

# Trends in hospitalization due to cardiovascular conditions sensitive to primary health care

## *Tendência das internações por doenças cardiovasculares sensíveis à atenção primária*

Maicon Henrique Lentsck<sup>1</sup>, Maria do Rosário Dias de Oliveira Latorre<sup>II</sup>,  
Thais Aidar de Freitas Mathias<sup>III</sup>

**ABSTRACT:** *Objective:* To analyze the trend in hospitalizations for primary care-sensitive cardiovascular conditions for residents of the state of Paraná, Brazil, from 2000 to 2011. *Methods:* Ecological, time series study of the rates of hospitalization for cardiovascular diseases in residents aged 35–74 years old by sex, age and main diagnosis for hospitalization. Data from the Hospital Information System of the Unified Health System (SIH-SUS) and polynomial regression models for trend analyses were used. *Results:* Hospitalization rates for cardiovascular conditions decreased during the period ( $r^2 = 0.96$ ;  $p < 0.001$ ), with similar decreasing patterns for males and females, in all age ranges, although always higher for males. Although hospitalization trends for hypertension, heart failure and cerebrovascular disease decreased, angina remained stable for males and females. *Conclusion:* A downward trend in hospital admissions due to primary care-sensitive cardiovascular conditions in the state of Paraná between 2000 and 2011 may have resulted from the expansion of the health network of and the access to primary health attention, as well as other factors that influence this set of diseases, such as improved socioeconomic conditions of the population, organization of primary care services for higher age ranges and women and decrease in risk factors.

**Keywords:** Cardiovascular diseases. hospitalization. Trends. Time series studies. Primary health care. Quality of health care.

<sup>1</sup>Universidade Estadual de Maringá – Maringá (PR), Brazil.

<sup>2</sup>Department of Epidemiology, Universidade de São Paulo – São Paulo (SP), Brazil.

<sup>3</sup>Department of Nursing, Universidade Estadual de Maringá – Maringá (PR), Brazil.

**Corresponding author:** Maicon Henrique Lentsck. Rua Conde D'eu, 531, Vila Carli, CEP: 85040-290, Guarapuava, PR, Brasil. Email: maiconlentsck@yahoo.com.br.

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**RESUMO:** *Objetivo:* Analisar a tendência das internações por condições cardiovasculares sensíveis à atenção primária de residentes no Estado do Paraná de 2000 a 2011. *Métodos:* Estudo ecológico de séries temporais das taxas de internação por doenças cardiovasculares de residentes de 35 a 74 anos de idade por sexo, idade e diagnóstico principal de internação. Foram utilizados os dados do Sistema de Informações Hospitalares do Sistema Único de Saúde (SIH-SUS). Para as análises de tendência foram utilizados modelos de regressão polinomial. *Resultados:* As taxas de internação por condições cardiovasculares declinaram no período ( $r^2 = 0,96$ ;  $p < 0,001$ ) e, embora sejam sempre maiores para os homens, foi observado decréscimo significativo em todas as faixas de idade para ambos os sexos. Enquanto a tendência das taxas de internação por hipertensão, insuficiência cardíaca e doenças cerebrovasculares foi de queda, observou-se estabilidade para a angina, tanto para homens como para mulheres. *Conclusões:* A redução nas taxas de internação por doenças cardiovasculares pode ser resultado da expansão da rede e do acesso à atenção primária à saúde, e de outros fatores que influenciam nesse conjunto de doenças como a melhoria das condições socioeconômicas da população e organização dos serviços primários para faixas etárias mais altas e mulheres e diminuição dos fatores de risco.

*Palavras-chave:* Doenças cardiovasculares. Hospitalização. Tendências. Estudos de séries temporais. Atenção primária à saúde. Qualidade da assistência à saúde.

## INTRODUCTION

The interest in studying hospital admissions as a way to monitor the quality and effectiveness of the actions developed in Primary Health Care (PHC) has increased in the last decade, mainly because agreement indicators were established by the Unified Health System<sup>1</sup>. Among the priorities in the Pact for Health, there are hospitalizations for stroke and diabetes mellitus, which later were grouped with other health problems in the list of causes whose actions taken in PHC intervene in admissions<sup>2</sup>.

