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Hospitalizations for diabetes mellitus and the Family Health Strategy, Paraná, Brazil, 2000-2012

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Abstract *The aim of this study was to identify trends in hospitalization for diabetes mellitus and their correlation with the Family Health Strategy (FHS) coverage in the state of Paraná, by Health District (HD), between 2000 and 2012. It is an ecological study based on secondary data from the Hospital Information System of the Brazilian Unified Health System and the Primary Care Department. There was downward trend for general admission rates (from 10.2 to 9.0/10,000 inhabitants), but upward trend for some HDs. No correlation was observed between admission rates and the FHS coverage for the state. However, there was strong inverse correlation for Paranaguá, Metropolitan, Foz do Iguaçu and Umuarama HDs, and strong and direct correlation for Pato Branco, Campo Mourão, Cianorte, Telêmaco Borba and Ivaiporã HDs. Overall, hospitalizations for diabetes mellitus proved to be decreasing and without correlation with FHS coverage; however, there were differences according to HDs.*

Key words *Diabetes Mellitus, Hospitalization, Family Health Strategy, Public health care services coverage, Primary Health Care*

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Introduction

The prevalence of Diabetes Mellitus is estimated to increase considerably by 2030 among the elderly in European countries and in the United States, and among people of all ages in developing countries, with a twice as higher rate for those aged between 20 and 44 years old[1]. In Brazilian capitals, the prevalence of self-reported diabetes among people older than 18 years old has risen from 5.3% to 5.6% between 2006 and 2011, but with differences as to age groups and regions[2].

Between 1990 and 2000, diabetes stood out among chronic conditions that have determined an increase in the number of lost years of life adjusted by incapacity, accounting for 5% of the latter; in addition, it causes early deaths, compromises people's ability to work and the maintenance of family savings for future years, possibly due to acute and chronic complications of the disease, which results in high morbimortality rates and costs for health systems[3].

Diabetes adverse trends require relevant political interventions that offer the sufficient and cost-effective attention[3]. In this sense, it is worth highlighting that diabetes constitutes an Ambulatory Care-Sensitive Condition (ACSC), as there is evidence that the adequate performance of healthcare professionals and managers at the level of Primary Healthcare (PHC) can help reduce the number of hospitalizations and deaths, especially through the prevention of micro and macro-vascular complications in the care provided by Family Health Strategy (FHS) teams[4].

In this way, hospitalizations for ACSC (HACSC) serve as an indicator of hospital activity and, at the same time, as an indirect measurement of effectiveness, access and quality of PHC[5]. The ACSC Brazilian List (Decree 221-SAS/MS-2008) is a reference for the assessment of the FHS operation[6]. It is worth highlighting that, besides the list, there are also specific lists of the states of Minas Gerais and Ceará, and the municipality of Curitiba, in Paraná[4], and all of them contain the diabetes diagnosis, followed or not by coma or ketoacidosis[4].

Considering that PHC is implemented in Brazil through the FHS, the increase in the FHS population coverage should lead to a decrease in morbimortality from ACSC, such as diabetes[6]. Studies of HACSC in Brazil have focused on identifying what evitable causes most cause hospitalizations in the Brazilian population[5,7]. Concerning diabetes, more specifically, three international studies have been found, which addressed this disease and its relationship with the care provided in PHC, conducted in Philadelphia[8], United States in general[9], and Ontario, Canada[10]. A study conducted with data on hospitalizations for diabetes in Ceará is an advancement, as it points the trends of hospitalization rates by sex and age group, but does not establish a correlation with the FHS coverage[11].

In addition, the FHS coverage is a vital component in the operationalization of PHC and should be considered in the assessment of universal health systems, because it indicates the set of actions and services to which the population has acess[12].

Thus, the question is: what is the trend of hospitalization for diabetes rates in the state of Paraná? Is there any correlation between rates of hospitalization for diabetes and the FHS coverage? In this way, the present study aimed to identify rate trends of hospitalization for diabetes mellitus and their correlation with the FHS coverage in the state of Paraná, according to Health Districts, from 2000 and 2012.

Methods

This is a time-series study about rates of hospitalization for diabetes among residents of the state of Paraná, and about the time evolution of the FHS population coverage in the same state, according to 22 HDs, from 2000 to 2012. Population information about Paraná and its HDs were obtained from results of the 2000 and 2010 Demographic Census, and also from inter-census estimates provided by the Brazilian Institute of Geography and Statistics. Data on hospitalization for diabetes were collected from the Hospital Information System (*Sistema de Informações Hospitalares*) of the Brazilian Unified Health System (*Sistema Único de Saúde*) SUS, available at the website of SUS's IT Department, between February and March 2014.

