

Social inequality and homicide rates in Sao Paulo City, Brazil

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Keywords

Homicide, statistics & numerical data.
Social conditions. Health status indicators. Social inequity.
Socioeconomic factors.

Abstract

Objective

The relation between income and mortality due to violence has been studied in recent years. The Synthesis of Social Indicators of 2002 [Síntese de Indicadores Sociais, 2002], published by The Brazilian Institute of Geography and Statistics (IBGE), states that one of the most outstanding characteristic of Brazilian society is inequality. The proposal of this ecological study was to test the association between homicide rates, and some health and socioeconomic indicators.

Methods

This is an ecological cross-sectional study. Data regarding Sao Paulo City, Brazil in the year 2000 was analyzed. The association between homicide coefficients and the following five indicators were tested: infant mortality rates, monthly average income of household heads, percentage of adolescents aged 15 to 17 years not attending school, proportion of pregnant adolescent women aged 14 to 17 years and demographic density. Pearson's correlation coefficient and a multiple linear regression model were utilized to test these associations.

Results

The municipal homicide rate was 57.3/100,000. The correlation between homicide rates and average monthly income was strong and negative ($r=-0.65$). Higher homicide rates were found in the districts whose inhabitants had lower incomes and lower rates were found in those districts whose inhabitants had higher incomes. The correlation between homicide rates and proportion of adolescents not attending school was positive and strong ($r=0.68$). The correlation between homicide rates and the proportion of pregnant adolescent women was positive and strong ($r=0.67$). The correlation between homicides and the rate of infant mortality was $r=0.24$ (for all: $p<0.05$). The correlation between demographic density and homicides was not significant. Although the univariate regression was positive for four indicators, the multivariate regression test was only significant for average monthly income (negative) and proportion of adolescents not attending school (positive) (for both indicators: $p<0.01$).

Conclusions

The findings highlight the problem of homicides and socioeconomic disparities in S. Paulo City. Economic development and reducing socioeconomic inequality may have an impact on the rates of mortality due to violence.

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INTRODUCTION

The effects of inequality and inequity on health conditions of populations have been generating great interest in the past few years. Although they are sometimes used as synonyms, these words do not have the same definition. According to Silva & Barros,¹³ inequalities may be classified in two ways: the natural ones, that correspond to differences between individuals, such as sex, race and age, and social inequalities, that originate from the different positions people occupy in the social organization. These occur in all known societies and do not remit to the idea of injustice. Inequity, on the other hand, is also related to the concept of difference, but is associated to the idea of injustice. Social inequity refers to groups who have advantages or disadvantages. Inequity in health is a measurable manifestation of social injustice, represented by different and perhaps evitable risks of becoming sick or of dying. These risks arise from heterogeneous living conditions and access to goods and services, including health services.

The Synthesis of Social Indicators 2002, published by the Brazilian Institute of Geography and Statistics (IBGE),⁵ confirms that one of the most outstanding characteristic of Brazilian society is inequality. Among the indicators of inequality utilized most frequently are the ratio between the income of the richest 10% of the population and that of the poorest 40%. This indicator presents values lower than 10 in the great majority of countries.³ According to data from the 2001 National Household Sample Survey, in Brazil, this ratio is 18.3, that is, the richest 10% of the population earn 18 times more than the poorest 40% of the population. The richest one per cent of the population accumulates almost the same amount of earnings as the poorest 50% of the population in Brazil.⁷ These indicators vary among the different states in Brazil and, in the Metropolitan Region of Sao Paulo, the ratio was 15.0.

