



FACTORS ASSOCIATED WITH INTERPERSONAL FIREARM VIOLENCE IN MEN IN THE MUNICIPALITIES OF MINAS GERAIS, BRAZIL, 2009-2019

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ABSTRACT

A problem observed in Brazil throughout the rest of Latin America, violence is a consequence of an imbalance in socioeconomic, political and cultural conditions, resulting from the abuse of economic and political powers and a policy of equitable distribution of living conditions and work, transforming this context. This study has a cross-sectional design, using secondary data and approaches in space and time. Spatial autocorrelation analysis was performed using the Moran Index in two steps: calculation of the Global Moran Index (I) for each explanatory variable and analysis of Local Moran Index (LISA) between each explanatory variable and the average rate, with those with the highest values of Local Moran Index being selected. Higher values of this index were observed in the variables rate of unemployed persons, people with inadequate water supply and sanitary sewage, SVI and proportion of people with income below half the minimum wage, with were selected as explanatory variables. The spatial correlation between interpersonal firearm violence and the variables presented can be interpreted as an indicator of inequality and social deprivation, resulting in conditions of vulnerability, present in Brazilian society.

Keywords: violence; firearms; vulnerabilities; spatial analysis; health planning.

FATORES ASSOCIADOS À VIOLÊNCIA INTERPESSOAL POR ARMA DE FOGO EM HOMENS NOS MUNICÍPIOS DE MINAS GERAIS, BRASIL, 2009-2019

RESUMO

Problema observado no Brasil e em todo o restante da América Latina, a violência é consequência de desequilíbrio de condições socioeconômicas, políticas e culturais, sendo decorrente do abuso de poderes econômico e político e tornando-se necessária uma política de distribuição equânime de condições de vida e trabalho, transformando esse contexto. O presente estudo possui delineamento transversal, com uso de dados secundários e abordagens no espaço e no tempo. Foi feita análise de autocorrelação espacial a partir do Índice Moran em duas etapas: cálculo do Índice de Moran Global (I) para cada variável explicativa e análise de Índice de Moran Local (LISA) entre cada variável explicativa e a taxa média, sendo selecionadas aquelas de maiores valores de Índice de Moran Local. Foram observados maiores valores deste índice nas variáveis taxa de desocupados, pessoas com abastecimento de água e esgotamento sanitário inadequados, IVS e proporção de pessoas com renda inferior a meio salário mínimo,

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que foram selecionadas como variáveis explicativas. A correlação espacial entre violência interpessoal por arma de fogo e as variáveis apresentadas pode ser interpretada como indicadora de desigualdade e de privação sociais, resultando em condições de vulnerabilidade, presente na sociedade brasileira.

Palavras-chave: violência; armas de fogo; vulnerabilidades; análise espacial; planejamento em saúde.

FACTORES ASOCIADOS A LA VIOLENCIA INTERPERSONAL COM ARMAS DE FUEGO EN HOMBRES EN LOS MUNICIPIOS DE MINAS GERAIS, BRASIL, 2009-2019

RESUMEN

Problema observado en Brasil y en el resto de América Latina, la violencia es consecuencia de un desequilibrio en las condiciones socioeconómicas, políticas y culturales, resultado del abuso de poderes económicos y políticos y que hace necesaria una política de distribución equitativa de las condiciones de vida. Y trabajar, transformando este contexto. Este estudio tiene un diseño transversal, utilizando datos secundarios y enfoques en el espacio y el tiempo. El análisis de autocorrelación espacial se realizó mediante el Índice de Moran en dos pasos: cálculo del Índice Global de Moran (I) para cada variable explicativa y análisis del Índice Moral Local (LISA) entre cada variable explicativa y la tasa promedio, siendo las seleccionadas valores mayores Del índice de Moran local. Se observaron valores más altos de este índice en las variables tasa de desocupados, personas con suministro de agua y alcantarillado inadecuado, IVS y proporción de personas con ingresos inferiores a la mitad del salario mínimo, las cuales fueron seleccionadas como variables explicativas. La correlación espacial entre la violencia interpersonal con armas de fuego y las variables presentadas puede interpretarse como un indicador de desigualdad y privación social, resultando en condiciones de vulnerabilidad, presentes en la sociedad brasileña.

