mother's date of death in SIM versus the date of discharge in SIH, and the age and address. It is emphasized that in the two linkages above, the principal fields were used as the references in the manual review and confirmation of true matches.

The program utilized for linkages between the systems was RECLINK II.[2] This software, which is available for free access, is divided into three sequential stages: database standardization; linkage, subdivided into blocking and matching; and combination of the files and manual review. The first of these stages only needed to be done once, while the other two were repeated in several steps, for different blocking keys, according to what was established by each investigator's subjective evaluation.

For the two linkages (SIM vs. SINASC and SIM vs. SIH), which were applied separately in each of the state capitals, strategies of blocking in multiple steps were established.[1] For the first linkage, the blocking keys were: 1) phonetic code (Soundex) for the first and last name and the initials of the middle names; 2) phonetic code for the first and last names together; 3) phonetic code for the first name; 4) phonetic code for the last name; 5) same ages; 6) date of death in SIM the same as date of birth in SINASC (this last key was applied specifically for deaths that occurred on the same date as the delivery).

For the second linkage, the differences were in steps 1 and 6. The initial blocking key related to the phonetic codes of the first and last name and also the month and year of birth. For the sixth step, dates of birth that were the same in the two systems were used. Two additional steps were applied in evaluating the complementary databases, which consisted of blocking records of individuals of male sex or whose age was outside of the reproductive age range. Through this, it was sought to avoid losing inconsistent cases that might have been typed in incorrectly.

Matches between SIM and SINASC with positive scores underwent manual review. In reviewing SIM versus SIH, for step 1 a complete check was made, while for step 2 the records with total score 5 were verified. For steps 3 to 6, the matches with scores 10 were checked. For the two additional steps, the minimum score for checking was five.

The initial statistical analysis consisted of calculating the official MMR (sources: SIM and SINASC) with the respective 95% confidence interval (95% CI),[6] and calculating the corrected MMR using adjustment factors from Laurenti et al,[9] 2004. Next, descriptive analysis was performed by means of frequency distribution tables for the variables listed previously, for all the cases of maternal death declared by SIM and, among these, those identified by SINASC (first linkage) or by SIH (second linkage). Finally, the diagnoses and procedures in SIH were described, with approximation to the group of severe maternal morbidity criteria of Mantel et al,[11] 1998 and Waterstone et al,[16] 2001. These two studies are the ones most used internationally for defining severe maternal mortality. Thus, these criteria were searched for using key words in ICD-10 (diagnoses) and in the list adopted by the Ministry of Health (procedures).

When more than one hospitalization record was found for the same person, they were evaluated manually and the reference record was the one corresponding to the date of death in SIM, or when they were not coincident, the closest one to this date. Thus, information on rehospitalization of the same woman was maintained in the same database line (record). The Epi Info 6.04d and SPSS v. 11.5 software was used.

The study was approved by the Research Ethics Committee of the School of Medical Sciences of the State University of Campinas (Report No. 147/2004) and it followed the principles enunciated in the Declaration of Helsinki. Confidentiality regarding case identification was ensured.

RESULTS

In 2002, for all the state capitals, 339 maternal deaths were recorded as the basic cause in SIM, and 730,800 LB were recorded in SINASC, thus resulting in an official MMR of 46.4/100,000 LB. The lowest and highest values for the MMR occurred respectively in Florianópolis (where there were no maternal deaths recorded) and Palmas with 126.8/100,000 LB. The capitals in the Northern region had the greatest confidence interval amplitudes, thus implying lower precision, due particularly to the small numbers of live births and small absolute number of maternal deaths. By using adjustment factors per region, adjusted MMRs were obtained. From this, the estimated total for the capitals was 64.9/100,000 LB (Table 1).

Table 1. Numbers and Proportions of Specialists who consider biomaterials to be a medicine. Federal District, 2002.

