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External causes and maternal mortality: proposal for classification

ABSTRACT

OBJECTIVE: To analyze deaths from external causes and undefined causes in women of childbearing age occurring during pregnancy and early postpartum.

METHODS: The deaths of 399 women of childbearing age, resident in Recife, Northeastern Brazil, in the period 2004 to 2006, were studied. The survey utilized the Reproductive Age Mortality Survey method and a set of standardized questionnaires. Data sources included reports from the Institute of Legal Medicine, hospital and Family Health Strategy records and interviews with relatives of the deceased women. External causes of death during pregnancy were classified according to the circumstance of death, using the O93 code (ICD) and maternal mortality ratios before and after the classification were calculated.

RESULTS: Eighteen deaths during pregnancy were identified. The majority were aged between 20 and 29, had between 4 and 7 years of schooling, were black and single parents. Fifteen deaths were classified using the O93 code as pregnancy related death (13 for homicide – code 93.7; 2 by suicide – code 93.6) and three were classified as indirect obstetric maternal deaths (one homicide – code 93.7 and two by suicide – code 93.6). There was an average increment of 35% in the RMM after classification.

CONCLUSIONS: Deaths from undefined causes in and in early postpartumdid not occur by chance and their exclusion from the calculations of maternal mortality indicators only increases levels of underreporting.

DESCRIPTORS: Pregnant Women. Violence Against Women. External Causes. Maternal Mortality. Classification.

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INTRODUCTION

Violence against women became an object of study and intervention in the health care area from the 1990s onwards, at the same time as it secured its position internationally as a question of human rights. The main aggressor is the partner or ex-partner (more than 80%), whose intimate relationship with the victim favors the repeated occurrence of increasingly serious episodes, which characterizes domestic violence.[7,10]

The term domestic violence is often used as a synonym for violence against women, but it could be perpetrated by a man against another man, a woman against another woman, or by a man against a woman, this being the most common form of this type of violence.[21]

The magnitude of violence during pregnancy depends on the definition and investigative methods used. Studies have shown prevalence varying between 0.9% and 35% and that the violence is associated with a pattern of violence having begun before the pregnancy.[4,10,11,13,14] In the city of São Paulo, the prevalence of physical violence during pregnancy has been estimated at 8.0% and 11.0% in the Zona da Mata area of Pernambuco (PE), Northeastern Brazil.[22] According to Durand & Schraiber,[8] 20.0% of the women using public health care services in São Paulo reported having suffered some type of violence whilst pregnant. Ludermir et al[16] (2010) found a prevalence of violence (psychological, physical or sexual) of 30.7% in Recife, PE.

Pregnancy may increase women's financial and emotional dependence on their partners, exposing them to extreme situations such as homicide and suicide. The violent deaths emerge as the first revelations of everyday inequalities, discrimination and abuse.[2]

Factors related to deaths from violent causes increase the underreporting, as violence against women occurs mainly in the private sphere and usually by their partner, with other family members and friends often being unaware of its occurrence. Living in violent situations can interfere with these women's autonomy and mobility and make it impossible for them to create support networks of institutions or family and friends.[2]

The World Health Organization (WHO)[18] defines maternal death as "death of a woman during pregnancy or within a period of 42 days after having given birth, irrespective of the duration or location of the pregnancy, due to any cause related to or aggravated by pregnancy or from measures taken in relation to it, although not due to accidental or incidental causes". Thus, violent deaths occurring in the postpartum period are excluded from calculations of indicators of maternal death.

Another definition, used in the United States, references the Maternal Mortality Study Group, coordinated by the Division of Reproductive Health Center of the Center of Disease Control (CDC) and by the American College of Obstetricions and Gynecologists (ACOG). Both define death related to pregnancy as "one resulting from complications of the pregnancy itself, from a chain of events which started during pregnancy not related to the clinical condition of being pregnant or a cause unrelated to the pregnancy, but which occurred during or up to a year after the pregnancy".[6]

The contribution of external causes (accidents and violence) to maternal mortality is a topic of discussion in many countries. Studies carried out from the 1990s onwards show that many violent deaths are related to the condition of pregnancy, questioning the accidental character of their occurrence. If domestic violence was behind the death of a pregnant woman or one who had recently given birth, such deaths should be investigated and classified as maternal deaths from indirect obstetric causes.[5,9,14,23]