Hospitalization rates were calculated for each HD through the ratio between the absolute frequency of hospitalizations for diabetes and the residing population, using the interval from E-10 to E-14 of Chapter IV of the International Classification of Diseases, version 10 (ICD-10). Subsequently, hospitalization rates, calculated on a base of 10,000 inhabitants, were standardized by means of direct method, having as standard the population of each region and the state of Paraná in 2010.

Data on the population covered by the FHS

were collected from the website of the Primary Healthcare Department (*Departamento da Atenção Básica*) of the Brazilian Ministry of Health. The next step was the calculation of estimated population coverages of the FHS for the state of Paraná and for each HD, adopting as base the population covered in December of each year of the historical series. Afterwards, this study used the ratio between the population covered by the FHS and the population residing in the region, the series year, and then multiplied it by 100 for the calculation of the estimated population coverage, represented by percentage values.

The Shapiro-Wilk test for normality was carried out, which is recommended for samples with size smaller than 30, in order to verify the distribution of data collected, for both hospitalization rates and population coverage. Later, for data with normal distribution, the Pearson Correlation test was applied, and for non-normal data, the Spearman Correlation test; from the correlation matrix it was possible to analyze the relationship between the behavior of hospitalizations for diabetes and the evolution in FHS coverage; the hospitalization rates met the normality supposition. In order to classify the intensity of correlation coefficients, this study adopted the following categorization: correlation coefficients < 0.4 (weak correlation), ≥ 0.4 to < 0.5 (moderate correlation) and ≥ 0.5 (strong correlation)[13]. Cases in which no significance was found in the correlation test ($p > 0.05$) were regarded as "without correlation". The coefficients also indicated direct or inverse correlation, according to the coefficient sign (positive or negative).

In the trend analysis, data corresponding to the 2000-2012 historical series were adjusted by polynomial regression models, which allow for the estimation of a statistical model for historical series, from which it is possible to verify the series behavior and indicate factors that are supposedly associated with this behavior. This type of analysis was chosen due to easy elaboration and interpretation of models and great statistical power[14].

Hospitalization rates composed the dependent variable (Y), and the calendar years of the study the independent variable (X), based on the assumption that the hospitalization rates varied over time, under the influence, in the case of the present study, of the FHS coverage. In order to prevent self-correlation between equation terms of the regression, the "year" variable was turned into "centralized year" variable, which is obtained by "year" minus the medium point of the historical series (year – 2003). The first model to be tested was simple linear regression ($Y = \beta_0 + \beta_1 X$) and, then, models of higher degree were tested: second order ($Y = \beta_0 + \beta_1 X + \beta_2 X_2$) and third order ($Y = \beta_0 + \beta_1 X + \beta_2 X_2 + \beta_3 X_3$).

For the choice of the model, there was analysis of the dispersion diagram, the determination coefficient value (r^2 closer to 1 corresponds to a better adjustment of the model) and the residue distribution, which, in turn, allowed verifying the data homoscedasticity supposition. In cases of statistical equality between models, the model of lower order was chosen (first order or linear model). The series were smoothened through the 3-point moving average. All data were stored in tables on Tabwin 2.7 (Datasus app for data tabulation and treatment) and then shifted to Microsoft Excel 2010, where they were organized into databases. Polynomial regression models were generated from SPSS, version 20. The level of significance adopted was $p < 0.05$ (5%) for all tests performed.

The research project that resulted in the present study was approved by the Ethics Committee on Research Involving Humans of the State University of Maringá (COPEP/UEM), under legal opinion.

Results

Between 2000 and 2012, 111,402 hospitalizations for diabetes were recorded in the state of Paraná. The highest number of hospitalizations (21,436/19, 2%) was recorded in the Metropolitan HD, followed by Maringá, with 9,487 (8.5%), Londrina, with 7,445 (6.7%), and Ponta Grossa, with 6,986 hospitalizations for diabetes (6.3%). The FHS coverage in Paraná rose from 27.0% to 56.2% in the period studied, representing an increase of approximately 108% (percentage variation = 29.2%). Among the HDs, Apucarana showed the highest percentage of FHS coverage, both in the beginning (76.8%) and in the end of the period (96.1%). (Table 1).

