

## Factors associated with death in women with intimate partner violence notification in Brazil

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**Abstract** *Intimate partner violence (IPV) is a social and public health concern. This article aims to identify factors associated with death in women with IPV notification. This is a case-control study based on the record-linkage of the Mortality Information System (SIM), from 2011 to September/2017, and the Notifiable Diseases Information System (SINAN), 2011 to 2016. The “case” group consisted of women aged 15 to 59 years old with notification of violence on SINAN, whose author was current or former intimate partner and died by any cause registered on SIM. The “control” group consisted of women 15-59 years old, living in the same municipality of the cases and victim of IPV registered on SINAN, but without a death record on SIM. Multiple logistic regression was used to estimate the odds ratio of death. 151,826 Brazilian women were victim of IPV and were notified by SINAN, and 2,538 died. The main cause of death was homicide. The following characteristics conferred a greater chance of death: having race/skin-color black or yellow; having disabilities; living in rural area; physical violence, torture and multiple types combined; violence perpetrated by a firearm, a sharp object and multiple means combined.*

**Key words** *Intimate partner violence, Gender-based violence, Public health surveillance, Epidemiological monitoring*

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## Introduction

Rosa, Maria, Angelica, they, us. Intimate partner violence (IPV) is an experience that cuts across women's history, either because we have already experienced it or because we have a situation in the family, among friends or acquaintances. From the struggles of feminist movements, in defense of women's rights, the subject has gained space in laws, political agendas, news and in our daily lives.

This problem has a global scale and the importance of addressing it has been realized with specific indicators in Agenda 2030<sup>1</sup>, where the 193 Member States of the United Nations have committed themselves to achieving the goals related to gender equity. A systematic review study with articles from 1990 to 2011, from different countries and continents, showed that 38.6% of all homicides against women were perpetrated by intimate partners<sup>2</sup>. Considering that these femicides are not an isolated fact in women's lives, but represent the end point in a sequence of violence and abuse, it can be inferred that between the deaths and the experiences of IPV, there is a large iceberg to be unveiled. In Brazil, a study with a representative sample of the city of São Paulo and 15 municipalities in the *Zona da Mata* (*Zona da Mata* is the narrow coastal plain between the Atlantic Ocean and the dry *agreste* and *sertão* regions in the northeastern Brazilian states of Maranhão, Piauí, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahia) of Pernambuco identified a prevalence, at least once in their lives, of more than 41% of psychological violence and more than 27% of IPV among women<sup>3</sup>.

IPV is also a public health problem, as physical, psychological, sexual abuse and neglect resulting from these assaults appear as main demands and in diffuse complaints in the sector's service. Moreover, health is a fundamental component for comprehensive care, whether through the recovery of physical and psychological status, or through referrals that are necessary to other bodies responsible for guaranteeing women's rights.

In order to expand the possibilities of diagnosis and monitoring of these events, in 2006, the Ministry of Health created the Brazilian National Violence and Accident Monitoring System (VIVA - *Sistema Nacional de Vigilância de Violência e Acidentes*), whose continuous component provides for compulsory notification of interpersonal and self-inflicted violence in public and private

services across the country as of 2011<sup>4,5</sup>. This notification is intended to give visibility to the problem, act as a care instrument and promote integrated action among the service network organizations for women in situations of violence.

Therefore, it is necessary to understand: what happens to women after notification? Do they stay alive or die? What are the main basic causes of death? What are the factors associated with death?

A death certificate is an instrument for standardized collection of data on mortality and does not contain information about the offender's sex and the type of relationship with the victim. However, it is possible to retell part of women's history from crossing violence and death notification records.