Among the various forms of analysis and evaluation of the actions of PHC, we can highlight those that use the Hospital Information System of the Unified Health System (SIH-SUS), which comprehends about 80% of the admissions in the country and is a source for health indicators, especially on access to and quality of services. With information from SIH-SUS, it is possible to analyze trends in hospitalization for cardiovascular disease (CVD), an essential tool for monitoring it<sup>3</sup>.

CVDs are the leading causes of death worldwide, with the greatest impact on low and middle income countries<sup>4</sup>. In Brazil, even with a reduction in mortality, CVDs accounted for 31.2% deaths in 2010<sup>5</sup>. This impact is not only related to mortality, but also to hospital admissions because, despite the decline in rates between 2000 and 2009, CVDs were the leading cause of hospitalizations in this period. In 2007, circulatory system diseases accounted for 12.7% of total hospitalizations, excluding those for pregnancy, childbirth and postpartum period, and 27.4% of hospitalizations among people over 60 years old<sup>6</sup>, with congestive heart failure (CHF) as the main cause<sup>7</sup>.

Aside from CHF, other CVDs, including high blood pressure (hypertension), angina and cerebrovascular diseases are examples of health problems listed in the Brazilian List of

Sensitive Conditions, considered as primary care-sensitive cardiovascular conditions (PCSCC) and used as markers in the indirect assessment of basic health services for being considered potentially preventable<sup>8</sup>.

In Brazil, a study conducted between 1998 and 2009 with hospitalizations for sensitive conditions found an average annual reduction of 3.7% for men and women<sup>9</sup>. For CVD, the authors identified, in both sexes, a decline in hospitalization rates for CHF and cerebrovascular diseases, and stability for hypertension. They also described differences between sexes in hospitalization rates for angina, increasing for males and stable for females. For the state of Goiás, a reduction in hospitalization rates for PCSCC was identified by sex and age<sup>10</sup>.

Regional inequalities in the implementation and expansion of PHC imply differences in admission profile<sup>9</sup> and, even with the expansion of coverage in Brazil's PHC, regional differences in the prevalence of CVD risk factors can interfere with hospital admission rates. Thus, behavioral studies of hospitalizations for PCSCC are needed for the monitoring and analysis of these differences.

The management of CVDs in primary care in the State of Paraná is based on the principles and guidelines of the PHC, which include a variety of actions from prevention and treatment to health promotion that can impact on hospital admissions for this group of diseases. The evaluation of the trend of hospital admissions can express the results of health measures adopted in the PHC. To date, there are no trend studies of hospitalizations, especially on PCSCC for residents of Paraná. Thus, this study aimed to investigate if there was a downward trend in hospitalization rates for PCSCC in the state of Paraná, according to diagnosis, sex and age.

## METHOD

This is an ecological, time series study of hospitalizations for primary care-sensitive cardiovascular conditions in the State of Paraná from 2000 to 2011. The admission rates were calculated by the ratio between total admissions of residents aged between 35 and 74 years old for different groups of PCSCC and population per 10,000 inhabitants of the same age and sex.

Information on the admissions was obtained in Hospital Admission Authorizations (AIH) Type 1, and population data were obtained from the Brazilian Institute of Geography and Statistics (IBGE), both provided by the Department of Information Technology of the Unified Health System (DATASUS).

The diagnoses of hospitalization were: Hypertension (ICD: I10 and I11), angina (I20), heart failure (I50 and J81) and cerebrovascular diseases (I63 to I7, I69, G45 and G46), selected from the Brazilian List of Primary-Care Sensitive Conditions, which classifies these conditions according to the tenth revision of the International Classification of Diseases (ICD-10)<sup>8</sup>. Age was stratified in: 35 – 44 years old; 45 – 54 years old; 55 – 64 years old and 65 – 74 years old, and analyzed by sex.