Concerning hospitalization rates, the state of Paraná showed reduction from 10.4 to 9.3 hospitalizations/10,000 inhabitants. In the beginning of the period, Umuarama health district showed the highest hospitalization rate (26.9 hospitalizations/10,000 inhab.), and Foz do Iguaçu presented the lowest (5.4 hospitalizations/10,000 inhabitants). In the end of the period, Cornélio Procópio showed the highest rate (21.9 hospitalizations/10,000 inhab.), and Irati the lowest (1.5 hospitalizations/10,000). Cornélio Procópio

Table 1. FHS population coverage proportion and rates of hospitalization for diabetes mellitus among residents of the state of Paraná, by health region, 2000 to 2012.

Health Region	2000		2001		2002		2003		2004		2005		2006	
	%	Rt	%	Rt	%	Rt	%	Rt	%	Rt	%	Rt	%	Rt
Paraná	22.4	10.2	31.5	10.7	35.9	10.1	38.4	9.3	41.4	9.1	45.9	9.8	48.0	9.5
1st Paranaguá HD	7.8	12.2	4.3	12.8	13.1	12.5	12.2	11.2	7.2	8.8	19.5	9.6	23.3	11.6
2nd Metropolitan HD	15.3	9.7	19.1	10.2	20.3	8.3	19.8	7.0	24.0	5.9	27.9	4.6	31.4	5.1
3rd Ponta Grossa HD	10.1	12.8	11.8	12.2	20.0	11.8	21.7	11.6	28.5	9.5	36.4	9.1	36.5	8.5
4th Irati HD	16.7	9.6	21.6	11.0	28.0	9.5	32.4	8.3	46.1	6.5	52.2	7.2	66.3	11.5
5th Guarapuava HD	12.3	10.1	23.1	11.8	29.2	10.8	43.1	9.4	52.1	9.3	52.4	11.0	53.0	10.8
6th União da Vitória HD	13.3	6.7	17.4	10.5	19.4	6.8	23.5	7.8	27.6	10.3	36.4	10.2	40.5	8.2
7th Pato Branco HD	17.6	7.6	20.4	9.1	27.5	9.2	31.7	8.1	14.3	9.1	27.0	10.6	30.9	11.6
8th F. Beltrão HD	20.4	9.7	34.1	10.1	44.0	7.6	52.4	9.8	57.8	8.9	65.2	11.9	66.3	10.7
9th F. do Iguaçu HD	8.0	5.6	15.4	5.3	16.0	7.4	17.4	6.2	21.6	6.2	39.2	6.9	42.4	5.4
10th Cascavel HD	30.7	5.3	39.0	6.0	34.3	4.2	34.6	3.8	34.0	3.9	38.9	6.4	36.1	6.0
11th Campo Mourão HD	18.8	9.4	34.4	10.0	41.8	12.6	45.1	12.3	43.8	14.2	67.7	16.8	71.5	19.3
12th Umuarama HD	39.1	26.1	40.6	27.7	43.8	29.2	47.6	32.8	54.9	31.3	61.0	43.3	65.1	36.1
13th Cianorte HD	39.6	7.5	59.9	8.3	59.6	11.5	64.6	11.6	69.6	15.9	67.1	17.4	67.5	21.1
14th Paranavaí HD	35.1	11.5	62.9	9.7	67.4	12.6	72.0	13.8	73.8	11.7	82.7	14.4	88.2	11.8
15th Maringá HD	41.1	11.0	43.5	11.4	44.2	10.6	49.3	11.9	55.3	12.0	39.2	14.0	52.3	13.4
16th Apucarana HD	62.8	16.2	85.2	15.8	91.7	17.1	92.0	13.8	90.8	15.4	89.2	17.2	91.1	13.0
17th Londrina HD	23.7	10.2	65.1	9.9	74.8	9.2	76.2	9.0	76.6	10.0	77.4	9.2	66.9	7.5
18th C. Procópio HD	35.5	21.4	32.6	20.8	61.9	26.0	67.2	24.3	67.7	20.2	72.9	23.5	77.2	20.6
19th Jacarezinho HD	17.7	14.8	38.2	13.8	48.6	15.2	58.7	11.9	58.6	13.9	69.5	16.6	68.8	17.2
20th Toledo HD	11.7	9.2	16.3	12.6	16.8	9.8	22.1	8.5	26.4	10.1	29.9	12.8	28.4	14.6
21st Telêmaco Borba HD	19.5	12.0	19.4	11.1	25.3	7.4	29.5	2.5	38.1	9.0	59.6	12.3	66.3	9.3
22rd Ivaiporã HD	45.6	3.9	54.2	7.8	63.3	9.7	64.0	9.2	64.6	10.6	78.0	14.3	78.0	18.2