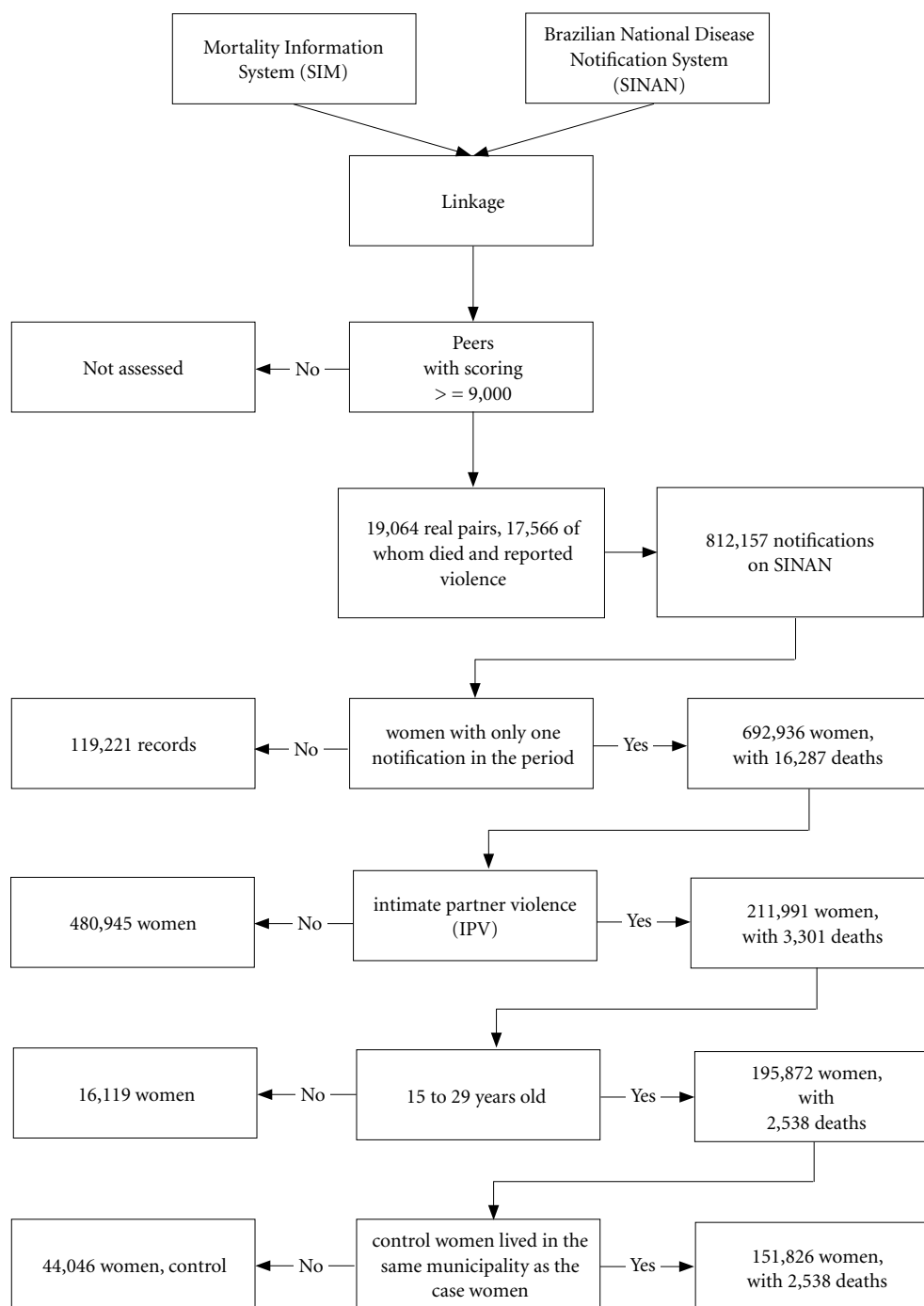
Given this situation, it is proposed to explore the factors associated with death in women with notification of violence by an intimate partner. This is intended to identify the variables that may signal higher risk scenarios and generate alerts to prevent premature and preventable deaths.

## Methods

This is a case-control study carried out based on the relationship between the Mortality Information System (SIM - *Sistema de Informação sobre Mortalidade*), with 3,492,636 female death records, of all ages, from 2011 to September/2017; and the Notifiable Diseases Information System (SINAN - *Sistema de Informação de Agravos de Notificação*), with 812,157 notifications of interpersonal and self-harm in women of all ages, from 2011 to 2016.

The relationship between SIM and SINAN databases was conducted by the Ministry of Health<sup>6</sup>, using the Bloom Filters technique and the following pairing variables: "patient's name", "date of birth" and "municipality of residence". Pairs with scores equal to 10,000 (maximum value) were considered true; those with scores between 9,000 and 9,999 underwent manual assessment, in which the "mother's name" variable was also used for analysis<sup>6</sup>. As a result, 19,604 pairs were identified as true, which represented 17,566 women with notification of violence who died in the assessed period (Figure 1).

It was also necessary to assess in SINAN the presence of women with one or more notifications in the period. To this end, an analysis was carried out, also conducted by the Ministry of Health, using the Bloom Filters technique. In this



**Figure 1.** Flowchart of the relationship between the Mortality Information System, from 2011 to September/2017, and the Notifiable Diseases Information System, from 2011 to 2016, Brazil.