Furthermore, in Brazil, homicides have recently become a public issue. This is due to increasing rates of mortality that have been verified in the country, particularly since the beginning of the eighties. This problem is particularly serious in the large urban areas. The homicide rates in Sao Paulo City, for example, increased 335% from 1980 to 2000, according to data from the Mortality Information System, operated by Brazil's Ministry of Health.¹⁰

Two aspects concerning homicides must be taken into consideration. The first is that these deaths affect adolescents and young adults as a group disproportionately. The transition from childhood to adult-

hood is a significant period in life, both from a biological and from a social point of view. The second is that studies conducted in Brazil^{1,14} and other countries,² indicate that there are intra-urban differentials with respect to violence, being that higher rates are found among groups with the least favorable socio-economic conditions.

Due to the magnitude and transcendence that homicides have come to represent in recent years, as well as the gravity of the situation of unequal distribution of income in Brazil, the objective of the present study is to test the association between homicide coefficients and several socio-economic indicators and a health indicator.

METHODS

An ecological, cross-sectional study was conducted among the 96 administrative districts of Sao Paulo City, each of which was considered a unit of analysis. On 1/15/91, Sao Paulo City was divided into these 96 districts according to Municipal Law 10,932. Data concerning population according to the districts were provided by the State System of Data Analysis Foundation (Fundação SEADE), based on the 2000 Census.⁸ The following indicators were utilized in this study:

Dependent variable

- Homicide rates – Data from 5,978 homicides among residents in São Paulo City in 2000 were obtained from the Program for Mortality Data Improvement in Sao Paulo City (PRO-AIM).

Independent variables

- Infant mortality rate – data from 2000 were obtained from State System of Data Analysis Foundation (SEADE Foundation) and/or IBGE.
- Household members' monthly average income – data from the 2000 Census, obtained from the Brazilian Institute of Geography and Statistics (IBGE). According to the latter, "the nominal monthly income of an individual 10 yrs of age or older, responsible for the maintenance of a permanent household, is the sum of the nominal monthly income earned from work with the income derived from other sources".
- Proportion of adolescent mothers aged 14 to 17 years old, among the total of live births. Data were obtained from the SEADE Foundation and are based on the 2000 demographic census. This variable was selected because fecundity and mortality may be considered aspects of juvenile violence since the end of the 20th century: where as young men practice brutal violence, resulting in deaths, young women become pregnant

precociously.¹¹ Furthermore, a relative increase in the number of children born to adolescent mothers aged up to 19 years old, has been observed and constitutes a reason for concern,⁶ since a decrease in fecundity has been verified in all age groups.

- Demographic density - data from Census 2000, obtained from the SEADE Foundation.⁸
- Percentage of adolescents aged 15 to 17 years not attending school - data from 1996 made available by the SEADE Foundation, based on the Population count undertaken in 1996, by the IBGE Foundation.⁸

These deaths were studied in absolute numbers, proportions and rates. In order to study the relation between homicide rates and possible associated factors, the Pearson correlation coefficient and models of multiple linear regression were utilized. The Kolmogorov-Smirnov test was used to test the normality of the distribution of homicide coefficients and of the four socioeconomic and health indicators as well. When the assumption of normality was not upheld in this study, the logarithmic transformation of the variable was undertaken. The decision to take this measure resulted in a distribution of the variable that was closer to the Normal distribution, thus stabilizing the variability.

To create models of multiple linear regression, the *stepwise forward* process was employed (including one variable at a time) and the variable was maintained in the model if, at the descriptive level of the test, it obtained a score of less than 0.05 ($p < 0.05$). Residual analysis of the final model of multiple linear regression was also undertaken. The Epi Info (6.04 version), SAS (8.01 version) and Statistica (5.1 version) software were employed in statistical analysis.

RESULTS

Among the 5,978 homicides that occurred in 2000, an accentuated predominance of male victims was observed. They represented 92.5% of all the victims. The homicide rates (per 100,000 inhabitants) were: 57.3 overall; 111.1 when considering only male victims and 8.2 when considering female victims alone. Values for

the male population and the overall population are high. Table 1 indicates the descriptive statistics of homicide rates, as well as of the health indicator and socio-economic indicators utilized in this study. Although most indicators present large variations, all of them, except average income, presented a normal distribution, according to the Kolmogorov-Smirnov test.

