


Homicides in Belo Horizonte, MG, Brazil: a portrait of urban inequality¹


Homicídios em Belo Horizonte, MG: um retrato das iniquidades nas cidades

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Abstract

In Brazil, homicides are one of the most sensitive indicators of urban social inequalities. Integrated social protection policies can have a definite impact over this health event. The objective of this article is to describe homicides in Belo Horizonte in the light of a conceptual model, part of the evaluation process of a redevelopment project in the city. Based on a review of the literature, this conceptual model was constructed to assess the relationship between homicides and urban living in Brazil. A descriptive study of homicides was carried out using data on the period from 2002 to 2012, extracted from the Mortality Information System (*Sistema de Informações sobre Mortalidade - SIM*). The conceptual model reinforces that the most expressive determinants of homicides are found in the cities, and are linked to inequality and exclusion, together with the values of a culture based on prejudice and the use of force. The prevalence of homicides in Belo Horizonte was high even in the formally urbanized part of the city, but reached numbers three to six times higher in its favelas. Most deaths pertain black young men of low schooling. These deaths usually take place in public roads and in vulnerable territories. Homicides are the synthesis of urban disadvantages, especially in vulnerable areas. The situation in Belo Horizonte is similar throughout the rest of Brazil. Pointing to the reality of living and dying in cities, these data testify against social inequality and its perversity.

Keywords: Homicides; Health Disparities; Urbanization; Vulnerable Areas.

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Resumo

Os homicídios no Brasil são um dos indicadores mais sensíveis da desigualdade social nas cidades. Assim, políticas de proteção social integradas nos territórios podem impactar esse evento em saúde. Este artigo objetiva descrever os homicídios em Belo Horizonte à luz de um modelo conceitual, parte de um processo avaliativo de um projeto de reurbanização na cidade. A partir da revisão da literatura, construiu-se um modelo conceitual para a compreensão dos homicídios e sua vinculação com o viver nas cidades. Realizou-se um estudo descritivo dos homicídios a partir de dados do Sistema de Informação sobre Mortalidade (SIM) relativos ao período de 2002 a 2012. O modelo conceitual reforça que os homicídios encontram nas cidades seus mais expressivos determinantes vinculados à desigualdade e à exclusão, junto a valores de uma cultura de força e preconceitos. Os homicídios em Belo Horizonte apresentam taxas elevadas na cidade formal, sendo de três a seis vezes maiores nas favelas. Morrem mais negros, jovens homens, de baixa escolaridade, nas vias públicas e nos territórios vulneráveis. Os homicídios são a síntese das desvantagens urbanas, especialmente em tais áreas. Retrata-se em Belo Horizonte o que se vê no Brasil, denunciando a desigualdade e sua perversidade no viver e morrer nas cidades.

Palavras-chave: Homicídios; Desigualdades em Saúde; Urbanização; Áreas Vulneráveis.

Introduction

Due to the process of urbanization, the construction of modern cities presupposes the exteriority of their own residents. Organized in the benefit of industrial, financial and real estate capital, according to a logic of consumption, this is a history in which residents are usually objects rather than subjects.

In Brazil, the growth of large cities began in the late nineteenth century, becoming more vigorous in the twentieth century, following the country's industrialization. Offering opportunities in the access to jobs, goods and services, the cities attracted masses of rural residents. Even in situations of unequal supply, such opportunities contributed to the improvement of indicators, as in the case of reduced child mortality rates (Maricato, 2000).

However, as a result of such a growth process - marked by a dismissive attitude towards the universal right to the city, and ordered by the logic of consumption (especially the consumption of urban space) - the poor were expelled to cities' outskirts, where Brazil's favelas first appeared. Since their inception, defined by precarious housing conditions, favelas have been separated from metropolitan urban centers (Maricato, 2000; Rolnik, 2013). The heritage of this growth format are expansive cities occupied by large favelas, facing many urbanistic challenges (UN-Habitat, 2003).

Within a dynamic marked by the social and historical determinants of the health-disease process, and in a context of positive and negative - but mainly unequal - urban determinants, the city exposes its residents to various risks (Buss; Pellegrini, 2007; Vlahov et al., 2007). In Brazil, especially since the 1980s' crisis, homicides have been one of the most sensitive indicators of the urban tragedy (Maricato, 2000).

Homicides bear a multiple and complex determination. Although not endemic to large cities, they find their most significant determinants there (Cardia; Adorno; Poletto, 2003; Cerqueira; Lobão, 2003; Chioda, 2017; Corburn; Sverdlik, 2017; Drummond; Souza; Hang-Costa, 2015; Ezeh et al., 2017; Minayo; Souza, 1999; Rivero, 2010; Zaluar; Ribeiro, 2009). Homicides are particularly common among favela dwellers. This is not surprising, as favelas went through

a historical process of accumulated inequalities and, as a result, falling ill and dying have become something other than natural processes, marked rather by the precocity, severity, and multiplicity of diseases (Corburn; Sverdlik, 2017; Ezeh et al., 2017).

The growth of violence may not be unique to Brazil, but it has reached an epidemic level in the Americas. Specifically, in Latin America (where 42 of the 50 most violent cities in the world were located in 2013), a sharp increase in homicide rates was observed from 2000 to 2012. Homicide rates in many of these cities have reached 30 for every 100,000 inhabitants (Chioda, 2017; UN, 2014). These are much higher than the European and global average rates, which, in 2012, were 2.0 and 6.2/100 thousand inhabitants, respectively (UN, 2014).