Source: Mortality Information System (SIM) and Notifiable Diseases Information System (SINAN), Ministry of Health.

new stage, SINAN records were grouped based on “patient’s name”, “date of birth”, “municipality of residence” and “mother’s name” variables, seeking to identify pairs or groups of similar women. Groups with scores less than 9,000 represented 692,936 records (85.3% of notifications) and were considered unique, i.e., they represented women with a notification in the period. The other 119,221 records with a score greater than or equal to 9,000 were listed in pairs or groups that could represent the same woman. However, these records have not been assessed (Figure 1).

Therefore, this study considered as a starting point 692,936 women with a report of violence in the assessed period. It is noteworthy that the variables analyzed came from SINAN, except for the basic cause of death, originating from SIM. Records were selected with the following bonds/degree of kinship between offenders and people served: “spouse”, “ex-spouse”, “boyfriend” and “ex-boyfriend”; cases with similar links to these four categories were also included in the “other” open field of this variable. Notifications with self-inflicted violence or information about attempted suicide or self-harm in the “Type of violence - Others” open field were excluded. Finally, to promote greater similarity between case and control groups, only young and adult women aged 15 to 59 years and those residing in the 1,104 municipalities where the cases resided when the notification was registered were selected (Figure 1).

The case group was composed of women aged 15 to 59 years old with notification of violence on SINAN, whose author was current or former intimate partner, and who died due to any basic cause registered on SIM. The control group consisted of women of the same age group, IPV notification on SINAN and the same municipality of residence of the cases, but with no death record on SIM in the assessed period (Figure 1).

The basic causes of death were described according to the International Classification of Diseases-10<sup>th</sup> Edition (ICD-10); were organized into groups of causes, which are available for access on the electronic tab of SUS Department of Informatics<sup>7,8</sup>.

In the violence notification form on SINAN, in “Type of violence” and “Means of aggression” variables, it is possible to tick more than one option, resulting in several possibilities of combinations. Therefore, it was necessary to propose a new organization of the variables, in order to ensure that each woman was identified with a single category. As a criterion for the creation of these

new variables, the frequency of categories and hierarchies of importance were considered based on the repercussions on health, as shown below.

The found combinations of types of violence were arranged in: psychological (only this type); physical (only that type); psychological and physical (only these two types); sexual (only that type or all combinations in which it is present); torture (only that type or all combinations in which it is present, except combinations of the previous category); financial (only this type or all combinations in which it is present, except for combinations of the two previous categories); others (only this type or all other possible categories or their intersections, except combinations of the previous three categories); ignored (when no category of type of violence was identified).

For the “means of aggression” variable, the new categories resulted in: “threat” (only this means); “Physical strength” (only this means); “Threat and physical strength” (only these two means); “Firearm” (only this medium and all combinations in which it is present); “sharp objects” (only this medium or all combinations in which it is present, except combinations of the previous category); “hanging” (only this means or all combinations in which it is present, except for combinations of the two previous categories); “Blunt object” (only this medium or all combinations in which it is present, except for combinations of the previous three categories); “others” (only this medium or all other possible categories or their intersections, except combinations of the previous four categories); ignored (when no category of means of aggression was identified).

A descriptive analysis of 12 categorical variables in the notification form was carried out, according to the outcome (not death; and death): age group; pregnant; race/color; educational level; marital situation; disability; area of residence; size of municipality of residence, according to the number of inhabitants; place of occurrence; chronic violence (if it occurred more than once); type of violence; means of aggression. The “missing” category was included in the “ignored” category for each variable. The chi-square test ( $X^2$ ) was also performed to compare the proportions between the two assessed groups.

As in this universe the case group (2,538 women) has a proportionally small number in relation to the control group (149,288 women), cross-validation<sup>9</sup> was used by generating training samples and testing to build the model, in the proportion of two control group individuals for each case, in order to find the model robust and

capable of generalization to avoid model overfitting. Ten training samples and the respective 10 test samples, representative of the universe, were generated at random.

Logistic regression analysis was performed for each training sample, with the 12 independent variables related to violence notification on SINAN, in order to estimate the odds ratio of death. The stepwise method was used to select the variables of the final model. Multicollinearity was assessed using the variance inflation factor (VIF) test, and model adjustment using the Hosmer and Lemeshow test. The final model of each training sample was applied to the respective test sample.

The training sample that showed the greatest balance between specificity, sensitivity and accuracy, in comparison with the test sample, was used to estimate the odds ratios between exposed and unexposed groups, according to the death and non-death outcomes. All analyzes were conducted using the R Studio<sup>10</sup> software.

This study is part of a project entitled “*Como morrem as mulheres com notificação de violência por parceiro íntimo no Brasil?*”, approved by the Research Ethics Committee of the Federal University of Minas Gerais.