Palabras llave: violencia; armas de fuego; vulnerabilidades; análisis espacial; planificación sanitaria.

INTRODUCTION

Violence is present all over the world and its impacts can be seen in various ways from homicides and injuries resulting from self-harm, interpersonal aggression or collective violence, being one of the main causes of death for people aged 15 to 44 years across the planet (DAHLBERG; KRUG, 2007).

A theme with historical roots in Brazil, violence has its origins in social inequalities, requiring an interdisciplinary approach with inclusive social policies in favor of the population's health (Malta *et al.*, 2017). Policies for equitable distribution of living and working conditions are also needed, making it possible to improve this scenario (Chaves *et al.*, 1987).

The presence of firearms in violent events and mortality is of great magnitude, however, there are few studies that specifically address the issue of firearms and their respective impacts on the Brazilian population (RIBEIRO; SOUZA; SOUSA, 2017).

Studies have analyzed homicides in the state of Minas Gerais, demonstrating that they are a relevant topic for national Public Health and contributing to reinforce the need for integration between social policies aimed at overcoming inequities in health (DE CASTRO; ASSUNÇÃO; DURANTE, 2003; DRUMMOND; DE SOUZA; HANG-COSTA, 2015).

According to the above, this study sought to correlate interpersonal violence by firearms in men living in Minas Gerais and indicators of inequalities and social deprivation (generating conditions of vulnerability), which are striking in Brazilian society.

METHODS

Cross-sectional study, using secondary data and approaches in space and time. Records were collected from DataSUS (BRASIL, 2021a), selecting only cases of interpersonal violence by firearms in men (records of self-harm being excluded). Records were organized by municipality of residence in the state of Minas Gerais and year of notification.

The annual population estimate of men residing in the municipalities of Minas Gerais was collected from the Ministry of Health (BRASIL, 2021b). Data referring to socio-environmental and economic variables were collected, appearing as probable explanatory variables. The 2015 Firjan Municipal Development Index (IFDM) was obtained from FIRJAN (FIRJAN, 2021). The Atlas of Human Development in Brazil (ATLAS BRASIL, 2021), which uses data from the IBGE Demographic Census, was the source of the variables percentage of the population in households without garbage collection and percentage of the population in households with running water (both referring to the year 2010). The unemployment rate of the population aged 18 or over, the Social Vulnerability Index (IVS - composed of the urban infrastructure, human capital and income and labor sub-indices), percentage of people in households with water supply and sewage inadequate sanitation, illiteracy rate of the population aged 15 and over and the illiteracy rate of the population aged 18 and over were obtained from the IPEA (Institute for Applied Economic Research) (IPEA, 2021). Variables: percentage of people aged 18 or over without complete primary education and in informal occupation, percentage of poor people, proportion of children in households with income below half the minimum wage, Gini Index, proportion of people with income below half the minimum wage, income ratio (number of times the aggregate income of the richest 20% is greater than the income of the poorest 20% of the resident population), average household income per capita and child labor rate are from the 2010 Census (IBGE, 2012).

Violence rates per year were calculated by dividing the number of records divided by population (multiplying this result by 100,000), respectively by municipality. It is noteworthy that one record was excluded for having ignored the municipality of residence. Subsequently, the average rate of firearm violence for the entire study period was calculated by the sum of all annual rates divided by 11 (number of years in the period).

