



## Original Article

# Cost of Heart Failure in the Unified Health System

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## Objective

To describe the direct and indirect costs of ambulatory and in-patient treatments of heart failure during 2002, in the University Hospital Antônio Pedro, Niterói.

## Methods

A cross-sectional and retrospective study on utilization and valuation of resources in 70 patients, consecutively selected, under ambulatory and in-patient treatment. Questionnaires and records of the patients were used for data collection. The resources used were valued in Brazilian Reals (2002). The study's point of view was the perspective from society. The data were analyzed in the EPINFO program, 2002 version.

## Results

The studied population consisted of 70 patients (39 women), with average age of 60.3 years old. 465 in-patient days (28.5% of the patients) took place. There were 386 ward hospitalizations and 79 in ICUs. The cost with ambulatory appointments was R\$ 14.40. The expenses with ambulatory medications amounted R\$ 83,430.00 (R\$ 1,191.86/patient/year). The cost per hospitalized patient was R\$ 4,033.62. The cost with complementary examinations totaled R\$ 39,009.50 (R\$ 557.28/patient/year). Twenty patients retired due to heart failure, which represented a loss in productivity of R\$ 182,000.00. The total cost was R\$ 444,445.20. Hospitalization represented 39.7% and the use of medications 38.3% from direct costs.

## Conclusion

The hospitalization cost and the expenses with medications represented the main components of direct costs. Indirect costs represented economic impacts similar to direct costs.

## Key words

cost of disease, heart failure, health economy

Heart failure is the major cause of hospitalization in Unified Health System - Sistema Único de Saúde (SUS), from 65 years of age. The prevalence of heart failure is ascending, arising out of the increase in life expectancy of our population and a greater effectiveness of new medications for the treatment, which extends life.

There are few national studies for the dimensioning of the socioeconomic impact and epidemiology of heart failure. There is the need for implementing economic methods to estimate the costs, instead of simply incurring expenses with heart failure. The estimate of the socioeconomic impact of the syndrome will provide the health policy formulators with a greater base for decision-making, before a scenario of lack of funds and need for prioritizing in its allocation.

Stewart et al.<sup>1</sup> did a study aiming at examine the cost of heart failure in the United Kingdom and estimated that 988 thousand individuals needed treatment in 1995.

The direct cost of health fund utilization for those patients was estimated in \$ 716 million pounds (US\$ 1.136 billion), which represented 1.83% from total expenses of National Health System (NHS). Expenses with hospitalizations [\$ 489.7 million pounds (US\$ 776 million)] and medications prescribed [\$ 128.6 million pounds (US\$ 203 million)] represented 69 and 18% of those expenses, respectively. The authors projected the costs for the year 2000 and estimated that the total direct cost of heart failure would reach \$ 905 million pounds (US\$ 1.436 billion), equivalent to 1.91% from the total expenses of NHS.

Heart failure represents a great worrying for health care providers in Sweden due to the increase of its prevalence and growing costs. The estimated prevalence of heart failure in that country is approximately 2%<sup>2</sup>, and the cost for treatment and follow-up represents 2% from the global health budget in the country. Heart failure is the main hospitalization cause in patients > 65 years old and 75% from the budget for that syndrome is spent with hospital and home care. In 1996, the length of hospital stay varied between 3.5 to 9.5 (average of 6.5) days in different hospitals. The expenses with medication refund increased from 8.4 to 14.9% of the total health budget, from 1990 to 1997, which represented an absolute increase of 81% in monetary terms. The cost of pharmacological treatment in heart failure was estimated in 11% from the total cost for that syndrome and ambulatory care represented 6% from the total cost of the treatment.

Xuan et al.<sup>3</sup> examined the economic impact and the standards of treatment for heart failure in managed care population and analyzed, retrospectively, the medical and pharmaceutical procedure request data. During the period of 1994, 378 patients from 2.777 with heart failure diagnosis (14%) were admitted in

hospitals, totaling an approximate cost of US\$ 3 million, an average of US\$ 7.863 per hospitalized patient. From the studied population, 78% had medication prescriptions, with an average of US\$ 942 per patient/year. Hospitalization represented 54% from the total cost for heart failure treatment and medication prescription for 38% of the costs.

The objective of the present study was to estimate the direct and indirect costs of ambulatory and in-patient treatment of heart failure in SUS.

