

# Analysis of Mortality and Hospitalization for Cardiovascular Diseases in Niterói, between 1998 and 2007

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## Abstract

**Background:** The reduction in mortality from cardiovascular disease has been observed in Brazil for years, attributed to a fall in risk factors, improved treatment and reduced hospital mortality.

**Objective:** To compare the mortality, the rate of hospitalization and hospital mortality in hospitals belonging to the Brazilian Public Health System, for ischemic heart disease (IHD), cerebrovascular diseases (CVD) and heart failure (HF), in Niterói, between 1998 and 2007.

**Methods:** We used the number of deaths and hospitalizations and mortality of residents in Niterói for Chapter IX of ICD10 and specific causes available in Datasus, in population aged 30 and older. The difference between the magnitude of the indicators was calculated for men and women taking the average of the first three year period less the average of the second three year period.

**Results:** There was drop in population mortality rates in men and women for all age groups, in three groups of causes and for Chapter IX. The falling trend of rates decreased with age. For IHD there was a decrease in hospital mortality. For CVD and HF, there was an increase. The rates of hospitalization from IHD decreased, with exception of some ranges.

**Conclusion:** This study has clarified some aspects of cardiovascular morbidity and mortality in Niterói. The reduction in population and hospital mortality from IHD indicates that there is a better approach in this condition. Increased mortality rate from cerebrovascular diseases and HF points to the need to give greater attention to the quality of hospital care for these groups of diseases. (Arq Bras Cardiol. 2011; [online].ahead print, PP.0-0)

**Keywords:** Hospital mortality; hospitalization; heart failure; stroke; myocardial ischemia.

## Introduction

In recent decades, in Brazil there was a consistent trend of reduction in overall mortality and mortality from circulatory diseases (CD). Still, CD are the leading cause of death in Brazil<sup>1</sup>. Recent studies show that mortality due to heart failure (HF), a chronic disease of high prevalence and mortality, also show a clear trend of decrease in the southern states and southeastern states<sup>2,3</sup>, and in Salvador<sup>4</sup>. One hypothesis for the decline in mortality from CD would be the drop in hospital mortality<sup>1,3</sup> from intensive use of more effective interventions<sup>5</sup>.

The decrease in mortality from CD in the world<sup>6</sup> is mostly attributed to the control of risk factors than advances in treatment<sup>7</sup>. However, in the United States, recent data indicate the possibility of a new stage of epidemiological transition being underway. There is an increase in the

prevalence of risk factors, reversing the events observed in previous decades, with a trend of increased mortality in the range of 35 to 44 years of age<sup>8</sup>. The question would be: will therapeutic advances overcome the impact of adverse trend in the prevalence of risk factors?<sup>9</sup>

In Brazil, VIGITEL data (2003 to 2009) indicate an increased prevalence of overweight and obesity, lower regular consumption of beans and increased alcohol abuse<sup>10</sup>, indicating increased exposure to cardiovascular risk factors in the period.

Niterói is one of the Brazilian cities with the highest Human Development Index from the United Nations Development Programme (HDI)<sup>11</sup>, with the oldest program of family health and the greatest coverage among medium-sized Brazilian cities<sup>12</sup>. Being aware of the population mortality standard and hospital mortality across the hospitals of the Brazilian Public Health System (SUS), in a city with a high HDI, may support prevention and control measures.

The purpose of this study is to compare the mortality, the rate of hospitalization and hospital mortality in hospitals belonging to the Brazilian Public Health System, for ischemic heart disease (IHD), cerebrovascular diseases (CVD) and heart failure (HF), in Niterói, between 1998 and 2007.

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## Methods

We used secondary data on the number of deaths, number of hospitalizations and hospital mortality rate (ratio between the number of deaths and the number of admissions paid in the period, considered as admissions, multiplied by 100) of people living in the city of Niterói, for chapter of CD (IX) of ICD10 and for the most frequent specific causes of the chapter. Ischemic heart diseases IHD (I20-I25), cerebrovascular diseases CVD (I61-I64) and heart failure HF (I50), in the population aged 30 years and older. The age groups selected were: 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 to 79 and 80 years or older. Data were drawn from computerized databases of records of death certificates from the Mortality Information System (SIM) of the Hospital Information System of the Brazilian Public Health System (SIH/SUS) from the Ministry of Health, data from IBGE Census (census conducted by the Brazilian Institute of Geography and Statistics) for 2000 and census estimates for the other years. All data were collected at the site of Datasus<sup>13-16</sup>. For HF, data were obtained from 1997 to 2006 at the State Health Office of Rio de Janeiro, currently the State Office for Health and Civil Defense of Rio de Janeiro. The difference between the indicators was calculated for men and women taking the average of the first three year period less the average of the second three year period. We calculated rates of mortality and hospitalization for 100,000 men and 100,000 women for all the events in the age groups for each year.

