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Analysis of the correlation of socioeconomic, sanitary, and demographic factors with homicide deaths – Bahia, Brazil, 2013–2015

Análise da correlação entre fatores socioeconômicos, sanitários, demográficos e óbitos por homicídio – Bahia, Brasil, 2013-2015

Análisis de la correlación entre factores socioeconómicos, sanitarios, demográficos y muertes por homicidio – Bahia, Brasil, 2013-2015

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ABSTRACT

Objective: To analyze the correlation of socioeconomic, sanitary, and demographic factors with homicides in Bahia, from 2013 to 2015. **Methods:** Ecological study, using data from the Information System on Mortality and from the Superintendence of Economic and Social Studies. The depending variable is the corrected homicide rate. Explanatory variables were categorized in four axes. Simple and multiple negative binomial regression models were used. **Results:** Positive associations were found between homicides and the Index of Economy and Finances (IEF), the Human Development Index, the Gini Index, population density, and legal intervention death rates (LIDR). The variables Index of Education Levels (IEL), rates of death with undetermined intentions (RDUI), and the proportion of ill-defined causes (IDC) presented a negative association with the homicide rates. **Conclusion:** The specific features of the context of each community, in addition to broader socioeconomic municipal factors, directly interfere in life conditions and increase the risk of dying by homicide.
Descriptors: Homicide; Mortality; Regression Analysis; Socioeconomic Factors; Epidemiologic Factors.

RESUMO

Objetivo: Analisar a associação entre fatores socioeconômicos, sanitários e demográficos e os homicídios na Bahia, no triênio de 2013-2015. **Métodos:** Estudo ecológico, usando dados do Sistema de Informação sobre Mortalidade e Superintendência de Estudos Econômicos e Sociais. A variável dependente é a taxa de homicídio corrigida, e as variáveis explicativas foram categorizadas em quatro eixos. Utilizaram-se modelos de regressão binomial negativa simples e múltipla. **Resultados:** Houve associação positiva entre homicídio e Índice de Economia e Finanças (IEF), Índice de Desenvolvimento Humano, Índice de Gini, densidade demográfica, taxa de morte por intervenção legal (TxILe). As variáveis Índice de Educação (INE), taxa de óbito de intenção indeterminada (TxInd) e proporção de causas mal definidas (CMD) apresentaram associação negativa com a taxa de homicídio. **Conclusão:** As especificidades dos contextos comunitários bem como os fatores socioeconômicos municipais mais amplos interferem diretamente nas condições de vida e alteram o risco de morrer por homicídio.
Descritores: Homicídio; Mortalidade; Análise de Regressão; Fatores Socioeconômicos; Fatores Epidemiológicos.

RESUMEN

Objetivo: Analizar la relación entre factores socioeconómicos, sanitarios y demográficos y los homicidios en Bahia, en el trienio de 2013-2015. **Métodos:** Estudio ecológico, usando datos del Sistema de Información sobre Mortalidad y Superintendencia de Estudios Económicos y Sociales. La variable dependiente es la tasa de homicidio corregida, y las variables explicativas han sido categorizadas en cuatro ejes. Se ha utilizado modelos de regresión binomial negativa simple y múltiple. **Resultados:** Hubo relación positiva entre homicidio e Índice de Economía y Finanzas (IEF), Índice de Desarrollo Humano, Índice de Gini, densidad demográfica, tasa de mortalidad por intervención legal (TxILe). Las variables Índice de Enseñanza (INE), tasa de óbito de intención indeterminada (TxInd) y proporción de causas mal definidas (CMD) presentaron relación negativa con la tasa de homicidio. **Conclusión:** Las especificidades de los contextos comunitarios así como los factores socioeconómicos municipales más amplios interfieren directamente en las condiciones de vida y alteran el riesgo de morirse por homicidio.
Descriptores: Homicidio; Mortalidad; Análisis de Regresión; Factores Socioeconómicos; Factores Epidemiológicos.

INTRODUCTION

Homicide has been used as a universal indicator of social violence both in sociological approaches and in the field of health. Its magnitude and distribution can be instruments to measure the quality of life conditions in a macro-social context[1].