Subsequently, spatial autocorrelation analysis (spatial dependence) was performed using the Moran Index, which has values from -1 to +1 (Brazil, 2007), namely: less than 0.3 (weak spatial

autocorrelation), 0.3 at 0.7 (moderate) and above 0.7 (strong) (Vale *et al.*, 2019). The analysis was performed in two steps: initially, the Global Moran Index (I) was calculated for each explanatory variable, estimating the global spatial autocorrelation of each variable. Afterwards, the Local Moral Index (LISA) analysis was performed between each explanatory variable and the average rate (dependent variable), and those with the highest Local Moran Index were selected. The Moran Local Index values were classified into the following strata: high-high (quadrant 1, highest priority), low-low (quadrant 2, lowest priority), high-low (quadrant 3, intermediate priority) and low -high (quadrant 4, intermediate priority) (the first two representing positive spatial association) (BRASIL, 2007).

The QGis Program (version 2.18.20) was used to generate thematic maps. Spatial autocorrelation analyzes were performed in the GeoDa Program, version 1.14.0.

RESULTS

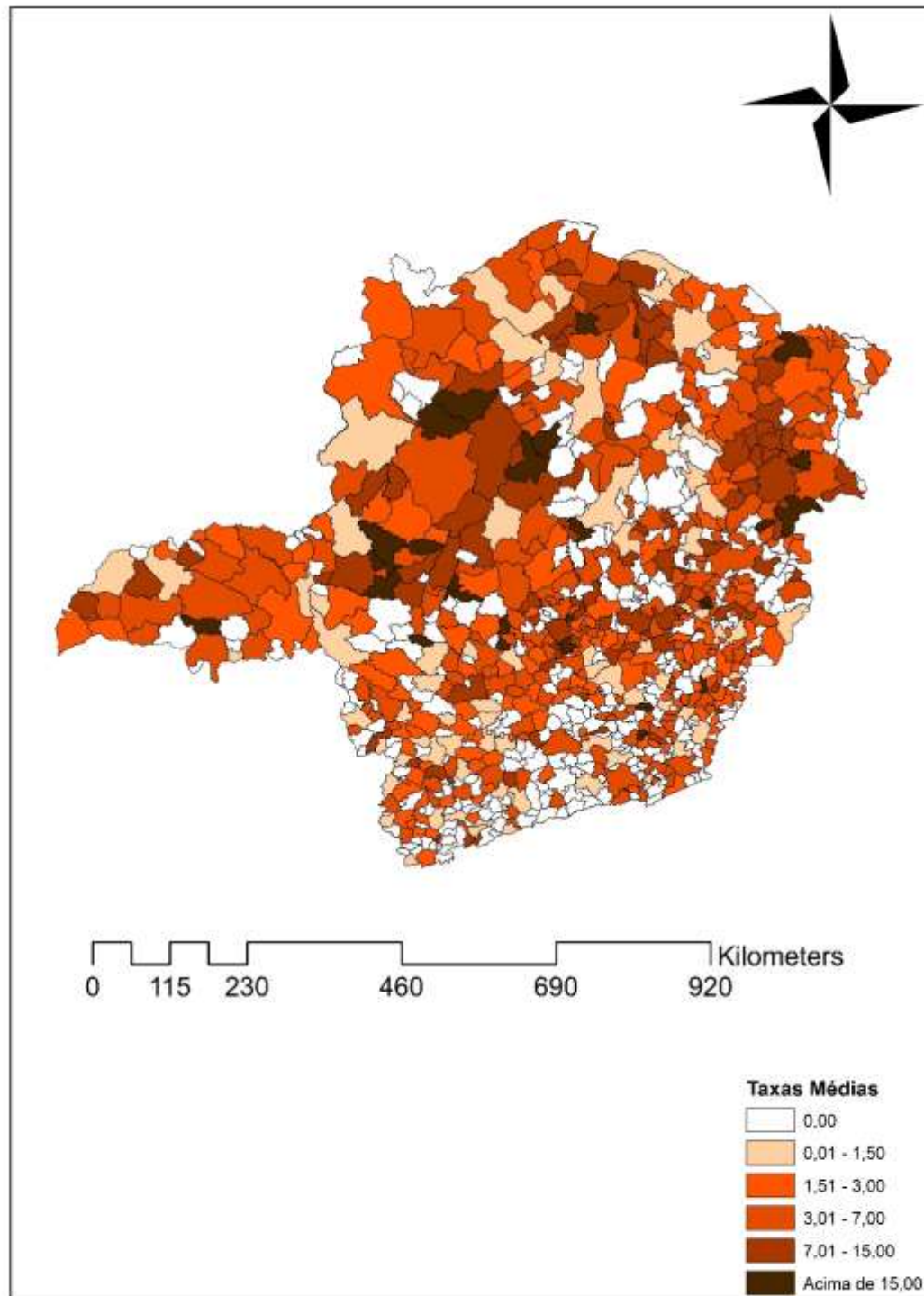
There were 4,321 records of interpersonal violence by firearms among men, with consecutive increases from 2009 to 2013 (from 46 to 497 records). In 2014, there was a decrease in this number (482), followed by an increase in 2015 (698), the largest number of records per year. With the exception of 2017, there were decreases in the number of records, with a lower value in 2019 (402) (Figure 1).