The trend in hospitalization rates was performed by the polynomial regression model, considering the rates as the dependent variable (Y) and the years of study as the independent variable (X). The X variable was centralized (year minus the midpoint of the time series), with 2005 as the midpoint. Scatter plots were built between the rates and years of study to identify the function that expresses the relationship between them and, therefore, choose the polynomial order for analysis. From this relationship, polynomial regression models were estimated, which, in addition to their statistical power, become easy to interpret<sup>11</sup>. The trend was considered significant when the estimated model obtained  $p < 0.05$ , and, as a measure of precision, the coefficient of determination ( $r^2$ ) was used.

Initially, the simple linear regression model was tested ( $Y = \beta_0 + \beta_1 X$ ) and later, models of higher order, second degree ( $Y = \beta_0 + \beta_1 X + \beta_2 X^2$ ) and third degree ( $Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \beta_3 X^3$ ). It was considered as the best model which showed the highest statistical significance, as well as unbiased residuals. When two models were statistically similar, the principle of parsimony was used<sup>11</sup>. In the model,  $\beta_0$  represents the mean rate of the period analyzed, and  $\beta_1$  represents trend rate.

The variations of the series were attenuated by using a moving average of three successive averages. Thus, the annual rates correspond to the arithmetic average of the rates in the previous year, current year and the year after.

For tabulation of the database, calculation and analysis of trends in hospitalization rates, Microsoft Excel (2007 version) and SPSS (18.0 version) software were used. The study was considered by the Research Ethics Committee and dispensed analysis, considering the nature of research and unique methodological design, with secondary data publicly available in the internet.

## RESULTS

In all analyses, the most significant models were linear regression models, and show that, for the population aged 35-74 years old living in the state of Paraná, hospitalizations for PCSCC ( $r^2 = 0.96$ ;  $p < 0.001$ ), as well as the set of total admissions ( $r^2 = 0.90$ ;  $p < 0.001$ ) and all Primary Care-Sensitive Conditions (PCSC) ( $r^2 = 0.98$ ;  $p < 0.001$ ) had a downward trend in their rates. Analysis of the models showed decrease due to hypertension ( $r^2 = 0.92$ ;  $p < 0.001$ ), CHF ( $r^2 = 0.97$ ;  $p < 0.001$ ) and cerebrovascular diseases ( $r^2 = 0.89$ ;  $p < 0.001$ ) with highly significant coefficients of determination. The exception was angina ( $r^2 = 0.24$ ;  $p = 0.148$ ), which remained stable (Table 1).

The average rate of hospitalization for PCSCC was lower for women ( $\beta_0 = 116.25$  and  $126.07$ , respectively), with a more pronounced drop rate ( $\beta_1 = -7.31aa$ ) than for men ( $\beta_1 = -6.20aa$ ). The trend was similar for both sexes in all diseases, despite the differences demonstrated by admission rates and models. The average rates and drop rate for hypertension were higher in women ( $\beta_0 = 19.54$  and  $\beta_1 = -1.65aa$ ) and, for cerebrovascular diseases, these indicators were higher in men ( $\beta_0 = 28.16$  and  $\beta_1 = -1.58aa$ ); in both causes,

Table 1. Rates of hospitalization for primary care- sensitive conditions and primary care-sensitive cardiovascular conditions from all causes in adults aged 35-74 years old and respective trend models. Paraná, Brazil, 2000 to 2011.

Causes	2000/ 2002	2003/ 2005	2006/ 2008	2009/ 2011	Model	r <sup>2</sup>	p-value	Trend
All	917.4	872.8	807.2	811.2	y = 856.95 – 15.33x	0.90	< 0.001	Decreasing
PCSC	332.5	298.0	238.8	209.1	y = 276.79 – 15.50x	0.98	< 0.001	Decreasing
PCSCC	143.0	131.8	103.8	92.8	y = 120.97 – 6.76x	0.96	< 0.001	Decreasing
Hypertension	20.4	18.4	14.8	9.3	y = 16.70 – 1.29x	0.92	<0.001	Decreasing
Angina	15.0	28.1	24.5	26.6	y = 23.84 + 0.62x	0.24	0.148	Stable
CHF	76.3	60.9	44.3	37.3	y = 56.42 – 4.73x	0.97	< 0.001	Decreasing
Cerebrovascular	31.6	24.4	20.2	19.6	y = 24.02 – 1.37x	0.89	< 0.001	Decreasing

PCSC: primary care-sensitive conditions; PCSCC: primary care-sensitive cardiovascular conditions; CHF: congestive heart failure.

the difference between the sexes decreased in the period. The average rates for angina were higher in men than in women ( $\beta_0 = 28.02$  and  $\beta_0 = 19.89$ , respectively), with this difference increasing mainly from 2003 on, when rates showed stability. The average rates of hospitalization for CHF showed a marked decrease and very similar values in both sexes (Table 2 and Figure 1).