Studies that use official data often show aggregated rates, indexes, and profiles to describe the rates of mortality by homicide in countries, federation units, and cities[2-3]. However, certain studies do not consider the differences in the quality of the information from the systems that offer data on mortality, treating it as if it were homogeneous. As a result, they fail to highlight issues that interfere in the clarification of the basic causes of death and the real impact they have in the overall meaning of the event.

Minayo[4] states that "*[...] homicide is the most hideous act in social relations, since it brings into effect the self-centeredness of human beings: the annihilation of others*". If, on one, side, death by homicide is an interpersonal event (individual — between people — relational), homicide mortality rates are expressions of absolute risk, and of the life conditions from a certain place and time. Although life and health conditions are described (explained) by epidemiological, socioeconomic, and sanitary factors, it is essential to verify how much do these factors contribute to the aggregate level of homicides.

The state of Bahia stood out in a global study on homicides[5]. Among the sub-national units of Brazil, Bahian cities underwent important changes throughout the last three decades. If homicide rates diminished in some states, such as São Paulo, they increased more than 50% in the same period in Bahia[5].

In absolute terms, Bahia is the state with the highest rate of homicides in the country from 2015 on (followed by São Paulo and Rio de Janeiro), with a total 5,787 deaths/year. In the same period, it has been the second state with the highest number of deaths with undetermined intentions (violent deaths which were not specified as homicide, suicide, or accident): 1,756. With regards to deaths caused by police officers (legal interventions), the state has the third higher absolute number, with 225 in 2015. No other state in the federation, apart from the other two with the most deaths, had a number of deaths caused by the police above 75 deaths/year[6].

The World Health Organization (WHO)[7] recommends regional efforts to prevent violence, which aim, among other things, to strengthen sub-regional organizations to work in data collection and dissemination, thus revealing the actual extension of the problem. Public health contributes to this end, as it considers the problem from a collective dimension, using epidemiological studies that can generate explanatory hypotheses [etiological] with regards to the deaths that take place within a city[8]. It is undeniable that people die from homicides, which is explained by individual and relational characteristics. However, there are characteristics from the area, macro-social factors, and characteristics of the city itself that directly interfere in life conditions and alter the risks of dying by homicide.

In order to investigate the association between homicides and global explanatory factors, considering aspects such as the quality of the information with regards to the basic cause of death, this study focuses on the socioecologic (macro-social) relations of homicides. Additionally, it revolves around environmental contexts, as opposed to individual risk-group factors. To do so, it considers global variables and measures, exclusively attributed to the places in which this type of death happens[9].

OBJECTIVE

To analyze the association of socioeconomic, demographic, and sanitary factors with the deaths by homicide in the state of Bahia, from 2013 to 2015.

METHODS

Ethical aspects

This study used, exclusively, secondary data, collected in public domain and open-access databases, whose variables do not allow for the identification of individuals/subjects. As a result, and in accordance to Resolution 466/2012 from the National Council of Health, this research is exempt from needing the approval of a Research Ethics Committee.

Design, period and place of study

This is an ecological study, of the multiple-group analysis type. It aims to analyze city measure variables (spatial and global) and relate them to the homicide rates in the state of Bahia, through the use of data from the System of Information on Mortality (SIM), made available by the Informatics Department of the Single Health System (DATASUS), referring to the three years from 2013 to 2015[9].

Population; criteria of inclusion and exclusion

Explanatory variables were selected according to the theoretical framework on the theme of homicides and their possible relations with several socioeconomic factors, their impacts and interactions on the field of health, as well as their character and their demographic and spatial areas of influence. The quality of information on the basic causes of homicide was also considered, as was the availability of data from official sources. Explanatory variables (exposure) were classified in four axis: *Axis 1 - Socioeconomic* (IEF - Index of Economy and Finances, IEL - Index of Education Level, HDI - City Human Development Index, Ir - Illiteracy rates; Gin - Gini Index); *Axis 2 - Sanitary* (HLI - Health Level Index, BInhab - Hospital beds per 1,000 city inhabitants, Sanit - Public expenditure with health as a percentage of the GDP); *Axis 3 - Demographic* (PD - Population Density, Pop13to15 - sum of the population who lived in the city in the three-year period analyzed); *Axis 4 - Quality of the information and lethal police action* (RUnd - rates of death by undetermined external causes in the three years analyzed, IDC - proportion of ill-defined causes (regarding the total number of deaths), LIDR - mortality rate due to legal interventions (here called "lethal police actions") during the three-year period).