Local	MD	Live births	Official MMR	95% CI for MMR	Adjustment factor*	Adjusted MMR
State capitals in the Northern region	54	97,461	55.4	[42.0 ; 72.9]	1.08	59.8
Porto Velho	3	7,202	41.7	[10.8 ; 132.7]		45.0
Rio Branco	2	7,710	25.9	[4.5 ; 104.6]		28.0
Manaus	23	38,161	60.3	[39.1 ; 92.0]		65.1
Boa Vista	1	6,072	16.5	[0.9 ; 106.9]		17.8
Belém	13	25,795	50.4	[28.0 ; 88.7]		54.4
Macapá	7	8,579	81.6	[35.8 ; 176.2]		88.1
Palmas	5	3,942	126.8	[46.7 ; 314.2]		137.0
State capitals in the Northeastern region	101	187,146	54.0	[44.2 ; 65.9]	1.76	95.0
São Luís	14	18,317	76.4	[43.5 ; 131.7]		134.5
Teresina	5	14,498	34.5	[12.7 ; 85.5]		60.7
Fortaleza	19	39,301	48.3	[30.0 ; 77.1]		85.1
Natal	6	13,286	45.2	[18.4 ; 103.6]		79.5
João Pessoa	8	11,140	71.8	[33.4 ; 147.6]		126.4
Recife	15	24,307	61.7	[35.9 ; 104.4]		108.6
Maceió	7	16,599	42.2	[18.5 ; 91.1]		74.2
Aracaju	6	9,354	64.1	[26.1 ; 147.2]		112.9
Salvador	21	40,344	52.1	[33.1 ; 81.1]		91.6
State capitals in the Southeastern region	131	307,408	42.6	[35.8 ; 50.7]	1.35	57.5
Belo Horizonte	10	32,601	30.7	[15.6 ; 58.4]		41.4
Vitória	1	4,444	22.5	[1.2 ; 146.0]		30.4
Rio de Janeiro	52	86,949	59.8	[45.1 ; 79.1]		80.7
São Paulo	68	183,414	37.1	[29.0 ; 47.3]		50.1
State capitals in the Southern region	18	51,649	34.9	[21.3 ; 56.3]	1.83	63.8
Curitiba	7	26,371	26.5	[11.6 ; 57.3]		48.6
Florianópolis	0	5,229	0.0	[0.0 ; 91.5]		0.0
Porto Alegre	11	20,049	54.9	[28.9 ; 101.4]		100.4
State capitals in the Midwestern region	35	87,136	40.2	[28.4 ; 56.5]	1.10	44.2
Campo Grande	4	12,347	32.4	[10.4 ; 89.1]		35.6
Cuiabá	7	8,953	78.2	[34.3 ; 168.8]		86.0
Goiânia	8	20,037	39.9	[18.6 ; 82.1]		43.9
Brasília	16	45,799	34.9	[20.7 ; 58.1]		38.4
Total for all state capitals	339	730,800	46.4	[41.6 ; 51.7]	1.40	64.9

Source: Laurenti et al[9] (2004)
MD: Maternal deaths from the Mortality Information System (SIM), according to underlying cause, except for subgroups O96 and O97.
Live births: from the Live Birth Information System (SINASC).
MMR: maternal mortality ratio, per 100,00 live births

Table 2. Percentage distribution of the records of declared maternal death in the state capitals, according to certain sociodemographic variables. Brazil, 2002. N=339

Variable	N	%
Age (years)		
≤ 19	40	11.8
20 – 24	63	18.6
25 – 29	77	22.7
30 – 34	72	21.2
35 – 39	69	20.4
≥ 40	18	5.3
Race (color) [N=304 (a)]		
White	119	39.1
Black	41	13.5
Brown	143	47.0
Indigenous	1	0.3
Schooling [N=219 (b)]		
None	12	5.5
1 - 3 years	44	20.1
4 - 7 years	78	35.6
8 - 11 years	60	27.4
≥ 12 years	25	11.4
Marital status [N=313 (c)]		
Single	182	58.1
Married	101	32.3
Widowed	1	0.3
Legally separated	5	1.6
Living together	24	7.7
Place where death occurred		
Hospital	328	96.8
Public road	1	0.3
Home	6	1.8
Other	4	1.2

Source: SIM, 2002.
Percentages of missing data: (a) 10.3%; (b) 35.4%; (c) 7.7%

Table 3. Percentage distribution* of the records of declared maternal death in the state capitals that were found in the Live Birth Information System, according to variables. Brazil, 2002. N=140 (46.5% of 301 maternal deaths**)

Variable	N	%
Place where death occurred		
Hospital	139	99.3
Home	1	0.7
Number of live children [N=114 (a)]		
None	31	27.2
1	28	24.6
2	27	23.7
≥ 3	28	24.6
Type of delivery		
Vaginal	49	35.0
Cesarean	91	65.0
Number of prenatal visits [N=131 (b)]		
None	5	3.8
1 to 3	15	11.5
4 to 6	49	37.4
≥ 7	62	47.3
Birth weight (g) [N=138 (c)]		
< 1500	15	10.9
1500 – 2499	41	29.7
2500 – 3499	61	44.2
≥ 3500	21	15.2
Apgar score [N=134 (d)]		
<7 at first minute	54	40.3
<7 at fifth minute	26	19.4
Length of time between childbirth and mother's death (days) *** [N=138 (c)]		
0	31	22.5
1	18	13.0
2 to 5	26	18.8
6 to 10	26	18.8
11 to 19	14	10.1
≥ 20	23	16.7