Figure 1 – Minas Gerais - Records of interpersonal violence by firearms among men in the municipalities of Minas Gerais, Brazil, 2009-2019 – 17/02/2022.



With regard to the average rates, no spatial pattern was observed in the distribution of values. However, higher values were observed in municipalities located in the northern, western and northeastern portions of the state. To a lesser extent, high rates were observed in some municipalities in the central portion of the state (Figure 2).

Figure 2 – Minas Gerais - Average rates of interpersonal firearm violence among men in the municipalities of Minas Gerais, Brazil, 2009-2019 – 17/02/2022.



Regarding the Moran Global Index, the variables percentage of the population in households without garbage collection, percentage of the population in households with running water, percentage of people aged 18 or over without complete primary education and in informal occupation, percentage

of poor and income ratio did not show statistical significance, being excluded from the study. Subsequently, spatial autocorrelation was performed between the variables and the average rate based on the Moran Local Index. The child labor rate variable was not statistically significant and was excluded. Higher rates were observed in the variable rate of unemployed people (0.128), people with inadequate water supply and sanitation (0.116), IVS (0.108) and proportion of people with income below half the minimum wage (0.039), which were selected as variables explanatory (Table 1).

Table 1 – Minas Gerais - Spatial autocorrelation tests between socioeconomic and environmental variables and average rates of interpersonal violence by firearms among men in the municipalities of Minas Gerais, Brazil, 2009-2019 – 17/02/2022.