The depending variable (outcome) was the number of homicides, corrected by the redistribution of deaths and the use of

correction factors, according to Szwarcwald et al.[10], and relativized according to the population of the period analyzed -- resulting in the corrected homicide rate. This study chose to consider the corrected number of homicides (HoC13to15) as opposed to the number directly extracted from the SIM (with no corrections). That was due to the difference between them, which became clear in the process of correction, and to the fact that there was a certain variability in the quality of information on the basic causes of death in the state.

The Index of Economy and finances (IEF) is made up of the arithmetic mean of four indexes, two of which are tied to the work marked (the Index of Formal Worker Income and the Index of Formal Work); and two related to the economy and finances of the cities (Index of Financial Independence and Index of Municipal Product). The Index of Educational Level (IEL) is formed by the arithmetic means of five indicators that aim to measure the capacity of the municipal basic education (Index of Enrollment in Kindergarten; Index of Enrollment in Elementary Education; and Index of Enrollment in High School) and one indicator to measure the quality of education, the Index of Elementary School Quality (initial and final series). The Index of Health Level (IHL) is made up of seven indicators. Five of them measure the capacity of the health services of the city (the Index of SUS Physicians Available, the Index of SUS Nurses Available, the Index of Coverage of Teams from the Family Health Program, the Index of Vaccination Coverage, and the Index of Prenatal Consultations), while two measure the quality of services offered (Index of Deaths from Defined Causes and Index of Hospitalizations from Non-Avoidable Causes)[11].

These indicators, originated from literature, are based on regional development. For them, the focus of public actions must be primary health care, in the health field; elementary teaching, in education; and reaching the average level of economic indexes of Brazilian cities, in the economic sector. In other words, the parameters should be those of mean national levels (they could also be those of mean regional levels), and compared to those, the levels of Bahian cities are low. Their objective is both to measure the offer of basic services and the quality with which these services are offered to the population[11].

Study protocol

The secondary data for the study were obtained from multiple sources. Population estimates, socioeconomic, environmental, and demographic features were found in the websites of the Brazilian Institute of Geography and Statistics (IBGE)[12]. The other variables were extracted from the websites of the United Nations Development Programme (UNDP), of the Superintendence of Economic and Social Studies of Bahia (SEI), and of the Institute of Applied Economic Research (IPEA)[11,13-14].

Analysis of results and statistics

To analyze the association of the variables and their outcomes, simple and multiple negative binomial regression models were used, with the individual contribution of each variable. The simple models considered associations with significance levels below 20% ($p < 0.20$), which led to the selection of the variables to be included in the multiple models. In the multiple analysis, a significance level of 5% was considered. Variables with a p-value of 0.05 or lower and that were in accordance with the adjustment selection and evaluation criteria were selected to be part of the final model.

The negative binomial regression models were constructed to estimate the reasons for the homicide rates (RHR) and their respective 95% confidence intervals (IC95%). The RHR is a relative measure, that can vary from 0 (zero) to $+\infty$. When values above 1 are presented, they suggest that exposure to the variable is a risk factor (positive association); values below 1 suggest protective factors (negative association); and values of 1 should be seen as null, meaning there is no apparent association between exposure and outcome.

Spearman's correlation was used to evaluate the existence of multicollinearity in explanatory variables. The analysis found association between the variables: GDP and IEF (0.71), Gin and GDP (0.41), HDI and GDP (0.42) - $p < 0.01$. Therefore, these variables were separated in the adjusted models. The modeling procedures, at first, considered Poisson's distribution. However, it was found that there was no equidispersion, which meant a violation of the basic assumption of mean/variance equality in this distribution of probability. The negative binomial regression model followed, which is also indicated for count data (deaths by homicide) and can accommodate for overdispersion. Due to the high number of cities and the different sizes of the populations, a regression model weighted by the population's logarithm was used, with a parameter called offset, which was added to the regression equation[15].