Source: SINASC, 2002
* For the Apgar score, the percentages (<7) at the first and fifth minutes are presented
** Except for maternal deaths due to abortion: 38
*** Sources: SIM and SINASC
Percentages of missing data: (a) 18.6%; (b) 6.4%; (c) 1.4%; (d) 4.3%

Among the 339 maternal deaths recorded in SIM, 74.3% of the cases were of women aged less than 35 years, and 97% of these occurred in hospital. Among the women for whom information was available in SIM, 47% were brown-skinned and 39% were white; 61% had not more than seven years of schooling, and 58% were single. Of these three variables, schooling had the highest proportion of missing information (35%) (Table 2).

In the linkage of SIM with SINASC, it was only possible to identify 46.5% (N=140) of the 301 maternal deaths, after excluding from the total those resulting from abortion complications. Thus, the reproductive variables were described for these 140 women, of whom 99.3% delivered in hospital and 65% of these were by cesarean. Among the women for whom information was available in SINASC, approximately 52% had had not more than one live child, 47% had had more than six prenatal visits and 41% had had a baby weighing less

Table 4. Percentages of the records of declared maternal death in the state capitals that were found in the Hospital Information System,* according to problem or dysfunction, for diagnoses and procedures. Brazil, 2002. N=187 (55.2% of 339 maternal deaths)

Problem or dysfunction, or management	Diagnoses	Procedures
Approximation to the criteria of Mantel et al[11]		
Cardiac	10.7	11.8
Vascular	0.5	-
Immunological (septicemia, infection)	13.9	10.7
Respiratory	4.8	5.3
Renal	1.6	0.5
Hepatic	0.0	0.0
Metabolic	0.5	0.5
Coagulatory	0.5	0.0
Cerebral	2.1	1.1
Admission to ICU	-	39.0**
Emergency hysterectomy	-	5.9
Anesthetic accidents	0.0	-
Approximation to the criteria of Waterstone et al[16]		
Severe preeclampsia	4.3	3.2
Eclampsia	7.0	2.7
HELLP syndrome	-	-
Severe hemorrhage	5.9	2.1
Severe sepsis	13.9	10.7
Uterine rupture	0.0	-
Other criteria		
Acute abdomen	3.2	-
Obstetric death	0.5	-

Source: SIH
HELLP: severe complication of preeclampsia, characterized by Hemolysis, Elevated Liver enzymes and Low Platelets.
* Among all the hospitalizations of women aged 10 to 49 years in the Brazilian state capitals in 2002 (SIH, 2002)
** Not found among the six daily intensive care unit (ICU) procedures that are located in the field relating to the total number of days in the ICU during the hospitalization.
- Without codes relating to the problem

than 2,500g. The length of time between childbirth and the mother's death was not more than 10 days for 73% of the 138 cases recorded (Table 3).

From the SIM data, it was possible to locate in SIH 55.2% (N=187) of the 339 maternal deaths declared. Among the percentages of different types of diagnosis obtained for these 187 records, the largest was 13.9%, relating to infection problems, followed by heart problems (10.7%). Among the procedures, the greatest percentage was for admission to the intensive care unit (ICU) (39.0%), followed by heart problems (11.8%) and infections (10.7%) (Table 4). Taking the diagnoses and procedures together, 66% of the records reported at least one maternal morbid condition (data not presented as a table).

DISCUSSION

It is not always easy to recognize when the death of a woman of fertile age was due to a maternal cause. Various factors may have an influence on correct filling out of the death certificate: the medical care at the time of death, the type of service (emergency, ICU, obstetric, clinical medical), the professional who was providing the care, and the person who filled out the death certificate. Diagnosing the basic cause of maternal death becomes more difficult when the death occurs at the start of the pregnancy or during the puerperium, or if the cause of death was indirect, especially if there had not been any previous knowledge of the pregnancy.

Studies carried out in Brazil[3,15] have shown that, because of these situations, the attribution of the basic cause of death and the measurement of maternal mortality are generally underestimated. In fact, a recent publication from the World Health Organization (WHO)[18] showed the existence of underreporting of the MMR in the State of Paraná, following an investigation of these cases by the Maternal Mortality Committees.