## Results

Table 1 shows the mortality rates by sex and age for the three groups of causes of Chapter IX and for the whole chapter in the two periods studied (1998 to 2000 to 2005 to 2007) as well as the relative percentage variation between the first and the second period. Analyzing the percentage variation, there was decrease in mortality rates for men and women for all age groups, for the three groups concerned and for the chapter. The falling trend of rates decreased with age.

Also in table 1, it is observed that the mortality rates for the period increased with age, and most of them doubled every 10 years and, in general, were higher in men. Only in the age of 80 years or more for CVD (1998 to 2000) and HF (in both periods), the rates were higher in women.

Hospital mortality rates are presented in Table 2. Only for IHD there was, in most age groups, a fall in hospital mortality. For CVD and HF, there was an increase of the rates between the two periods in both sexes and in five of the six age groups. Hospital mortality rates increased with age, but in a less consistent manner than in the population mortality. Mortality in some age groups and for all groups of causes was higher in women.

The rates of hospitalization decreased between the two study periods for both sexes and all age groups, except for some age groups for IHC (Table 3). There was no clear trend of such reduction with age. There was a higher hospitalization rate for men, for the three groups of causes for the chapter in most age groups.

## Discussion

This study showed reduced population mortality from CD and from IHD, CVD and HF, between 1998 and 2000 and 2005 and 2007. However, hospital mortality did not follow this fall, especially for the latter two causes.

According to data from Datasus<sup>13</sup>, the percentage of poorly-defined causes in Niterói remained around 8% between 1998 and 2007, which can be inferred that they did not influence the changes observed.

The decline in mortality from CD, specifically from IHD, CVD and HF has been observed in Brazil in the last three decades<sup>3</sup>, specifically in Niterói<sup>17</sup>. Although this fall is a world trend, Ford et al<sup>7</sup> point out that in the United States, there was a recent stability in the age group between 35 and 45 years, which has not been observed in Niterói yet.

Niterói was one of the first Brazilian cities that had lower mortality rates from CVD than those relating to IHD<sup>17</sup>, indicating better control of blood pressure as a consequence of better access to health services<sup>1</sup>. In this study, we observed equally for both sexes decreased mortality from all CD and IHD, unlike that seen in a similar study conducted in São Paulo<sup>5</sup>, where the reduction occurred especially for females. In Niterói, the difference between risk of death from cardiovascular diseases among men and women tended not to increase, as opposed to what happened in São Paulo, where men had higher rates and lower falling speed than women. Another difference observed with other Brazilian regions is the decline in mortality from HF, which occurred in Niterói in all age groups, including 80 years or older, for both sexes (1998 to 2000 and 2005 to 2007), unlike what occurred across the states of Rio de Janeiro, São Paulo and Rio Grande do Sul from 1999 to 2005, where there was stability in mortality from HF in this age group<sup>3</sup>.

The data discussed so far point to a better epidemiological situation regarding population mortality in Niterói: mortality from CVD remains lower than in mortality from IHD, the decline in mortality from CD and IHD occurred in both sexes and the decline in mortality due to HF occurred in all age groups, including individuals aged 80 years or older.

The fall in mortality from CD has been attributed to reduction of risk factors, better control of hypertension with the advent of new drugs available through the Brazilian Public Health System, better approach to IHD, as well as better management of HF<sup>1</sup>. In the latter case, the falls have been related to earlier diagnosis, more aggressive treatment during hospitalization for decompensation and the use, in higher proportions, of angiotensin-converting enzyme inhibitors and beta blockers<sup>18,19</sup>. The reduction in hospital mortality is also another main reason for the decline in mortality from cardiovascular diseases<sup>1</sup>.