## Results

Among the 692,936 women with a notification of interpersonal or self-harm, 16,287 (2.4%) died from various causes between January 2011 and September 2017. This fact represented the death of more than six women with a report of violence every day in Brazil, during the assessed period. From this universe, IPV notifications (211,991) were selected; women between 15 and 59 years old (195,872); and the municipalities of residence of women who died. Therefore, this study worked with 151,826 women, being 149,288 from the control group and 2,538 from the case group (Figure 1).

The ten main groups of basic causes of death for women were: “Aggressions”, totaling 1,030 deaths (40.6%); “Malignant neoplasms”, with 196 deaths (7.7%); “Human immunodeficiency virus (HIV) disease”, with 125 deaths (4.9%); “Transport accidents”, with 110 deaths (4.3%); “Cerebrovascular diseases”, with 96 deaths (3.8%); “Ill-defined and unknown causes of mortality”, with 89 deaths (3.5%); “Ischemic heart disease”, with 84 deaths (3.3%); “Liver disease”, with 78 deaths (3.1%); “Events (facts) whose intention

is undetermined”, with 76 deaths (3.0%); “Other external causes of accidental injuries”, with 64 deaths (2.5%).

The comparison of the distribution of characteristics related to women and events in the notification form shows particular characteristics of the group that died within a maximum period of 6.9 years after notification: 25.97% of young people between 15 and 29 years old; 46.70% were black women, considering black and brown; and 8.67% were women with disabilities (Table 1). In the group with “death” outcome, the percentage of women with lower educational level was higher (Table 1).

Assessing the municipalities and areas of residence at the time of notification showed the greatest vulnerability of women who lived in rural and periurban areas and in small municipalities (<50,000 inhabitants), totaling 11.58% and 36.96% of deaths, respectively (Table 1).

In the analysis of variables related to the reported violence, the following characteristics stand out in the group whose outcome was death: the main place where violence occurred was at home (74.78%); physical violence predominated in 57.21% of cases; and the expressive percentage of aggressions perpetrated with sharp objects (23.84%) and firearms (10.68%). Chronic violence was observed in 45.43% of women with death, however, this variable had more than 25% of ignored cases (Table 1).

The training sample selected to represent the universe showed 72% sensitivity, 71% specificity and 72% accuracy. In this training sample, the multiple logistic regression model presented the following significant variables, at the significance level of 0.05: age group (30 to 44; 45 to 59); pregnant (yes); race/color (black and yellow); educational level (high school and higher education - complete or incomplete); disability (yes); area of residence (rural); size of municipality of residence (all categories); place where violence occurred (residence and ignored); chronic violence (ignored); type of violence (physical, sexual, torture and others) and means of aggression (firearm, sharp object, blunt object and other means) (Table 2).

According to this model, it is observed that women in older age groups (30 to 44; and 45 to 59 years) have a lower chance of death compared to young women (15 to 29 years). Pregnant women at the time of notification of violence were less likely to die compared to non-pregnant women. This unexpected result may be related to the high proportion of ignored cases in this vari-

**Table 1.** Percentage distribution of the characteristics of women with notification of violence by an intimate partner and of registered violence according to death and non-death, Brazil, 2011 to 2016.