The selection and evaluation of models took place based on the results from deviance, the information criteria from Akaike (AIC), and the significance of the parameters. The adequacy of the model was verified using the Normal Probability chart and the chart of residues and adjusted values[15].

The objective of the model was quantifying the magnitude of the association between exposure (socioeconomic, sanitary, and demographic data, as well as those related to the quality of information) and the outcome (the response variable [homicide rate in the period]). To do so, the software RStudio Foundation for Statistical Computing, version 3.0.3, was used[16].

RESULTS

From 2013 to 2015, in the 417 cities in the state of Bahia, 13,355 homicides were recorded, according to the SIM. The corrected total was 16,824 homicides, with a rate of 32 deaths per 100 thousand residents, in the period. From the 20 cities highlighted, 8 are from the Extreme South of the state, while 7 are from the West macro-region. The greatest corrected homicide rates took place in Santa Cruz Cabrália (Extreme South) with 171,2 deaths per 100 thousand people (Table 1).

The process of modeling homicides and their co-variables started based on an analysis of individual contributions (univariate) from each of the 12 explanatory variables of the study, as shown by Table 2, with the 12 univariate models and the effects of the estimates of variable coefficients, the RHR, p-values, and confidence interval.

Table 1 - Number and rates of homicides in the period, organized in order of the 20 cities with the highest rates, according to the health macro-region, Bahia, Brazil, 2013-2015

State/city	Macro-region	Population 2015	Number of homicides, not corrected	Number of homicides, corrected	Homicide rate, not corrected	Homicide rate, corrected
BAHIA	-	15,203,934	13,355	16,824	25.4	32.0
Santa Cruz Cabrália	Extreme South	28,226	119	144	141.5	171.2
Santa Luzia	South	13,626	44	60	107.5	146.6
Itabela	Extreme South	31,055	99	134	107.0	144.3
Pojuca	East	37,543	124	157	111.6	140.9
Lauro de Freitas	East	191,436	542	649	96.1	115.1
Simões Filho	East	133,202	351	427	88.9	108.0
Terra Nova	Mideast	13,547	33	41	81.3	101.8
Porto Seguro	Extreme South	145,431	377	427	87.7	99.4
Itagimirim	Extreme South	7,351	13	21	58.7	95.8
Itapebi	Extreme South	10,882	23	31	70.3	95.1
Mata de São João	East	45,813	94	122	69.3	90.4
Eunápolis	Extreme South	113,191	241	299	71.7	88.9
Valença	South	97,305	220	253	75.8	87.1
Mascote	South	14,877	29	39	64.1	86.6
Rio Real	Nordeste	40,809	85	103	69.9	84.6
Vera Cruz	East	42,650	82	106	64.9	83.7
Dias d'Ávila	East	78,058	154	183	67.0	79.8
Teixeira de Freitas	Extreme South	157,804	293	373	62.8	79.8
Vereda	Extreme South	6,696	7	16	34.6	79.3
Camaçari	East	286,919	586	664	69.4	78.6

Table 2 - Estimates of the coefficients, reasons for homicide rates, p-value, and confidence interval of the explanatory variables of the model for homicides (univariate analysis), Bahia, Brazil, 2013-2015

