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Indicators of violence and asthma: An ecological study

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ABSTRACT

Background: Global studies on asthma point to socioeconomic status as one of the main variables in terms of prevalence and disease severity in various parts of the world. Social factors related to community violence have been linked to higher incidence of asthma in the current studies. This study investigates the relationship between indicators of both community violence and development and hospital admissions due to asthma.

Methods: This was an analytical ecological study of multiple groups, using public databases with information up until 2006. All Brazilian municipalities with more than 100,000 inhabitants were considered as units of analysis. The main index used as socioeconomic indicator was the FIRJAN Index of Municipal Development (FIMD). The Index of Youth Vulnerability to Violence (IYVV) was used as indicators of community violence. The rate of admissions due to asthma was used as the outcome. Pearson's correlation was used for multivariate analyses. The coefficient of determination (R^2) was calculated and the simple linear regression model adjusted for significant correlations.

Results: There was an inverse correlation between asthma admissions and FIMD ($r = -0.354$, $p < 0.001$), with statistical significance for all dimensions of the index. Admissions due to asthma were associated with the IYVV ($r = 0.240$, $p < 0.001$) and its component related to school attendance and employment ($r = 0.315$, $p < 0.001$), homicides ($r = 0.112$, $p = 0.034$), and poverty ($r = 0.303$, $p < 0.001$).

Conclusions: There was a direct correlation between indicators of violence and rates of admission due asthma, and an inverse correlation with indicators of development. These results suggest that social detriment can act as a risk factor for hospital admissions due to asthma.

Introduction

Results published by different phases and places of the International Study of Asthma and Allergies in Childhood (ISAAC) were sufficient for researches to conclude that the disease prevalence has increased worldwide. There is, however, insufficient information to explain the temporal trends and the values of variable distribution of its prevalence and severity around the world.[1,2] In view of the huge levels of social inequality that corrode the planet, one of the main factors that explains such variation is socioeconomic status.[3–5] Some studies have demonstrated that there is a higher prevalence and severity of asthma, as well as worse disease control in poorer regions where living conditions are precarious.[3–5]

Multiple studies have attempted to explain the relationship between asthma and socioeconomic status.[6–8] Social factors, such as crime and drug-related neighborhood problems, as well as lack of family support have been associated with a higher incidence of asthma in young people.[8] Communities with a low socioeconomic status not only carry a higher burden of social issues, but they are also frequently characterized by high rates of crime and violence.[9] Violence is an inherently important source of stress both at individual and community levels.[10–12] The psychological stress of a child or their caregivers was considered an enhancer to the effects of well-established risk factors on asthma, such as traffic pollution and exposure to cigarette smoke.[6,8] By the viewpoint of psychoneuroimmunology stress-induced enhancement of IgE production, greater susceptibility to infection, conditioned histamine release and nerve/mast cell interaction and these factors can contribute to onset and exacerbation of asthma.[13,14] Community violence itself

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also demonstrated its direct role as an enhancer of classic risk factors of asthma.[15] Violence at its various levels, simply feeling unsafe or fearful[11] to witnessing[11,12] and being a victim of violence,[10–12] was presented as a significant factor associated to a higher prevalence of asthma.

A trend to associate higher prevalence and severity of asthma with indicators of community violence in different neighborhoods has been reported.[9] The ecological design is appropriate for such studies, since it analyses the effects that an entire population suffers with community violence, as opposed to the direct effect on an individual. Brazil is characterized by both significant social and income distribution inequalities, with clear disparities between regions,[16] where the violence–asthma relationship is particularly unexplored. Therefore, the aim of the present study was to analyze the associations observed between hospital admissions due to asthma and indicators of socioeconomic status and violence at an ecological level in different municipalities within Brazil.

Methods

A search was performed using available indicators from databases of public domain. An epidemiological study of ecological design with analysis of multiple groups was performed. The rate of hospital admissions due to asthma was used as the study outcome and was calculated using data from the Department of Information Technology of the Unified Health System (DATASUS).[17] The independent variables were the Index of Youth Vulnerability to Violence (IYVV)[18] of the Brazilian Public Security Service in association with the Ministry of Justice and the FIRJAN index of Municipal Development (FIMD),[19] operated by the Federation of Industries of the State of Rio de Janeiro (FIRJAN), with data from all Brazilian municipalities. The information available for the year 2006 was used to allow a synchronic analysis, since this was the last time period for which all the information was uniformly available.

