FACTORS ASSOCIATED WITH DEATHS FROM FIREARM INJURIES: IN PRE-HOSPITAL MOBILE CARE AT A REGIONAL SAMU IN PARANÁ

FATORES ASSOCIADOS A ÓBITOS POR FERIMENTOS POR ARMA DE FOGO: EM ATENDIMENTOS MÓVEIS PRÉ-HOSPITALARES DE UM SAMU REGIONAL DO PARANÁ

FACTORES ASOCIADOS CON MUERTES POR LESIONES CAUSADAS POR ARMAS DE FUEGO: EN SERVICIOS MÓVILES PREHOSPITALARIOS DE UN SAMU REGIONAL DE PARANÁ

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ABSTRACT

Objective: to analyze the sociodemographic profile, morbidity and mortality and spatial distribution of victims of firearms injuries attended by the mobile emergency care service. *Methods:* cross-sectional study of the care records of 603 firearm injury victims attended by the Mobile Emergency Care Service. Descriptive statistics, univariate association analysis and Kernel map were used for spatial distribution. *Results:* most of the victims were male (94%), aged between 21 and 30 years (61.5%). Most deaths (73.7%) occurred in this same age group. The spatial distribution showed the majority of victims in conurbated municipalities in the metropolitan region, with high morbidity and mortality. *Conclusion:* there was a higher prevalence of victims and deaths in men, aged 21 to 30 years, with head and neck injuries and multiple sites. In this sample it was not possible to establish a statistically significant relationship between the cities of the occurrences, but there are quite expressive focuses in the cities of Sarandi and Paiçandu. The results can provide input to formulate public policies for preventing violence and preparing for emergency care.
Keywords: Firearms; Wounds, Penetrating; Violence; Emergency Medical Services; Nursing.

RESUMO

Objetivo: analisar perfil sociodemográfico, morbimortalidade e distribuição espacial de vítimas de ferimentos por armas de fogo atendidas pelo serviço de atendimento móvel de urgência. *Métodos:* estudo transversal dos registros de atendimento de 603 vítimas de ferimento por arma de fogo atendidas pelo Serviço de Atendimento Móvel de Urgência. Utilizaram-se estatística descritiva, análise de associação univariada e mapa de Kernel para distribuição espacial. *Resultados:* a maioria das vítimas era do sexo masculino (94%), com idade entre 21 e 30 anos (61,5%). A maioria dos óbitos (73,7%) ocorreu nessa mesma faixa etária. A distribuição espacial demonstrou a maior parte das vítimas em municípios conurbados da região metropolitana, com elevada morbimortalidade. *Conclusão:* houve maior prevalência de vítimas e óbitos em homens, na faixa dos 21 aos 30 anos, com ferimento em cabeça e pescoço e múltiplos sítios. Nesta amostra não foi possível estabelecer relação estatística significativa entre as cidades das ocorrências, porém se notam focos bem expressivos nas cidades de Sarandi e Paiçandu. Os resultados podem fornecer subsídios para formular políticas públicas para prevenção da violência e preparo para atenção às emergências.
Palavras-chave: Armas de Fogo; Ferimentos Penetrantes; Violência; Serviços Médicos de Emergência; Enfermagem.

RESUMEN

Objetivo: analizar el perfil sociodemográfico, la morbimortalidad y la distribución espacial de las víctimas de lesiones causadas por armas de fuego atendidas por el servicio móvil de urgencias. *Métodos:* estudio transversal de los registros de atención de 603 víctimas de lesiones por armas de fuego atendidas por el servicio móvil de urgencias. Se utilizó estadística descriptiva, análisis de asociación univariante y el mapa de Kernel para la distribución espacial. *Resultados:* la mayoría de las víctimas eran hombres (94%), entre 21 y 30 años de edad (61,5%). La mayoría de las muertes (73,7%) ocurrió en este mismo grupo de edad. La distribución espacial mostró la mayoría de víctimas en los municipios conurbados de la región metropolitana, con alta morbilidad y mortalidad. *Conclusión:* hubo mayor prevalencia de víctimas y muertes en hombres, entre 21 y 30 años, con lesiones de cabeza y cuello y múltiples lugares. A pesar de haberse observado focos bastante expresivos en las ciudades de Sarandí y Paiçandu, en esta muestra no se ha logrado establecer una relación estadísticamente significativa entre las ciudades de los incidentes. Los resultados podrían proporcionar información relevante para formular políticas públicas de prevención de la violencia y preparación para la atención de emergencias.