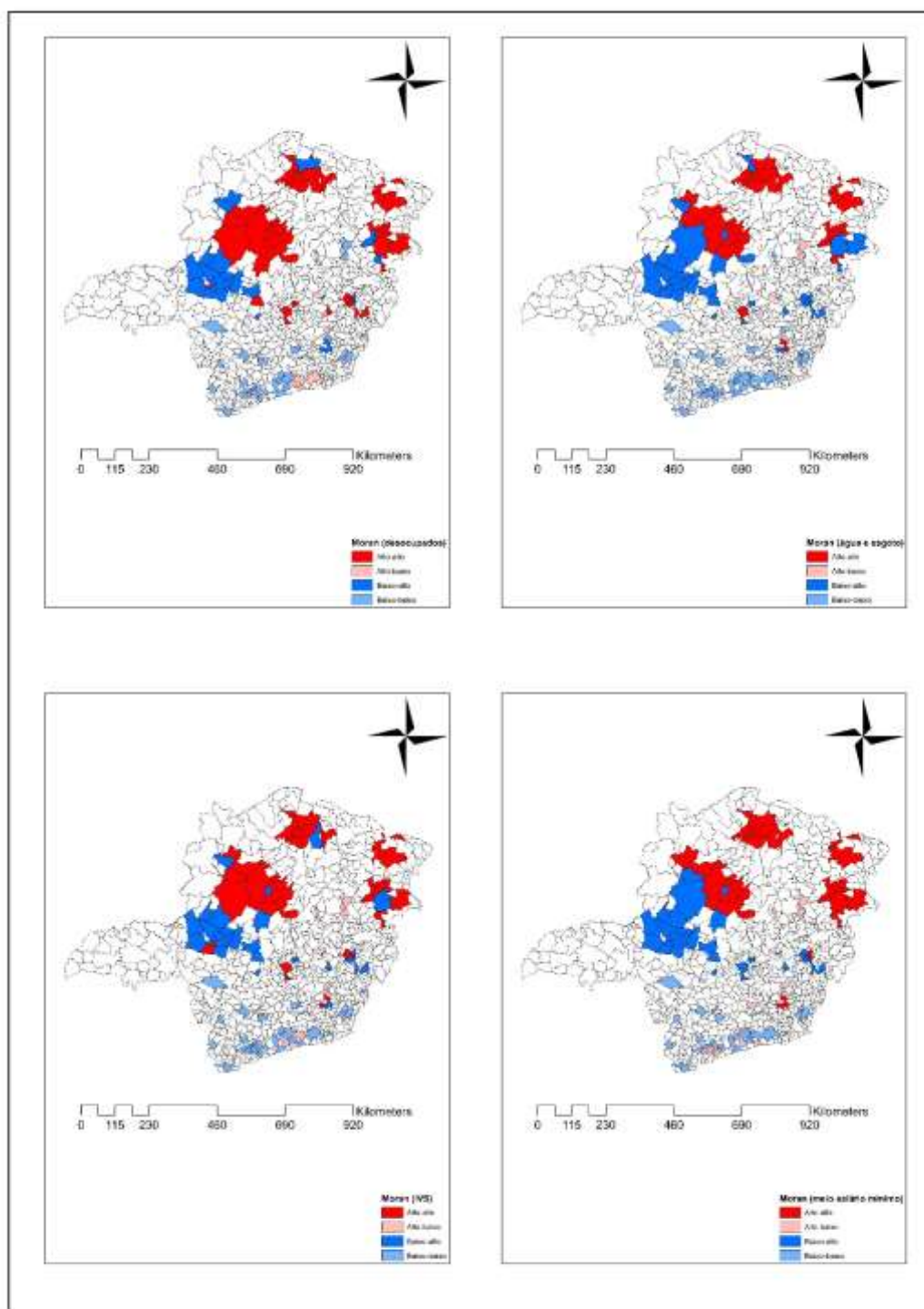
Variable	Moran Global Index	p-value	Moran Local Index (in autocorrelation with average rate)	p-value
IFDM 2015	0.426	Less than 0.01	-0.034	0.01
Population without garbage collection	0.007	0.30	-	-
Population with piped water	0.010	0.31	-	-
Unoccupied rate (18 years and over)	0.414	Less than 0.01	0.128	Less than 0.01
IVS	0.676	Less than 0.01	0.108	Less than 0.01
People with inadequate water supply and sanitation	0.548	Less than 0.01	0.116	Less than 0.01
Illiteracy rate aged 15 or over	0.778	Less than 0.01	0.065	Less than 0.01

Illiteracy rate aged 18 or over	0.781	Less than 0.01	0.067	Less than 0.01
Persons aged 18 or over without complete primary education	-0.032	0.08	-	-
Percentage of poor	0.006	0.33	-	-
Proportion of children in households with less than half a salary mínimo	0.75	Less than 0.01	0.039	Less than 0.01
Gini Index	0.154	Less than 0.01	0.056	Less than 0.01
Proportion of people with income below half the minimum wage	0.787	Less than 0.01	0.069	Less than 0.01
Income reason	0.003	0.11	-	-
Average household income per capita	0.555	Less than 0.01	-0.041	Less than 0.01
Child labor rate	0.247	Less than 0.01	-0.001	0.49

From the analysis of Local Moran Indexes, in general, spatial autocorrelations were observed between high values of the explanatory variables and the average rates in municipalities in the northern, northwestern and northeastern portions of the state. Autocorrelation was also observed between low values of the explanatory variables and high values of the average rates in municipalities in the western portion and, to a lesser extent, in municipalities in the western and northern parts. Additionally,

autocorrelations were observed between high values of explanatory variables and low values of mean rates in municipalities in the southern and southeastern portions of the state (the same occurring with autocorrelation between low values of explanatory variables and mean rates) (Figure 3).