Brazilian homicide rates went through a slow growth starting in the 1960s. From then on, this growth accelerated. In 1980, especially, homicides increased significantly. This growth was associated with the country's political and economic crisis, and also with the expansion and consolidation of organized crime - alongside the country's grave levels of social inequality (Maricato, 2000; Minayo; Souza, 1999). Indices continued to grow in the 1990s, sharpened by neoliberal policies, and also in the period from 2000 to 2015, despite the decline observed in some Brazilian states in the first half of the 2000s (Cerqueira et al., 2018; Peres; Santos, 2005). This slight decline was attributed to state policies aimed at preventing violence associated with disarmament (Cerqueira et al., 2017; Waiselfisz, 2010). Homicide rates, however, remained high - more than 20 per 100 thousand inhabitants. As of 2007, homicides are rising again, even in medium-sized Brazilian cities, which also suffer from a disorderly and rapid urbanization. In 2015, the rate of homicides reached 29 per 100 thousand inhabitants. Continuing its ascent, in 2016 the national rate reached 30.3/100 thousand inhabitants (Cerqueira et al., 2018).

As a large urban center, Belo Horizonte's spatial logic of organization is not far from that of megacities. Thus, the capital is subjected to poor housing conditions, complex social relationships, large favelas, and the emergence of health problems amplified by social inequality, such as homicides (Friche et al., 2015).

Such disadvantages have unfair, but avoidable consequences for the population. Currently, there

are discussions on urban and social, intersectoral, structurant public policies for favela re-urbanization. These may have a positive influence on quality of life by reducing health problems, including homicides (Caiaffa et al., 2008; Cerdá et al., 2012; Corburn; Sverdlik, 2017; Ezeh et al., 2017).

This is the backdrop for the development of the "BH-Viva" project (Friche et al., 2015), which has been employing quantitative and qualitative methods to build a model for evaluating public policies aimed at urban reconstruction in the city's favelas. More specifically, the model aims to assess the "Vila Viva" program (Afonso; Magalhães, 2014), implemented by the Belo Horizonte City Hall (*Prefeitura de Belo Horizonte* - PBH), and its impact on health events, including homicides.

Thus, the aim of this article is to describe homicides in the city of Belo Horizonte in the light of a conceptual model, contributing to the design of actions that minimize this grave epidemic that currently plagues Brazilian cities. Moreover, based on the model, we intend to compare homicides in the formally urbanized portion of the city with homicides in its segregated territories. This will be the basis for a future, quasi-experimental study evaluating the Vila Viva program's impact on homicide rates by comparing similar favelas that have or have not been subjected to the program's intervention, since, as shown in the literature, homicide events can be influenced by reurbanization projects, especially in vulnerable territories.

Method

Conceptual model construction

Considering theories and models proposed in the consulted literature, the developed model aimed to deepen the understanding on homicides, as well as their relationship with the urban space and the inequality therein. This effort was based on the recognition of these four pillars:

1. Cities, in their prevalent model of sociopolitical, economic and cultural organization, expose their residents - especially those living in vulnerable areas - to various risks;

2. Homicides are unevenly distributed in cities and represent an event of recognized gravity and enormous impact on individuals, their families and society; this makes them one of the most sensitive indicators of urban tragedy;
3. The avoidability of homicides is related to public social inclusion policies;
4. In this sense, it is opportune to evaluate a revitalization project of favelas implemented by the municipal public power and its potential to impact homicides.

Model bases: definitions and concepts

The right to life and safety is a democratic guarantee, constitutionally established by the Brazilian state and by international human rights laws. Homicides run counter to these rights (Peres; Santos, 2005; UN, 2014), and have become one of contemporaneity's major public health problems.

Any approach to the issue of homicides requires multidisciplinary reflections from various fields of study. Furthermore, any theoretical and methodological reflection on violence must comprehend that violence is not irrational, and is linked to historically and socially constructed meanings and determinations.

In reviewing the individualistic, biologicistic, and behavioral theories that place excessive blame on individuals and their families, the modern environmental theories that are important for crime control, but generally claim that physical space is the cause of homicide and, still, tend to ignore the historical process, together with the impacts of exclusion and territorial segregation, we look for new ways.

Advancing beyond environmentalist theories, in order to build the proposed model and seek a link between homicides and the city - as well as establish a conceptual framework - we carried out a brief theoretical synthesis. Included in this synthesis would be theories that consider social inequalities as well as economic, social, and cultural expropriation as important ingredients for understanding the bases of violence (Cerqueira; Lobão, 2003; Minayo; Souza, 1999; Rivero, 2010; Sampson; Raudenbush, 1999).

The model

Homicides are defined as injuries committed to another person using any means intended to injure or kill a person (Drumond; Souza; Hang-Costa, 2015). Other constructs can be aggregated to this basal definition in order to understand the phenomenon of violence and its most damaging expression.

Although it cannot be treated as exclusive and closed, the proposed model has four main components, corresponding to the processes that contribute to or determine the occurrence of homicides (Figure 1).