For Niterói, there was a decrease in hospital mortality only for IHD, although the rate has increased among men aged 70 or older and women aged 80 or older. Albanesi<sup>20</sup> has found an increasing trend of mortality rate from CD from 2000 to 2003 in the State of Rio de Janeiro. Regarding HF, the author describes a slight drop. In Niterói, there was an increase in hospital mortality rates from HF and CVD. Increase

**Table 1 - Mortality rate per 100,000 inhabitants. Niterói 1998 to 2000 and 2005 to 2007**

Age group/cause	Men			Women		
	Mortality rate 1998 to 2000	Mortality rate 2005 to 2007	Percentage difference between rates	Mortality rate 1998 to 2000	Mortality rate 2005 to 2007	Percentage difference between rates
Total of chapter - CD						
30 to 39	43.42	25.88	-0.40	38.12	22.84	-0.40
40 to 49	171.03	107.66	-0.37	143.54	89.38	-0.38
50 to 59	422.48	358.96	-0.15	349.15	288.89	-0.17
60 to 69	1,018.95	785.81	-0.23	761.41	575.49	-0.24
70 to 79	2,572.31	2,015.22	-0.22	1,574.71	1,211.67	-0.23
80 to e+	5,278.41	4,795.49	-0.09	2,341.32	2,115.74	-0.10
Ischemic heart diseases						
30 to 39	18.48	7.67	-0.58	0.81	0.85	0.04
40 to 49	79.81	38.00	-0.52	16.27	11.39	-0.30
50 to 59	200.21	171.88	-0.14	79.93	36.72	-0.54
60 to 69	446.53	331.58	-0.26	166.84	148.03	-0.11
70 to 79	1,052.31	756.73	-0.28	544.61	375.87	-0.31
80 to e+	2,028.99	1,798.31	-0.11	1,488.70	1,208.26	-0.19
Cerebrovascular diseases						
30 to 39	11.09	3.83	-0.65	11.35	2.54	-0.78
40 to 49	38.77	27.44	-0.29	30.62	18.40	-0.40
50 to 59	132.34	77.57	-0.41	61.70	46.52	-0.25
60 to 69	239.89	211.21	-0.12	133.11	111.44	-0.16
70 to 79	747.29	559.33	-0.25	438.80	358.56	-0.18
80 to e+	1,296.72	1,469.21	0.13	1,529.30	1,317.15	-0.14
Heart failure						
30 to 39	4.65	2.89	-0.38	0.00	0.00	0.00
40 to 49	11.48	3.18	-0.72	5.78	3.52	-0.39
50 to 59	29.03	24.47	-0.16	16.94	7.38	-0.56
60 to 69	78.89	34.25	-0.57	42.87	21.74	-0.49
70 to 79	148.40	115.78	-0.22	203.60	47.25	-0.77
80 to e+	690.93	212.69	-0.69	708.35	333.75	-0.53

Source: Datasus (\*\*\*).

in hospital mortality from HF ranged between age groups but was significantly higher in the age of 80 years or older among men, and 70 or older among women. This increase was less intense in CVD.

The data in Niterói point to two situations. The first one relates to IHD where there was a decrease of two types of mortality rates for most age groups. In this case, it is valid to think that not only prevention of risk factors improved (better approach to the conditions that cause atherosclerosis, such as treatment of hypertension, diabetes, dyslipidemia and smoking), as well as improved pre-hospital and in-hospital treatment. It is worth reminding that the Emergency Mobile Healthcare Service (Samu) started to operate in Niterói in 2004. Farias et al<sup>5</sup>, analyzing the decrease in mortality

from cardiovascular diseases in São Paulo, argue that the highly complex procedures such as coronary artery bypass grafting (CABG) and coronary angioplasties (PCI), which frequency doubled in the period they studied, may have a positive impact for reducing lethality. This fact was also reported by Ford et al<sup>7</sup>, in a study on North-American data. We examined the number of CABG and PCI for residents of Niterói. There were 150 admissions whose primary diagnosis was acute myocardial infarction in 1998 and 227 in 2007. Information about PCI and CABG were only available for the years 2004 to 2007, when 24 and 65 procedures were performed, respectively, with a slight increase in procedures regarding admissions, which may have had a little impact<sup>15</sup>. The number of hospitalizations was also examined by Farias

**Table 2 - Hospital mortality rate per 100 hospital admissions in hospitals from the Brazilian Public Healthcare System<sup>1</sup>. Niterói 1998 to 2000 and 2005 to 2007**

