Evolution of inequalities in mortality in Salvador, Bahia State, Brazil, 1991/2006

Evolução das desigualdades na mortalidade em Salvador, Bahia, Brasil, 1991/2006

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Abstract

An ecological study was carried out with the aim of analyzing the evolution of inequalities in mortality in Salvador, Bahia State, Brazil, between 1991 and 2006. The city was divided into four social strata from 95 geographic Information Zones. The variables used for social stratification were education level and income of heads of households. Crude and age-standardized mortality rates, age specific mortality rates, proportional Infant mortality and the proportional mortality ratio, were calculated for each zone and social strata. Data was obtained from Death Certificates and the Populational Census. Although differences between strata were smaller in 2000 than in 1991, they persist and are still high, ranging from 28.7% to 65.5%. The differences between Information Zones were as much as 575%. The authors discuss the shortcomings of information systems, recommending that health indicators should be estimated by social classes and pointing out the limits and possibilities of the methodology used here.

Social Inequity; Social Conditions; Mortality

Introduction

The relationships between living conditions and health have been studied in different countries of various levels of development and with distinct health system models. Differences in mortality and morbidity between social strata and their spatial distribution may be found in a variety of countries for example the United States [1], Italy [2], Britain [3], Japan [4], Argentina [5,6] and Brazil [7,8]. In those studies different health indicators were used, such as life expectancy, morbidity for cerebrovascular and neoplasia diseases, infant mortality and violence. It is these differences between and within countries that are not only avoidable but also unjust and constitute inequities [9] or inequalities [10].

Most published studies provide evidence of the relationships between social inequalities and morbidity-mortality [11,12,13] although some studies do refute them [14]. A number of investigations, amongst which should be mentioned the Black Report [15] and the Whitehall Study [16], which monitored 10,000 British civil servants over two decades, have demonstrated that the relationship between living conditions and health is not only present in the contrast between rich and poor, but is also seen in the distinct degrees of different socio-economic levels.

Brazil is the tenth most unequal country in the world in terms of income distribution, surpassed only by countries in Africa and Latin

America. 10% of the Brazilian population appropriates 45.8% of the national income, while at the other extreme the poorest 10% hold only 0.8% of income; there are only seven other countries with a worse distribution, including Haiti (47.7%) and Namibia (64.5%) [17]. Although changes in the country's economy have resulted in improvements in income distribution amongst wage-earners [18], they do not seem to have been capable of reducing inequalities in mortality. Important differences in the distribution of morbidity and mortality persist both between states and within the same state [19,20,21,22].

The equity guidelines upheld by Brazilian Unified National Health System (SUS) and initiatives that focus on the decentralization of health policies, the expansion of coverage and the development of territorial-based activities, all require the use of health indicators that are disaggregated both spatially and, above all, by groups and social classes, in order to support health policies aimed at overcoming inequities. Given Brazil's lack of an information system with indicators produced according to social strata or socio-economic variables, an analysis of the evolution of inequalities in the country's mortality rates requires the setting up of specific studies aimed both at monitoring this problem and at improving methodological techniques and strategies capable of estimating these inequalities and which are supported by the secondary databases available. Similarly, an analysis of the spatial and social distribution of mortality in Salvador, Bahia State in 1991 demonstrated the existence of profound inequalities. The difference between the mortality rate in the strata with better living conditions and those with worse living conditions varied from 43.1% to 142% which corresponds to an inequality ratio of between 1.4 and 2.4, and these differences occasionally reached 656.3% [23].

To what extent have these inequalities evolved as a result of socio-economic changes and the establishment of the SUS in the decade following this analysis? In order to answer this question, this study aims to carry out a comparative analysis of the mortality distribution in the social space of Salvador city in the period between 1991 and 2006, and to describe the differences in mortality from classifications based on census data from 1991 and 2000 and Death Certificates from 1991, 1997, 2000 and 2006.