The YIVV[18] was created to integrate relevant variables in the association between young people and violence in an index, depicting the situation found in the covered municipalities. Therefore, the index can be decomposed into five dimensions: two reflecting injury from external causes - incidence of homicides and traffic accidents – one that reflects educational conditions and involvement in crime – proportion of individuals who lack school or work – and two reflecting socioeconomic characteristics – variables expressing poverty levels (low-income) and inequality.

Based on the FIMD, FIRJAN objectively reclassifies all Brazilian municipalities annually, using exclusively official data. In addition to the overall score, the index can be split into three dimensions: employment and income; education; and health. These were used as an indicator of socioeconomic status.[19]

Brazilian municipalities with more than 100,000 inhabitants were considered as units of analysis, owing to their being considered large, as per the National Policy for Social Services,[20] which amounted to a total of 266 towns.

Brazil is composed of 5 official regions, which were established in order to aid statistical interpretations and implementation of administration systems of public interest. These federal states are grouped in the following regions: North, Northeast, Central-West, Southeast and South. The descriptive analysis of the present study used such regions to expose grouped municipal data and to subjectively assess the behavior of the different indicators in each region.

The variables were tested using Kolmogorov–Smirnov, which revealed that the null hypothesis of normal distribution could not be rejected. Bivariate analyses were therefore plotted in dispersion diagrams and evaluated using Pearson's correlation coefficient at a significance level of $p < 0.05$. The independent variables, both in their overall presentation and in their split dimensions, were correlated with the rate of hospital admissions due to asthma. Whenever the correlations were significant, the coefficient of determination was measured (R^2).

The Ethics Committee in Research of the University of Southern Santa Catarina (number 11.476.4.01.III) approved this study.

Results

In 2006, Brazil reported a total of 272,712 hospital admissions due to asthma (14.4 per 10,000 inhabitants), of which 82,986 comprised our target population, which included towns with more than 100,000 inhabitants. The regional distribution of admissions due to asthma from towns with over 100,000 inhabitants and the data analysis in terms of regional rates are described in Table 1.

The average scores of the FIMD and its dimensions by municipalities with over 100,000 inhabitants are presented in Figure 1. Towns in the North and Northeast had the lowest scores for this socioeconomic index, both overall and in terms of individual dimensions.

The relationship between municipal rates of admissions due to asthma and the socioeconomic index (FIMD) is described in Table 2. A significant yet inverse correlation was observed ($r = -0.354$, $p < 0.001$). The dimensions with the highest scores were health ($r = -0.350$, $p < 0.001$) and education ($r = -0.347$, $p < 0.001$), both with determination of up to 12%.

Regarding the community violence index (IYVV) and its dimensions, their average scores are described in Figure 2. The North and Northeast regions showed the highest scores, especially in terms of poverty, as well as school and job absence. The highest homicide rates were found in towns from the Northeast and Central-West regions. The South and Central-West had the highest rates of road traffic accidents. Finally, the inequality dimension demonstrated similar levels in all Brazilian regions, except for the Central-West.

The relationship between the rates of admissions due to asthma and community violence (IYVV) is described in Table 3. A positive and significant correlation was found between violence and admissions for asthma ($r = 0.240$, $p < 0.001$). The IYVV was responsible for up to 5.8% of the variation in admissions ($r^2 = 0.058$), however, only the components relating to school and job absence ($r = 0.315$, $p < 0.001$), homicides ($r = 0.112$, $p = 0.034$) and poverty ($r = 0.303$, $p < 0.001$) were associated, particularly the first variable in terms of magnitude. Figure 3, 4 show the relationship between municipal rates of admissions due to asthma and the socioeconomic index and between violence and admissions for asthma, respectively.

Discussion

The present study used public databases to gather information about all Brazilian towns with more than 100,000 inhabitants in

Table 1
Regional distribution of admissions due to asthma from towns with over 100,000 inhabitants in 2006.

Region	Number of towns	Sum of admissions	Sum of population	Regional rate of admissions (per ten thousand)
North	19	5834	6,676,153	8.7
Northeast	53	26,949	20,168,586	13.3
Central-west	15	6562	7,117,752	9.21
Southeast	135	35,210	54,615,834	6.4
South	44	8468	12,499,304	6.7
Total	266	82.986	101.077.629	