Age group/cause	Men			Women		
	Hospital mortality rate 1998 to 2000	Hospital mortality rate 2005 to 2007	Percentage difference in hospital mortality	Hospital mortality rate 1998 to 2000	Hospital mortality rate 2005 to 2007	Percentage difference in hospital mortality
Total of chapter - CD						
30 to 39	7.81	5.29	-0.32	3.13	1.94	-0.38
40 to 49	7.85	3.78	-0.52	4.45	4.73	0.06
50 to 59	7.58	7.59	0.00	7.24	6.20	-0.14
60 to 69	10.99	9.95	-0.09	8.36	13.41	0.60
70 to 79	13.03	15.11	0.16	13.34	13.17	-0.01
80 to e+	18.52	26.06	0.41	18.14	20.73	0.14
Ischemic heart diseases						
30 to 39	4.76	1.96	-0.59	10.37	0.00	-1.00
40 to 49	5.20	3.36	-0.35	1.52	0.00	-1.00
50 to 59	7.17	4.33	-0.40	6.74	2.86	-0.58
60 to 69	9.39	5.15	-0.45	7.56	14.15	0.87
70 to 79	9.46	18.21	0.92	20.27	16.33	-0.19
80 to e+	28.18	31.11	0.10	24.44	19.06	-0.22
Cerebrovascular diseases						
30 to 39	12.90	31.75	1.46	14.42	12.73	-0.12
40 to 49	30.57	22.21	-0.27	24.70	26.31	0.07
50 to 59	16.55	30.32	0.83	24.08	28.37	0.18
60 to 69	22.55	29.06	0.29	25.65	26.08	0.02
70 to 79	24.67	32.81	0.33	25.24	33.64	0.33
80 to e+	35.18	46.47	0.32	29.28	36.07	0.23
Heart failure						
30 to 39	12.41	13.33	0.07	6.67	3.33	-0.50
40 to 49	5.35	3.01	-0.44	2.77	14.28	4.16
50 to 59	5.65	8.23	0.46	5.09	11.76	1.31
60 to 69	8.92	11.25	0.26	3.90	16.74	3.30
70 to 79	12.76	17.52	0.37	8.05	20.35	1.53
80 to e+	14.17	26.17	0.85	12.94	24.84	0.92

Source: Datasus (\*\*\*).

et al<sup>5</sup> to explain the decline in mortality from CD and IHD in São Paulo. In this study, we used the rate of hospitalization (number of admissions divided by population in each age group) to make comparability easier. With regard to IHD, there was an increase in admissions in younger age groups and a decrease in both age groups in which there was increased mortality in men (70 to 79 years and 80 years and older) and one among women (60 to 69 years old).

The latter refers to what happened to CVD and HF and some hypotheses appear to explain the increased hospital mortality observed in Niterói, while there was a fall in the population mortality. The first hypothesis refers to the fact that patients are being followed up for a longer time in the

community, being admitted only in the most severe cases. The second hypothesis could be the reduction in healthcare quality, which would require further investigation. The third hypothesis is the difficulty of access to beds, which would worsen the condition of patients to be admitted.

Concerning HF, the hypothesis of hospitalization of patients with more severe conditions to justify the increase in hospital mortality may be attributed to the fact that in this period there was widespread adoption of beta-blockers in clinical practice, and these drugs reduce hospitalization. Another argument would be the increasing prevalence of HF with normal ejection fraction (HFNEF), which has been studied for about 10 years and has no specific ICD code<sup>3</sup>, but may be

**Table 3 - Rate of hospitalization in hospitals from the Brazilian Public Healthcare System<sup>1</sup> per 100,000 inhabitants. Niterói 1998 to 2000 and 2005 to 2007**