Characteristics	Non-death	Death	X <sup>2</sup> test p value	Characteristics	Non-death	Death	X <sup>2</sup> test p value
	N=149,288	N=2,538			N=149,288	N=2,538	
Age group (years)				Size of municipality of residence			
15 to 29	12.44	25.97	<0.01	<10,000	1.60	9.26	<0.01
30 to 44 years	41.94	42.91		≥10,000 and <50,000	14.14	27.70	
45 to 59	45.62	31.13		≥50,000 and <100,000	13.93	14.34	
Pregnant women				≥100,000 and <500,000	38.57	29.47	
No	64.62	68.60	<0.01	500,000	31.76	19.23	
Yes	6.50	4.49		Place of occurrence			
Ignored	28.88	26.91		Public highway, bar or commerce/services	12.91	15.56	0.01
Race/color				Domicile	77.89	74.78	
White	43.46	41.57	<0.01	Others <sup>2</sup>	3.45	4.49	
Black	9.72	11.82		Ignored	5.76	5.16	
Yellow	0.66	1.10		Chronic violence			
Brown	33.73	34.87		No	25.17	29.20	<0.01
Indigenous	0.57	0.59		Yes	57.38	45.43	
Ignored	11.86	10.05		Ignored	17.45	25.37	
Educational level				Types of violence			
Illiterate	0.83	2.88	<0.01	Psychology	12.40	4.89	<0.01
Elementary school <sup>1</sup>	33.29	40.50		Physical	44.15	57.21	
High school <sup>1</sup>	28.32	17.02		Physical+psychological	31.52	21.75	
Higher education <sup>1</sup>	6.02	2.40		Sexual <sup>3</sup>	4.25	3.86	
Ignored	31.53	37.19		Torture <sup>3</sup>	3.63	7.09	
Marital status				Financial <sup>3</sup>	2.68	1.34	
Single	30.34	26.32	<0.01	Others <sup>3</sup>	0.88	2.76	
Married	51.09	53.19		Ignored	0.48	1.10	
Separated	9.82	10.91		Means of aggression			
Widowed	0.62	1.58		Threat	11.27	4.85	<0.01
Ignored	8.13	8.00	Strength	44.33	31.05		
Disability			Strength+threat	13.83	7.88		
No	82.74	75.37	Firearm <sup>3</sup>	1.16	10.68		
Yes	3.13	8.67	Sharp objects <sup>3</sup>	7.66	23.84		
Ignored	14.13	15.96	Hanging <sup>3</sup>	6.40	5.20		
Area of residence				Blunt object <sup>3</sup>	3.97	5.28	
Urban	91.72	85.70	<0.01	Other means <sup>3</sup>	6.52	7.09	
Rural or periurban	5.40	11.58		Ignored	4.87	4.14	
Ignored	2.89	2.72					

Notes: <sup>1</sup>Complete or incomplete education; <sup>2</sup>Includes the categories: collective housing, school, sports venue, industry/construction and other; <sup>3</sup>Includes all possibilities of combining with other categories of this variable, except with the categories that precede it.

Source: Information System for Notifiable Diseases (SINAN), Ministry of Health.

able. Black and yellow women were 1.29 times and 3.76 times more likely to die, respectively, compared to white women. The presence of secondary or higher education, complete or incomplete, represented a protection for women in a situation of IPV. The presence of disability was

considered a risk factor for women, as they were 2.19 times more likely to die compared to those without disability. Women who lived in rural or periurban areas at the time of violence notification on SINAN had a 1.42 times higher chance of death compared with those living in urban ar-

**Table 2.** Final multiple logistic regression model, based on the selected training sample. Brazil, 2011 to 2016.

Characteristics	$\beta$	Standard error	P value	Odds Ratio	Lower limit (95%CI)	Upper limit (95%CI)
Age group (years)						
15 to 29	1.00			1,00		
30 to 44	-0.85	0.09	<0.01	0.43	0.25	0.61
45 to 59	-1.28	0.10	<0.01	0.28	0.09	0.47
Pregnant women						
No	1.00			1,00		
Yes	-0.45	0.16	<0.01	0.64	0.33	0.95
Race/color						
White	1.00			1,00		
Black	0.25	0.12	0.03	1.29	1.06	1.52
Yellow	1.32	0.36	<0.01	3.76	3.06	4.46
Educational level						
Illiterate	1.00			1,00		
High school <sup>1</sup>	-0.82	0.26	<0.01	0.44	-0.08	0.96
Higher education <sup>1</sup>	-1.53	0.32	<0.01	0.22	-0.4	0.84
Disability						
No	1.00			1,00		
Yes	0.78	0.14	<0.01	2.19	1.91	2.47
Place of occurrence						
Public highway, bar or commerce/ services	1.00			1,00		
Domicile	-0.35	0.10	<0.01	0.71	0.51	0.9
Ignored	-0.58	0.18	<0.01	0.56	0.21	0.91
Chronic violence						
No	1.00			1,00		
Ignored	0.36	0.11	<0.01	1.43	1.22	1.64
Types of violence						
Psychological	1.00			1,00		
Physical	0.90	0.19	<0.01	2.45	2.09	2.82
Physical+psychological	0.37	0.19	0.05	1.44	1.07	1.81
Sexual <sup>2</sup>	0.77	0.23	<0.01	2.16	1.71	2.61
Torture <sup>2</sup>	1.20	0.23	<0.01	3.33	2.87	3.78
Others <sup>2</sup>	1.64	0.30	<0.01	5.19	4.56	5.75
Means of aggression						
Threat	1.00			1,00		
Firearm <sup>2</sup>	2.53	0.26	<0.01	12.52	12.02	13.03
Sharp objects <sup>2</sup>	1.14	0.20	<0.01	3.14	2.74	3.53
Blunt object <sup>2</sup>	0.54	0.23	0.02	1.71	1.25	2.16
Other means <sup>2</sup>	0.75	0.19	<0.01	2.12	1.74	2.5
Area of residence						
Urban	1.00			1,00		
Rural or periurban	0.35	0.13	0.01	1.42	1.17	1.67
Size of municipality of residence						
<10,000	1.00			1,00		
≥10,000 and <50,000	-1.06	0.19	<0.01	0.35	-0.02	0.72
≥50,000 and <100,000	-1.61	0.20	<0.01	0.2	-0.18	0.58
≥100,000 and <500,000	-1.73	0.19	<0.01	0.18	-0.19	0.54
500,000	-1.92	0.19	<0.01	0.15	-0.23	0.52