There was a decreasing trend in hospitalization rates in all age groups, being higher in the population aged 65 – 74 years old ( $\beta_1 = -26.14aa$  and  $-27.31aa$ , for men and women respectively). The average rates were higher in males, except for the age group of 35 – 44 years old ( $\beta_0 = 25.41$ ), and the drop rate was higher among females in all age groups. The average rates of the age groups become higher with increasing age (Figure 2).

## DISCUSSION

The study showed that, in the state of Paraná, total hospital admissions for PCSC and PCSCC showed a decreasing trend in the period. There were differences in trends with decrease in hospitalization rates for hypertension, CHF and cerebrovascular diseases, and stability in hospitalization rates for angina. This trend pattern in causes was seen for both sexes. However, the similarity is not perceived when analyzing the rates and models, with differences between the sexes for hypertension, cerebrovascular diseases and angina. The trend by sex, according to age groups, decreased, with lower average rates and higher drop rate for females in most age groups.

As in this study, the reduction of total hospitalization rates was also identified in Goiás<sup>10</sup>. The drop in rates for PCSC follows the national reduction<sup>9</sup>, in Brazilian states and municipalities<sup>10,12,13</sup>. Although there are no trend studies on PCSCC in Brazil, the data are close to recent studies<sup>10,14</sup> that have identified a decrease in hospitalizations for CVD.

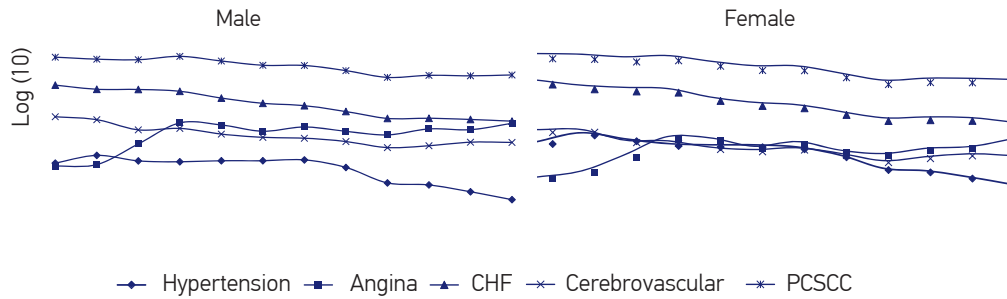
CVDs showed importance in health policies in Paraná and Brazil over the last decade, after the introduction specific initiatives for its treatment and prevention, adopting PHC as a priority action model<sup>3</sup>. In Paraná, the Family Health Strategy (FHS) increased its population coverage of 22.4% in 2000 to 55.7% in 2011<sup>15</sup>. The impact of this health policy in Brazil was associated with lower rates of hospitalization for PCSC in regions with higher coverage of the FHS<sup>16</sup>.

The dissemination and knowledge of the population about risk factors agree with the decreasing trends. In high-income countries, the decline in mortality from CVDs was attributed to the reduction of risk factors and to medical attention<sup>5</sup>. In Brazil, it is suggested that the main cause for the drop in mortality rates and hospitalization is the decreased prevalence of