Palabras clave: Armas de Fuego; Heridas Penetrantes; Violencia; Servicios Médicos de Urgencia; Enfermeria.

INTRODUCTION

The global burden of firearms mortality in 2016 was concentrated in six countries in the Americas - Brazil, United States, Mexico, Colombia, Venezuela, and Guatemala - which together accounted for 50.5% of all worldwide deaths. It is estimated that 32.0% of deaths caused by firearms in the world occurred in Brazil and in the United States, with Brazil alone accounting for a quarter of all homicides caused by firearms in the world.[1]

External causes and interpersonal violence have increased in Brazil and are currently among the main causes of morbidity and mortality.[2] Firearm injuries (FAI) are considered the greatest single factor of death and serious disability for people under 45 years old.[3]

According to the 2019 Map of Violence, Brazil had 65,000 homicides in 2017, and the state of Paraná increased the number of homicides by firearms from 13.6 to 19.2 per 100,000 inhabitants.[4]

It is necessary to demonstrate the incidents caused by firearm injuries from the perspective of public health, which has, among its main objectives, the health and well-being of the population. Violence imposes a heavy burden on the population's quality of life. The creation of safe communities requires health professionals to generate data that can reveal the interfaces of violence and enable contributions that act in the persuasion of different sectors - at global, national and community levels - to commit to the creation of affirmative public policies, to combat this social scourge.[4,5]

In this context, the assistance provided to victims of external causes, in essence, enables urgent and emergency services. Therefore, investigating the theme in the light of contexts and data derived specifically from this type of care can allow more detailed information about the victim to be obtained, as well as the circumstances and place of occurrence of these events, which are not known from official hospital morbidity and mortality data.

The present study aimed to analyze the sociodemographic profile, morbidity and mortality and spatial distribution of victims of firearms injuries attended by the Mobile Emergency Service (*Serviço Móvel de Urgência* - SAMU).

METHODS

Quantitative study, with cross-sectional design, developed at the SAMU *Regional Norte Novo* in the city of *Maringá* (PR), southern Brazil, located 426 km from the state capital, with an estimated population of 406 thousand inhabitants in the year 2017.[6] SAMU has regional coverage, serving a region of 30 municipalities that are part of the 15th Regional Health Region of the state of Paraná, with a population of approximately 800,000 people.

Currently SAMU is the main mobile component of the emergency care network, being a free service offered by the Unified Health System (*SUS*). SAMU *Regional*, where data collection took place, has eight mobile service units, with five other decentralized bases with five more mobile service units that are related to *SAMU Regional Norte Novo* with an average service of seven thousand services/month.

Data were collected from victims of firearm injuries assisted by SAMU *Regional Norte Novo*, from January 2012 to December 2016. These data were composed of information included in the firearm injury care forms completed by all professionals working in mobile and advanced units. Data were collected from March to October 2017, and the forms containing incomplete data were excluded from the analysis.

The variables collected were: location of the occurrence (street), age of the victim, sex, body part affected, Glasgow coma scale and outcome of assistances (referral to a health unit or death on site), in addition to the spatial location of the occurrences.

The data were compiled into a database using the IBM Statistical Package for Social Science® (SPSS®) software, version 23, and were treated with descriptive statistics, using relative and absolute frequency. In order to facilitate the understanding of the data, the age of the victims was presented in age groups every 10 years considering its amplitude.

