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Social and health indicators as a measure of access to primary heathcare in Brazil

Indicadores sociais e de saúde como medida de acesso aos cuidados primários no Brasil

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Abstract *The aim was to investigate the influence of social and health indicators on access to Primary Healthcare in the Belo Horizonte Metropolitan Area, Minas Gerais State, Brazil. Secondary data of 34 municipalities were analyzed; the dependent variables were three basic healthcare indicators: coverage of the Family Health Strategy; coverage of scheduled first dental appointment and mean annual number of appointments in medical specialties per inhabitant. All independent variables were analyzed using Principal Component Analysis, with VARIMAX rotation and Kaiser normalization. Student's t-test was used to compare the components originated by the factor analysis in relation to the primary care indicators with a significance of 5%. The development conditions had significantly greater weight in cities with low FHS coverage (p=0.022). The socioeconomic conditions were weighted significantly higher in municipalities with high dental appointment coverage (p=0.030) and with greater mean number of medical appointments (p=0.022). Socioeconomic and development conditions may be crucial to the identification of municipalities with the best and worst primary care indicators.*

Key words *Health status indicators, Social indicators, Primary care*

Resumo *O objetivo foi investigar a influência de indicadores sociais e de saúde no acesso à Atenção Primária na Região Metropolitana de Belo Horizonte, Minas Gerais, Brasil. Os dados secundários de 34 municípios foram analisados e as variáveis dependentes foram três indicadores básicos de saúde: cobertura da Estratégia Saúde da Família, cobertura de primeira consulta odontológica programada e número médio anual de consultas médicas por habitante. As variáveis independentes foram analisadas usando Análise de Componentes Principais, com rotação VARIMAX e normalização Kaiser. O teste T Student foi utilizado para comparar os componentes fornecidos pela análise fatorial em relação aos indicadores básicos de saúde com significância de 5%. As condições de desenvolvimento foram significativamente maiores em cidades com baixa cobertura da ESF (p=0,022). As condições socioeconômicas foram significativamente mais relevantes em municípios com alta cobertura de primeira consulta odontológica (p=0,030) e com maior número médio de consultas médicas (p=0,022). Condições socioeconômicas e de desenvolvimento podem ser decisivas para a identificação dos municípios com melhores e piores indicadores de atenção primária.*

Palavras-chave *Indicadores básicos de saúde, Indicadores sociais, Atenção primária à saúde*

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Introduction

Health indicators are measures that contain relevant information on particular health status attributes and dimensions as well as the performance of the Healthcare System. Together, such indicators should reflect the health status of a population and serve in the surveillance of health conditions[1].

In Brazil, the broadening of primary health coverage through the expansion of the Family Health Strategy (FHS) has made a positive contribution to improvements in many health indicators[2]. In this context, studies that investigate the association between oral health indicators of primary care and municipal socioeconomic conditions are particularly important to the formulation of health policies directed at reducing health-related inequalities, especially with regard to the use of and access to healthcare services[3].

The aim of the present study was to investigate the influence of social and health indicators on access to Primary Care in the Belo Horizonte Metropolitan Area, Minas Gerais, Brazil.

Materials and methods

An ecological cross-sectional study was carried out using secondary data of the Belo Horizonte Metropolitan Area, Minas Gerais State, Brazil. It is located in Southeast of the country and has almost 5.397.438 inhabitants living in 34 cities[4]. The data were obtained in March and April of 2009 from an electronic page of the dataset generated by the Information Department of the Brazilian Public Healthcare System and the Electronic Human Development Atlas. Data were also obtained from the United Nations Development Program, which is a global development network for combating poverty.

The dependent variables were three primary care indicators: 1) coverage of the Family Health Strategy (FHS); 2) coverage of scheduled first dental appointment; and 3) mean annual number of appointments in medical specialties per inhabitant. These indicators were chosen for representing good sources of information in relation to access to and use of public healthcare services by the population of this study. FHS coverage refers to the proportion of the population covered by this strategy, calculated by dividing the population registered in the Primary Care Information System (FHS model) by the total population in the same local and period, subsequently multiplying this number by 100. First dental appointment coverage was calculated by dividing the total number of scheduled first dental appointments carried out in each municipality in 2007 by the total population in the same locale and period, subsequently multiplying this number by 100. The mean annual number of medical appointments was calculated by dividing the number of medical appointments for basic specialties carried out in the municipality in 2007 by the total population in the same locale and period.

The independent variables were selected from among the social indicators available in the datasets consulted: literacy rate; percentage of employed individuals; coverage of piped water supply; coverage of water supply with residential bathroom; garbage collection coverage; demographic density; infant mortality; mean hospitalization; Human Development Index (HDI); Gini Index; Theil Index; and the Minas Gerais Social Responsibility Index (MGSRI).