Analysis of the distribution of homicide rates indicates that the lowest value (3.6/100,000, in the Jardim Paulista district) was 28 times smaller than the highest value (106.3/100,000, in the district of Parelheiros). These rates were classified in four groups: 1) up to 24.9/100,000: low risk (there were 23 districts in this group, that represents 17% of the overall population); 2) from 25 to 49.9/100,000: medium risk (there were 37 districts in this category, representing 29.6% of the total population); 3) from 50 to 74.9/100,000: high risk (22 districts, representing 30.7% of the total population); 4) 75.0/100,000 and more: very high risk (14 districts, representing 22.4% of the total population). The districts with the lowest homicide rates were those characterized by the most favorable living conditions, most of which are located in western region of the city. The districts that displayed the highest homicide rates were located in central and peripheral zones of the city.

Analysis of households' monthly nominal average income according to the districts in which they were located also indicates the concentration of wealth in the Municipality of Sao Paulo. Table 1 shows that the highest income, in Moema district, was 11.5 times higher than the lowest income, in Marsilac district. The districts with the lowest incomes are located in the peripheral areas of the city. A coincidence was found between the districts with the lowest monthly average income and those classified as very high risk for homicides. No exceptions were found.

The Pearson correlation coefficient was employed to test the relation between homicide rates and households' monthly average income. A negative correlation, $r = -0.65$ (and $r = -0.70$ for the logarithm of income) was observed (see Table 2). The Figure illustrates the negative relation between monthly aver-

Table 1 - Descriptive statistics for homicide rate and socio-economic and health indicator. São Paulo City, 2000.

Variable	N	Mean (DP*)	Median	Minimum-maximum	p value**
Homicide rates/ 100,000	96	44.53 (25.28)	40.15	3.60-106.30	0.13
Infant mortality rate	96	14.38 (4.99)	14.49	2.83-31.06	0.87
Monthly average income of households (in "reais")	96	1,608.37 (1,138.85)	1,193.01	447.04-5,576.78	<0.001
% of adolescent mothers aged 14 to 17 years among the total of live births	96	6.25 (2.21)	6.48	1.04-12.42	0.14
% of adolescents aged 15 to 17 years not attending school	96	21.22 (7.46)	20.83	7.52-41.30	0.87
Demographic density (inhabs/km ²)	96	10,299.08 (5,037.55)	9,682.00	42.00-24,304.00	0.70

*Standard deviation

**Kolmogorov Smirnov test

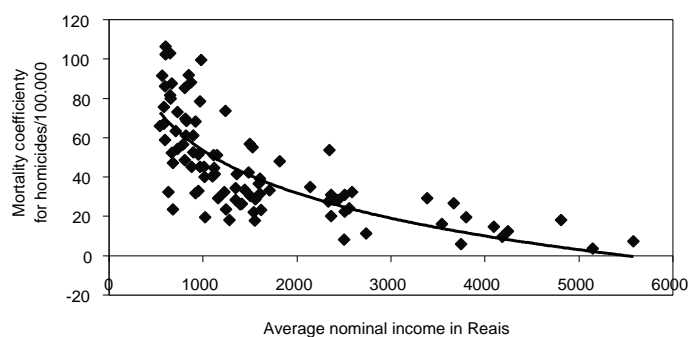


Figure - Adjusted curve for the mortality coefficients by homicides according to the place of residence and average nominal income. Municipality of Sao Paulo, 2000.

age income, without it being transformed into a logarithm, and homicide coefficients.

The analysis of infant mortality rates by districts indicate that most districts classified as very high risk for homicides, except S. Mateus and Guaianazes, also had infant mortality rates higher than the average for the Municipality. Sao Paulo City's infant mortality rate for was 15.8/1,000. Pearson's linear correlation coefficient for homicide rates according to place of inhabitation and infant mortality rate indicated a positive correlation, but with a low value, $r=0.24$. The correlation between homicide rates and demographic density was not statistically significant.