Although the relationship between suicide and pregnancy is a controversial topic in the literature, some authors have shown the existence of an association at the same time as they question its exclusion from the construction of maternal death indicators.[20,23] In some suicide cases, the pregnancy does not appear; in others, they represent unsuccessful attempts to abort a pregnancy which could not be legally terminated.[1]

Alves & Antunes[2] proposed adding a category to chapter XV, "Complication in pregnancy, birth and postpartum" of the 10th edition of the International Classification of Diseases (ICD-10),[18] code (O93) to admit, after investigation, deaths from external causes as deaths related to pregnancy or obstetrically indirect maternal death. This code contains the figures from O93.0 to O93.9 according to the organizational logic of the ICD-10 chapters. As it is internationally determined, code O93 cannot be included in the Mortality Information System of Ministry of Health (SIM), but it is possible to calculate indicators of maternal mortality with or without external cause at local levels.

In Brazil, there have been no studies specifically on death from external causes during pregnancy and in the postpartum period. This study aimed to analyze death from external or unknown causes in women of childbearing age, occurring during pregnancy or soon after birth.

METHODS

This is a descriptive study, part of a larger piece of research on violent deaths during pregnancy.[a]

196 homicides	95 accidents	42 suicides

399 deaths MIF (external and unidentified causes
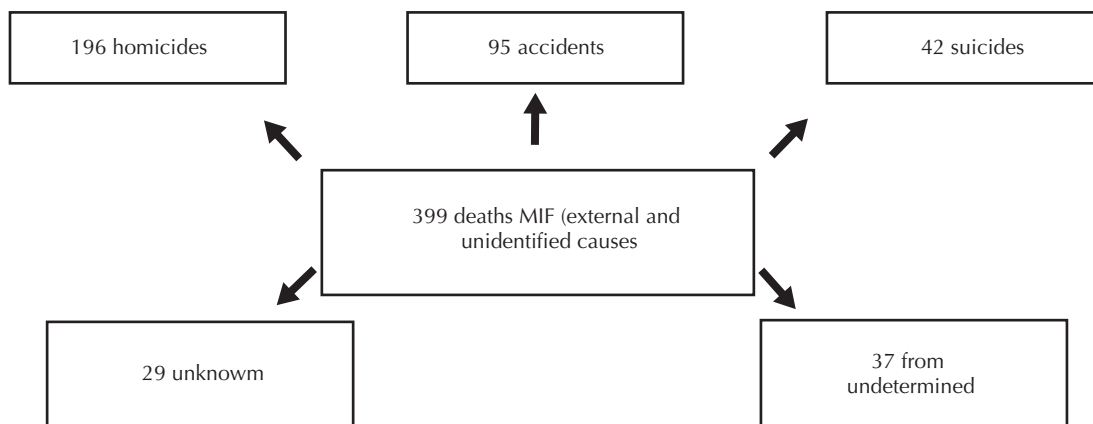
29 unknowm	37 from undetermined

Figure. Distribution of deaths of women of childbearing age (MIF) from external andunidentified causes. Recife, Northeastern Brazil, 2004-2006.

The deaths, registered by SIM, of 399 women of childbearing age, resident in Recife, recorded as being from external (chapter XX) and unknown (chapter XVIII) causes according to the CID-10, between 2004 and 2006 were investigated.

The Reproductive Age Mortality Survey (RAMOS) was used. This survey is based on the identification of maternal deaths in women of childbearing age using hospital records, autopsy reports and household interviews. Two sources of data were consulted: secondary, consisting of Institute of Legal Medicine (IML) records and Family Health Strategy records; and primary, based on interviews conducted with relatives of the deceased women and key informants.

The research made use of the death certificate of the women of childbearing age, modified by the research team and the set of records from hospital and domestic investigation standardized and currently used in the state of Pernambuco.

The women's death certificates were revised, looking for information about or indications of pregnancy in the records and autopsy reports, regardless of whether the reproductive organs had been examined. Signs of drug use were also investigated, especially Carbamate and drugs known to induce abortion.

This stage involved investigations of the women's households to identify or confirm the presence, absence or suspicion of pregnancy in the women studied. The household interviews were carried out by a specially trained team. The families and key informants signed consent forms.