The literacy variable was the ratio between the number of adults with reading/writing skills and the total number of adult inhabitants in each municipality. The employment percentage referred to the percentage of formally employed individuals compared to the total population between 16 and 64 years of age. The water supply variable was calculated by the percentage of the individuals who live in residences with piped water. Presence of bathroom coverage was calculated by the percentage of the individuals who lived in residences with piped water and a bathroom. Garbage collection was calculated by the percentage of individuals who lived in urban areas with a garbage collection service.

Regarding to the population, demographic density was determined from the mean number of inhabitants per km^2. The infant mortality coefficient was obtained from the Live Birth Information System and was the number of deaths of children under one year of age per one thousand live births in a given locale. Mean hospitalization referred to the mean number of hospitalizations in the Brazilian Health Care System per location of residence and was obtained from the Ambulatory Information System.

The HDI is a development indicator that aggregates economic data from the *per capita* gross domestic product with other data related to education [adult literacy rate and schooling (combined elementary, high school and university education)] and health (mean life expectancy at birth). The Gini Index measures the degree of inequality according to *per capita* household income.

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Its value ranges from 0 (when there is supposedly no inequality and the income of all individuals is the same) to 1 (maximal inequality – only one individual possesses all the income in the society and all other individuals have no income). The Theil Index referred to the Theil's second inequality measure, denominated Theil's L, which measures the degree of inequality in the distribution of individuals according to *per capita* household income, excluding those with no income.

The Minas Gerais Social Responsibility Index (MGSRI) is an indicator that expresses the level of development of each municipality in the state of Minas Gerais (Brazil). This index was designed to assess the situation of municipalities through the analysis of nine dimensions: income, health, education, public security, management, housing, environment, culture and sports/leisure. The indicators of each dimension are transformed into indexes and the weighted means of these indices give the index a value between 0 and 1, with values approaching 1 denoting a higher level of development.

The first step of the statistical analysis was the dichotomization by the median of FHS coverage (85.6%), dental appointment coverage (9.75%) and mean medical appointments (1.83), thereby forming two groups (low and high values) for each of the three indicators. These groups were subsequently crossed and compared. All independent variables were analyzed using Principal Component Analysis, with VARIMAX rotation and Kaiser Normalization. This orthogonal rotation method minimizes the number of variables in each factor and confirms the correlations between the components of each factor to obtain groups more or less correlated. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were used to determine whether factor analysis could be employed. Both tests were used to determine the variability of data and they are sine qua non to conduct the factor analysis. Variables with a factor load greater than 0.50 (minimum acceptable cutoff point for correlation) were considered to form the factors, Factor analysis is a statistical method designed to summarize the information contained in a set of variables using the smallest possible set of common factors. In order for the extraction of factors to be pertinent, the proportion of variance of each variable explained by the common factors (commonalities) must be higher than 0.6. Initial commonalities are equal to 1, with both principal components and variables. Following the extraction, the commonalities range from 0 and 1, with 0 denoting common factors that do not explain any of the variance in the variable and 1 denoting common factors that explain all the variance[5]. Data analysis was carried out using the Statistical Package for Social Sciences (version 17.0). The Student's t-test was used to compare the components obtained by the factor analysis in relation to the primary care indicators. The *t* distribution is used when the number of observations is small with a normal distribution. The level of significance was set at 5%.

Results

The KMO test was 0.62 and the test of sphericity revealed a significance value less than 0.001, demonstrating the suitability of the data for the factor analysis. Following the extraction of factors, commonalities ranged from 0.62 to 0.94.

The rotation converged in eight interactions, resulting in four components that accounted for 80.7% of the total variance. The number of components was defined by the curvature of the eigenvalue in Scree Plot, provided by factor analysis in *SPSS*. Table 1 lists the variables organized in decreasing order of size based on the rotated coefficients of greater load. The denominations of the factors were attributed in a discretionary fashion, but sought to represent the set of variables associated to the factor.

Component 1 (economic conditions) was made up of the MGSRI, Theil Index, Gini Index and employment rate. Component 2 (basic sanitation conditions) was made up of the water supply plus bathroom, piped water supply and garbage collection percentages. Component 3 (development conditions) was made up of the literacy rate, demographic density and HDI. Component 4 (health conditions) was made up of infant mortality rate and mean number of hospitalizations (Table 1). A new variable was created for each component, derived from factor loads expressed in standardized scores (mean of zero and standard deviation of 1), indicating to what extent the deviations of each component deviated from the mean. The variables created from the Z score of the factor analysis were used to test the differences in factor loads between municipalities with high and low basic care indicators (Tables 2, 3 and 4).