## Methods

A cross-sectional retrospective study that estimated the use and valuation of funds, in 12 months, in patients under ambulatory follow-up of Cardiology of Universidade Federal Fluminense (UFF). We elaborated questionnaires for the survey of demographic, socioeconomic, clinical data, use of funds at Hospital Universitário Antônio Pedro (HUAP), use of funds in other healthcare units. The records of selected patients were reviewed with the aim of quantifying the use of funds.

The study was approved by the Committee of Ethics in Research from the College of Medicine of UFF and the participants were clarified on the purpose of the study. They signed an informed consent term.

The patients were over 18 years old, classified in C and D stages of heart failure defined by the criterion of *American College of Cardiology* and *American Heart Association*.

Seventy consecutively selected patients were included, in accordance to the order of attendance in UFF ambulatory and interviewed by a medical team trained for the task of application of questionnaires.

Those costs directly resulting from interventions, specifically cost from hospital admission, complementary examinations, medications, professional fees, operational costs and transport of the patient to the hospital, were calculated as direct costs.

The estimate of indirect costs was obtained through human capital approach, in which the salary loss in 2002 was calculated and expressed the human capital in monetary terms.

The study's point of view was the perspective from society regarding the economic impact of heart failure.

Costs in Brazilian Reais were attributed to the funds used, values from 2002.

The respective operational cost (overhead) was attributed to each hospital unit, based on a survey carried out by the Program of Advanced Studies in Hospital and Healthcare System Administration - Programa de Estudos Avançados em Administração Hospitalar e de Sistemas de Saúde de Universidade de São Paulo (PROAHSA) in 40 public hospitals, in the states of São Paulo, Rio de Janeiro and Minas Gerais that estimated the hospital cost arrangement in such units<sup>4</sup>.

The valuation of ambulatory appointment considered fees of the coordinating physician and the resident physicians, added by the operational cost of HUAP. An operational cost (overhead) of 12% from the total costs of HUAP was attributed to the ambulatory unit. In order to estimate the medical fee cost, the salary apportionment was defined by the number of hours dedicated at the ambulatory of heart failure by the residents and coordinator.

The hospital daily rate comprised the bed for the patient, bedclothes, cleaning, hygienization of ward or ICU, hygiene care of the patient, medication administration (orally or topic), and control of vital signs, diuresis and weight.

For the estimate of daily costs of hospitalization, 3 patients with syndrome diagnosis were prospectively analyzed. The objective was to establish the use of resources, including medications and complementary exams during the hospitalization, for the calculation of the average value of hospital daily rate. An operational cost (overhead) of 15.7% from the total of costs of HUAP was attributed to the hospitalization unit.

The prices of medications were calculated through Brasindice table in the year 2002. For the presentations that had generic medications, that modality was used. An adherence of 100% of the patients was attributed to medicamentous treatment.

The values of complementary exams were obtained in the List of Medical Procedures of Brazilian Medical Association, reference values of 1999.

The data were compiled and reviewed in EPINFO program - 2002.

## Results

The sample consisted of 70 patients with heart failure, 55.7% females. The average age was 60.3 (variation from 34 to 90) years old. Forty-two patients were white.

From the 70 interviewees, 47.1% belonged to functional class I by the classification of New York Heart Association, 41.4% to functional class II, 8.5% to functional class III and 2.8% to functional class IV.

Concerning the etiology of heart failure, 30% had coronary artery disease, 24.2% were with hypertensive cardiopathy, 27.1% showed association of coronary artery disease and hypertensive cardiopathy, 11.4% had alcoholic etiology dilated cardiomyopathy, 4.2% from sequels of rheumatic orovalvar disease, 1.4% with pericardial disease and 1.4% with acyanotic congenital cardiopathy.

As for the education level, 20% were illiterate, 62.8% only had the fundamental education and 17.1% had completed the intermediate education.

The monthly family income was characterized by 12.8% in 1 minimum salary (R\$ 200) range, 21.4% between 1 and 2 minimum salaries (R\$ 200 to R\$ 400), 35.7% between 2 and 4 minimum salaries (R\$ 400 to R\$ 800), 21.4% between 4 and 6 minimum salaries (R\$ 800 to R\$ 1.200) and 7.1% over 6 minimum salaries (> R\$ 1.200). A patient reported he did not have his own and family income, and was in the need for the help of others for his survival.