Variables	Coefficient	RTH	*p*	AIC	*Deviance*	IC95%
Axis 1						
Index of Economy and Finances (IEF)	2.229	9.29	**<0.001**	3217.453	478.099	5.78-15.18
Index of Educational Level (IEL)	-1.663	0.19	0.013	3296.804	473.933	0.05-0.71
Municipal Human Development Index (HDI)	6.1074	449.17	**<0.001**	3254.324	477.901	81.45-2568.30
Illiteracy rates (Ir)	-0.0404	0.96	**<0.001**	3256.092	478.294	0.95-0.97
Gini Index (Gin)	2.5380	12.65	0.003	3294.225	474.170	2.34-69.27
Axis 2						
Index of the Health Level (IHL)	0.179	1.20	0.781	3302.788	474.128	0.34-4.16
Hospital beds per 1,000 inhabitants (LInhab)	0.0421	1.04	0.184	3301.143	478.099	0.98-1.11
Public expenditure with health in percentage of the GDP (Sanit)	0.0051	1.01	0.413	3301.866	474.149	1.00-1.02
Axis 3						
Population density (PD)	0.0009	1.00	**<0.001**	3284.743	474.354	-
Axis 4						
Legal intervention death rates (LIDR)	0.1579	1.17	**<0.001**	3283.543	475.186	1.09-1.27
Rates of death with undetermined intentions (RUnd)	-0.0097	0.99	0.002	3295.809	474.171	0.98-1.00
Proportion of ill-defined causes (IDC)	-0.0162	0.98	**<0.001**	3276.377	475.208	0.98-0.99

Note: RHR: reasons for homicide rates. IC95%: RHR confidence intervals of 95%. AIC: Akaike information criteria.

Table 2, regarding Axis 1 of the socioeconomic variables, which includes the Index of Economy and Finances (IEF), the Human Development Index (HDI) and the Gini Index (Gin) showed positive coefficients and RHR > 1, indicating that these factors are positively associated to the homicides. On the other hand, the index of educational level (IEL) showed a negative coefficient and RHR < 1, as did the illiteracy rate.

In Axis 2, all variables of health condition assessment were directly associated to the response-variable, although only the variable "number of beds per 1,000 inhabitants (BInhab)" presented a p < 0.20. The population density (PD - Axis 3) had no association with the outcome (homicide rate).

Finally, negative coefficients were estimated, and an RHR < 1 was found for the rate of deaths with undetermined intentions (RUnd) and for the proportion of deaths with ill-defined causes (IDC), all of which with significant associations. However, the rate of legal interventions (index of lethal police activity [LIDR]) presented an RHR > 1, meaning a positive association with the outcome in the state (Table 2).

Later, a single model was adjusted (multivariate analysis) involving all variables in the study. The automatic selection technique was used in the final model. It considers the quality evaluation criteria of the earlier model and continues with its systematic construction, considering successive variable additions and exclusions of variables, until there are no more variables to enter or leave, in accordance to the criteria of statistical significance.

Therefore, the multivariate model that fit the best to describe the association of the homicide rate in Bahia, in the period from 2013 to 2015, is presented on table 3. It includes the explanatory variables: Index of Economy and Finances (IEF), Index of Educational Level (IEL), and Rates of mortality due to lethal police intervention/activity (LIDR).

Table 3 - Estimates of the coefficients, reasons for homicide rates, p-value, and confidence interval of the final model for homicides (Multivariate Analysis), Bahia, Brazil, 2013-2015

Variables	Complete model			Final chosen model*			
	Coefficient	RHR	*p*	Coefficient	RHR	*p*	IC95%
Index of Economy and Finances (IEF)	1.915	6.79	**<0.001**	2.274	9.72	**<0.001**	5.95-16.09
Index of Educational Level (IEL)	-2.502	0.08	**<0.001**	-2.347	0.10	**<0.001**	0.02-0.15
Index of the Health Level (IHL)	-1.575	0.21	0.009	-	-	-	
Municipal Human Development Index (HDI)	2.100	8.17	0.244	-	-	-	
Illiteracy rates (Ir)	-0.002	1.00	0.839	-	-	-	
Gini Index (Gin)	-0.144	0.87	0.854	-	-	-	
Hospital beds per 1,000 inhabitants (LInhab)	0.003	1.00	0.913	-	-	-	
Public expenditure with health in percentage of the GDP (Sanit)	-0.003	1.00	0.552	-	-	-	
Population density (PD)	-0.000	1.00	0.443	-	-	-	
Legal intervention death rates (LIDR)	0.0635	1.07	0.056	-	-	-	
Rates of death with undetermined intentions (RUnd)	-0.012	0.99	**<0.001**	-0.012	0.99	**<0.001**	0.98-1.00
Proportion of ill-defined causes (IDC)	-0.006	0.99	0.028	-0.005	1.00	0.049	-

** Note: Final chosen model - adjusted through a negative binomial regression, including the population of the period as an offset. RHR: reasons for homicide rates. IC95%: RHR confidence intervals of 95%.*

The association of the IEF variable with the outcome suggests that, the better the economy and finances index in the cities, the higher the rate of deaths from homicide. The opposite result was found with regards to the variables Index of Educational Level, rates of death from undetermined causes, and percentage of ill-defined causes. No significant interaction could be observed in the adjustment.