The development conditions had significantly greater weight in cities with low FHS coverage (p=0.022), whereas only health conditions (infant mortality rate and mean number of hospitalizations) weighed more in municipalities with

high FHS coverage (Table 2). Table 3 shows that socioeconomic conditions weighed significantly more in municipalities with high coverage of first dental appointment (p=0.030). Basic sanitation conditions also weighed more in this group, but the difference did was not statistical significant (p=0.665). Table 4 shows that socioeconomic conditions were determinants in municipalities with a greater mean number of medical appointments (p=0.022), whereas development conditions were determinants in municipalities with a lower mean number of medical appointments (p=0.001).

The municipalities with greater FHS coverage had a higher number of appointments (2.50 ± 0.22). The value for municipalities in the group with lower FHS coverage had a relatively large confidence interval (1.29 to 2.06). The comparison between FHS coverage and coverage of first dental appointment revealed similar mean (standard deviation) values between cities with low and high coverage (10.72 ± 2.00 and 10.34 ± 2.06, respectively). However, unlike the finding regarding medical appointments, municipalities with lower FHS coverage had greater first dental appointment coverage (data not presented).

Table 1. Rotated components with a factor load matrix for the four components extracted.

	Components			
	1	2	3	4
Socioeconomic conditions				
Theil Index	0.90	0.00	-0.18	-0.25
Gini Index	0.90	-0.05	-0.16	-0.23
Employment rate	0.67	0.23	0.35	0.32
MGSRI	0.62	0.34	0.24	0.56
Basic sanitation conditions				
Water supply with bathroom	-0.01	0.88	0.34	0.21
Piped water supply	-0.04	0.87	0.32	0.24
Garbage collection	0.19	0.84	-0.01	-0.06
Development conditions				
Literacy rate	0.06	0.48	0.80	-0.03
Demographic density	-0.33	0.03	0.70	0.16
HDI	0.50	0.37	0.66	-0.11
Heath Conditions				
Infant mortality	0.01	-0.18	0.07	-0.78
Mean number of hospitalizations	-0.26	-0.05	0.12	0.78

The greatest loads in each component are shaded in gray

Table 2. Scores of the factor for each component derived from factor loads for municipalities with low (n = 17) or high FHS coverage (n = 17) in metropolitan area, 2009.

Components	FHS coverage *	Mean (Z score)	Standard deviation	t-test	p-value
Socioeconomic conditions					
	Low	0.176	1.232	1.04	0.299
	High	-0.187	0.665		
Basic sanitation conditions					
	Low	0.029	0.857	0.17	0.868
	High	-0.031	1.161		
Development conditions					
	Low	0.378	1.029	2.40	0.022
	High	-0.402	0.818		
Health conditions					
	Low	-0.112	0.943	-0.65	0.520
	High	0.118	1.075		

* FHS coverage: Proportion of population covered by the Family Health Strategy

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Table 3. Scores of the factor for each component derived from factor loads for municipalities with low (n = 17) or high dental appointment coverage (n = 17) in metropolitan area, 2009.

Components	Dental coverage *	Mean (Z score)	Standard deviation	t-test	p-value
Socioeconomic conditions					
	Low	-0.362	0.886	-2.273	0.030
	High	0.385	0.995		
Basic sanitation conditions					
	Low	-0.075	1.052	-0.438	0.665
	High	0.079	0.969		
Development conditions					
	Low	0.258	0.919	1.553	0.129
	High	-0.274	1.038		
Health conditions					
	Low	0.086	1.026	0.503	0.619
	High	-0.091	0.997		

* Coverage of first scheduled dental appointment

Table 4. Scores of the factor for each component derived from factor loads for municipalities with low (n = 17) or high mean number of medical appointments (n = 17) in metropolitan area, 2009.

Components	Mean med. appoint.*	Mean (Z score)	Standard deviation	t-test	p-value
Socioeconomic conditions					
	Low	-0.378	1.021	-2.415	0.022
	High	0.402	0.828		
Basic sanitation conditions					
	Low	0.024	0.805	0.140	0.890
	High	-0.026	1.201		
Development conditions					
	Low	0.509	0.893	3.518	0.001
	High	-0.541	0.822		
Health conditions					
	Low	-0.237	0.879	-1.415	0.168
	High	0.252	1.085		

* Mean med. appoint.: Mean annual number of medical appointments for basic specialties per inhabitant

Discussion

The initial idea of the present study was to offer a basis for the discussion on differences among municipalities through indicators available from the Brazilian Ministry of Health and hightlight the importance of the use of secondary data as an aid to public healthcare management. Factor analysis revealed that socioeconomic and development conditions may be crucial to identify municipalities with better and worst primary care indicators. For this the t test was used to compare the means of primary care indicators among the components of factor analysis. The means Z score in each component had opposite values, suggesting important differences among the municipalities related to coverage of the Family Health Strategy, coverage of scheduled first dental appointment and mean annual number of medical appointments.