In order to establish statistical associations between the occurrence of deaths from firearm injuries and the sociodemographic variables, a univariate analysis was performed, using Pearson's chi-square test as a measure of association, the

relative risk and its 95% confidence interval. Associations with p-value<0.05 were considered significant.

Then, they were submitted to geoprocessing analysis, using Open Street mapping and georeferencing software (open access), which are part of a Geographic Information System, using the Qgis 2.18 program to compose the map, using a Kernel density estimator, which measures the density of events generating hot spots (hot spots), i.e., the amount of firearm injuries in relation to space in the city of *Maringá* and the metropolitan region.

The development of the study met the ethical principles in research involving human beings. The project was submitted to the Ethics Committee in Research Involving Human Beings of the *Universidade Estadual de Maringá*, with a favorable opinion report (2,609,666/2018).

RESULTS

In the period from 2012 to 2016, six hundred and thirteen victims of firearm injuries were attended by SAMU *Norte Novo*, with 144 (23.9%) calls in 2012; 142 (23.5%) calls in 2013; 101 (16.7%) calls in 2014; in 2015, 92 (15.3%) calls; and, in 2016, 124 (20.6%) calls. The only year with a number of less than 100 calls was 2015 (Table 1). Ten forms were excluded due to incomplete data.

Regarding the sex of the victims of firearm injuries, the majority were men (567; 94%). Still, the victims had a mean age of 26.01 years (standard deviation ± 7.25 years), a median age of 25 years and a mean age of 25 years. The youngest victim was 3 years old and the oldest, 73 years old. Most victims were between 21 and 30 years old (370; 61.5%), although it was observed that the majority of deaths (174; 73.7%) occurred in that same age group.

Most occurrences was in the city of *Maringá*, with 371 (61.5%) occurrences and *Sarandi* (26.0%), followed by *Paiçandu* (10.4%) and other municipalities in the metropolitan region of *Maringá* (RMM) (2.1%), such as *Mandaguari*, *Nova Esperança*, *Astorga* and *Colorado*. The body parts affected in most cases were head and neck, with 139 (23.1%) occurrences; multiple sites, with 124 (20.6%) occurrences; and thorax, with 92 (15.3%) occurrences.

Two hundred and ninety-seven (49.3%) victims were referred to hospitals in *Maringá* - 203 died at the place of care.

Glasgow coma scores, in cases with outcome in hospital units, ranged from five to 15 and had a median of 15 in *Maringá*, 13 in *Sarandi* and 15 for the emergency room in *Maringá*.

Table 2 shows the analysis of the chi-square association statistics and respective relative risk, in addition to the 95% relative risk confidence interval between deaths and sociodemographic and care-related variables. In this sense, no significant associations were possible between the years of the deaths.

When the sex of the victim of a firearm injury was evaluated, a significant association was observed for males with a relative risk

Table 1 - Victims of firearms wounds treated by the Mobile Emergency Service, 2012 to 2016, *Maringá*, *Paraná* - Brazil

Variable	n (%)
Year	
2012	144 (23.9)
2013	142 (23.5)
2014	101 (16.7)
2015	92 (15.3)
2016	124 (20.6)
Municipality of occurrence	
Maringá	371 (61.5)
Sarandi	157 (26.0)
Paiçandu	63 (10.4)
Other RMM	12 (2.1)
Sex of the victim	
Male	567 (94.0)
Female	36 (6.0)
Age of the victim, in years	
0-10	4 (0.7)
11-20	110 (18.1)
21-30	370 (61.5)
31-40	99 (16.4)
41-50	13 (2.2)
51-60	5 (0.7)
61 or more	2 (0.4)
Body region affected	
Head and neck	139 (23.1)
Thoracic	92 (15.3)
Abdominal	58 (9.6)
Low back	35 (5.8)
Upper limbs	74 (12.3)
Lower members	81 (13.4)
Multiple sites	124 (20.5)
Outcome of care	
Maringá Hospitais	297 (49.2)
Sarandi Hospital	97 (16.1)
Maringá UPA	4 (0.8)
Sarandi UPA	2 (0.8)
Death on site	203 (33.1)

RMM: Metropolitan Region of *Maringá*; UPA: emergency care unit.

of 2.5. In the sample, there were 39.6 deaths in males for each death due to firearm injuries in females, indicating the prevalence of males.