Even though we are well aware that, in order to construct an explanation for an event with such complex determination, isolating an effect and treating it as independent does not seem possible or desirable, we opted for a mode of presentation that facilitates the understanding of distinct determinants, knowing full well that these are in practice intertwined.

1. Urban disadvantages: these arise from accelerated urbanization, high population density and the disorganization of urban space. Without proper offer of public policies, including protective-security ones, and aggravated by income concentration, such disadvantages cannot but deepen social inequality. By choosing those who "are" and those who "are not" citizens based on property laws, society reveals its fundamentally segregationist and exclusionary violence, a basis for structural urban violence (Cerqueira; Lobão, 2003; Maricato, 2000; Rolnik, 2013).
2. Territorial disadvantages: the social and spatial segregation of vulnerable territories, arising from the separation of classes and social groups that, forgotten by state and "market," continue to accumulate disadvantages, and suffer from scarce citizenship when it comes to accessing social welfare and safety public policies. In these vulnerable areas, the absent state is replaced by the forces of organized drug trafficking and its enemies and allies, which end up exacerbating the violence inherent in this "war." In this

perverse logic of domination, these forces eventually tear entire communities' social tissue, weakening their associative power and their organization around social and political demands. This includes the coaxing of young community dwellers who, in their social invisibility, are the ones dying the most (Cardia; Adorno; Poletto, 2003; Cerqueira; Lobão, 2003; Maricato, 2000; Minayo; Souza, 1999; Rivero; 2010; Rolnik, 2015, 2013; Souza, 2006; UN, 2014; UN-Habitat, 2003; Zaluar; Ribeiro, 2009).

3. Cultural values: the combination of the prevailing socioeconomic organization, the individualistic cultural formation, the lack of solidarity, and the patriarchal values exacerbates a culture of force, machismo and consumption, deepening prejudice. In addition, disrespect for diversity and intolerance against poor folk, blacks, women, LGBTs and other minorities lead to conflict and death. The fragile governance of a state that does not care for everyone, preoccupied only with fulfilling

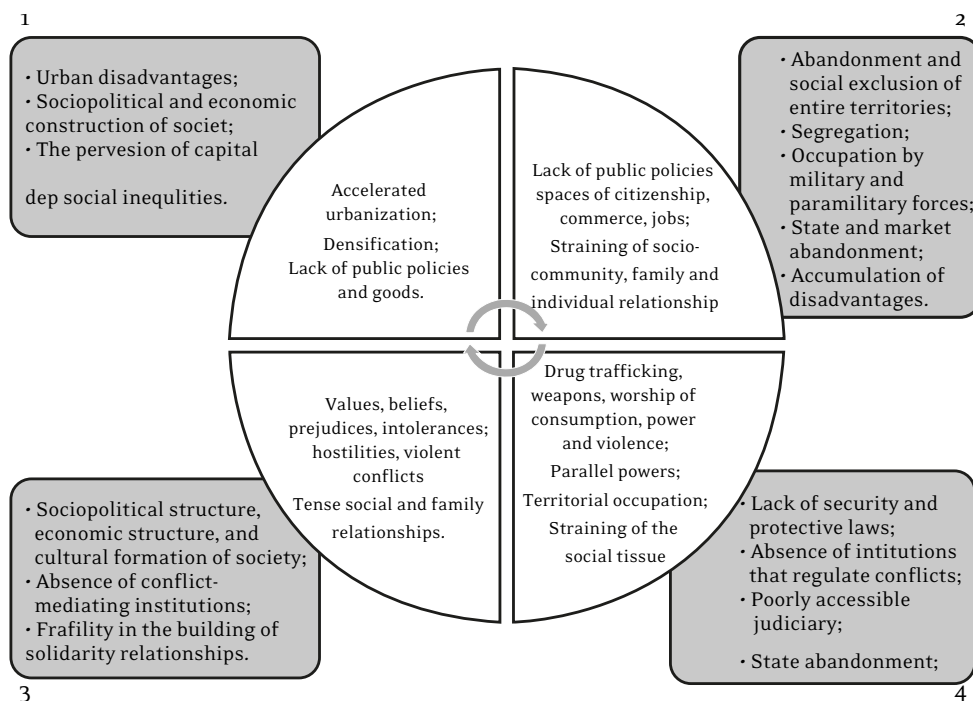
dominant interests (Minayo; Souza, 1997), increases inequality and violence.

4. Justice and security system: an unfair justice system that plays a central role in structuring interpersonal conflicts. This is associated with a police system that is generally violent, corrupt and arbitrary, failing to exercise its role of protecting citizens and notable for the inadequacy of existing citizen security policies and protective laws. Bad state governance - which gives way to a coexistence between misused lethal police violence, drug and arms trafficking, militias and other extermination groups - once again acts in detriment of the most vulnerable groups and territories (Kucinsk; Dunker, 2015; Lima; Souza; Santos, 2012; Zaluar; Ribeiro, 2009). This is potentiated by the amounts of firearms available to both offenders and citizens with no criminal record, which plays a relevant role in the determination and increase of homicides.

At this point, it is important to emphasize that we are not disconsidering individual or subjective issues

as part of the causality chain of homicides. However, we do believe these issues are generally secondary factors in the exclusionary process that takes place in society and cities, and cannot justify the sometimes-lethal violence against those who commit murder.