An ecological study carried out in Rio de Janeiro pointed out that the higher demographic density, the worse the health status, along with an extremely high homicide rate and a seven-year shorter life expectancy. This demonstrates that social and organizational characteristics in low-income areas play an important role in the dynamic of health status[6].

An evaluation of the incorporation of oral health care to the Family Health Strategy and factors that affect the process of change in oral healthcare models in the Brazilian Health Care System was carried out in the northeastern region of the country. The municipalities classified as unsatisfactory or less than satisfactory profile had a low or medium HDI and similar characteristics, such as a high infant mortality rate and low life expectancy at birth for instance[7]. Infant mortality is a good indicator of health and living conditions of a populations. Despite the recent gains made, there remain striking regional contrasts regarding this indicator[8]. In this respect, the present study found differences in the infant mortality rate among the municipalities investigated. However, in the comparison of the factor loads between health conditions and each of the three outcomes (FHS coverage, coverage of 1st dental appointment and mean number of medical appointments), these differences were not statistical significant.

The main discussion of this present study is based on a model proposed to illustrate the social determination of the health and illness process[9]. It was presumed that the more distal levels *Living and Work Conditions* and *Socioeconomic, Cultural and Environmental Conditions* contribute differently regarding the social determination of disease as well as the organization and offering of public healthcare services. The set of factors grouped as socioeconomic conditions regarded income, employment and the commitment of the state government to social issues. Development conditions regarded education, housing and the Human Development Index. Despite a certain conceptual proximity between these indicators, the difference resides in the fact that the former measures individual aspects and the latter measures collective aspects.

Interventions regarding social stratification mechanisms are among the most important to combating inequalities in health and include policies that reduce social differences[8]. Even though the public health care system of a country may be resolutive and efficient in ensuring the population the right to health, public policies should exist that ensure the right to life. There have been important advances in the Brazilian Health Care System, such as the Family Health Strategy which is an important issue to organize the primary care through health promotion and disease/illness prevention actions centered on the family through the actions of multidisciplinary teams[10]. In fact, it is relevant to analyze aspects of a given public program such as social, economic and political characteristics during all steps of its establishment and execution[11].

However, in some locations, the majority of actions carried out by the FHS still follow the traditional care model, prioritizing individualized curative actions and limiting the potential for effective change. Thus, it is important for heath actions and services to be improved in order to ensure better-quality integral care to the clientele[2].

Another issue regards the late integration of dentistry, which occurred four years following the implantation of the FHS. The number of oral health teams increased from 2,248 in 2001 to 17,715 in 2008 and the population covered increased 1.7-fold between 2002 and 2008[12]. Despite these numbers, the assurance of integral care to families and individuals is not yet a reality in Brazil and for instance, dental actions occur in a fragmented way which hampers teamwork.

Some of the results of our study exemplify this situation. Municipalities with greater FHS coverage also had a greater number of annual medical appointments. Conversely, it appears that the expansion of the FHS has contributed little to the increase in the 1st scheduled dental appointment. This scheduled dental appointment variable is an indicator of access to healthcare services and is not necessarily limited to dental treatment. In contrast, the former indicator extrapolates the issue of access *per se* and may be considered an indicator of care.

Without significant reductions in social inequality, it will be impossible to make more substantial gains in the overall health status of the Brazilian population[13]. Interventions regarding diverse social determinants surpass the skills and power of healthcare institutions and require the coordinated action of different sectors and governmental agencies[8]. Therefore, the challenge of developing countries, like Brazil, is to offer quality health care services aligned with policies that support the dignity of human life.

Further studies that evaluate the impact of the programs implementation should be continuously carried out, incorporating evaluative research as a component of the model. Finally, it should be noted that this study has some limitations that prevents the generalization, especially in relation to the particularities and differences between the municipalities considered that cannot be measured with secondary data.

Collaborations

ACVC participated in the preparation, collection, data analysis and discussion of results; CMB participated in data collection and writing of the manuscript; CRL participated in data analysis and approval of the final version of the manuscript; AMDV and EFF coordinated the research, conducted the review critical text and approving the final version of the manuscript.

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