Age group/cause	Men			Women		
	Hospitalization rate 1998 to 2000	Hospitalization rate 2005 to 2007	Percentage difference of hospitalization	Hospitalization rate 1998 to 2000	Hospitalization rate 2005 to 2007	Percentage difference of hospitalization
Total of chapter - CD						
30 to 39	269.74	206.10	-0.24	355.22	181.88	-0.49
40 to 49	742.26	534.06	-0.28	710.03	500.38	-0.30
50 to 59	1,683.12	1,419.12	-0.16	1,148.41	1,045.38	-0.09
60 to 69	2,700.58	2,139.40	-0.21	1,778.39	1,192.56	-0.33
70 to 79	4,087.24	2,977.59	-0.27	3,084.06	2,171.12	-0.30
80 to e+	5,446.22	3,255.76	-0.40	3,884.15	2,950.63	-0.24
Ischemic heart diseases						
30 to 39	20.32	38.35	0.89	23.52	5.92	-0.75
40 to 49	140.24	122.43	-0.13	58.37	62.22	0.07
50 to 59	380.06	403.07	0.06	147.23	166.48	0.13
60 to 69	472.66	592.76	0.25	225.41	202.92	-0.10
70 to 79	640.54	522.31	-0.18	314.32	323.94	0.03
80 to e+	488.18	470.15	-0.04	324.81	347.44	0.07
Cerebrovascular diseases						
30 to 39	42.49	40.26	-0.05	37.31	35.53	-0.05
40 to 49	145.94	120.32	-0.18	122.49	99.90	-0.18
50 to 59	413.99	282.91	-0.32	342.14	227.68	-0.33
60 to 69	736.31	538.26	-0.27	550.20	394.19	-0.28
70 to 79	1,230.24	781.41	-0.36	753.12	469.83	-0.38
80 to e+	1,434.02	975.55	-0.32	636.08	430.41	-0.32
Heart failure						
30 to 39	72.05	29.72	-0.59	63.26	26.22	-0.59
40 to 49	163.05	108.71	-0.33	136.84	90.26	-0.34
50 to 59	461.50	333.11	-0.28	381.40	268.08	-0.30
60 to 69	942.95	433.79	-0.54	704.61	317.68	-0.55
70 to 79	1,392.91	752.62	-0.46	852.71	452.52	-0.47
80 to e+	2,593.44	728.73	-0.72	1,150.36	321.51	-0.72

Source: Datasus (\*\*\*).

classified as unspecified HF (150.9). HFNEF is more common in women and elderly and is more related to hypertension, which suggests that its prevalence has been increasing with the population aging and declining mortality from hypertension. There is no effective treatment for ICFEN<sup>21</sup> yet, and its prognosis is not better than the prognosis of HF with reduced ejection fraction (HFREF)<sup>22</sup>. In Niterói, about 65% of patients diagnosed with HF in primary care had a diagnosis of HF with normal ejection fraction (HFNEF)<sup>23</sup>.

Both for HF and for CVD there were reduced rates of hospitalization in both sexes and all ages, conversely to what happened to the mortality rate. Two hypotheses can be raised: on the one hand, the decrease in demand for beds

as outpatient approach improved, and on the other hand, difficulty of access.

The comparison of population mortality and hospital mortality in Niterói should be considered with caution, once the former refers to the entire population living in Niterói and the second, only those served by the Brazilian Public Health System. The study Epica-Niterói showed that age-standardized mortality due to HF in units linked to the Brazilian Public Health System was almost 80% higher than that occurring in private units<sup>24</sup>. Data from the Brazilian Supplementary Health Agency data indicate that most residents of Niterói is covered by private health insurance (Brazilian Supplementary Health Agency). It is possible that the hospital mortality rate in private



units has not increased and perhaps, if we consider only the population without coverage of health insurance plans, the reduction of population mortality could be less pronounced.

It is important to note that using only the root cause to assess mortality does not provide the true perspective of the problem represented by cardiovascular disease, especially when there are more elderly people, in which more than one disease may be contributing to death<sup>3</sup>. It should be noted also that the rates were not standardized for age, because it was considered that the influence of age was too small since we have worked on ages of 10, comparing three-year averages at intervals of four years between them.

## Conclusion

A comparison between population mortality, hospital mortality and hospitalization rate clarified some aspects concerning the situation of cardiovascular morbidity and mortality in Niterói. The decrease in mortality from all CD in the city follows the pattern observed in developed countries. With respect to IHD, the fall in population mortality followed

the decline in hospital mortality. This did not occur with CVD and HF, for which there was an increase in hospital mortality. This study compared general population data for mortality and data from the Brazilian Public Healthcare System for admissions, which may have generated differences in the two rates. However, the discrepancy between the two mortalities was not observed for IHD, pointing to the need for increased care in health care for HF and CVD.

## Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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## Study Association

This study is not associated with any post-graduation program.

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