Cases of confirmed pregnancy were discussed by the research team and the Technical Group of the State Committee for Maternal Mortality, including coding the cause of death, revising the identified causes. Classification of death from unidentified causes related to pregnancy and postpartum referencing the CDC and ACOG definitions.[6] The classification of indirect obstetric maternal deaths by external causes was based on the ICD-10 definition of maternal death.[18]

The code O93 was added to the classification of the deaths, disaggregated according to the circumstances of the death (accident, suicide, homicide or causes of undetermined intent) (Figure). The maternal mortality ratios were calculated before and after classification with O93 code. Data on live births during the period in question were obtained from the Live Births Information System of Ministry of Health (SINASC), in Recife, PE, and used as denominators. Ratios were calculated for before and after the investigations.

The research project was approved by the Research Ethics Committee of the *Centro de Ciências da Saúde, Universidade Federal de Pernambuco* (Protocol nº 248/2007).

RESULTS

Deaths by homicide were the highest number in all age groups, with a mean of 57.0%, except in the 40 to 49 age group, in which 36.5% of deaths were caused by accidents. Black women predominated (46.8% of homicide deaths), followed by white women. The majority of deaths caused by accident suicide and undetermined intent were women who engaged in some kind of paid work. Among those classified as homicide, the highest percentage were students (15.4%).

The majority of pregnant women whose deaths were from external causes were single. Eighteen deaths were related to the pregnancy (Table 1).

The classification of deaths from external causes and the deaths related to pregnancy/postpartum and indirect obstetric maternal death using code O93 are shown in Table 2.

Table 1. Characterization of deaths related to pregnancy from external causes after investigation. Recife, Northeastern Brazil, 2004 to 2006. (N = 18)

Variable	n	%
Year		
2004	8	44.4
2005	3	16.7
2006	7	38.9
Initial cause		
Homicide	13	72.2
Suicide	4	22.2
Unknown	1	5.6
Age group (years)		
10 to 19	6	33.3
20 to 29	10	55.6
30 to 39	2	11.1
Race/color		
White	2	11.1
Black	15	83.3
Unknown	1	5.6
Schooling (years)		
1 to 3	1	5.6
4 to 7	10	55.6
8 to 11	4	22.2
Unknown	3	16.7
Marital status		
Single	12	66.7
In a relationship	5	27.8
Unknown	1	5.6
Autopsy		
Yes	18	100.0
No	-	-
Reproductive organs examined		
Yes	10	55.6
No	5	27.8
Unknown	3	16.7

Maternal mortality ratiosbefore and after classification using code O93 can be seen in Table 3. The data in Table 4 show the variation in maternal mortality ratios by age group before and after classification using code O93. The age group ten to 19 experienced the greatest increase in the whole period, reaching a value of 200%.

DISCUSSION

This study uses a new methodological approach to classify deaths from external causes in pregnant or postpartum women.

The findings presented here reaffirm the high prevalence of homicide among young women.[17] Campero et al[5] (2006), analyzing deaths of women who had suffered violence, observed a mean age of 19.7 in women who died from external causes during pregnancy. Granja et al[12] (2002) emphasized that death by suicide among pregnant women occurred in women aged younger than 25. Similar data are seen in this study.

All of the deaths from external causes underwent an autopsy, and 55.6% included examining the reproductive organs. This confirms that often coroners (IML and the Autopsy Service) were not following guidelines to verify the reproductive organs of women of childbearing age, especially those who are killed by physical or sexual violence and suicide, as recommended in the Committee for Maternal Mortality manuals.[b]

Autopsies are shown to improve accuracy about the causes of natural deaths and the causes and circumstances of violent deaths. It is considered the gold standard of clinical diagnosis.[15,b] The "guide to removal of the body", established in Pernambuco, is an instrument established by the SIM state coordination at the beginning of the 1990s to provide clinical support to local autopsies.

Even so, among the deaths studied, in which there was analysis of the uterus and annexes, many medical examiners and "body removal" guides were not sufficient to identify the presence or absence of pregnancy.

Many families of the deceased women were not aware of the pregnancy and were only made aware of it through the IML autopsy reports during the household interviews. As the results show, the majority of death occurred early in the pregnancy, before the women or their families were aware of it. In other situations, household interviews were strategies critical to concluding the case. The death certificates contains data on the cause of death, with no references to the circumstances in which it occurred and/or other factors important in defining it.

In more than 70% of the deaths identified in the study, the women were in the first trimester of pregnancy. Granja et al[12] (2002) identified that 85% of women studied who died from external causes had a gestational age under 28 weeks. Our results confirm these findings and emphasize the contribution of deaths from external causes to maternal mortality.