Figure 3 – Minas Gerais - Moran Local indices between explanatory variables and average rates of interpersonal firearm violence among men in the municipalities of Minas Gerais, Brazil, 2009-2019 – 17/02/2022.



DISCUSSION

A problem resulting from the social inequalities that affect Brazil and the rest of Latin America (LEAL; LOPES, 2005), in the 1980s, attention was already drawn to violence as a consequence of an imbalance in socioeconomic, political and cultural conditions and resulting from the abuse of economic and political powers, causing different possibilities of survival (CHAVES *et al.*, 1987).

Violence and insecurity are complex phenomena, with symbolic, institutional and subjective dimensions, with feelings of vulnerability and threat contributing to the proliferation of violent and individualistic solutions, leading the population to do justice for themselves, removing this attribution from the government (SPINELLI *et al.*, 2007). Therefore, a policy of equitable distribution of living and working conditions becomes necessary, enabling the transformation of this context (CHAVES *et al.*, 1987).

Several studies have shown that men with lower purchasing power and low education levels are the main victims of assaults by firearms in Brazil (MACIEL; SOUZA; ROSSO, 2016; SANCHES; DUARTE; PONTES, 2009; NACHIF, 2006; MANSANO *et al.*, 2013), explained by the lack of social capital and inequalities in access to health, culture, education and leisure rights, leading to an increase in competition among the population, which should be better served and protected by the government (CARDIA; SCHIFFER, 2002). In 1990 and 2015, assaults by firearms represented the biggest cause of years of life lost due to death or disability among interpersonal and self-inflicted violence, explained by the historical trajectory from the social inequalities of the country, requiring policies and measures capable of reversing this situation (MALTA *et al.*, 2017a), which is scrapped from social equipment incapable of guaranteeing citizens' rights, in addition to contributing to negligence, impunity, criminality, corruption and, therefore, to more violence (DE LIMA *et al.*, 2002).

From the analysis of our results, it could be observed that the populations of the municipalities located in the northeast, north and northwest portions of Minas Gerais experience more intense situations of vulnerability, exemplified by spatial autocorrelation maps. These municipalities would be considered as high priorities for interventions aimed at minimizing these conditions. Among the municipalities that would be the highest priority, stand out Ibiracatu, Glaucilândia and São João das Missões, which presented, respectively, unemployment rates of 15.17%, 13.20% and 13.06%. With regard to inadequate water and sewage supply, high proportions were observed in municipalities that also had high average rates, such as Pai Pedro (28.26%), São João das Missões (26.67%, both in the northern part of the country) and Cachoeira de Pajeú (24.22%, northeastern portion). As for the IVS, high values were observed in Josenópolis (0.631), Santa Fé de Minas (0.589), São João das Missões (0.579), Novo Oriente de Minas (0.555) and Bonito de Minas (0.543), demonstrating that a large part of their populations live under

conditions of vulnerability. Regarding the proportion of the population that earns less than half the minimum wage, Guaraciama (29.14%) was considered as a high priority.

This situation of vulnerability, marked by factors such as illiteracy and unemployment, concentration of income and unequal living conditions, is observed in a portion of the impoverished population and which ends up opposing the scenario of a privileged elite and holder of wealth, generating a favorable scenario for growth in violence (DE LIMA *et al.*, 2002). The entire country needs policies against violence, in favor of economic growth, reducing social exclusion and encouraging education and professional training. Furthermore, investigations into the habits and psychosocial maladjustments of people involved in these episodes are needed (DE FREITAS *et al.*, 2017). We must remember that social exclusion, translated into unequal opportunities for accessing school and the formal labor market, causes many young people to lose interest in work/study, leading them to more immediate recognition from their entry/co-option into the labor market drugs, tending to exacerbate violent acts (DRUMMOND; SOUZA; HANG-COSTA, 2015).