The patients attended, in the period of 12 previous months, for ambulatory and urgency appointments, submission to complementary exams, hospitalization in HUAP or in other healthcare units, in a total of 1,248 times (average of 17.8 patients/year). The ambulatory appointments represented an average of six appointments per patient per year.

Twenty patients (28.5%) needed admission and/or readmission in the last 12 months, amounting 386 daily rates in ward (average of 19.3 days/patient/year, if we only consider hospitalized patients) and 79 daily rates in intensive care units (average of 3.9 days/patient/year, if we only consider hospitalized patients).



The description of the number of medications used, in the last 12 months, for ambulatory control of cardiopathy is on table I, and the description of the number of complementary exams performed in the last 12 months is on table II.

The estimate of unit cost, per ambulatory appointment, was R\$ 14.40. The patients were seen in the last 12 months, with an average periodicity of two months, amounting a cost estimate of R\$ 6,048.00.

The ambulatory use medications were purchased by the patients, without any government subsidy, in the pharmacies and drugstores in the city of Niterói. The total cost in the purchase of ambulatory medications was R\$ 83,430.00.

The estimate of total cost with complementary exams, added by the operational cost of the hospital for their performance, was R\$ 39,009.50, with an estimate of average cost per patient per year of R\$ 557.28.

The estimated cost of hospital daily rate in ward was R\$ 139.54 and in ICU was R\$ 250.58.

The estimate of total cost with hospitalization was R\$ 84,706.70 for the 386 days in ward and 79 days in ICU.

The estimate of average cost with hospitalization was R\$ 4,033.62/hospitalized patient in the year 2002.

The expenses with collective transport for patients and the person with them to have an appointment, be hospitalized or have complementary exams amounted R\$ 11,580.80, representing R\$ 165.43 per patient/year. That total represented 2,496 and 1,264 return trips, respectively for patients and escorts.

The unit price of the journey was R\$ 3.08, referring to the average price of bus fare in the city of Niterói. All patients used bus as transportation means.

The patients who worked (n=36), missed 772 working days and had an average monthly income of 3.29 minimum salaries in 2002, equivalent to R\$ 658.00, which represented an amount of R\$ 21.93/day.

The escorts who had a regular job missed 1,037 working days. That group had an average monthly income of 3 minimum salaries (R\$ 600.00) in 2002. Such income represented an amount of R\$ 20.00/day.

Twenty patients had an early retirement in consequence of heart failure and had an average monthly income, before retirement, of 3.5 minimum salaries (R\$ 700).

Table III refers to the estimate of total costs in Brazilian Reais for the 70 patients in the last 12 months of treatment.

**Table I - Ambulatory medications used in the 12 months, by the patients with heart failure, followed-up in the cardiology ambulatory of HUAP**

Ambulatory medications	Absolute number of patients using	Average dose (mg/day)	Monthly cost per patient (R\$)	Total cost (R\$)
Captopril	45	100	35.84	19,353.60
Enalapril	10	20	16.37	1,964.40
Valsartan	5	80	33.79	2,027.40
Losartan	2	100	64.93	1,558.32
Furosemide	41	40	4.77	2,346.84
Hydrochlorothiazide	24	25	11.32	3,260.16
Spironolactone	21	25	13.29	3,349.08
Propranolol	26	80	6.55	2,043.60
Carvedilol	16	12.5	52.60	10,099.20
Metoprolol	2	150	10.72	257.28
Atenolol	5	25	3.78	226.80
Digital	25	0.25	7.47	2,241.00
Mononitrate	17	40	17.07	3,482.28
Propatylnitrate	3	10	10.58	380.88
Dinitrate	1	10	13.20	158.40
Hydralazine	4	50	4.12	197.76
Clonidine	4	0.15	3.49	167.52
Nifedipine	1	30	7.10	85.20
Amlodipine	7	5	37.03	3,110.52
Verapamil	5	240	21.10	1,266.00
Diltiazem	3	120	17.32	623.52
Acetylsalicylic acid	41	200	7.66	3,768.72
Ticlopidine	2	500	28.76	690.24
Clopidogrel	2	75	184.44	4,426.56
Amiodarone	2	200	15.85	380.40
Atorvastatin	1	10	90.07	1,080.84
Sinvastatin	19	10	28.43	6,482.04
Pravastatin	2	10	27.59	662.16
Gemfibrozil	2	600	49.69	1,192.56
Warfarin	8	5	11.72	1,125.12
Fenoterol/Ipatropium	2	15 ml	25.84	620.16
Formoterol/Budesonide	1	12 mcg/200 mcg	59.76	717.12
Aminophylline	1	200	4.37	52.44
Prednisone	1	5	9.28	111.36
Glibenclamide	5	5	5.33	319.80
Metformin	2	850	5.80	139.20
Glimepiride	2	2	30.96	743.04
Insulin	2	120U	44.84	1,076.16
Omeprazole	2	20	31.56	757.44
Ranitidine	4	150	11.80	566.40
Thiamin	2	300	13.28	318.72