Finally, the adequacy of the model with regards to heteroscedasticity, linearity, and normality was verified through an analysis via chart of residues and through the chart of normal probability, according to Figure 1. In it, the normal probability chart is close to a straight line, with most dots distributed over it, which makes it possible to assume the normality of the residues. In the chart of the residues versus adjusted values, the distribution of the residues is random, and does not present any structure or evidence of multicollinearity. In other words, the model was found to be valid and reliable to defend the evidences found in the study.

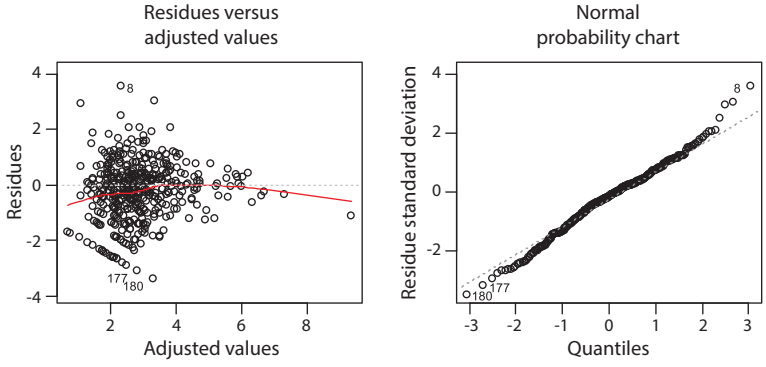

Figure 1 - Analysis of residues for the final model of deaths by homicide

DISCUSSION

The findings of this study showed that economic indexes (IEF) are directly associated to homicide rates in the state. The study pointed out that places with better economic conditions have 9.29 times higher homicide rates than those with low economic and financial conditions. It was also found that the index of educational levels (IEL) was a protective factor against homicides. The homicide rate is almost 20% lower in cities with higher educational levels. Similarly, the two indexes of quality of information were inversely associated to the homicides, since undetermined mortality and ill-defined causes are higher in places where there is less homicide detection through homicide rates. That explains, up to a point, the low number of homicides in places with dubious quality of information.

Other positive coefficients found in the univariate analysis of the Human Development Index of the cities, Gini Index, and population density also agreed with the results of similar studies on homicides in Bahia and other locations[17-18]. With regards to the role of socioeconomic factors, the findings were in accordance to literature. Lima et. al[17], for example, found an inverse association of homicides with both illiteracy rates and poverty rates (which, together, explained nearly 25% of the variation in homicide rates). Another study indicated that the increase in inequality expressed by the Gini index increased the risk of deaths by homicide in the general population, in the state of Pará[19].

The analysis of the association of homicides with the health sector, in this study, was carried out using three variables (IHL, BInhab, and Sanit), but none of them contributed individually in a significant way; only in the complete adjusted model the index of health levels (IHL) was significantly and inversely associated to homicide. This index is made up, among other indexes, from the coverage of family health teams and the number of physicians and nurses per 1,000 inhabitants in each city. Keeping that in mind, one of the hypotheses defended by this study is that a greater coverage of Primary Health Care services can be an important protection factor for violence in general and for deaths by homicide in specific.

Therefore, policies that make possible to bring health professionals to the countryside of the state can be a measure to confront the homicides, in a period in which an increase in violence can already be observed[20] and during which it is necessary to tend for the multiple complex harm it brings. Regions and cities with information quality problems (high rates of deaths with undetermined intention and high proportion of deaths from ill-defined causes) also have generally prejudiced health assistance conditions, which certainly impacts in the homicide rates. That is why correcting imprecisions in the identification of the intentionality of deaths (homicides, suicides, or

accidents) includes increasing the coverage of health services towards regions that are rarely included in public policies[21].