Health Region	2007		2008		2009		2010		2011		2012	
	%	Tx	%	Tx	%	Tx	%	Tx	%	Tx	%	Tx
Paraná	47.5	8.4	50.5	9.5	51.9	9.8	55.7	10.0	55.7	9.0	57.3	9.0
1st Paranaguá HD	30.6	10.1	39.9	11.1	39.3	11.8	49.8	9.0	50.6	8.9	52.8	7.0
2nd Metropolitan HD	31.2	4.6	33.4	4.5	34.5	4.9	38.8	5.4	38.9	4.6	42.3	5.3
3rd Ponta Grossa HD	34.8	9.2	45.6	10.5	45.0	11.3	41.5	12.2	44.1	10.7	45.0	9.1
4th Irati HD	57.6	7.5	57.1	9.7	64.4	11.8	64.2	14.4	63.9	12.7	60.8	7.5
5th Guarapuava HD	52.7	9.7	57.8	13.6	58.3	16.1	69.6	13.4	68.6	12.0	68.9	12.4
6th União da Vitória HD	40.4	5.7	40.1	8.5	40.0	8.5	41.7	10.2	42.7	12.2	46.6	11.5
7th Pato Branco HD	36.8	11.0	48.4	10.0	55.6	13.0	64.1	12.0	64.9	11.5	64.5	10.8
8th F. Beltrão HD	68.3	10.2	69.1	10.3	70.9	9.8	78.5	10.7	79.7	10.8	80.3	11.5
9th F. do Iguaçu HD	39.3	5.4	43.2	6.0	41.6	4.7	54.3	4.0	52.4	3.9	52.6	3.8
10th Cascavel HD	32.7	6.0	34.6	6.4	36.5	6.5	38.6	6.1	38.2	6.6	42.5	5.1
11th Campo Mourão HD	75.0	15.5	71.9	19.4	80.1	18.7	82.3	15.3	81.1	14.9	82.1	17.0
12th Umuarama HD	70.0	27.5	61.9	10.1	72.8	12.9	75.0	12.0	74.7	11.7	79.7	8.0
13th Cianorte HD	72.8	18.7	70.4	17.1	72.4	16.0	69.5	16.8	68.9	15.2	69.8	13.7
14th Paranavaí HD	87.9	12.2	79.6	14.1	816	18.5	86.8	17.8	84.2	17.2	85.5	14.3
15th Maringá HD	48.6	11.3	50.8	13.3	53.7	12.7	55.0	12.1	57.8	9.8	55.1	10.5
16th Apucarana HD	95.1	11.2	96.1	11.8	96.5	13.5	97.0	16.8	96.7	15.3	94.7	12.5
17th Londrina HD	70.2	5.6	72.0	6.3	68.8	5.0	68.0	6.1	63.6	6.9	65.5	6.0
18th C. Procópio HD	78.6	17.6	78.1	24.4	78.2	20.5	79.0	24.3	79.7	19.1	81.3	22.4
19th Jacarezinho HD	60.0	15.1	69.7	20.1	75.8	20.5	79.0	22.3	82.1	16.3	85.6	16.0
20th Toledo HD	25.6	13.5	33.6	12.6	30.4	12.7	32.2	12.9	37.7	10.2	35.2	10.3
21st Telêmaco Borba HD	53.7	8.7	60.7	12.0	65.2	12.4	71.7	15.1	73.8	13.7	75.5	25.7
22rd Ivaiporã HD	72.6	10.5	66.5	14.6	74.3	15.2	78.8	19.1	75.6	12.4	73.3	17.8

Source: SIH/SUS – Datasus (Ministry of Health); % - FHS coverage Percentage. Rt.: hospitalization rate.

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showed high rates permanently, always around or higher than 20 hospitalizations/10,000 inhab. The highest rate found was 37.2 hospitalizations/10,000, in Umuarama health district, from 2004 to 2005 (Table 1).

Regarding hospitalization trends, it was found that in nearly 2/3 of the HDs (14 HDs), hospitalizations for diabetes increased, seven HDs showed downward trend, and only one showed stability. Ivaiporã, Telêmaco Borba and Jacarezinho health districts were those with the highest yearly medium increments, representing an increase of almost 1 hospitalization/10,000 inhabitants/year. Umuarama HD showed the highest historical average (29.9), but has been showing downward trend in hospitalization rates, having the greatest yearly average reduction observed, which was 2.4 hospitalizations/10,000 inhabitants. Londrina and the Metropolitan HDs were also among those which showed the greatest average reduction. Though stable, hospitalization rates in Cornélio Procópio HD presented a historical average of about 22 hospitalizations/10,000 inhabitants (Table 2).