Methodology

A spatial aggregate study of the years 1991, 1997, 2000 and 2006 was carried out in Salvador, the capital of Bahia State, in the Northeast Region of Brazil, which had 2,075,273 inhabitants in 1991 and 2,450,254 in 2000, according to the census demographics of 1991 and 2000, respectively. The units of analyses were social strata and 95 geographic information zones that make up the city's urban space and were classified according to physical-urban criteria by the Company for the Development of the Metropolitan Region of Salvador (Companhia de Desenvolvimento da Região Metropolitana de Salvador – CONDER), from an aggregation of census sectors, established by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e estatística – IBGE).

Data sources were supplied by the Information Section of Salvador's Department of Health in the form of CD copies of the Death Certificates of municipality residents for the years 2000 and 2006, while for the years 1991 and 1997 our sources were photocopies of original Death Certificates stored at the State Health Department and filed at the Institute of Collective Health (Instituto de Saúde Coletiva – ISC) at the Bahia Federal University (Universidade Federal da Bahia – UFBA). The coding of registrations according to the respective information zones was determined by street name and neighborhood of residence recorded in the standard address section of the Death Certificates. When the address field was blank, and attempts to ascertain this information were unsuccessful, the information zones was coded as zone of information unknown (code 99), which made up 7.8% of the total analyzed for 2000. Demographic and socio-economic information came from the census of 1991 and 2000.

The information zones were then classified selecting two preliminary individual characteristics as determinants of living conditions: economic capital and cultural capital, using the categories of analysis developed by Bourdieu [24]. The individuals and groups of individuals placed themselves within the social space principally according to the composition of their economic and cultural capital. In the first measurement, individuals situated themselves in the social space according to the global composition of their capital while in the second they did so according to the structure of their capital, in other words, this depended on the weight of different types of capital (economic and cultural). An approximation of these categories was obtained by using the variables income and level of schooling, as supplied by the census in a published study [23].

Using the census sector data, families were classified according to the income level of the head of the household by zone of information group, thus: (1) low economic capital (LEC) – without income and with an income of up to

double the minimum wage; (2) medium economic capital (MEC) – income of between 2 and 5 times the minimum wage; (3) high economic capital (HEC) – income above 5 times the minimum wage. Each information zone was assigned to one of three strata, according to the largest proportion of heads of household with HED, MEC or LEC. The head of household's level of schooling was assessed according to the following classification: (1) low cultural capital (LCC) – up to 7 years of schooling (elementary education incomplete); (2) medium cultural capital (MCC) – 8 to 14 years of study (elementary and high school education complete); (3) high cultural capital (HCC) – 15 years of schooling and above (further education, completed Masters and/or PhD degree).

Based on these criteria, each information zone was distributed in one of the three strata of economic capital and cultural capital, with respect to the highest proportion of the heads of family with HEC, MEC, or LEC and with HCC, MCC or LCC, respectively. By way of an example, the information zone number 9 included 8.3% of householders with LEC, 7.4% with MEC e 84.1% with HEC. As such, it was classified as HEC. This criterion was used for the cultural capital stratification where the same zone of information had 9.8% of heads of family with LCC, 39.9% with MCC and 50.1% with HCC, and thus it was considered as HCC. Therefore, it was classified as high social stratum (HEC/HCC) or stratum 1 because there was a predominance of householders with incomes above 5 times the minimum wage and with 15 or more years of education.

Nineteen zones of information had rates that were equivalent or had a difference of less than 10% in respect of two strata and were therefore systematically allocated half to one stratum and half to another. The classification of the zones of information led to four social strata: stratum 1 – HEC/HCC; stratum 2 – HEC/MCC; stratum 3 – LEC/MCC; and stratum 4 – LEC/LCC). A new classification was subsequently created in which the information zone that had a difference of less than 10% formed another stratum, named stratum H (heterogeneous).

Crude mortality rates (CMR), and Age-Standardized Mortality Rates (ASMR) were calculated for each social strata. Age standardization was calculated using the direct method and the population of Salvador in 1991 as a standard; 19 zones that had a population of less than, or equal to, 5,000 inhabitants were excluded to avoid distortions in rates and also to make a comparison with 1991. Salvador's islands, information zones 74 and 76, did not form part of the analysis. If the age of the dead person had not been recorded, we looked at the difference between date of death and of date of birth, which enabled us to fill in the gaps and to exclude only those records that did not contain these dates.