It is necessary to prevent this type of violence through protective strategies, based on public policies for safety, social inclusion, health promotion and education incentives (MACIEL; SOUZA; ROSSO, 2016), in addition to increasing the population's well-being with the development of squares, parks and improvement of public transport (DA TRINDADE; CORREIA, 2015). As noted, school dropout in elementary school influences the number of firearm-related homicides, since people with low education (a variable that in itself is related to violence in general) represent the group that most demands firearms (BACULI *et al.*, 2021), demonstrating a normalization of violence, which is configured as an excuse that disguises societies with authoritarian behavior and unequal distribution of goods and services, leading to deprivation and social exclusion. Therefore, society must be mobilized to transform traditional and outdated social structures in search of social justice and peace (NACHIF, 2006).

With regard to water and sewage supply, it is known that where there is greater violation of rights, there is greater vulnerability to health problems. In this way, interventions to improve access to water and sanitation (which are the rights of individuals and the State's obligation, not understood as an act of charity) can make a difference in the lives and health of vulnerable populations, resulting in improved well-being, improved access to education, improved quality of life and poverty reduction (ensuring justice, dignity and equity) (NEVES-SILVA; HELLER, 2016), requiring the integration of housing, sanitation and environment policies (ALVES, 2006).

Because it has an intersectorial and complex character, the problem of violence requires the articulation of forces to face it, making it even necessary to strengthen the surveillance and care networks (identifying patterns, risk factors and causes) for the organization of protection services and prevention, mainly focusing on the most vulnerable populations, contributing to the improvement of public health (SOUTO

et al., 2017) (COSTA; DA TRINDADE; SANTOS, 2014). Collective action and cooperation between the areas of health, education and justice are essential for solving complex health problems, often understood only from a “medical” point of view. Nevertheless, Public Health can contribute to understanding and intervening in the problem of violence, based on interdisciplinary actions, formulating public policies integrated in a network (HENNINGTON *et al.*, 2008).

It is noteworthy that although there was a decrease in the number of records of interpersonal violence by firearms (from 2017 to 2019), there were consecutive increases in this number until 2013, followed by a new increase in 2015. These results reinforce the findings of another study, which showed an upward trend in homicide mortality rates (2000 and 2015), highlighting small (less than 50 thousand inhabitants) and medium-sized (from 50 to less than 100 thousand inhabitants) municipalities (SOARES FILHO; DUARTE; MERCHAN-HAMANN, 2020). This scenario can be explained by the loss of the idea of neighborhood, so characteristic of homes and a strong point of sociability in the interior, leading to an increase in crime in these municipalities and transforming urban violence into something daily, harming autonomy, freedom and spontaneity that supported the feeling of closeness (COSTA *et al.*, 2014).

As possible limitations of the present study, it is recognized that cases of violence are underreported (FIORINI; BOECKEL, 2021) and that using secondary publicly accessible data can influence the municipality's sensitivity in reporting episodes of firearm violence (PINTO *et al.*, 2020), biasing information. Another limitation concerns the data on variables with reference to the 2010 census, which may be time-lag (PINTO *et al.*, 2020).

FINAL CONSIDERATIONS

The present study sought to correlate interpersonal firearm violence in men and social, environmental and economic variables, understood as indicators of inequality and social deprivation, resulting in conditions of vulnerability present in Brazilian society.

As a relevant Public Health problem, firearm violence is inserted in the context of social relations, and it is essential to analyze it for planning health actions (MACIEL; SOUZA; ROSSO, 2016). Although there is great magnitude in the presence of firearms in violent events, there are few works that specifically analyze this issue in Brazilian society (RIBEIRO; SOUZA; SOUSA, 2017).

Far from understanding the problem as fully understood, it is emphasized that the methodology used allows to highlight areas of higher priority for interventions aimed at correcting the analyzed vulnerability situations. Additionally, further work is needed (mainly those with a qualitative approach) in order to provide even more evidence to the issue of firearm violence against men.

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