Table 2. Rates of hospitalization for primary care-sensitive cardiovascular conditions by sex and age group. Paraná, Brazil, 2000 to 2011.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Hypertension												
Male	14.53	17.22	15.26	14.97	15.31	15.31	15.59	13.21	9.41	9.00	7.74	6.51
Female	22.82	27.50	24.25	21.86	21.30	21.27	20.33	17.09	12.94	12.29	10.73	9.17
35 – 44 years	6.65	7.55	6.54	5.95	5.97	5.77	5.71	5.03	3.96	4.04	3.29	2.92
45 – 54 years	18.01	20.95	18.07	16.49	16.72	15.80	15.33	12.07	9.19	8.45	7.52	6.29
55 – 64 years	30.27	37.01	32.23	30.06	29.27	30.51	29.37	24.57	16.93	16.28	13.75	11.01
65 – 74 years	47.44	58.84	54.50	52.15	51.80	53.12	53.42	42.50	30.81	28.39	24.88	22.13
Angina												
Male	13.60	14.06	22.13	35.19	33.59	29.28	32.15	29.22	27.00	30.80	30.29	34.85
Female	10.79	12.20	17.16	25.30	24.59	20.64	22.78	18.96	17.71	19.82	20.55	24.37
35 – 44 years	2.72	3.06	3.61	6.08	5.65	4.51	5.23	4.72	3.93	5.10	5.24	6.00
45 – 54 years	11.04	11.82	16.90	26.74	27.26	22.83	24.07	20.66	17.70	20.31	20.23	23.49
55 – 64 years	23.55	24.79	37.68	57.83	55.02	47.76	53.77	43.63	42.41	45.59	44.14	52.44
65 – 74 years	31.50	34.87	56.68	83.62	78.48	71.49	76.38	64.21	59.06	66.08	67.40	77.40
CHF												
Male	80.65	73.65	73.32	70.43	60.69	54.10	51.37	45.20	38.80	38.95	37.95	36.55
Female	83.36	75.12	71.69	69.92	58.33	52.25	49.69	43.01	37.62	38.34	37.77	34.22
35 – 44 years	14.34	13.48	12.87	12.28	9.81	8.58	8.31	7.12	6.63	6.03	5.97	5.79
45 – 54 years	50.52	45.36	43.43	43.13	35.14	32.46	31.87	25.69	21.91	20.38	19.53	18.47
55 – 64 years	142.27	127.39	123.69	118.53	100.79	91.34	87.93	71.40	59.76	59.65	58.67	54.97
65 – 74 anos	317.44	290.96	287.67	279.06	242.55	213.78	198.49	172.41	147.62	154.63	148.33	136.94
Cerebrovascular												
Male	40.25	37.75	30.17	31.16	27.51	25.59	25.11	23.34	20.44	21.29	23.01	22.89
Female	29.36	29.50	23.52	23.18	20.25	19.26	20.00	17.76	15.23	16.61	17.62	16.91
35 – 44 years	6.94	6.50	4.93	4.85	4.37	4.15	4.30	4.19	4.29	4.43	4.66	4.08
45 – 54 years	22.53	22.48	17.74	17.54	15.92	13.95	14.07	12.13	10.64	11.43	11.87	12.41
55 – 64 years	60.22	57.42	45.53	45.07	39.78	38.26	38.87	32.72	27.65	29.22	31.24	29.56
65 – 74 years	127.32	123.94	101.18	105.76	91.14	87.04	86.79	77.03	63.49	66.59	70.97	70.72

CHF: congestive heart failure.



Male				
Cause	Model	r <sup>2</sup>	p-value	Trend
Hypertension	$y = 13.63 - 0.92x$	0.82	< 0.001	Decreasing
Angina	$y = 28.02 + 0.96x$	0.36	0.064	Stable
CHF	$y = 56.96 - 4.67x$	0.97	< 0.001	Decreasing
Cerebrovascular	$y = 28.16 - 1.58x$	0.80	< 0.001	Decreasing
PCSCC	$y = 126.07 - 6.20x$	0.94	< 0.001	Decreasing
Female				
Cause	Model	r <sup>2</sup>	p-value	Trend
Hypertension	$y = 19.54 - 1.65x$	0.96	< 0.001	Decreasing
Angina	$y = 19.89 + 0.31x$	0.10	0.365	Stable
CHF	$y = 55.92 - 4.78x$	0.97	< 0.001	Decreasing
Cerebrovascular	$y = 20.85 - 1.18x$	0.89	< 0.001	Decreasing
PCSCC	$y = 116.25 - 7.31x$	0.97	< 0.001	Decreasing