## Discussion

The average age was 60.3 years old, similar to those in EPICA Project-Niterói<sup>5</sup> on the epidemiology of heart failure in Niterói, carried out in 2001. In Framingham Heart Study<sup>6</sup>, the average age at the appearance of heart failure was 65 years old. The earliest age, in the sample of the city of Niterói, showed that the population of public health system manifested the syndrome among a younger and more productive age range, determining a greater load of disease for the society, as demonstrated by the indirect costs estimated in the studied sample.

**Table II - Complementary exams performed in the last 12 months in patients with heart failure, followed-up in the cardiology ambulatory of HUAP**

Complementary exams	Number of exams performed	Unit cost	Total cost
Biochemical	281	21.00	5,901.00
Coagulogram	149	20.40	3,039.60
Lipidogram	37	21.00	777.00
Hepatic assessment	11	41.80	459.80
Cardiac enzymes	14	40.00	560.00
Hemogram	256	9.00	2,304.00
USE	9	5.40	48.60
Urine culture	4	15.00	60.00
Anti-HIV	1	45.00	45.00
Artery gasometry	4	20.10	80.40
Thyroid assessment	1	51.00	51.00
Serology for hepatitis	1	142.50	142.50
HbA <sub>1c</sub>	1	13.50	13.50
Thoracic radiography	114	16.00	1,824.00
Column radiography	1	17.50	17.50
Coronariography	10	435.00	4,350.00
Abdomen USG	3	84.00	252.00
Brain CAT scan	1	189.00	189.00
Abdomen CAT scan	1	226.00	226.00
Thorax CAT scan	1	226.00	226.00
Myocardial cintigraphy	11	450.00	4,950.00
ECG	211	18.00	3,798.00
AMBP	1	105.00	105.00
Treadmill	6	66.00	396.00
Spirometry	2	20.00	40.00
Echocardiogram	64	114.00	7,296.00

USE - Urinary sediment exam; HbA<sub>1c</sub> - Glycosylated hemoglobin; USG - Ultrasonography; CAT scan - Computer-Aided Tomography; ECG - Electrocardiogram; AMBP - Ambulatory monitoring of blood pressure

**Table III - Total of direct and indirect costs**

Results	Amounts (R\$)
Direct cost	224,775.24
Direct cost per patient/ last 12 months	3,211.07 per patient/year
Average cost per patient with hospitalization	4,033.62 per patient/year
Average cost per patient with medications	1,191.86 per patient/year
Indirect cost	219,669.96
Indirect cost with early retirement	182,000.00
Indirect cost per working days missed	37,669.96
Total cost	444,445.20
Separation of direct cost per modalities	%
Hospitalization	39.73%
Medications	38.93%
Complementary exams	18.50%
Ambulatory appointments	2.84%

Ratifying that hypothesis, Philbin et al.<sup>7</sup>, identified the socioeconomic status as determining for the development of heart failure and qualified as an independent risk factor for hospital readmission in the arising of heart failure.

The socioeconomic data of the patients revealed the low education level, with 20% of illiterates and 62.8% with only fundamental education. Such low level of education can be a limiting factor for the education of patients in self-care and compliance with medical recommendations.

The monthly family income was concentrated in the range from 2 to 4 minimum salaries (35.7%), showing a limited ability of self-financing the necessary funds for the treatment, especially the chronic use medications.

The high rate of admission and readmission, in the analyzed length of time, is in accordance to the systematic review performed by Berry et al.<sup>8</sup>, who reported that up to a third of the patients are admitted within the first year after discharge.