Despite legal interventions (deaths by police action), the studies have included these homicide deaths as a single variable[22-23]. However, despite being similar to homicides, these deaths have different interpretations and contexts. When considering social violence, it is paramount to understand the relation between legal interventions and homicides. Still, there is scarce information in the field of public health and little indicators of the conflict frameworks and territory dynamics, which are not always available in a municipal level, or for all states in the federation[24].

Considering the above, the model made it possible to discuss explanatory hypotheses to understand homicides in the state. It stands out that the reasons that lead some places to have high levels of homicides include much more factors than those related to vulnerabilities or excess mortality of certain groups[25]. In other words, it is not enough to identify risk groups, through, for instance, defining characteristics of the homicide victims (sex, age, color, among others). The alarming homicide rates in the country show that there are significant shortcomings in the policies of safety and public health, in addition to showing the inefficiency of the State in confronting violence. Therefore, individual and ad hoc actions on risk groups are inefficient, if they do not understand which contextual and collective vulnerabilities are related to the deaths by homicide.

Study limitations

The limitations of this study and the difficulties in creating multivariate models in ecological studies are highlighted, among other reasons, by the relative slowness in the development of pertinent analytical techniques with ecological designs. Therefore, this study has a limitation that is relative to ecological studies: for example, its formulation and the text of explanatory hypotheses with regards to the occurrence of homicides may be prejudiced by the difficulties in the control of confounding factors.

Another issue is that the conduction and the planning in the study of population groups involve profound knowledge of the phenomenon, considering the multicollinearity between variables, the detection and correction of confounding situations (bias), the validation of assumptions, inference problems, and other aspects that make the work more difficult, and the analysis, more complex[15]. Despite not considering all of them, this investigation showed to be consistent and coherent with regards to other findings by studies involving many populations.

Contributions to the fields of Nursing, Health or Public Policy

Health assistance and sanitary infrastructure are the aspects of the provision and distribution of health services, resources, and equipment to a certain population, to satisfy their health needs, including those of dealing with diseases and other health-related problems[21]. In this context, this study contributed for Nursing, Collective Health, and for Public Health Nursing, as it fomented a debate focused on the promotion and protection of the health of the populations, considering that this approach is adopted since the inception of modern Nightingalean nursing. In 1922, for example, nursing already adopted sanitary strategies to offer support to the Brazilian government, aiming to go beyond a medical-curative approach and to avoid focusing on the disease[26].

Therefore, this study revolves around proposals to develop local, regional, and national health policies, without ignoring the relevance of ad hoc and individual care[27]. This research furthers nursing and public health knowledge (epidemiology) and uses this knowledge in a novel way, to develop work that is targeted at indexes, health programs and policies, economy, and at the social sphere, in the scope of the population.

CONCLUSION

Considering that the ecological model aims to explain violence based on the interaction of individual, relational, community, and social factors[25], this study could, with the aid of the statistical model and of theoretical concepts, raise, test, and prove certain hypotheses to explain the high rates of homicides. In addition, this work helped consolidating the understanding about how broader factors (specific to the cities) are associated to the homicides.

Among the hypotheses defended here, the importance of the education level (evidenced through the negative association with homicide rates) in the locations and period analyzed stood out as protective factors for cities with lower indexes. Another finding was a direct relation between the economic and financial level of Bahian cities and high death rates - which could be partially explained due to the greater wealth inequality in certain locations.

Seeking to broaden the concept of vulnerability beyond risk groups, profiles of victimization by homicides, and individual trajectories, this study built correlations based on the contextual (in a population/social level) aspects of the problem. To broaden and improve debate in this direction, other studies must further the analysis of the community context, involving quantitative and qualitative characteristics in the study of homicidal violence. This approach can be considered in tandem with an ecosystemic view of homicide, as suggested by Minayo and Constantino[28].

Future efforts should help not only to better understand the phenomenon of violence and its implications, but especially, propose measures and interventions in the collective trajectory (at a population level) to diminish social inequalities and its hazards, as well as to advance proposals to create environments and cities that promote a culture of peace.

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