Mortality rates by stratum were also estimated for each age group (0-4; 5-19; 20-39; 40-64; > 64) per 100,000 inhabitants, with the exception of the 0 to 4 age group, which was calculated per 1,000 inhabitants. We also calculated the proportional infant mortality (PIM), which corresponded to the proportion of deaths of those less than one year of age, and the proportional mortality ratio (PMR) relative to the proportion of deaths of those aged 50 years and over. The relative risk was obtained by calculating the ratio between the mortality indicator of each stratum and the indicator of the stratum of better living conditions (stratum 1), here called the inequality ratio. Stratum 4 was used as a reference for the inequality ratio calculation of the PMR, where the lowest values corresponded to the worst living conditions.

The 1997 and 2006 populations were estimated applying the geometric method to the census data of 1991 and 2000, respectively. From the 1997 database of deaths, zones of information 4 and 5, 11 and 12 and 15 and 25 were aggregated, since they referred to the same neighborhoods. The zones of information for 1997 were classified using strata formed for 1991 as a reference and for 2006 we used the classifications for the year 2000.

The data were consolidated using the Stata program version 10.0 (Stata Corp., College Station, USA) from eight initial databases with data from 1991, 1997, 2000 and 2006 entered into 53 working bases. The study proposal was submitted to and approved by the Ethics Research Committee of the ISC/UFBA.

Results

The geographical zones of information in Salvador situated in stratum 1 (best living conditions) bring together neighborhoods in which the proportion of householders with income above 5 minimum salaries ranged between 78.5% and 85.4% whilst zones located in stratum 4, with worse conditions and which comprise the majority of the population presented variations of between 69.5% and 80.6% of the householders who have no income or an income of up to double the minimum wage.

In 2000, as compared to 1991, there was a greater allocation of information zones in strata 1 to 3 and a significant reduction of the number of zones in stratum 4. The proportion in strata 1,

2, 3, and 4 in 2000 is equal to 9.3%, 26.7%, 14.7% and 49.3% respectively, while in 1991 these proportions were 9.1%, 19.7% 12.1% and 59.1%, showing an increase in the number of zones of information with the best living conditions. We also noted that 36% of the zones were classified as high economic capital and 64% of low economic capital in 2000, as against 29% of HEC and 71% of LEC in 1991. In relation to cultural capital in the strata HCC, MCC and LCC we found proportions of 9.3%, 41.3% and 49.3% respectively in 2000 and 9.1%, 31.8% and 59.1% in 1991.

The CMR for Salvador was 5.1/1,000 inhabitants in 2000 and 5.3/1,000 in 1991, representing a variation of 3.15%. During this period, in Valéria, for example, the ASMR changed from 11/1,000 inhabitants to 7.8/1,000 although it still remained one of the highest with a difference of 500% compared to that of Horto Florestal, zone 13, where the SMR was 1.3/1,000 and which was classified as HEC, with 59% of households earning more than five times the minimum wage.

Looking at the strata of living conditions, in 2000 the ASMR varied between 3.4 and 4.4 from the first stratum to the last, which represented a difference of 29.4% (Table 1). In 1991, there was a reduction in most of the strata, but not in the first (Table 2). In the period from 1991 to 2006, the evolution of ASMR declined over time in all four strata (Figure 1), with the greatest variation seen in stratum 2 (HEC/MCC) at 51.5%. Similarly, the PMR increased in all strata (Table 1 and Table 2).

In relation to PIM by zone of information, Pituaçu, Campinas, Nordeste, Fazenda Grande, Piatã/Itapuã are amongst those localities that had the highest values. The neighborhoods of Mata Escura and Coutos are also in this group, and in 1991 they had a PIM of 25% and 20.9%, which by 2000 had reduced to 12.5% and 13%. In 2000 the variation in this indicator reveals a linear gradient moving from 2.9 in the best stratum to 9.8 in the fourth; this is equivalent to a percentage variation of 175% and an inequality ratio of 3.3 (Table 1). Over all the years analyzed, the PIM showed growth from stratum 1 to stratum 4, with differences that varied from 273% in 1991 to 141% in 2006 (Table 2).