There was a statistically significant association between the occurrence of deaths and the age groups between 11 and 20 years and 21 and 30 years. The relative risk in the 11 to 20 age group was 400

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Table 2 - Descriptive statistical analysis of 203 deaths of victims of firearm injuries attended by the Mobile Emergency Service, 2012 to 2016, *Maringá*, *Paraná* - Brazil

Variable	n (%)	Death	X^2	p-value	RR	95%CI
Year						
2012	144 (26.6)	54	1.25	0.31	1.2	0.90-1.49
2013	142 (24.2)	49	0.08	0.84	1.0	0.80-1.35
2014	101 (19.2)	39	1.33	0.24	1.2	0.89-1.57
2015	92 (12.8)	26	1.42	0.23	0.8	1.14-0.58
2016	124 (17.2)	35	2.07	0.15	0.8	1.08-0.60
Municipality of occurrence						
Maringá	371 (59.6)	121	0.48	0.49	0.9	1.16-0.73
Sarandi	157 (26.6)	54	0.05	0.82	1.0	0.80-1.33
Paiçandu	63 (12.8)	26	1.82	0.18	1.3	0.90-1.75
Other RMM	12 (1.0)	0.2	1.60	0.20	0.4	1.26-0.14
Sex of the victim						
Male	567 (97.5)	198	5.80	0.016*	2.5	1.25-5.05
Female	36 (2.5)	5			0.4	0.80-0.20
Age of the victim, in years						
0-10	4 (0.7)	1	0.03	0.087*	0.7	3.65-0.15
11-20	110 (18.3)	21	12.01	<0.001*	0.5	0.74-0.36
21-30	370 (61.3)	149	18.71	<0.001*	1.7	1.35-2.23
31-40	99 (16.4)	29	1.01	0.31	0.8	1.17-0.62
41-50	13 (2.2)	2	1.24	0.26	0.5	1.36-0.15
51- 60	5 (0.8)	0	-	-	-	-
61 or more	2 (0.3)	0	-	-	-	-
Body region affected						
Head and neck	139 (23.0)	87	67.68	<0.001†	2.5	2.01-3.12
Thoracic	92 (15.3)	16	12.87	<0.001†	0.5	0.71-0.32
Abdominal	58 (9.6)	7	13.40	<0.001†	0.3	0.60-0.19
Lombar	35 (5.8)	1	14.36	<0.001*	0.1	0.28-0.02
Upper limbs	74 (12.3)	0	-	-	-	-
Lower limbs	81 (13.4)	0	-	-	-	-
Multiple sites	124 (20.6)	92	114.82	<0.001†	3.2	2.59-3.96

* Fisher's exact test; † Chi-square association test.
RR: relative risk; 95% CI: 95% confidence interval; RMM: Metropolitan Region of *Maringá*.

times greater than in the zero to 10 age group; 11 times higher than in the 31 to 40 age group; and 9.6 times higher than in the 41 to 50 age bracket, just behind the 21 to 30 age bracket (0.64 times). The relative risk of the 21 to 30 age group was 623 times greater than from zero to 10 years, 1.5 times greater than the 11 to 21 age group, 18.5 times the 31 to 40 age group and 15 times greater than the 41 to 50 age group.

It was not possible to establish a statistically significant relationship between the occurrence of deaths in victims of firearms injuries and the cities of the subjects, however, the analysis of the Kernel density estimation map referring to the records of the occurrences of firearms injuries in *Maringá* and its metropolitan region and showed a very expressive outbreaks in *Sarandi* and *Paiçandu*, with most occurrences being spatially located in these two municipalities (Figure 1).