Figure 1 – Conceptual model for homicide



Homicides

This study gathered data on the homicides of Belo Horizonte residents in five favelas (known locally as “vilas,” or villages) that were included in the Vila Viva program (Serra, Morro das Pedras, São José, Pedreira Prado Lopes, and Vila São Tomaz), and five favelas that received no intervention by the same program (Cabana, Ventosa, Vista Alegre, Santa Lúcia, and Jardim Felicidade). Together, those account for 40% of the population of the city’s 198 favelas. For comparison purposes, we also evaluated homicides in the formally urbanized part of the city.

Thus, this study’s units of analysis were the aforementioned favelas and the “formal city” - the legally urbanized part of Belo Horizonte - as opposed to the “informal city” of poor favelas, the latter comprised of housing built by the residents themselves and marked by poor conditions of habitability.

Study period

The study encompassed the period from January 1, 2002 to December 31, 2012.

Study design

This was a descriptive study of the frequency distribution, rates and risks of death from homicide, according to the study variables, and in the chosen units of analysis.

Data source

Secondary data used for this study were obtained from the following sources:

Belo Horizonte Municipal Health Secretariat (Secretaria Municipal de Saúde de Belo Horizonte - SMSA-BH)

1. Mortality Information System (SIM) of the Ministry of Health/DataSUS: records of deaths caused by homicide from 2002 to 2012. Made available by the SMSA-BH. The Assault codes X85.0 to Y09.9 of the International Classification of Diseases

(ICD-10) were used to select the pertinent records (Drumond; Souza; Hang-Costa, 2015).

2. The Health Vulnerability Index 2012 (*Índice de Vulnerabilidade da Saúde 2012 - IVS-2012*) (PBH; SUS, 2013) - built in 2012 for the city’s census tracts, using information from the 2010 census - was used to define risk areas. Its constructs are related to indicators pertaining the context in the household and the surrounding area, as well as other social indicators. A final index is calculated from these indicators and the definition of their weights, and, based on the mean and standard deviation of the grades, the census tract is categorized as low risk (LO), medium risk (ME), high risk (HI), or very high risk (VH).

Information Technology and Information Company of the Belo Horizonte Municipality (Empresa de Informática e Informação da Prefeitura de Belo Horizonte - Prodabel)

The geographical database of addresses of the 2000 and 2010 census tracts was used to georeference homicide deaths by place of residence, based on the *x* and *y* coordinates in the census tract of the homicide victim’s home address. These addresses were then grouped (both for the favelas and the formal city).

Brazilian Institute of Geography and Statistics (IBGE)

The populations of the 2000 and 2010 censuses were used as the denominator for the analysis of rates, risks and estimates of population size in the period between censuses.

Study variables

The study variables were: sex of the homicide victim (male or female); age in years and age groups, grouped according to age at the date of death (from 0 to 9; 10 to 19; 20 to 39; 40 to 59; 60 years or older; or age not known); color/race (white; brown and black, grouped as: black; yellow; and indigenous); educational level grouped according to years of study (none: illiterate; 1 to 3: incomplete elementary school; 4 to 7: complete elementary school; 8 to 11: high

school; 12 and over: higher education; or educational level not known); place of death (public street; hospital and other health facilities, grouped as: health facility; home; or location not known); and year of death. These data were extracted from the SIM, contemplating the years between 2002 and 2012.

As yet another study variable, the census tract corresponding to the place of residence at death was extracted from the IVS-2012 and classified according to IVS-2012 risk categories (low; medium; high; and very high) (PBH; SUS, 2013).

Data analysis

Descriptive analysis of homicides was performed according to place of residence in the territorial units chosen for the study. Absolute and relative frequency distributions of the study variables were used, as well as a numerical synthesis of the age of death variable. Homicide mortality rates were also calculated year by year.

The 2002 to 2012 rate was calculated from the number of deaths in each year, divided by the population in 2007, and then by the number of years (11 years). We also calculated the rate in the period according to sex and age group. However, for the calculation of the period's rate according to color/race, the population in 2010 was used. This variable was not present in the 2000 census, and thus could not be projected into the interstitial census years.

The period's rate was calculated to provide greater stability to the number of events in each area (Mausner; Kramer, 1990) since, at this stage of the study, it was not possible to employ actual rate stabilization techniques.

The rate per IVS for the period was obtained from the number of deaths georeferenced according to the LO, ME and HI/VH risk sectors and then divided by the population of 2010, georeferenced according to these same sectors and divided by the period's 11 years. The 2010 census population was used for this calculation because of its greater compatibility with the 2010 sector designs. Deaths in sectors whose IVS was "not evaluated" in the formal city and in the favelas were excluded, in agreement with the IVS 2012 methodology (PBH; SUS, 2013).

The percentage change in rates was calculated considering the years 2002 to 2012 and 2010 to 2012.

To this end, we used the initial year's rate as a basis to calculate the rate's percentage changes in the final year of each of the two periods.

Relative risk (RR) calculations were referenced on the following categories: female sex, 40 to 59 years age group (as this population group has exposure to death comparable to that of adolescents and young adults, but different from children and young adults, considered more protected), and the white color/race (less exposed than blacks). The mortality rate and RR for indigenous and yellow color/race were not calculated, as the number of deaths was very small in these populations. It was also not possible to calculate the mortality rate by educational level, since this variable was not comparable in the 2000 and 2010 censuses. Thus, the educational level variable was assessed by means of proportional mortality.