For the official MMR to be continuously used as a valid indicator, especially for evaluating the reach of recommended targets for reducing maternal mortality,[17] it is necessary to raise the awareness of the professionals who are responsible for filling out the death certificates. They must be trained to seek detailed information and conduct better investigations on the conditions that preceded the death of women of reproductive age. This would improve the quality of the health information, with greater validity and precision of the indicators.

Another important question in obtaining MMRs is to know whether the official national data have a high coverage of vital events in the various systems that exist, because both the numerator and the denominator may be incorrect. The Brazilian Ministry of Health has only published MMRs for the states in the Southeastern, Southern and Midwestern regions (not Mato Grosso), which have a minimum coverage of 90% for the vital information systems. Thus, a large proportion of Brazilian territory does not have good coverage of vital events, despite the fact that there is no charge for obtaining a death certificate.

Because of the underreporting of deaths and of maternal causes, the validity and reliability of the official values for MMRs can be questioned. It was observed in the present study that, even though only the state capitals were analyzed, the corrected value for the MMR was

65/100,000 LB. This figure was the same as published by the Ministry of Heath in 1998, and differs from what was obtained through the PNDS in 1996 and from the WHO estimate for the year 2000.[1] These last two were, respectively, 160 and 260/100,000 LB. Thinking only in orders of magnitude, given that the populations, the reference periods and the methods were different, it can be imagined that the quality of the information has not improved substantially over the last few years.

The main focus of the present study was on testing the use of the routine health information databases as the principal source for such information. Correction of the MMRs using adjustment factors according to the region of the country[8] may lead to over estimation or underestimation in each state capital within the same region. Nonetheless, it was deemed pertinent to use these factors, since they are used by the Ministry of Health itself for making corrections to maternal mortality ratios obtained from death certificates.

In Brazil, the computerized systems for vital data (SIM and SINASC), and also the hospital data system (SIH), present inconsistent information. Considering that more than 96% of the declared maternal deaths recorded the hospital as the place where death occurred, the percentage of records found in the two linkages of the present study was unsatisfactory (SIM vs. SINASC with 46.5%, and SIM vs. SIH with 55.2%).

It can also be imagined that some maternal deaths may have occurred in private hospitals that do not have links with the Brazilian National Health System. However, it is not expected that this would be relevant for explaining the failure to locate matches between SIM and SIH.

In a publication on the probabilistic linkage of a household survey with SIH data, Coeli et al[5] found a low percentage of matching between the records from the two sources. Among the possible errors in processing the linkage, they highlighted the use of several fields instead of a single identifier (non-existent), and put forward the possibility that there had been incomplete recording of authorizations for hospitalization because of administrative problems or partial coverage of services.

With regard to the linkage between SIM and SINASC, some of the records that were not found were probably due to cases of stillbirth and ectopic pregnancy, in addition to the abortions that were initially identified. Other possible explanations would be the occurrence of delivery at home that was not recorded officially, deaths that occurred without hospitalization and possible hospitalization without issuing the corresponding document for insertion in SIH.

Despite the above explanations for possible failures and/or impossibility of matching the records, none of these alternative situations separately or in combination are able to explain why there was such a low percentage of identification of cases in the correlations between the systems. This is despite the facts that the events (maternal deaths) have relatively low prevalence and that the information was only from the state capitals, where the data is usually of better quality. It is possible that some of these records that were not found related to births or hospitalizations that occurred in 2001 and thus were lost because the analysis period was not retrospectively expanded. However, this was not done, particularly because of operational unviability.

The Brazilian experience of probabilistic linkage of databases is recent. Its starting point was the development of the Reclink software, which is now in its second version and is freely available.[2] Through this, methodological studies have been conducted with the aim of evaluating and improving the strategies utilized for correlating health databases.[4,10]

It was observed that the majority of the deaths located in SINASC occurred within the first ten days after delivery. Also, two thirds of the SIM records that were found in SIH had diagnoses and procedures relating to at least one severe maternal morbid condition, which perhaps could be explored as a predictor for maternal death. In reviews on maternal mortality and severe maternal morbidity,[13,14] it has been suggested that women who died or who suffered severe worsening of health associated with pregnancy might have similar characteristics, in accordance with some published studies.[11,16]

Future studies based on hospital records may be able to better explore the situations of maternal mortality and severe maternal morbidity. Furthermore, the topic of database linkage, which is relatively new in Brazil, gives rise to promising perspectives for exploring different health information sources in combination.

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