There was no correlation between hospitalization rates and the FHS population coverage. However, strong and inverse correlation was found for Paranaguá, Metropolitan, Foz do Iguaçu and Umuarama health districts. Pato Branco, Campo Mourão, Cianorte Telêmaco Borba and Ivaiporã districts, in turn, showed strong and direct correlations. There was no correlation for the remaining districts (Table 3).

Figure 1 shows that Cornélio Procópio HD (18th HD), lighter in the map, was the only presenting stability. There is some proximity between the HDs that presented linear upward and upward trend most of the time – the darker ones in the map.

Figure 2 shows some proximity between the HDs that presented strong positive or negative correlation.

Discussion

The greater proportion of hospitalizations in the Metropolitan HD can be explained by the larger

Table 2. Polynomial regression analysis for trend of hospitalizations for Diabetes Mellitus, in the state of Paraná, by Health District, Brazil, 2013.

State/Region	Model	*p*	r^2	Trend
State of Paraná	Y = 9.288 – 0.059 + 0.025	0.012	0.669	Downward until 2007
1st Paranaguá HD	Y = 10.524 + 0.252 +0.007 – 0.028	< 0.001	0.911	Upward from 2004
2nd Metropolitan HD	Y = 4.920 – 0.407 + 0.101	< 0.001	0.981	Downward until 2007
3rd Ponta Grossa HD	Y = 9.576 – 0.075 + 0.100	0.008	0.698	Downward until 2006
4th Irati HD	Y = 8.795 + 0.353 + 101	0.005	0.740	Upward from 2004
5th Guarapuava HD	Y = 11.170 + 0.383 + 0.042	0.011	0.677	Upward from 2003
6th União da Vitória HD	Y = 8.300 – 0.298 + 0.056 + 0.027	0.010	0.786	Downward until 2007
7th Pato Branco HD	Y = 10.409 + 0.371	< 0.001	0.888	Upward
8th F. Beltrão HD	Y = 10.082 + 0.168	0.006	0.583	Upward
9th F. do Iguaçu HD	Y = 5.591 – 0.246	< 0.001	0.813	Downward
10th Cascavel HD	Y = 5.555 + 0.192	0.004	0.616	Upward
11th Campo Mourão HD	Y = 17.126 + 0.605 – 0.172	< 0.001	0.953	Upward until 2007
12th Umuarama HD	Y = 29.947 – 2.407 – 0.514	0.001	0.819	Downward from 2005
13th Cianorte HD	Y = 17.975 + 0.625 – 0.262	< 0.001	0.935	Upward until 2006
14th Paranavaí HD	Y = 13.936 + 0.585	< 0.001	0.794	Upward
15th Maringá HD	Y = 12.880 + 0.024 – 0.083	< 0.001	0.871	Upward until 2006
16th Apucarana HD	Y = 13.679 – 0.210 + 0.088	0.032	0.578	Downward until 2007
17th Londrina HD	Y = 7.682 – 0.472	< 0.001	0.847	Downward
18th C. Procópio HD	Y = 22.055 – 0.174	0.109	0.260	Stable
19th Jacarezinho HD	Y = 16.655 + 0.681	< 0.001	0.790	Upward
20th Toledo HD	Y = 12.626 + 0.226 – 0.089	0.023	0.610	Upward until 2006
21st Telêmaco Borba HD	Y = 10.709 + 0.850	0.001	0.698	Upward
22rd Ivaiporã HD	Y = 12.909 + 0.880	< 0.001	0.858	Upward

Tabela 3. Coeficientes e significância de correlação entre as internações por *Diabetes Mellitus* e a proporção de cobertura populacional da ESF, segundo Regional de Saúde, Estado do Paraná, 2000 a 2012.