The mortality rate (MR) for specific age groups revealed differences that ranged between the first and the last stratum from 28,7% for the group of 0 to 4 year-olds to 65.5% for the 40 to 64 year-olds and with inequality rates of 1.2 and 1.6, respectively (Table 3).

The second classification, in which the urban space zones considered to be heterogeneous were brought together in a new stratum (stratum H), demonstrates that approximately 30% of the population of Salvador is concentrated within these zones and that the differences between the stratum of best and worst living conditions persisted, with values remaining equivalent to inequalities rates. All of the indicators assessed accentuate the character of heterogeneity of this aggregate and place it between the third and fourth strata (Table 4).

Discussion

This study reveals that in the Municipality of Salvador, despite a drop in the general mortality rate between 1991 and 2000, inequalities persist in their distribution between the geographic information zones and distinct social strata, although there was a reduction in such inequalities over the period under analysis. Neighborhoods that are considered wealthy, situated in the south and along the coast, had the greatest proportion of people with high economic and cultural capital, good infrastructure and good service provision and demonstrated low general mortality, while in the peripheral neighborhoods and in those in the centre of the municipality, the mortality indicators remained high. For example, the risk of death in a neighborhood in which these indicators were considered very low (Valéria) was 5.23 times greater than in an area with the highest indicators of income and education (Graça).

Such differences in mortality between social strata reproduce the inequalities in income distribution that exist in this municipality and which are greater than those seen in states with the country's highest and lowest incomes. Residents of the Federal District earn five times more that those who live in Maranhão State, while a resident in a wealthy area in the municipality studied here receives on average 25 times more than is earned by an inhabitant in a poorer area [17]. In Salvador, the Gini Index, which is an indicator of income inequality, is equal to 0.660, greater than that of Brazil (0.580) and Lesotho (0.632). If it was a country, Salvador would have the second worst income distribution in the world [17]. Differences such as these, which demonstrate the coexistence of the least favorable socio-economic indicators with mortality, were observed during the same period in the capitals of Recife, a city in Pernambuco State and São Paulo [22,25].

The study also demonstrated that important changes have taken place in the composition of Salvador's social strata during the period under analysis. The reduction in the number of geographic information zones situated within the stratum of worst living conditions and the increase in the number of information zones

Table 1

Population, crude mortality rate (CMR), age-standardized mortality rate (ASMR), proportional infant mortality (PIM), proportional mortality ratio (PMR) and inequality ratio according to social strata. Salvador, Bahia State, Brazil, 2000.

Strata	Population	CMR	ASMR	Inequality ratio *	PIM	Inequality ratio	PMR	Inequality ratio **
1	147,672	5.7	3.4	1.0	2.9	1.0	80.5	1.5
2	284,224	5.0	3.5	1.0	5.1	1.7	72.4	1.3
3	438,065	5.7	4.8	1.4	7.9	2.7	62.9	1.2
4	1,566,293	4.6	4.4	1.3	9.8	3.3	51.7	1.0

* Strata n/stratum 1;

** Strata n/stratum 4;

Stratum 1: HEC/HCC (high economic capital/high cultural capital); stratum 2: HEC/MCC (high economic capital/medium cultural capital); stratum 3: LEC/MCC (low economic capital/medium cultural capital); stratum 4: LEC/LCC (low economic capital/low cultural capital).

Table 2

Age-standardized mortality rate (ASMR) by age, proportional infant mortality (PIM), proportional mortality ratio (PMR) and inequality ratio according to social strata. Salvador, Bahia State, Brazil, 2000.