The 2000 and 2010 population and sector design were matched for the units of analysis. The 2010 base was used, as its sector boundaries had greater compatibility with the favelas' design.

As for the georeferencing of homicides, only 5% were not located at the described address (or had unknown address). There was no differentiated loss in the units of analysis. In the formal city, 82% were located at the exact address and 17.5% at an approximate address; in the favelas, these percentages were 68.8% and 29.5%, respectively. Approximately 1.7% of the homicides were georeferenced to a single area.

Ethical aspects

The project was approved by the Research Ethics Committee of the Federal University of Minas Gerais and the Belo Horizonte Municipal Health Secretariat (SMSA-BH) (CAAE n^o 11548913.3.0000.5149).

Results

From 2002 to 2012, Belo Horizonte had 7,220 homicides in the analyzed units. Among these, 865 (12.0%) occurred in favelas included in the Vila Viva program; 749 (10.4%) in favelas with no Vila Viva intervention, and 5,606 (77.6%) in the formal city.

Homicide mortality rates by year of occurrence, either in the intervention or non-intervention favelas, showed a decrease starting in 2007 in

the majority of favelas, with a greater downward trend starting in 2010 (Table 1).

In the years from 2002 to 2012, intervention favelas had a percentage decrease of 49.2%; from 2010 to 2012, the reduction was 25.9%. In non-intervention favelas, the reduction in rates was 51.4% in the years 2002 to 2012, but there was an increase of 4.9% from 2010 to 2012. The formal

city presented more stable gradients throughout the study period (Table 1).

When analyzing the period's rate, very high values were found both in the favelas and in the formal city. The rate in the formal city (25.9/100 thousand inhabitants) was high; however, it was lower than in the favelas, where it was up to six times higher (Table 1).

Table 1 – Rates of death due to homicide per 100 thousand inhabitants, year by year; rate from 2002 to 2012 per 100 thousand inhabitants; and percentage change in rates from 2002 to 2012 and from 2010 to 2012 according to favela, favelas with and without program intervention and in the formal city, Belo Horizonte, Minas Gerais

Units of analysis	Year to year rates											% variation 2002 to 2012	% variation 2010 to 2012	Period's rate 2002 to 2012
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012			
Serra	108.6	81.1	77.2	48.7	93.6	102.0	77.8	63.4	64.0	38.5	43.8	-59.6	-31.5	72.62
Morro	192.8	211.0	158.4	148.9	150.3	89.9	85.0	102.8	86.4	75.2	87.1	-54.7	-0.9	126.18
São Tomaz	39.9	50.2	191.5	131.6	81.3	153.1	102.4	41.1	92.6	102.9	92.6	132	0	98.11
Pedreira	150.0	210.7	410.7	159.7	142.5	186.8	126.9	172.3	131.6	44.4	44.9	-70	-65.8	161.88
São José	109.2	196.3	187.0	177.1	227.0	108.6	79.5	113.9	150.0	50.6	68.4	-37.4	-54.4	133.42
Santa Lúcia	182.7	187.7	225.8	105.2	84.6	103	89.1	50.4	112	86.4	104.1	-43	-7.1	120.99
Ventosa	199.2	302.9	243.1	90.8	157.7	119.8	94.3	109.2	82.8	83.6	70.3	-64.7	-15.2	141.24
Cabana	158.3	130.3	91.4	77.1	88.4	68.4	85.1	53.8	59.8	76.5	49.4	-68.7	-17.3	85.31
Vista Alegre	129.2	138.5	32.9	99.4	50.1	58.9	50.9	25.6	17.2	60.6	52.3	-59.5	204.3	65.04
Jardim Felicidade	44.4	133.6	102.0	134.0	89.3	146.5	133.5	57.0	44.1	63.2	56.9	28	28.8	91.32
Favelas with intervention	121.9	124.5	139.5	99.0	118.9	111.3	85.6	80.0	83.4	56.3	61.8	-49.2	-25.9	72.62
Favelas without intervention	137.7	163.9	129.2	101.3	88.8	97.7	92.2	54.8	63.6	73.8	66.7	-51.4	4.9	128.18
Formal city	21.8	28.2	33.5	30.4	27.6	28.6	26.3	22.8	20.1	24.3	21.8	0	8.4	25.96

Source: SIM/SMSA-BH, data from the 2002 to 2012 period

Regarding victim age at the date of death, we found that the average age of death by homicide is between 20 and 30 years even in the formal city, ranging from 25.4 years in one of the favelas to 28.8 years in the formal city. We also verified that 75%

of homicide deaths in favelas and in the formal city involve people with up to 34 years of age. In regards to minimum and maximum values, deaths have occurred in children aged 0 to 9 years and in older adults (Table 2).