Health Region	Correlation Coefficient	*p-value*	Correlation
State of Paraná	-0.532*	0.061	No correlation
1st Paranaguá HD	-0.603*	0.029	Strong
2nd Metropolitan HD	-0.657**	0.015	Strong
3rd Ponta Grossa HD	-0.529*	0.063	No correlation
4th Irati HD	0.459**	0.114	No correlation
5th Guarapuava HD	0.427*	0.146	No correlation
6th União da Vitória HD	0.413**	0.160	No correlation
7th Pato Branco HD	0.709*	0.007	Strong
8th F. Beltrão HD	0.523*	0.067	No correlation
9th F. do Iguaçu HD	-0.643*	0.018	Strong
10th Cascavel HD	0.307**	0.214	No correlation
11th Campo Mourão HD	0.637**	0.019	Strong
12th Umuarama HD	-0.555*	0.049	Strong
13th Cianorte HD	0.626**	0.022	Strong
14th Paranavaí HD	0.440**	0.133	No correlation
15th Maringá HD	-0.197*	0.519	No correlation
16th Apucarana HD	-0.379**	0.201	No correlation
17th Londrina HD	0.058**	0.851	No correlation
18th C. Procópio HD	-0.256**	0.399	No correlation
19th Jacarezinho HD	0.527*	0.064	No correlation
20th Toledo HD	0.313*	0.297	No correlation
21st Telêmaco Borba HD	0.579*	0.038	Strong
22rd Ivaiporã HD	0.868*	<0.001	Strong

**Pearson coefficient; **Spearman coefficient.*

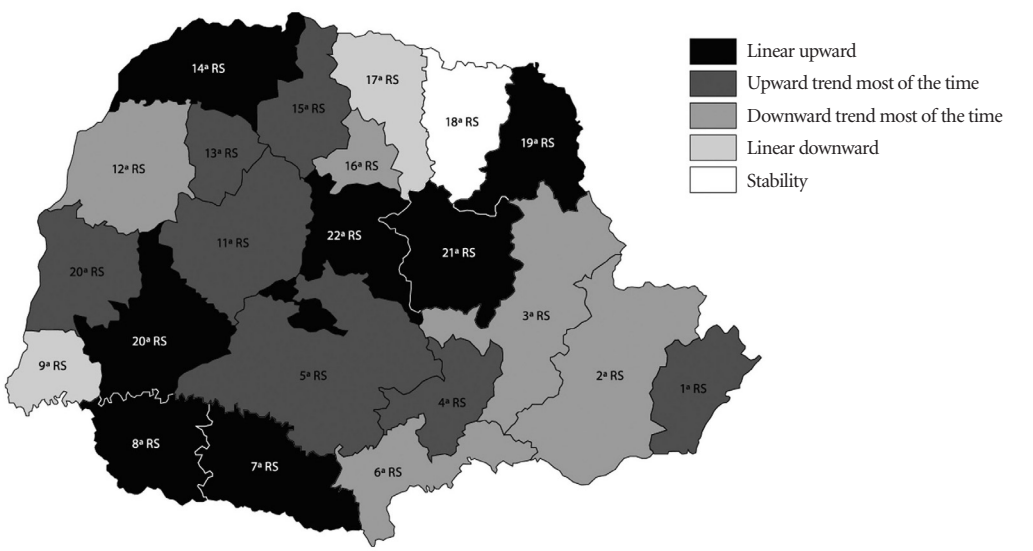

Figure 1. Map showing the analysis of rate trends of hospitalization for Diabetes Mellitus in the state of Paraná, by Health Districts. Paraná, Brazil, 2000-2012.

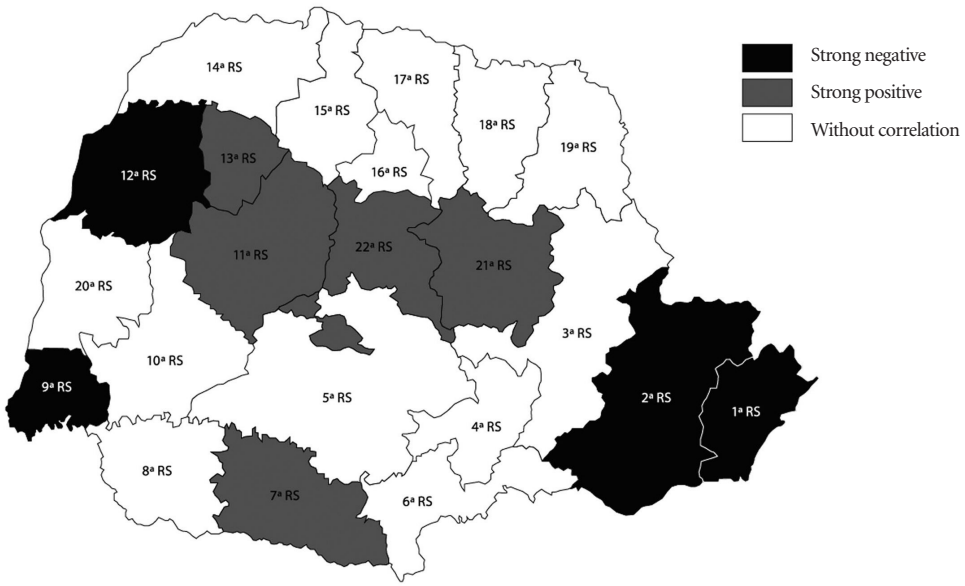

Figure 2. Map showing the analysis of correlation between rates of hospitalization for Diabetes Mellitus and the family health strategy population coverage, by Health Districts, Paraná, Brazil, 2000-2012.

population residing in that region, especially because it is where the most populous city in Paraná is located, Curitiba. The present study found reduction in hospitalization rates and strong correlation with the expansion in the number of FHS teams in the Metropolitan HD.