Notes: <sup>1</sup>Complete or incomplete education; <sup>2</sup>Includes all possibilities of combining with other categories of this variable, except with the categories that precede it.

Source: Information System for Notifiable Diseases (SINAN), Ministry of Health.

as. In line with the previous result, the larger the size of municipality of residence, the greater the protection of women with respect to death, compared to those who lived in municipalities with up to 10,000 inhabitants. The occurrence of violence at home and in places ignored by the professionals who filled out the notification form, appear as protective factors for death in comparison to the violence that occurred in public places such as public highway, bars or commerce/services. In cases where the chronic character of IPV was ignored, the chance of death for women was 1.43 times greater. With regard to types of violence, the presence of physical violence “only” and all combinations identified were considered a risk factor for death, in comparison with the psychological violence “only”. The factor associated with a higher risk of death for women was the use of a firearm, with a 12.52 times greater chance of death compared to women whose violence was perpetrated through threats. Other risk factors for death were sharp, blunt objects and combination of other means (Table 2).

## Discussion

Rosa, Maria and Angélica are eighteenth century women who lived in the state of São Paulo, and had their stories revealed by Mary del Priore<sup>11</sup>. Situations of threat, physical, psychological and neglect perpetrated by their partners, against them and their children, show how gender-based violence has deep roots in the constitution of our society.

Currently, there are other ways of revealing these stories: through the media, service network records, such as police reports and reports of violence in health, and death certificates. Health sector data are essential to identify women at risk of intimate femicide<sup>12</sup>. Moreover, there are legal instruments, such as the *Maria da Penha* Law, to combat, punish and offer protection to women in situations of violence. However, the occurrence of intimate femicide, a crime committed against women whose offenders had or have an intimate, affectionate or sexual relationship<sup>13</sup>, is a sign of failure of public, private institutions and society in violence prevention, protection of women and in guaranteeing their rights.

This article presented a portrait of more than 151 thousand Brazilian women who had their IPV cases registered by health units on SINAN. Despite the fact that the public authorities are aware of all situation of vulnerability to which

they were subjected, 2,538 women died within 6.9 years after notification. The main cause of death was homicide, which suggests a possible occurrence of intimate femicide, especially because literature points to their intimate partners as the main authors of the femicides<sup>2,14</sup>. In this field of study, we work with this type of estimate because the information about the bond/degree of kinship of the offenders is not present in the death certificate; investigations are needed to understand the circumstances and context of the crime<sup>13</sup>.

Some chronic non-communicable diseases and infection by the HIV virus were among the most prevalent causes, denoting possible impacts of IPV in chronic condition care. The study by the Ministry of Health that used this same database demonstrated a higher mortality rate for chronic non-communicable diseases in women with notification of violence registered on SINAN<sup>6</sup>. In fact, the negative effect of violence against women in health care that requires continuous monitoring is recognized, and is even a risk factor for inadequate screening for cervical cancer<sup>15</sup>. Literature has also shown that, in addition to physical injuries, IPV has been linked to a higher risk of transmission of sexually transmitted infections, including HIV, and effects on mental health, such as loss of self-esteem, anxiety, depression and post-traumatic stress syndrome<sup>16</sup>.

In general, at the time of notification, the following characteristics were associated with death: having black and yellow race/color; having disabilities; living in a rural area; living in a small municipality (<10,000 inhabitants); being in a situation of physical violence, torture and multiple types combined; violence being perpetrated by a firearm, sharp objects and multiple means combined.

The experience of IPV often begins in adolescence or youth and cuts across different social classes<sup>17</sup>. In the experience of staying and dating that women face gender patterns in affective and sexual relationships, which can generate conflicts and aggressions of different types. A study on notifications of violence against women from 2011 to 2017 found that 41.3% of the violence recorded in adolescents aged 15 to 19 years were perpetrated by intimate partners<sup>18</sup>, showing a very high frequency of this problem in such a young population, under construction of their identity and often without financial autonomy.