As to the social indicators, Pearson's linear correlation coefficient between homicide rates and the proportion of pregnant adolescent women aged 14 to 17 years among the total live births for the year 2000, showed a positive correlation ($r=0.67$). The correlation between homicide rates and percentage of adolescent males aged 15 to 17 years not attending school was also positive ($r=0.68$).

Most indicators, except demographic density, showed significant correlations with the homicide coefficients within the univariate analysis. However, when considering the multiple regression analysis, only households' monthly average income and percentage of adolescents aged 15 to 17 years not attending school were significant, when analyzed within the model by means of its logarithm.

Table 3 shows the final multiple linear regression model. The percentage of adolescents aged 15 to 17 years not attending school (for each percentage point of youth that do not attend school, there is a 1.15 increase in the homicide rates) and the logarithm of income (for each increase in the logarithm of income, there is a corresponding decrease in the homicide rates of 17.92) were the independent factors related to homicide rates in Sao Paulo City. The residues of the final model of regression presented a normal distribution, with a mean of zero and a standard deviation equivalent to one, without the presence of tendencies.

DISCUSSION

These findings indicate a marked difference in homicide rates across different districts in São Paulo City. It points to the profound inequality within the urban space, expressed by violent death. Although society as a whole feels threatened by violence, the findings indicate that, the most fatal victims were concentrated in specific geographical areas. In addition, a coincidence was observed between districts with the lowest socio-economic indicators and those with the highest homicide rates. This finding was confirmed by Pearson's correlation coefficient. Rólnik,¹² calls this phenomenon *risk urbanism* be-

Table 2 - Matrix of Pearson's correlation among indicators. São Paulo City, 2000.

Variable	Homicide rate	Infant mortality rate	Average income	% of adolescent mothers aged 14 to 17 among the total of live births	% of adolescents aged 15 to 17 yrs not attending school	Demographic density
Homicide rates/ 100,000	1	0.24*	-0.65**	0.67**	0.68**	0.11
Infant mortality rate		1	-0.37**	0.47**	0.41**	-0.02
Monthly average income of households (in "reais")			1	-0.78**	-0.70**	-0.07
% of adolescent mothers aged 14 to 17 years among the total of live births				1	0.85**	0.09
% of adolescents aged 15 to 17 years not attending school					1	0.03
Demographic density (inhabs/km ²)						1

*Significant at the level of 5%

**Significant at the level of 1%

Table 3 - Multiple linear regression for homicide rate. São Paulo City, 2000.

Independent variables	Regression coefficient	p	adjusted r ²
% adolescents aged 15 to 17 years not attending school	1.15	0.003	0.53
Monthly average income (in "reais")	-17.92	< 0.001	

cause this model of urban development concentrates qualities in specific areas of the city which are not available to all inhabitants. Deep contrasts between radically distinct urban conditions, co inhabiting and conflicting with each other within the same city and are a strong characteristic of big Brazilian cities.

The strong negative correlation found between households' monthly average income and homicide rates does not indicate causality, but it means that an increase in monthly average income may determine a decrease in homicides rates. Although the association between income and was found in this study, the issue of how to interpret these results is still a challenge for public health. Caution is necessary when discussing such a complex social phenomenon as violence which cannot simply be associated to income inequalities. In the contemporary world, the issue of violence deserves to be analyzed from all possible perspectives. Furthermore, this is not a specificity for homicides, for other studies^{3,4} have demonstrated the association between the unequal distribution of male adult mortality in São Paulo City is also associated to other causes.