The 108% rise in the FHS population coverage was higher than that observed in Brazil between 1998 and 2006, which stood at 86.5%[15], and in Minas Gerais, between 2000 and 2010, where the relative difference between coverages in the beginning and end of the period oscillated between 26.5% and 74.8%, according to HDs[16]. Considering Paraná's territorial dimensions and administrative divisions, this increase in coverage represents the progress of the process to reorient PHC and the gradual overcoming of barriers in the access to services and socioeconomic differences between the HDs[15]. About said differences, the division of the state into HDs represents the decentralization of healthcare proposed by the Ministry of Health in Brazil, as it is believed that this model of organization, based on regionalization, favors the access to and efficiency of healthcare networks[15].

The drop in rates of hospitalization for diabetes in Paraná, in general, was also observed in the state of Minas Gerais, 0.85 to 0.80 hospitalizations/1,000 inhabitants, between 2000 and 2010[16]; in the capital city Campo Grande, 5.9 to 3.1 hospitalizations/10,000 inhabitants, between 2000 and 2009[17]; and in the capital city Rio de Janeiro, among the elderly, 3.8 to 2.6 hospitalizations/1,000 inhabitants, from 2000 to 2010[18]. On the other hand, just as evidenced in the present study for HDs, for instance, Ivaiporã, there was an increase in the overall rate of hospitalization for diabetes in Juiz de Fora, between 2002 and 2009[19]; in Guarulhos, with increase of 10% in hospitalizations, between 2008 and 2012[20]; and even in Poland, between 2005 and 2009[21].

Although downward trend has been found for the state of Paraná, in most part of the period, most of the HDs studied presented upward trend. In the state of Ceará, the overall trend of hospitalizations for diabetes was upward; however, the analysis stratified by sex performed found downward trend among women[11]. As for Minas Gerais, the difference between 2000 and 2010 rates pointed significant overall reduction in rates; however, the regionalized analysis identified increase in two HDs[16].

Such results may vary largely according to economic, political and environmental determinants. A study conducted in Victoria, Australia, points that, in addition to diabetes and its complications being the main ACSC among hospitalizations of people older than 28 years old,

variables such as sex, age, rurality, socioeconomic disadvantages and access difficulties are important predictors for increased hospitalizations[22].

Moreover, there is great influence of the structuration of health services in each territory on hospitalizations, with highlight to the organization of the ambulatory service, composition of health teams (which have as an important challenge the establishment of doctors in the locations), qualification of professionals, employment ties, among other elements linked to the structural dimension[23]. Therefore, the analysis is deemed necessary, not only of the results of the assistance, through hospitalizations, for instance, but also of the working process and the structure professionals have to implement their actions.

When it comes to the state of Paraná, the correlation between FHS coverage and rates of hospitalization for diabetes was nearly significant (p=0.061), in an inverse way and with strong intensity. However, in Paranaguá, Metropolitan, Foz do Iguaçu and Umuarama HDs, the correlation analysis suggests that the increase in FHS coverage may have influenced the reduction in rates of hospitalization for diabetes.

Consonantly, a study conducted in the south of Santa Catarina observed that hospitalizations for diabetes presented an upward trend in the population with basic ambulatory care rated as adequate[23]. Other studies also observed inverse correlation between PHC coverage and hospitalization for diabetes[8,17]. However, this question is pondered, stressing that, even with free access to ambulatory services for underprivileged populations, the latter still present an excessive number of HACSC[10].

In the case in which no correlation was found, it can be inferred that the FHS, which, strictly speaking, should lead to a reduction in hospitalizations for diabetes, may still present difficulties in the implementation of resolutive actions about diabetes, although it is considered the most sensitive one among the ACSC, because the obtainment of positive results requires minimal organization from the health service. A study conducted in Rio Grande do Sul also identified higher rates in regions with greater concentration of small cities, and attributes this profile to the fact that hospitals in said cities use their maximum installed capacity. For this reason, they admit more easily cases which would not necessarily need this level of assistance, in order to obtain resources according to the number of hospitalizations performed[24].