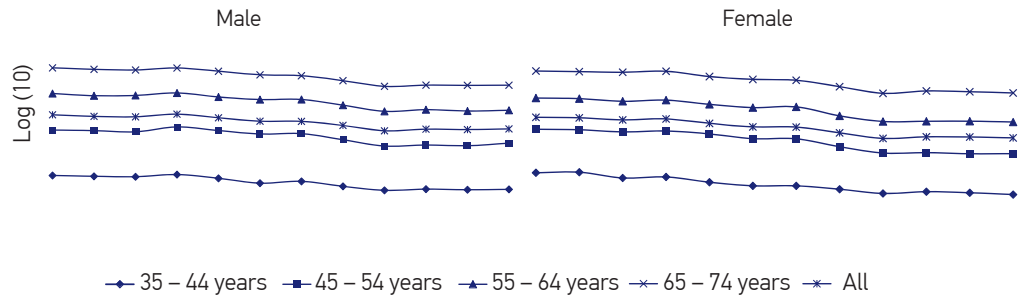
CHF: congestive heart failure; PCSCC: primary care-sensitive cardiovascular condition.

Figure 1. Rate of hospitalization for primary care-sensitive cardiovascular conditions in adults aged 35 – 74 years and respective trend models by sex and cause. Paraná, Brazil, 2000 to 2011.

risk factors<sup>6</sup>. The Surveillance System for Risk and Protective Factors for Chronic Diseases (Vigitel) observed an average annual reduction of 0.6% between 2006 and 2011 in the average rate of male smokers, and a reduction of 0.7% per year between 2009 and 2011 in the frequency of physical inactivity<sup>17</sup>.

When considering the broad approach of PHC on the risk factors for CVDs, its control and treatment, the results may reflect changes in care standards in Parana. The attention to patients with chronic diseases implies providing support for the self-management of health, empowerment and autonomy, with longitudinal follow-up of multidisciplinary teams<sup>3</sup>.

The use of protocols in the treatment and prevention of CVDs, the availability of antihypertensive drugs in the PHC through the *Farmácia Popular* (People's Pharmacy) program and the encouragement to physical activity through the dissemination of *Academias da Terceira Idade* (Gyms for Seniors) and *Academias da Saúde* (Health Gyms) may have contributed to the downward trend. These actions are part of the Strategic Action Plan for Tackling Chronic Non-Communicable Diseases (NCDs) in Brazil, 2011 – 2022, which aims



Male				
Age group	Model	r <sup>2</sup>	p-value	Trend
35 – 44 years	y = 23.58 – 1.15x	0.95	< 0.001	Decreasing
45 – 54 years	y = 85.59 – 4.52x	0.89	< 0.001	Decreasing
55 – 64 years	y = 224.41 – 12.36x	0.94	< 0.001	Decreasing
65 – 74 years	y = 450.79 – 26.14x	0.95	< 0.001	Decreasing
All	y = 126.07 – 6.20x	0.94	< 0.001	Decreasing
Female				
Age group	Model	r <sup>2</sup>	p-value	Trend
35 – 44 years	y = 25.41 – 1.51x	0.96	< 0.001	Decreasing
45 – 54 years	y = 83.29 – 6.17x	0.97	< 0.001	Decreasing
55 – 64 years	y = 189.99 – 13.55x	0.97	< 0.001	Decreasing
65 – 74 years	y = 403.09 – 27.31x	0.96	< 0.001	Decreasing
All	y = 116.25 – 7.31x	0.97	< 0.001	Decreasing

Figure 2. Rate of hospitalization for primary care-sensitive cardiovascular conditions in adults aged 35 – 74 years and respective trend models by sex and age group. Paraná, Brazil, 2000 to 2011.

to develop and implement effective public policies for prevention and control of NCDs and their risk factors, while strengthening care services<sup>3</sup>.

In addition to the access to and quality of care, other factors influence the rate of admissions for sensitive conditions such as socioeconomic inequality, specialized health services<sup>18</sup>, unhealthy lifestyle, variation in medical practice, use of preventive health care and high rates of diseases<sup>19</sup>.