There was a statistically significant association between the body part affected and the occurrence of deaths with firearms injuries to the head and in multiple sites. The association was significant, however, in the sense of protection between the occurrence of deaths and injuries from firearms in the chest, abdomen and lumbar region.
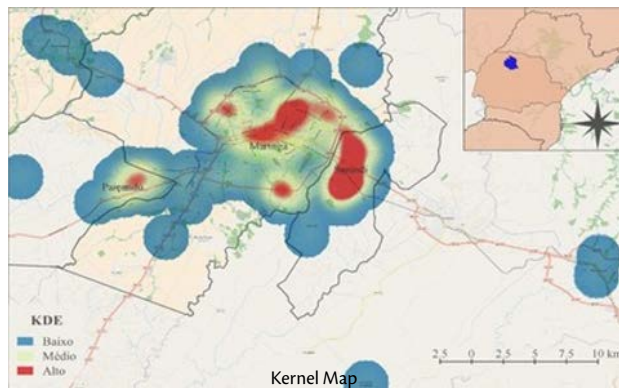
Figure1 - Kernel density estimate for calls for firearm injuries performed by the Mobile Emergency Service

DISCUSSION

Among the limitations of this study, the incomplete completion of some forms stood out, making more in-depth analysis difficult. This is explained by the emergency nature of care and the death of the victim, making it impossible for the best quality of the data reported. As advantages, the data allowed to evidence the profile of the victims, being able to subsidize prevention policies.

The results of this work provide subsidies for possible formulation of public policies, with the objective of developing measures to prevent firearms violence, such as the creation of campaigns by the media, exposing the number of firearms victims, their epidemiological profile and mortality rate, in the search for society's awareness, with an emphasis on schools, for disarmament and for restraining the use of firearms by adolescents and young people - the main victims of this form of violence.

In the last decades, changes in the Brazilian scenario related to violence have been observed. In the present study, we verified stability in the frequency of deaths from firearms injuries, and it is not possible to statistically associate the number with the year of deaths. However, in 2014 the 10 years since the implementation of the campaign for disarmament were celebrated. Despite its little effectiveness and the short period analyzed, the data corroborate other studies, indicating low effectiveness of public disarmament policies and increase in crime.[7,8]

The sociodemographic characteristics were similar to that of other studies, with a predominance of young men. A study carried out in *Rio de Janeiro* between 2011 and 2012 found that men are more exposed to violence, in adolescence and youth, in relation not only to social problems, but also to immaturity and low perspective regarding planning. A study carried out in *Bahia* on mortality from firearms injuries in the years 2000 to 2012 revealed that the risk of death in males between 20 and 29 years of age is 20 times higher than that of females in the same age group, being seven times higher than other age groups and four times higher than the rest of the male population.[4,9,10]

Female victims, albeit in lower numbers, show increased female involvement in violence, crime and among deaths from firearms injuries. The explanation for the differences in the levels of male and female mortality from firearms injuries is in exposure to risk factors, which are influenced by lifestyles. It can be suggested that the different occupational activities developed by men and women could complement this hypothesis, since men often perform more dangerous activities, thus, subjecting themselves to more risks.[9]

Regarding the place of occurrence, the highest incidence of absolute frequency and deaths occurred in the city of *Maringá* (61.5%). This is explained not only by its territorial, population and other factors, but also by *Maringá* presenting higher economic rates to those identified in the surrounding municipalities, consolidating a process of socio-spatial segregation that pushes misery to *Sarandi*, *Paiçandu* and other cities in their metropolitan region.[9]

Studies show that low-income people are socially more vulnerable. Due to their basic living conditions, they are weakened with regard, e.g., to safety, employment and education, factors that amplify the chances of exposure to risk situations capable of resulting in firearm injuries.[8,11-13]