Strata	1991	inequality ratio	1997	inequality ratio	2000	inequality ratio	2006	inequality ratio
ASMR								
1	2.9	1.0	3.4	1.0	3.4	1.0	3.3	1.0
2	5.3	1.8	4.2	1.2	3.5	1.0	3.1	0.9
3	4.5	1.6	5.2	1.5	4.8	1.4	4.5	1.4
4	5.4	1.9	3.8	1.1	4.4	1.3	4.2	1.3
PIM								
1	3.0	1.0	0.8	1.0	2.9	1.0	2.7	1.0
2	6.1	2.0	3.6	4.5	5.1	1.8	3.1	1.1
3	6.2	2.1	4.8	6.0	7.9	2.7	5.9	2.2
4	11.2	3.7	5.7	7.1	9.8	3.4	6.5	2.4
PMR								
1	76.0	1.5	83.2	1.4	80.5	1.6	80.6	1.4
2	66.4	1.3	74.6	1.3	72.4	1.4	74.5	1.3
3	68.5	1.3	68.7	1.2	62.9	1.2	65.7	1.1
4	50.9	1.0	58.8	1.0	51.7	1.0	57.7	1.0

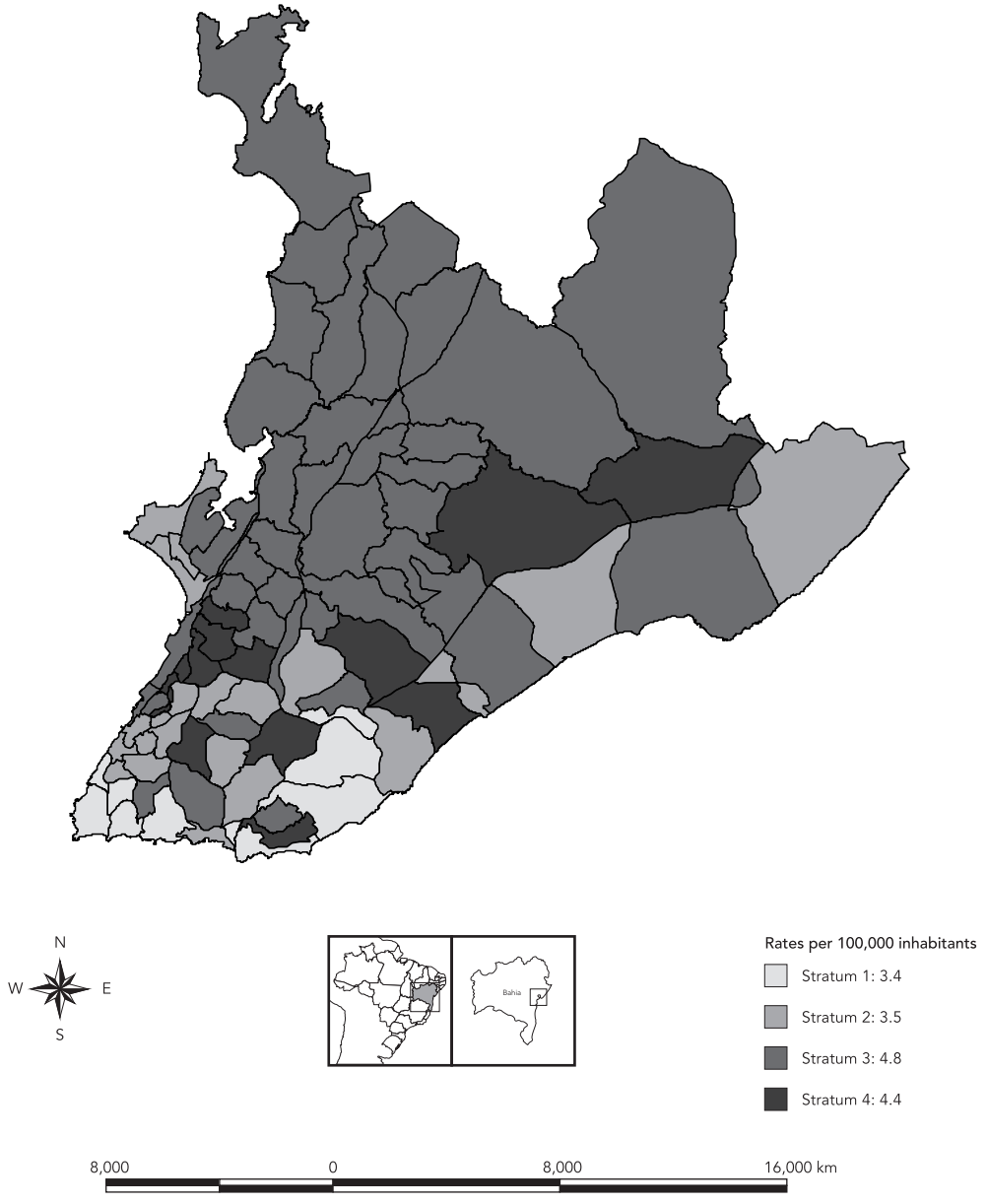
Stratum 1: HEC/HCC (high economic capital/high cultural capital); stratum 2: HEC/MCC (high economic capital/medium cultural capital); stratum 3: LEC/MCC (low economic capital/medium cultural capital); stratum 4: LEC/LCC (low economic capital/low cultural capital).