In the case of race/color, structural racism and inequities in access to health services and guarantee of rights may be related to the greater



chance of black women having the outcome of death in relation to white women. The data presented in this study showed that pregnant women at the time of notification were less likely to die, i.e., pregnancy appeared as a protective factor for death. However, this result may have been impacted by the completeness problems of this variable. Therefore, a specific study is needed to assess the relationship between IPV in pregnancy and the outcome of death. In any case, it is known that violence during pregnancy has repercussions on women's access to health services, prenatal and postpartum follow-up, as well as having negative consequences on the baby's health<sup>19,20</sup>.

Higher education was a protective factor for the occurrence of death after notification of IPV. This fact reveals the importance of access to education for girls and women who are better able to identify the violence suffered and seek specialized services that can support them. Additionally, greater education promotes women's financial autonomy and, consequently, facilitates the break with abusive relationships.

Women with disabilities who had reported IPV were more likely to die, which reveals situations of vulnerabilities that add up. In the future, it is necessary to explore the different disabilities and their associations with this outcome.

Residence in rural areas appeared as a factor associated with death. Possibly women who live in rural areas have greater difficulty in accessing health services and the network of services that assist women in situations of violence. Furthermore, the distance from neighbors, the lower demographic density as well as patriarchal cultural and social patterns favor the invisibility of the problem in the community.

In the same sense, living in municipalities with a larger population was associated with protection in relation to death. It can be inferred that in municipalities with a larger population it is expected to have reference services in the fields of health, social assistance, and public safety. This situation can favor access to the service network and civil society in order to seek care, protection and even shelter in cases of risk of death.

More than 74% of the violence in both groups (death and non-death) occurred at home, revealing how the domestic environment can represent a risk for women. Despite this fact, women with IPV notification at home seem to be more protected from death than those with IPV notification in public places. This may be due to the fact that the public exposure of aggressions reveals a more serious and chronic stage of violence.

Despite the study working only with women with a notification in the assessed period, the variable on the SINAN notification form referring to "chronic violence" pointed out that this problem occurred repeatedly in most cases, showing that it is necessary and urgent to develop concrete and effective actions to prevent these announced deaths.

Physical violence and the presence of different types of violence combined in the same episode were shown to be risk factors for death. In fact, another study in Brazilian municipalities identified that the most serious violence is related to the overlap of various types of violence<sup>3</sup>.

Likewise, the use of firearms, sharp objects and combination of other means were associated with a higher risk of death. Therefore, in the police approach to women in situations of IPV, it is essential to know whether the offenders have access to firearms and to activate the mechanisms necessary for compliance with the law that determines the immediate seizure of firearms under their possession<sup>21</sup>.

The limitations related to SINAN and the selections used for the clipping of this article stood out. In relation to SINAN, it is known that there is underreporting of IPV cases, either due to the difficulty of identifying cases in the visits or due to non-registration of violence. In addition, some variables on SINAN such as "educational level", "pregnant woman" and "chronic violence" showed low completeness, which may interfere with the results and hide situations of vulnerability. It is important to note that the 2015 and 2016 SINAN were preliminary as well as the 2017 SIM. Therefore, on SINAN there could be duplicities that had not been assessed by the Ministry of Health in consolidating the national database, as done with the databases of previous years. This fact influenced the choice to work only with women with a notification in the period, added to the fact that the researchers did not have access to the nominal databases for evaluating peers or groups of women. Finally, the regression model applied to the training sample had a sensitivity of 72%, and future analyzes may find samples with better performance, which also depends on improving SINAN data quality.

### Final considerations

This study showed that the relationship between the SIM and SINAN databases is essential to understand the impact of IPV on women's lives. It is

suggested that this type of relationship be made periodically and that it includes other databases or even other SINAN problems. Other activities that are necessary are improvement in the health data quality and professional training for humanized care and proper registration of cases.

The definition of better statistical models to explain the problem and even the prediction can contribute to the performance of health surveillance together with the intersectoral network to combat violence against women. It is observed that the health sector is aware of the cases and can develop alerts for the service network, in order to prevent announced and preventable deaths.

### **Collaborations**

IV Pinto worked on the design, methodology, results, writing and final review. RTI Bernal worked on the methodology, results and final review. MFM Souza worked on the design, methodology and final review. DC Malta worked on the design, methodology, results and final review.