Two cases of homicide involved the women's partners, one with a firearm and the other with physical aggression. Espinoza & Camacho[9] and Campero et al[5] (2006) discuss how domestic violence during pregnancy or early postpartum is part of the factors involved in

Table 2. Classification of maternal deaths after investigation, according to code O93. Recife, Northeastern Brazil, 2004 to 2006.

Age (years)	Initial cause	Motive of death	Investigation source	Final cause (post-investigation)	New classification (O93)
			Year 2004		
14	Homicide (X95.0)	Homicide by firearms by the partner, was in the 1st trimester of pregnancy	Hospital, household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
15	Homicide (X95.4)	Homicide by firearm, assaulted and thrown from a footbridge, was between 3-4 months of pregnancy	IML, household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
18	Suicide (X68.0)	Suicide by Carbamate, attempted abortion, was in the 1st trimester of pregnancy	IML, household	Indirect obstetric maternal deaths	O93.6 (X60-X84)
20	Unknown (R99.0)	Found in mangrove advanced state of putrefaction, suffered abuse by the partner, was in the 1st trimester of pregnancy	Household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
22	Homicide (X95.4)	Homicide by firearm, was in the 1st trimester of pregnancy	IML	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
23	Homicide (X95.4)	Homicide by firearm was involved with drugs, had surgical scar with stitches due to a caesarean	Household	Death due to external causes related to postpartum	O93.7 (X85-Y09)
28	Homicide (Y07.0)	Homicide due to assault by partner, was in the 9th month of pregnancy	Household	Indirect obstetric maternal deaths	O93.7 (X85-Y09)
32	Homicide (X99.4)	Homicide by bladed weapon after discussion in a bar, was in the 1st trimester of pregnancy	Household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
			Year 2005		
20	Homicide (X95.4)	Homicide by firearms by masked men, partner imprisoned, was in the 1st trimester of pregnancy	Household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
22	Homicide (X95.4)	Homicide by firearm involved with drugs, was in the 6th month of pregnancy	IML, household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
24	Homicide (X95.4)	Homicide by firearm involved with drugs, was in the 1st trimester of pregnancy	Household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
			Year 2006		
13	Suicide (X80.0)	Suicide, threw herself from the 5th floor, was in the 1st trimester of pregnancy	Others (school)	Death due to external causes related to pregnancy	O93.6 (X60-X84)
18	Homicide (X95.4)	Homicide by firearms, covering tracks, was in the 1st trimester of pregnancy	IML, household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
19	Suicide (X68.0)	Suicide by Carbamate, attempted abortion, was in the 1st trimester of pregnancy	IML, household	Indirect obstetric maternal deaths	O93.6 (X60-X84)
24	Suicide (X68.4)	Suicide by poisoning, suspected homicide by the partner, as was against pregnancy, was in the 1st trimester of pregnancy	Household	Death due to external causes related to pregnancy	O93.6 (X60-X84)
26	Homicide (X95.4)	Homicide by firearm involved with drugs, was in the 6th month of pregnancy	IML, household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)

Continue

Continuation

27	Homicide (X95.4)	Homicide by firearm because of a fight in a bar, was in the 1st trimester of pregnancy	IML	Death due to external causes related to pregnancy	O93.7 (X85-Y09)
32	Homicide (X95.4)	Homicide by firearms, covering tracks as was witness a murder, was in the 1st trimester of pregnancy	Household	Death due to external causes related to pregnancy	O93.7 (X85-Y09)

maternal mortality and how the quantity of maternal deaths which are a consequence of this type of violence are not measured.

Unplanned pregnancy may play an important role in the occurrence of violent death during pregnancy, especially by suicide.[12,20,23] In this study, two suicide cases of suicide involving Carbamate due to unwanted pregnancy were identified. From the information available, it is not possible to conclude whether the aim was to interrupt the pregnancy or to actually commit suicide.

Suicide is the last resort for women who do not have access to family planning or when abortion is illegal. An unwanted pregnancy may be the principle cause of suicide in women from less well-off social conditions, without the conditions to resolve the situation.[20,23]

A study in Pernambuco reports cases of suicide to hide unplanned pregnancy or resulting from attempts to interrupt the pregnancy and homicides committed by partners denying paternity.[1]

After the investigations in the IML and the households, three cases were re-classed as indirect obstetric maternal deaths. Not knowing the contribution of violent deaths to maternal mortality is due to the belief, wrongly held, that these deaths occurred by chance and do not take into account the history of violence before and during the pregnancy, mental illness and unintended pregnancy behave as comorbidities.[5,9,12] If the domestic violence were responsible for the deaths

of women who are pregnant or postpartum, such deaths should be investigated and classified as indirect obstetric maternal deaths.