within the other strata is indicative of improvements in the population's living conditions. Furthermore, social policies through income transfer programs and the increased monetary value of the minimum wage may have contributed to improvements in the health indicators analyzed. Although there is no evidence of a significant increase in welfare coverage in the primary health care network in the last decade, the implementation of the SUS in Salvador has enabled greater access to a variety of other forms of services. Thus, although social inequalities in mortality persist in this municipality, these factors may have contributed to the decrease observed here.

It is noticeable that the PIM and PMR indicators were most sensitive to the social variables

Figure 1

Age-standardized mortality rate according to social strata. Salvador, Bahia State, Brazil, 2000.



studied and revealed an increase and a reduction, respectively, with regard to the worsening of living conditions. Some of the values found here, however, require further investigation, such as, for example, the mortality rate for the 0 to 4 age group in the year 2000, which was high when compared to the other years studied.

We should provide here a justification of the use of Bourdieu's theory, given that it cannot be fully incorporated when utilized in studies of secondary data. The theory, however, guided the selection of the boundary variables of social space giving them an explanatory potential supported by a theory about social practices and their relationships to the health-illness space [23].

Table 3

Mortality rate by age group (per 100,000 inhabitants) and inequality ratio according to social strata. Salvador, Bahia State, Brazil, 2000.

Stratum	Age group (years)									
	0-4		5-19		20-39		40-64		65+	
	Mortality ratio *	Inequality ratio **	Mortality ratio	Inequality ratio **	Mortality ratio	Inequality ratio **	Mortality ratio	Inequality ratio **	Mortality ratio	Inequality ratio **
1	6.6	1.0	41.19	1.0	134.8	1.0	463.8	1.0	3861	1.0
2	7.8	1.1	37.1	0.9	131.8	0.9	503.7	1.0	4758.6	1.2
3	8.7	1.3	68.3	1.6	185.3	1.4	741.1	1.5	5204.34	1.3
4	8.5	1.2	60.5	1.4	192.0	1.6	767.9	1.6	4199.6	1.0

* Mortality rate per 1,000/under 5 years old;

** Inequality ratio = Stratum/stratum 1.

Stratum 1: HEC/HCC (high economic capital/high cultural capital); stratum 2: HEC/MCC (high economic capital/medium cultural capital); stratum 3: LEC/MCC (low economic capital/medium cultural capital); stratum 4: LEC/LCC (low economic capital/low cultural capital).

Table 4

Population, crude mortality rate (CMR) of age-standardized mortality rate (ASMR), proportional infant mortality (PIM), proportional mortality ratio (PMR) and inequality ratio according to social strata. Salvador, Bahia State, Brazil, 2000.

Strata	Population	CMR	ASMR	Inequality ratio	PIM	Inequality ratio	PMR	Inequality ratio
1	132,284	5.3	3.3	1.0	3.2	1.0	78.7	1.5
2	179,540	5.4	3.7	1.1	5.1	1.5	71.2	1.4
3	133,221	3.2	2.8	0.8	7.9	2.4	60.9	1.2
4	1,172,057	4.6	4.6	1.3	10.0	3.0	49.9	1.0
H	819,152	5.4	4.5	1.3	7.9	2.4	63.1	1.2

Stratum 1: HEC/HCC (high economic capital/ high cultural capital); stratum 2: HEC/MCC (high economic capital/medium cultural capital); stratum 3: LEC/MCC (low economic capital/medium cultural capital); stratum 4: LEC/LCC (low economic capital/low cultural capital); stratum H: composed of information zones with equivalent proportions or a difference of less than 10% in the distribution of economic and cultural capital.