The elements of characterization of the socio-spatial typology of the areas where firearms injuries occur make up a social structure in which the territory analyzed is composed of municipalities where the so-called classes of popular workers are found, with predominance of residents engaged in non-specialized activities. and low income and education. This shows a strong correlation between the social characteristics of the territory and the occurrence of violence. These results converge with those of other studies in which it is explained that the socio-occupational type, low income, and low education are associated with the increase in the rate of violence.[5,9-13]

Spatial analysis demonstrates the importance of social, political, and economic organizations in the territory as determining factors with respect to violence, especially in regions that have a high degree of integration, such as *Maringá*, *Sarandi* and *Paiçandu*. Thus, the knowledge of the characteristics, organization and planning of the territory must be observed and evaluated by public administrations, when elaborating affirmative public policies to reduce violence.[4,6-9]

As for the affected body region, a similar study conducted in Recife with homicide victims showed that 71% of the victims were shot in the head. Injuries to the skull region are the main determinants of the high risk of death and neurological sequelae. In this study, the fact that a large portion of the victims died before the arrival of help, given the severity of the injuries, explains the fact that the majority did not even receive assistance. This fact indicates that primary prevention is the best measure to reduce mortality. Knowledge of the location of the injury is important to guide the planning and organization of health services, which must allocate resources and professionals to care for victims for whom prevention has not been successful.[12,13]

The SAMU care record uses the Glasgow coma scale as one of the variables to classify the severity of the victims. In a study on the severity of firearms injuries in a metropolitan trauma center in Pietermaritzburg, South Africa, from 2004 to 2014, twenty percent of victims scored on the Glasgow coma scale between three and eight and 61% between nine and 12. These findings are confirmed in the study. In the initial care, the Glasgow coma scale has proved to be quite useful, not only for standardization and comparison of the assessment of severity and neurological involvement, but also as a strong indicator of pregnant women reflecting the primary and secondary injuries associated with trauma.[14]

In this study, 400 victims were referred to hospital units (66.4%). It was not the scope of this research to analyze the hospital costs involved. However, the literature has demonstrated a high cost for *SUS*, in the form of the increased need for surgical care, subsidiary exams, intensive treatment and long-term hospitalizations, in addition to the economic losses generated by the absenteeism of these users in their workplaces and other social and psychological impacts that are difficult to measure.[4,5,9,15]

As for death, 203 victims (33.7%) were already dying on site, similar data to those of other studies. Studies report that, in addition to death on site, hospital lethality is 9.7% due to injuries caused by firearms, also worth mentioning, since victims of hospitalized firearms injuries are at risk of death 3.6 times greater than other types of hospitalizations.[2]

CONCLUSION

The sociodemographic profile of the victims of FAI revealed that they are mostly residents of *Maringá*, however it is highlighted that this city is the largest in population in the three municipalities analyzed. It was composed mainly of young adults, aged 21 to 30 years, with FAI mainly affecting the head and neck and multiple sites, with high mortality in the sample presented. Deaths were statistically associated with men, age between 21 and 30 years and injuries to the head and neck and in multiple sites.

Geospatial data did not show significant statistical relationships, however the analysis of the Kernel map revealed occurrences of significant numbers in the three municipalities, especially in the municipalities of *Paiçandu* and *Sarandi*, allowing a glimpse of the relation between urban violence and the way in which the territory is socially organized and economically, emphasizing that it is a phenomenon that goes beyond social groups and differences in territorial limits.

Knowledge about the prevalence, incidence and mortality rates due to firearm injuries in different populations, as well as the glimpse of their spatial panorama, are of paramount importance, as they reveal risk factors that can be modified and be sensitive to social investments. and preventive strategies. They also serve to prepare for the proper care of these victims in order to reduce the lethality of these occurrences. Finally, reducing the global burden of gun violence and improving the health and safety of individuals, families and communities provide compelling reasons for integrating this area in Nursing science.

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