Another complicating factor is that CVDs become vulnerable to other infections, with AMI and stroke strongly associated with recent respiratory infections<sup>20</sup>. Infections by influenza virus favor hemodynamic, atherogenic and thrombogenic instability, exacerbating underlying cardiovascular complications, and immunization against influenza may have a protective role in preventing morbidity and mortality from cardiovascular diseases. In São Paulo, mortality from ischemic heart diseases was significantly reduced after the start of influenza vaccination in people over 60 years old, and mortality from cerebrovascular diseases maintained its decrease<sup>21</sup>.

The hospitalization rates for hypertension showed a downward, constant trend, increasing with age and especially in women, corroborating a recent American study<sup>22</sup>. Hypertension



is present in 22.7% of the Brazilian population and most prevalent in women than in men in the capital of Paraná (24 and 19%, respectively), being in line with the admission data found<sup>17</sup>. However, even with a higher average rate, the decrease was also higher in the female population.

Hypertension is an important risk factor and a cause for the emergence of other chronic diseases. As this is, in most cases, a discovery for the individual with an aggravated cardiovascular system, requires proper and priority management. The Strategic Action Plan for Tackling Chronic NCDs in Brazil, 2011 – 2022, presents interventions for hypertension articulated in three areas: disease surveillance, comorbidities and determinants; comprehensiveness of care; and health promotion in order to enhance self-care and healthy habits<sup>3</sup>. These interventions have a direct impact in other PCSCC, particularly in cerebrovascular diseases and CHF.

CHF was the leading cause of hospitalization for PCSCC and is one of the most frequent causes of hospitalization in Brazil<sup>7</sup>. However, it showed a constant downward trend with the highest drop rate.

Among the CVDs, CHF is the one with the most common and obvious complications, which could lead to an overestimation of the disease due to readmissions, especially in the elderly, relating to higher hospitalization rates in older age groups. There is an entire therapeutic arsenal used against the disease with early diagnosis, active management in the treatment with angiotensin-converting enzyme (ACE) inhibitors, spironolactone and  $\beta$ -blockers, which have been related to the decrease in first hospitalization rates for CHF and increased survival in both sexes<sup>23</sup>, and may have contributed to the downward trend in the State.

The reduction in hospitalization rates for CHF in Paraná, in addition to the similarity in average rates of hospitalization and drop rate between sexes, demonstrates the positive impact of interventionist actions on the disease, which confirms the downward trend in its mortality States in the South and Southeast between 1999 and 2005 in all age groups below 80 years old<sup>24</sup>.

On the other hand, stability in hospitalization rates for angina shows relevance due to the disease being related to acute myocardial infarction events and sudden death. Therefore, they require therapeutic interventions used for chronic and acute conditions. The advance in the treatment of coronary syndrome, interventions such as reperfusion therapies, improved access to medical services and use of specific medications may have influenced the maintenance of the magnitude of hospitalizations for angina.

In the scope of the organization of health services, the expansion of PHC coverage, improved access to hospital services, expansion of support services and the organization of the urgency and emergency network with the regulation of pre-hospital care with the mobile urgency care service (SAMU) and Centrals for Hospital Bed Capacity in the main cities of the State of Paraná, in addition to technological advances in the diagnosis and interventional treatment with highly complex hemodynamic procedures, are factors that, in addition to ensuring reduction in mortality from ischemic heart diseases in Brazil<sup>21</sup> and

in the capital of Paraná<sup>25</sup>, may also have influenced the maintenance of hospitalization rates for angina.

For angina, the actions developed in PHC are based on addressing risk factors such as smoking, dyslipidemia, obesity, early diagnosis and treatment of the aggravation of ischemia with pharmacological treatment. The use of the risk classification in PHC is another tool that can be implemented in the work process in order to organize access to health services, prioritizing those who are most at risk.

The decrease in hospitalization rates due to stroke is a positive result, given that the trend of mortality from stroke between 2000 and 2009 in Brazil was reduced in all age groups in both sexes<sup>26</sup>. This reduction is related to the incidence and mortality of the disease and the improvement in the socioeconomic conditions of the population. In this sense, access to primary and secondary care could explain the reduction in hospitalizations.