Szwarcwald et al¹⁴ state that, several studies have reported, in a consistent manner, the existence of better health conditions in societies with a more equitable distribution of income. In addition, some societies have much better health conditions than would be expected for their levels of income and vice versa. This suggests that several factors related to the complexity of the social structure may have a more profound influence on health status than the rates of poverty. The problem would not be poverty in itself, but the coexistence of poverty with profound social inequalities. This phenomenon, referred to as relative poverty, excludes people, both socially and materially, from opportunities made available by society. According to these authors, urban violence among youth should not be dissociated from the acute disparities present in societies similar to the Brazilian society that invest so little in social programs, of education and public medical care, habitation and appropriate professional training.

Rolnik¹² states that poverty, inequality and even the changes in the labor market may be treated in different ways by communities and individuals depending on the level of social cohesion and vulnerability. Of course, exclusion contributes significantly towards making individuals, families and communities particularly vulnerable, opening the path for violence and conflict.

Furthermore, the relation between homicides and

the distribution of income may be affected by factors such as availability of public goods and services as well as social and physical environment. It is possible that in the lower income areas there is also less public security, illumination and transportation, and the distance between residence and place of work is longer, thus exposing people more to violence. In addition, considering the hypothesis that the increase in violence is related to organized crime surrounding drug dealing, it is possible that it is easier for organized crime to flourish in areas where the State's presence falters, coinciding with the lower income areas.

The weak association between infant mortality and homicide rate is consistent with a study conducted in the Municipality of Rio de Janeiro¹⁴ in which infant mortality rate was the indicator least correlated with the level of inequality. This indicator has lost sensitivity as an indicator of health status because it is influenced by the improvement in health care services, childbirth and perinatal care, better sanitation and other factors.

Among the limits presented by this study is the expressive number of addresses classified as unknown - 524 deaths, which represents 8.8% of the total in the year 2000. It was not possible to locate the addresses of 23 of these homicide victims (4.4%), in the city's street guide. However, in most cases (504, 95.6%) the victim's address was not declared in the Death Certificate which may be due to the fact that the person was unknown, and/or a street dweller or that the appropriate blank was not filled out.

Furthermore, the most violent and least violent zones of the Municipality cannot be deduced because the certificates do not refer to the place where the homicide occurred, but to the place of residence of the victim. Therefore the results indicate the districts whose inhabitants are submitted to more or less accidents and violent situations.

Another limit encountered by this study concerns the unit of analysis that was employed, that is, the district. Some districts are geographically extensive, inhabited by large populations, which may not be socially and economically homogeneous. For this reason, some authors¹⁴ have suggested that indicators of inequality with respect to income, such as the Gini Index and/or the income ratio of the poorest and the richest be employed instead of absolute income in this type of analysis. Thus, it would be useful, if such data were available, to utilize data concerning indicators of inequality for districts of the Municipality of Sao Paulo. These results indicate the need to undertake further studies so as to explore this aspect

and others that could not be contemplated in the present study.

Also, these findings suggest the need to develop public policies to promote social inclusion of adolescents and youths is urgent. The increase in the number of births among adolescent mothers is troublesome, for it is known that the risks of maternal and perinatal mortality are higher among very young women. It is also important to note that this phenomenon occurs primarily among economically disadvantaged adolescents. It is important to point out that the role of the school must be discussed in Brazilian society, where conditions for young people and for teachers to remain in school have to be created. According to Madeira,⁹ rich and poor youth want a school where they can learn, but which is also a pleasant place to stay. It is necessary to create an adequate

environment according to the characteristics and interests of this group.

Finally, the growing process of social exclusion is considered a factor that contributes towards increasing violence in urban areas. Currently this issue has become an international concern; in March 1996, the International Society for Equity in Health was founded. In October 2002, a declaration was emitted in favor of equity in health throughout the world.¹⁵ It is necessary to recognize and overcome the inequality in Brazilian society; efforts should be directed towards identifying, measuring and reducing the inequalities in living conditions, health and access to services and treatments. A reduction in these inequalities, particularly if it is associated to an increase in economic and social growth, should contribute towards diminishing homicide rates.

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