Table 2 – Numerical summary for victims’ age at death in favelas with and without intervention and in the formal city, Belo Horizonte, Minas Gerais, 2002 to 2012

Favelas and formal city Average		Numerical synthesis of age at death						
		Standard deviation	Minimum	1st quartile	Median	3rd quartile	Maximum	
With intervention	Serra	27.2	10.1	13.0	20.0	25.0	32.0	69.0
	Morro	26.2	9.7	8.0	20.0	23.0	31.0	77.0
	São Tomaz	27.7	9.8	13.0	20.0	25.0	34.0	58.0
	Pedreira P. Lopes	25.6	11.1	0.0	18.0	22.5	33.0	65.0
	São José	26.2	9.7	11.0	19.0	24.0	29.0	55.0
Without intervention	Santa Lúcia	26.1	11.0	9.0	19.0	23.0	30.0	79.0
	Ventosa	25.4	8.9	12.0	19.0	23.0	30.0	62.0
	Cabana	27.2	11.1	3.0	19.0	24.0	32.0	68.0
	Vista Alegre	25.6	8.4	14.0	20.0	24.0	29.0	48.0
	J. Felicidade	24.7	8.6	0.0	19.0	23.0	28.0	65.0
Formal city		28.8	11.9	0.0	20.0	26.0	34.0	91.0

Source: SIM/SMSA-BH, data from the 2002 to 2012 period

Considering the proportion of homicides by level of education in the favelas and in the formal city, it appears that more than 60.0% of deaths were of people with elementary education (complete or incomplete), corresponding to 60.8% in the formal city and 61.8% to 80.7% in the favelas; followed from afar by residents with high school education (34.1% in the formal city and 16.9% to 29.8% in the favelas). Proportional mortality of illiterate people was higher in the favelas than in the formal city; in the favelas it ranged from 1.3% to 7.5%, and in the formal city it was 1.2%. Also in the formal city, 3.9% of deaths were of people who had attended higher education; deaths affecting this educational group only occurred in three of the favelas, and with lower percentages (0.9% in two of them and 2% in a third one). Only 1.2% of deaths were of people with an unknown level of education.

Regarding black color/race, percentages ranged from 72.0% in the formal city to 86.0% in one of the favelas. The white population follows, with mortality rates ranging from 14% in one of the favelas to 27.9% in the formal city. The percentage of deaths of yellow people was 0% in nine favelas; 1.2% in one of them; and 0.1% in the formal city. Regarding the indigenous, there were no deaths in the favelas and the percentage of deaths was 0.1% in the formal city.

Regarding place of death, most occurred on public roads in the formal city (42.9%). In favelas, the percentage of deaths in public roads ranged from 44.4% to 58.9%, with the exception of the favelas of Pedreira and Santa Lúcia (33.0% and 39.5%, respectively), where most deaths occurred in health establishments (58.0% and 47.3%). In the formal city, the percentage of deaths in

health establishments was 36.5%, while in the remaining eight favelas it ranged from 22.7% to 37.2%. Household deaths accounted for a maximum percentage of 15.5%, in an intervention favela; deaths occurring in a place not specified by the death certificate ranged from 6.3% to 11.4% in the favelas, and corresponded to 12.3% in the formal city. The percentage of unknown death locations was only 0.5% in the formal city.

By analyzing the deaths according to IVS (excluding those that occurred in the sectors with unevaluated IVS - 20, 1.2%, in the favelas and 120, 2.1%, in the formal city), we found that among 1,614 favela deaths 92.5% occurred in 'high' and 'very high' risk sectors, where 92.1% of the residents live. This amounts to an average rate of 102.9 homicides per 100 thousand inhabitants. An average rate of 87.9 per 100 thousand was found in the medium-risk sectors, where 7.3% of residents live and where 6.3% of all deaths occurred. In the formal city, where 35.8%, 42% and 22.2% of the residents live in low, medium, and high/very high risk sectors, respectively, homicide mortality rates were 8.9, 30.6, and 28.6 per 100 thousand inhabitants (Table 3).

When comparing rates by sex, although they were significantly higher for men in the favelas and in the formal city, there were also high rates for women, reaching 4.1 per 100,000 inhabitants in the formal city and 39.1 per 100,000 inhabitants in one of the favelas. Compared to women's, men's risk of death was 8.1 to 31.2 times higher (Table 4).

Regarding age groups, we highlight the high homicide mortality rates in children aged 0 to 9 years in favelas with and without intervention. Some favelas also had high rates of death by homicide in the older adults population, reaching 60 per 100 thousand inhabitants in the Santa Lúcia favela.

Considering the age group of 40 to 59 years old as a reference, the risk of death was 2.3 to 6.6 times higher among young people aged 20 to 39 years in all study areas, and 1.7 to 5.1 times higher in the 10 to 19 years old age group (Table 4).

When analyzing the rates in terms of color/race, we found that they were higher for blacks in all units of analysis (Table 4). The risk of death among blacks was 1.2 to 3.2 times higher when compared to whites, with the highest values in the Vista Alegre favela (3.2) and in the formal city (2.8) (Table 4).

Table 3 – Population, percentage of homicides and homicide mortality rates per 100 thousand inhabitants, according to residence IVS (favelas and formal city), Belo Horizonte, 2012–2012

Group	Variables	IVS					
		High/Very high		Medium		Low	
		n	%	n	%	n	%
Favelas	Population	131,894	92.1	10,446	7.3	840	0.6
	Homicide	1,493	92.5	101	6.3	0	0.0
	Rate*	102.9		87.9		0.0	
Formal city	Population	494,708	22.2	934,964	42.0	797,957	35.8
	Homicide	1,558	27.8	3,147	56.1	781	13.9
	Rate*	28.6		30.6		8.9	

*Per 100 thousand inhabitants.