## References

- Instituto Brasileiro de Geografia e Estatística (IBGE). *Objetivos de Desenvolvimento Sustentável* [Internet]. [acessado 20 Jan 2020]. Disponível em: <https://ods.ibge.gov.br/>
- Stöckl H, Devries K, Rotstein A, Abrahams N, Campbell J, Watts C, Moreno CG. The global prevalence of intimate partner homicide: a systematic review. *Lancet* 2013; 382(9895):859-865.
- Schraiber LB, D'Oliveira AFPL, França-Junior I, Diniz S, Portella AP, Luderimir AB, Valença O, Couto MT. Prevalência da violência contra a mulher por parceiro íntimo em regiões do Brasil. *Rev Saúde Pública* 2007; 41(5):797-807.
- Minayo MCS, Souza ER, Silva MMA, Assis SG. Institucionalização do tema da violência no SUS: avanços e desafios. *Cien Saude Colet* 2018; 23(6):2007-2016.
- Silva MMA, Mascarenhas MDM, Lima CM, Malta DC, Monteiro RA, Freitas MG, Melo ACM, Bahia CA, Bernal RTI. Perfil do inquérito de violências e acidentes em serviços sentinela de urgência e emergência. *Epidemiol Serv Saude* 2017; 26(1):183-194.
- Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. *Saúde Brasil 2018 uma análise de situação de saúde e das doenças e agravos crônicos: desafios e perspectivas*. Brasília: MS; 2019.
- Brasil. Ministério da Saúde (MS). *Departamento de Informática do SUS. CID-10* [Internet]. [acessado 2019 Set 3]. Disponível em: <http://datasus1.saude.gov.br/sistemas-e-aplicativos/cadastros-nacionais/cid-10>
- Brasil. Ministério da Saúde (MS). *Departamento de Informática do SUS* [Internet]. [acessado 2020 Jun 1]. Disponível em <http://tabnet.datasus.gov.br/cgi/def-tohtm.exe?sim/cnv/obt10uf.def>
- Santos HG. *Comparação da performance de algoritmos de machine learning para análise preditiva em saúde pública e medicina* [tese]. São Paulo: Universidade de São Paulo; 2018.
- R Core Team. *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing; 2020.
- Del Priore M. *Ao sul do corpo: condição feminina, maternidade e mentalidades no Brasil Colônia*. São Paulo: Editora UNESP; 2009.
- Campbell J, Webster D, Koziol-McLain J, Block C, Campbell D, Curry MA, Gary F, Glass N, McFarlane J, Sachs C, Sharps P, Ulrich Y, Wilt AS, Manganello J, Xu X, Schollenberger J, Frye V, Laughon K. Risk factors for femicide in abusive relationships: results from a multisite case control study. *Am J Public Health* 2003; 93(7):1089-1097.
- ONU Mulheres. *Diretrizes Nacionais Feminicídio. Investigar, Processar e Julgar com Perspectiva de Gênero as Mortes Violentas de Mulheres*. Brasília: ONU Mulheres; 2016.
- Gollub EL, Gardner M. Firearm legislation and firearm use in female intimate partner homicide using National Violent Death Reporting System data. *Preventive Med* 2019; 118:216-219.
- Rafael RMR, Moura ATMS. Violência física grave entre parceiros íntimos como fator de risco para inadequação no rastreio do câncer de colo de útero. *Cad Saúde Pública* 2017; 33(12):e00074216.
- Johnson MP. *A typology of domestic violence*. United States of America: Northeastern University Press; 2008.
- Brancaglioni BCA, Fonseca RMGS. Intimate partner violence in adolescence: an analysis of gender and generation. *Rev Bras Enferm* 2016; 69(5):890-898.
- Mascarenhas MDM, Tomaz GR, Meneses GMS, Rodrigues MTP, Preira VOM, Corassa FB. Análise das notificações de violência por parceiro íntimo contra mulheres, Brasil, 2011–2017. *Rev Bras Epidemiol* 2020; 23(Supl. 1):E200007.
- Moraes CL, Arana FDN, Reichenheim ME. Violência física entre parceiros íntimos na gestação como fator de risco para a má qualidade do pré-natal *Rev Saúde Pública* 2010; 44(4):667-676.
- Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. *Saúde Brasil 2017: uma análise da situação de saúde e os desafios para o alcance dos objetivos de desenvolvimento sustentável*. Brasília: MS; 2018.
- Brasil. Presidência da República. Secretaria Geral. Subchefia para Assuntos Jurídicos. Lei nº 13.880, de 08 de outubro de 2019. Altera a Lei nº 11.340, de 7 de agosto de 2006 (Lei Maria da Penha), para prever a apreensão de arma de fogo sob posse de agressor em casos de violência doméstica, na forma em que específica. *Diário Oficial da União*; 2019.

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