In this sense, another study, conducted in Rio Grande do Sul as well, identified strong and positive correlation between HACSC and FHS coverage in municipalities with small-size hospitals, differently from those municipalities which did not have small-size hospitals, indicating lower rates of HACSC in medium-size cities and big centers[25].

It is believed that the same principle can be attributed to HDs where there was direct correlation with FHS coverage. That is, "unnecessary" hospitalizations may have influenced this correlation. In this way, the coordination power of PHC over the flow of health system users ceases to impact the occupation of hospital beds, and begins to comply with a certain accounting logics that opposes to the model of reorganization of assistance and reaffirms the healing perspective with which health services are impregnated.

Furthermore, it should be taken into consideration that the rise in hospitalizations in said HDs, concomitant with that of the FHS coverage, may be linked to improved access, the system's better capacity for diagnosis, and empty hospital beds[17]. Therefore, in the case of chronic conditions, the demand for longer care time, the influence of morbidity profile, the search for health services, and the population's lifestyle can restrict the assessment of the impact of the FHS on such conditions[17].

Although the population coverage of the service is an essential component of the health system's problem-solving ability, the high HACSC rates man indicate poor access to services offered by PHC or the offering of low-quality services. A systematic review of the literature found that PHC deficiencies were associated with HACSC in different countries, whereas the continuity of care, the performance of the multiprofessional team and the population served by said team were associated with lower likelihood of hospitalization for ACSC[26].

The regionalized analysis of diabetes trends and correlations with the FHS can provide subsidizes of epidemiological character to the planning of local interventions. In this way, it is possible to meet – besides population needs – municipal agreements with the Ministry of Health, which include, among other indicators, the rate of hospitalization for diabetes and complications among people aged 30 years or over, as well as the focus on the 30-59 years old age group, as a strategy to avoid the aforementioned events, since the longer the diagnosis time, the smaller the success of interventions[26].

In this line, a study about people aged between 30 and 59 years old, hospitalized due to diabetes or its complications, conducted in Jo-

inville, Santa Catarina, indicates some characteristics of health profile, use of health services and compliance with therapy, which may be associated with hospitalizations, such as type-2 diabetes with evolution time equal or greater than 10 years, comorbidities, re-hospitalizations, non-attendance to PHC consultations in the last 12 months, discrepancies in appointed consultations, difficulty of access to specialized consultations, flaws in the performance of drug therapy and low compliance with health practices, especially the regular practice of exercises[27].

As options, strategies coming from clinical management and based on risk stratification and biopsychosocial factors of the population, such as operative groups and supported self-care, can be decisive in the gaining of self-efficacy by PHC users and, consequently, in the achievement of lower hospitalization rates[28]. The implementation of multidisciplinary intervention programs at basic health units can promote the adoption of health practices among people with diabetes, as pointed by a study conducted in a municipality in northwestern Paraná[29]. In general terms, PHC must be associated with the improvement in decision-making as to drug prescriptions, to additional exam requests and to other assessments, including improvement in glycemic control, decrease in consultations with specialists and in search for emergency services[30].

The results of the present study can indicate stalemates in the organization of the health system at local and regional levels, that is, for each HD and the state of Paraná. Concerning diabetes, this study may contain subsidizes for the surveillance and operationalization of health planning, focusing on the capacity of organization of the health system PHC has. It is worth stressing methodological limitations of the present investigation. First, the use of data from secondary databases, which may present problems concerning the range and quality of information recorded and conveyed by the system and, for this reason, the use of information for epidemiological purposes requires caution.

Additionally, the absence of demographic and socioeconomic data may represent a limitation as well, as they can constitute important information to be associated with hospital morbidity deriving from diabetes. Thus, as a recommendation, further investigations should perform an analysis of hospitalizations, with control of confusion factors represented by demographic and socioeconomic variables, as well as variables concerning local health services, which may require the crossing of data from different sources. Finally, the fact that the information system does not discriminate what individuals are or are not assisted by the FHS, that it does not consider private hospitalizations and does not allow for the identification of re-hospitalizations, constitutes limitations of this study. Therefore, the correlation coefficients evidenced cannot be regarded as consequences derived exclusively from FHS interventions, because confusion variables have not been controlled.

Collaborations

GO Arruda, DB Schmidt and SS Marcon were responsible for the conception and development of the study, data analysis and interpretation, writing of the manuscript and critical review of the content.

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