Source: PBH/SMSA/IVS; SIM/SMSA-BH, 2002 to 2012

Table 4 – Rate of deaths due to homicide per 100 thousand inhabitants, and relative risk for sex, age and color/race in favelas with and without intervention and in the formal city, Belo Horizonte, Minas Gerais, 2002 to 2012

Favelas and formal city Rate (RR)	Sex		Age group					Color/race	
	Male	Female	0 to 9 years	10 to 19 years	20 to 39 years	40 to 59 years	60 years	White	Black
	Rate (RR)	Rate (RR)	Rate (RR)	Rate (RR)	Rate	Rate (RR)	Rate (RR)	Rate	Rate
Serra	141.5 (14.1)	10.0	0.0 (0.0)	81.9 (2.0)	137.4 (3.3)	41.3	9.8 (0.2)	67.1 (1.2)	80.4
Morro	249.2 (15.7)	15.8	2.5 (0.1)	139.5 (3.0)	252.4 (5.4)	46.4	30.2 (0.7)	106.5 (1.3)	141.1
São Tomaz	187.6 (13.0)	14.4	0.0 (0.0)	114.3 (1.9)	184.2 (3.1)	59.9	0.0 (0.0)	80.9 (1.4)	113.1
Pedreira P. Lopes	310.1 (8.1)	39.1	9.7 (0.1)	283.8 (3.0)	259.8 (2.7)	96.6	22.4 (0.2)	121.5 (1.6)	188.8
São José	265.9 (19.6)	13.8	0.0 (0.0)	170.2 (1.7)	235.2 (2.3)	101.8	0.0 (0.0)	123.4 (1.4)	172.3
Santa Lúcia	228.8 (12.2)	19.2	2.8 (0.1)	157.7 (3.3)	216.3 (4.2)	51.7	60.3 (1.2)	72.2 (1.9)	135.6
Ventosa	288.1 (31.2)	9.4	0.0 (0.0)	175.6 (3.2)	279.2 (5.1)	54.9	19.4 (0.4)	129.9 (1.3)	164.2
Cabana	165.0 (11.2)	14.7	5.2 (0.1)	119.4 (2.4)	144.9 (2.9)	50.1	27.1 (0.5)	69.1 (1.5)	103.2
Vista Alegre	127.1 (14.3)	8.9	0.0 (0.0)	92.4 (3.7)	127.1 (5.1)	24.9	0.0 (0.0)	28.5 (3.2)	89.9
J. Felicidade	175.9 (13.1)	13.4	3.1 (0.1)	132.5 (5.1)	168.1 (6.5)	26.0	7.8 (0.3)	65.4 (1.6)	104.9
Formal city	50.7 (12.3)	4.1	0.6 (0.0)	36.2 (2.5)	46.1 (3.2)	14.5	5.9 (0.4)	14.0 (2.8)	38.7

RR: relative risk; reference categories: female, 40 to 59 years old, black.
Source: SIM/SMSA-BH, data from the 2002 to 2012 period

Discussion

This study analyzed homicide mortality in Belo Horizonte, establishing a comparison between favelas (with and without intervention by the Vila Viva program) and the formal city, in the light of a conceptual model.

The results confirmed the weight of inequality and perversity in the occurrence of this event, by showing that the 2002-2012 average homicide rates are extremely high in comparison to the European rates of 2.0 per 100 thousand inhabitants (UN, 2014), even in the formal city. In favelas with and without intervention, homicides rates are up to five times higher than in the formal city. Within the formal city, rates in HI and VH IVS areas are three times higher than in the LO IVS areas. In addition, rates in the HI and VH IVS areas of the formal city are about three times lower than in the same risk areas of the favelas. Leading the rates of death due to homicide are men (which are at higher risk of death than women, in all favelas and in the formal city), young people (75% of them around 30; they are six times more likely to die than adults aged 40-59), blacks (with risk of death up to three times higher than that of whites, especially in the formal city and in a favela with ME risk sectors, where segregation is probably more evident), people with low levels of education, and people who die in public roads. Women, older adults and even children from 0 to 9 years also die at very high rates.

The collected information on homicide rates from 2002 to 2012 has a clear association with the proposed conceptual model: the high rates in the formal city, and the rate differences in the HI/VH and LO IVS risk areas therein, points to structural violence in cities, related to inequality and accelerated growth without a linear correspondence in inclusive urban and social policies. The much higher rates in favelas as compared to the formal city point to accumulated territorial disadvantages. Moreover, rates in the HI/VH risk areas of the formal city, which are lower than in these same risk areas of the favelas, show that exclusion in the formal city's poor territories is very likely minimized, heralding territorial segregation. The deaths of women, blacks, youth, and residents marked by the exclusion of the

favelas are linked to a culture of patriarchal values, unnecessary use of force, and prejudice. All of these deaths, especially in the favelas, are associated with the model components corresponding to inequality, the violence of the justice and security system, and lack of responsibility by the government - which allows itself to be replaced by and coexist with the forces of drug trafficking, as well as their enemies and allies. This makes the poorest inhabitants and the residents of segregated regions of the city extremely vulnerable.