Firearms were involved in more than 60% of the homicides. Of these, four were due to involvement with illegal drugs and were committed by the partner. Links were found between violence and drug abuse, and the victims of violence were more likely to smoke, drink alcohol and use drugs before and during the pregnancy.[3,19]

Granja et al[12] (2002) showed that homicide was the most common cause of deaths classified as maternal deaths, 37% of cases. In this study, more than 70% of the deaths were due to homicide.

Some homicide cases, such as the deaths of a 27 year old and a 32 year old woman in 2006 (Table 2), in spite of appearing coincidental, were classed as death by external cause related to pregnancy. Studies[5,9,14,23] show that the causal link between violent death and pregnancy/postpartum is not easily identified in investigations. In this study, it was decided to classify them as related to pregnancy.

Despite the majority of deaths being classified as from external causes, it was verified that one death by an unidentified cause was, in fact, a violent death during pregnancy. After the final classification of the deaths according to code O93, four death were classified as O93.6 (death by suicide related to and/or maternal) and 14 as O93.7 (death by homicide related to and/ or maternal).

No accidental death was classified as death related to and/or maternal as, in this study, no accidental deaths during pregnancy or postpartum were identified.

Using deaths which had been reported to SIM, incorporated the main limitations of the study, which are under reporting and incomplete documentation, although the good coverage and decreasing percentages of deaths by unidentified causes in Recife should be born in mind.[c]

Some variables remained unknown, even after the household interviews. Many families felt coerced,

Table 3. Maternal Mortality Ratios (100,000 live births) before and after classification (Indirect obstetric maternal deaths and from external causes related to pregnancy) using code O93. Recife, Northeastern Brazil, 2004 to 2006.

Years	MMR		
	Classification[a]	Reclassified O93	Increase (%)
2004	91.7	126.6	38.1
2005	43.1	56.0	30.0
2006	79.5	110.4	38.9
Total	71.3	97.4	36.7

[a] ICD-10 (1993)
MMR: Maternal Mortality Ratios

[c] Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Ações Programáticas Estratégicas. Manual dos comitês de mortalidade materna. 3.ed. Brasília (DF); 2007. (Série A. Normas e Manuais Técnicos).

Table 4. Maternal Mortality Ratios (100,000 live births) before and after classification (Indirect obstetric maternal deaths and from external causes related to pregnancy) using code O93, according to age group. Recife, Northeastern Brazil, 2004 to 2006.

Age group (year)	Before	After	Variation (%)	Ratio
10 to 19	21.0	63.0	200.0	3.0
20 to 29	67.1	94.0	40.0	1.4
30 to 39	112.1	124.6	11.1	1.1
40 to 49	257.9	–	–	–

scared of dealers or reprisals due to connections with drugs or feared to draw attention to the violent situations in which they found themselves. Many had experienced family breakdown, and even had to move away. To this should be added the natural bias of people's memories, especially as the interviews took place four years after the death occurred.

There are no Brazilian studies which approach this topic with which to make comparisons. However, the indicators proved to be underestimated, as after calculating the new MMRs a variation of around 35.0% in each year studied was found.

To use the O93 code, it is critical that exhaustive investigations are carried out in the IML, the hospitals and the household. Only then can a causal link between death from external causes and pregnancy be made. Changes in the practices of IML professionals are needed, as 16.7% had information on the verification of the reproductive organs missing or (27.8%) this procedure was simply not carried out.

Although deaths classified as O93 cannot be included in the country's official mortality statistics, its use in studies/estimates is important until the 11th revision of the International Classification of Diseases (ICD -11) takes place. Moreover, the argument that these deaths did not happen by chance and that other factors such as domestic violence, unwanted pregnancy and the criminalization of abortion is reinforced and are part of the context.

The national coordination of the SIM is working to create a special method of codifying and to include code O93 in the next revisions of the program (Report nº 1 – Part II – Principal Notifications of version 3.2 of SIM and SINASC, 2010:1). The scarcity of national publications with similar methodology increases the need for further investigations and research.

It is hoped that this study helps to bring about a new form of reclassifying deaths from external causes, using a standardized alternative classification and decreasing levels of under reporting of maternal deaths.

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