Infrastructure elements, such as the availability of basic equipment, antihypertensive and antiplatelet drugs<sup>27</sup> and specialized treatment are considered important. The risk factor control interventions, accessible in PHC, especially for hypertension, can be the initial target of primary prevention, which includes the promotion of a healthy diet, physical activity and cessation of smoking.

The decrease in hospitalization rates for CVD in women is consistent with trends in mortality rates for these diseases in the State, which showed increased mortality in males and higher drop rate than in female rates in the population aged 30–79 years old<sup>28</sup>. This data may mean greater access to health services by women with chronic condition.

Men showed disadvantages compared to women in hospitalization rates with increasing age. This difference was identified for the mortality in elderly in Maringa (PR), and the higher downward trend in women of mortality from diseases of the circulatory system was seen as one of the factors for excess male mortality<sup>29</sup>.

Average rates of hospitalization, higher in the 65 – 74 years old age group in both sexes, stress a positive aspect, considering that they are occurring in an older age group. The higher drop rate in older age groups, as well as in women, can result in a better organization of health services and improved directing of PHC actions for these portions of the population than an improved behavior in relation to CVDs.

It is important to highlight the hospital's role and the use of hospitalization data within the health services network, to facilitate discussions on the timing and levels of care. Hospital admission is not the only health care resource and the provision of health services structured by the PHC can be a substitute for many diseases.

As with other health services, diagnosis for hospitalization may be affected by misclassification and misuse of ICD-10, influencing in the reimbursement aspect and in accurate information, as there may be under- or overestimation of the diagnosis of CVDs. The fact that SIH-SUS was created to reimburse hospital services can stimulate the overpricing of diagnoses and procedures performed in the AIH in the system, especially in hospitals that work exclusively on a per-procedure basis, and even though the activities provided are contractualized through operational plans, this is a bias to be considered.

While there is the possibility that PHC actions positively affect the behavior of hospital admissions for PCSCC, since there was a great expansion of the network and of the FHS coverage in the last ten years, other factors can influence the behavior of this group of diseases, such as, for example, the influence of a variability in medical practice in the clinical management, determined by training and performance based on hospital practice, as well as criteria for indicating an admission from the determinants for the consumption of health services<sup>30</sup>.

Other determinants that may influence the morbidity profile for PCSCC in Paraná that are not in the scope of action of the PHC are economic and cultural aspects of the population, seen as crucial for the development of CVDs<sup>24</sup>, with a greater ease in accepting the use hospital services, rather than adherence to the actions of PHC, in addition to frequent hospitalizations for these diseases in which the PHC may not have a structure that provides appropriate care outside of the hospital, among other determinants already mentioned in the text.

The time series analysis of hospitalizations not only identified the behavior of PCSCC, but also, indirectly, the effectiveness of primary and secondary prevention<sup>11</sup>, which corroborates the importance of using the Brazilian List of Primary Care-Sensitive Conditions and contributes for the epidemiological surveillance of CVDs.

## CONCLUSION

The results of this study provided reflections on the hospital morbidity pattern and changes in hospitalization rates for primary care-sensitive cardiovascular conditions among residents of the State of Paraná, from 2000 to 2011. They show significant decline in the rates investigated, observed in the analysis by sex and age, except for admissions for angina, which were stable. The trend of hospitalization rates for older residents and women had a higher drop rate.

This analysis confirms and strengthens the importance of using the SIH-SUS database as a monitoring and evaluation tool for these diseases in the community, as it may constitute an indirect and supplementary interpretation of the improvement of PHC in the 2000s, since the PHC effects on CVD depend on long-term health care.

On the other hand, the results may have been potentiated by other determinants, such as improvement of the socioeconomic conditions of the population, reduction of cardiovascular risk factors, among other relevant factors for hospitalization. Further analysis is needed to explore these factors, as well as a combined analysis of data from various sources, focused on models that explain disparities.

In this sense, even with the conduction of a time series analysis, influences that are exogenous to PHC, such as characteristics of the patients, the health problem and the medical attention given can distort the ability of the indicator to capture health problems that really require hospitalization, as well as limit its use.

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