When we analyze the homicide rates in the period studied in the formal city, we find that they have grown, albeit only slightly. In the favelas, although they remain very high and are yet to be corrected by stabilization techniques, the rates fell significantly starting in 2007. Between 2002 and 2010 there were decreases of 49.2% and 51.40% in favelas with and without intervention, respectively. Homicide rates continued to fall more systematically in the intervention favelas, with a decrease of 25.9% between 2010 and 2012. This movement is comparable to the one observed until 2012 in some Southeastern states and in Pernambuco, where violent crime prevention policies were implemented. The decrease seen in the favelas and especially in the intervention favelas in both periods was not observed in Brazil as a whole, where homicide rates increased 5.4% from 2002 to 2012, and 5.7% from 2010 to 2012. In Minas Gerais, rates increased by 40% from 2002 to 2010 and 23% from 2010 to 2012 (Cerqueira et al., 2017).

Social protection policies in force in Brazil and Belo Horizonte, with democratic and popular governments installed in the city during this period - as well as preventive and urbanization policies for favelas and favelas, such as the Vila Viva program - may have had an influence over the decreases seen in the capital of Minas Gerais (especially in the intervention favelas). Such a decrease is counter to the growth in rates observed in other Brazilian states.

Very high rates in the favelas denounce the historical gulf of urban inequality and predatory urbanization. The differences between the favelas point to the necessity of further studies, aiming to better understand their peculiarities. The invasion of

trafficking, the role of community participation and social cohesion in the favelas, as well as important projects such as Vila Viva and other policies could explain these differences, and should be further investigated as causal hypotheses.

Over-mortality by homicide of men, blacks, youth and low-educated people, but also women, older adults and children, move parallel to the overall Brazilian data - and once again denounce inequality, lack of inclusive policies and prejudice. These data are also deserving of further discussion and investigation (Cardia; Adorno; Poletto, 2003; Cerqueira et al., 2017, 2018; Lima; Souza; Santos, 2012; Minayo; Souza, 1993; Rivero, 2010).

Deaths on public roads in most units of analysis (except in two favelas very close to a hospital and to a large health center) denounce fear, which can impede solidarity assistance, as well as the state's neglect of violent deaths. They may also point to cars' and ambulances' difficulty of access to the favelas, due to the accessibility conditions of the road system. We highlight the need for discussions with the teams of the Mobile Emergency Care Service (Samu) and other care service locations, so pre-defined access flows can be defined, enhancing the rescue of victims. Dying on the street without receiving help is a strong determinant of social inequality and possible state abandonment.

Household deaths may indicate domestic violence and neglect, as well as revenge killings, and may also be related to the after-effects of violence. These potential factors are also deserving of in-depth research.

Study limitations

In spite of this study's strengths - as a description of homicides in light of a model that seeks to link homicide rates and structural violence in cities, inequality and territorial segregation, indicating ways for an evaluative model of an urbanization project in Belo Horizonte - we should point to some temporary shortcomings, considering that this is only the first step of a larger study known as BH-Viva.

In an upcoming stage, it is necessary to crosscheck mortality rates with variables extracted from secondary databases (employment, school vacancies for young people, Bolsa Família,

presence of social and protective security projects in the favelas, etc.). Moreover, new analyzes and quantitative or qualitative studies are needed in order to better understand the differences between the formal city and the favelas, together with the connections between the favelas and homicide rates.

Besides, even though studies indicate that about 70% of homicides occur close to home (Rivero, 2010), cross-checking mortality data according to place of death with mortality data according to place of residence would allow for a more refined analysis, especially in a descriptive study that is meant to be the basis of the evaluation process of a favela redevelopment project.

Another limitation, at the current stage, is the impossibility of employing methodologies for stabilizing rare event rates in small geographic regions. This would confer the analysis on homicide rates in the favelas and on the differences between these favelas with greater robustness and assertiveness.

It would also be necessary to gather data from the Legal Medical Institute for a better understanding of deaths caused by homicide, especially pertaining to children, older adults and women, as well as home deaths. Thus, given the complexity of the studied event, further studies and analysis are already underway.

Final remarks

As we have shown, high homicide rates are not unique to Belo Horizonte. A careful look at this phenomenon is necessary, since these rates point to inequality, territorial segregation and prejudices prevailing in our society. The phenomenon is also clearly linked to the proposed conceptual model, as shown by the evidence of over-mortality among men, youth, and low-educated blacks living in the favelas.

Despite the fact that homicide rates in the studied favelas and even in the formal city remain very high, they went through a decrease in the surveyed favelas from 2002 to 2012, and especially from 2007 onward. Although it was not homogeneous in all favelas, the decrease is a departure from what took place in Minas Gerais as a whole and in other Brazilian regions: an increase in homicide rates during the same period.

Although homicide is a preventable event, as proven by the very low rates in other parts of the world, it is also a phenomenon of complex determination. Thus, discussions with the municipal administration are necessary - and not only in Belo Horizonte - in order to foster a culture of solidarity and peace, towards inclusive policies, especially for the most vulnerable segments of the population. Simplistic and/or armed “solutions” are unfeasible and will only bring more deaths and disrespect towards diversity and human rights. Despite the difficulties, there may be other, viable paths to solving this historic problem.

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Authors' contributions

Dias, Friche and Caiaffa were responsible for the conception and methodology of the study, data analysis, literature review, critical content review, article elaboration and writing. Costa, Freire and Oliveira participated in the methodological process.

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