Income and level of schooling, which were adopted here to measure the concept of economic and cultural capital, delineate possibilities of access to food, housing, knowledge and representations of diseases and risks, and of the preventive methods related to the ability to cope with these risks.

Because of the limitations in the databases utilized, this study was not able to incorporate environmental and psychological factors or factors related to the social organization of groups; and this is a significant limitation. However, the classification technique utilized in the study allowed us to join zones of information with similar characteristics and form more homogeneous strata than is possible in studies which adopt purely administrative and/or geographical criteria. Furthermore, the modification made to the technique used in 1991, which grouped the heterogeneous information zone into one unique stratum gave the remaining strata greater homogeneity, and the gradient between the strata was therefore more consistent than that obtained using the previous technique. The results obtained point to the heterogeneity of the municipality, within whose urban space developed areas, of high economic and cultural capital, sit side-by-side with their opposites.

It is also important to emphasize that no information area had a majority of householders

with an income equivalent to the rating of middle economic capital. Possibly this occurred because the cut-off for middle income (MCE), from 2 to 5 minimum wages (inclusive), was not sufficient to discriminate an average economic stratum.

ASMR was the indicator that had the lowest relationship with the social variables used, and presented higher rates in the intermediate strata than at the extremes in 1991, 1997, 2000 and 2006. The second classification, which was used for the year 2000, in which all the zones with equivalent proportions of people of a determined type of economic and/or cultural capital were grouped into stratum H (heterogeneous) inverted this trend to reveal an association between living conditions and this indicator. This finding demonstrated the need to obtain more homogeneous strata, either through the utilization of smaller ecological units, such as the census sector, or through linkage in future investigations between mortality databases and those of the census. The fact that the heterogeneous stratum had rates equivalent to stratum 3 may be related to an effect that some authors associate with relative income and greater ability to discriminate.

Despite the limitations of studies that use secondary mortality data, it is possible to make an approximation between geographical space and social space. These data are routinely supplied by official bodies and if utilized properly can produce a substantial amount of information.

A description of the evolution and magnitude of mortality and its distribution according to spaces and social strata may be used as a management and decision-making instrument, since existing information systems are not capable of supplying information that expresses the diversity of health status between different social groups. In this way the contribution of this study is not only related to the necessary monitoring of health inequalities in the country; it is also concerned with improvements in and the testing of classification techniques that can be adopted as technologies to support the formulation of policies and health-related activities that focus on the promotion of equity through the identification of groups and areas of greater vulnerability.

Resumo

Com o objetivo de analisar a evolução das desigualdades na mortalidade em Salvador, Bahia, Brasil, entre 1991 e 2006, foi realizado estudo de agregados espacial. A cidade foi dividida em 4 estratos sociais a partir das 95 zonas de informação. As variáveis utilizadas para a estratificação social foram o grau de instrução e a renda dos responsáveis pelos domicílios. Foram calculadas taxa de mortalidade geral, taxa de mortalidade padronizada por idade, mortalidade infantil proporcional e razão de mortalidade proporcional. As fontes de dados foram as Declarações de Óbito dos residentes no município e os Censos Demográficos. Apesar de as diferenças entre os estratos terem sido menores em 2000 em comparação com 1991, elas persistem e ainda são mais elevadas, variando entre 28,7% e 65,5%. Essas diferenças atingiram 57,5% entre as zonas de informação. Os autores discutem as lacunas existentes nos sistemas de informação recomendando que os indicadores de saúde sejam estimados segundo as classes sociais e comentando os limites e possibilidades da metodologia utilizada.

Inequidade Social; Condições Socias; Mortalidade

Contributors

S. A. Cruz, L. M. Vieira-da-Silva, M. C. N. Costa and J. S. Paim participated in the design and implementation of the project, the analysis and interpretation of data, the writing up of the article, a critical review of its intellectual content and approval of the final version.

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