The utilization profile of medications specified for the treatment of heart failure showed a little frequent fact in the medical practice in the real world. In the studied sample, there was a great adhesion to medications recommended in the treatment protocol of Brazilian Cardiology Association. Such finding is not the usual one, even in developed countries. In the Swedish study carried out by Cline et al.<sup>9</sup>, only 24% of the sample used the IACE inhibitor, despite all evidences available in medical literature demonstrating the benefit of morbid-mortality with the use of that therapeutic class in patients with heart failure. Such unusual adhesion to clinical protocols, recommended by the main cardiology associations in the world, is attributed to the fact that HUAP is a university hospital, where the evidence-based medicine practice is directed to resident physicians, in the way of obtaining the most from medicamentous benefit with the treatment of patients with heart failure.

The estimate of unit cost, per ambulatory appointment, was R\$ 14.40. SUS refunded to HUAP, in 2002, the amount of R\$ 2.54 per cardiologic appointment, demonstrating the 82% difference between the refund and the estimated cost of appointment.

The medications were financed, exclusively, by the patients and their families, as there was not a free medication-supplying program for them. The absence of a pharmaceutical assistance policy in SUS at that time encumbered the patient, who bought the medication from retailers, without discounts, becoming an important determinant for descompensations of heart failure and repeated hospital admissions due to the lack of continuity in the pharmacological treatment, as there is frequently a disproportion between the increase in the income of the patient and the increase of prices of medications. EPICA Project-Niterói showed that the abandonment of medicamentous treatment was the main reason for hospital admission in SUS, in patients with heart failure.

The complementary exams were valued by the List of Medical Procedures of Brazilian Cardiology Association, version 1999. The decision for the use of such values was based on technical difficulties to carry out the costing of each complementary exam.

The estimate of coast per patient hospitalized in the last 12 months was R\$ 4.033.62. SUS accounted the amount of R\$ 533.52 in 2002, for a total of 372.594 hospitalizations with a main diagnosis of heart failure<sup>10</sup>. Such difference of values ex-



press the lack of data on the real cost of chronic patients in SUS, compromising the management of scarce funds available for the public health system.

Early retirement and abstention show the importance of indirect costs in the load of heart failure for the Brazilian society. Such component of cost is frequently underestimated by the public health policy formulators. The estimate of indirect cost in the studied sample showed as important, quantitatively, as the direct cost. The qualitative aspects for the society are even greater, as they represent an early exit from the job market, with a big damage for the self-esteem of the individual and need of social security help. That scenario also took place in the American health system, in 2001, when the CI-related indirect cost reached the amount of US\$ 53.6 billion and the direct cost was US\$ 58.2 billion, demonstrating the same quantitative impact<sup>11</sup>.

The separation of direct costs per types of use showed a finding inconsistent with publications on the cost of heart failure. In the studied sample, hospitalization accounted for 39.73% and the use of medications 38.93%. A transversal study, based on prevalence of heart failure, during 1 year, carried out in the United Kingdom<sup>12</sup>, showed that hospitalization contributed for 69% and the use of medications was 18% from the total direct cost. Another transversal study, based on prevalence of the syndrome, during a

year, carried out in Sweden<sup>13</sup>, revealed that hospitalization represented 74% and the use of medications accounted for 11% from the total direct cost. The explanation for such difference can be attributed to the lack of a pharmaceutical assistance program in SUS, thus determining a financial burden to the patient, who needs to purchase the medications from retailers, without any power to trade.

Such finding reveals the need of implementation of a policy to facilitate the access to chronic use medications in SUS, under the risk of encumber, even more, the system with hospitalizations arising from the lack of ambulatory medications.

The present study is an initiative aiming at making the many actors in the system aware of the importance of the cost in decision-making process in health, which contributes for a better allocation of scarce funds, a greater access for the population to healthcare services and a better quality of assistance to patients with heart failure.

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## References

1. Stewart S, Jenkins A, Buchan S et al. The current cost of heart failure to the National Health Service in the UK. *The European Journal of Heart Failure* 2002; 4: 373-6.
2. Cline CMJ, Boman K, Holst M et al. The management of heart failure in Sweden. *The European Journal of Heart Failure* 2002; 4: 373-6.
3. Xuan J, Duong PT, Russo PA et al. The economic burden of congestive heart failure in a managed care population. *Am J Manag Care* 2000; 6:693-700.
4. *Gazeta Mercantil – Análise Setorial do Sistema Hospitalar* 1998; III: 66.
5. Tavares LR, Victor H, Linhares JM et al. Epidemiologia da Insuficiência Cardíaca Descompensada em Niterói - Projeto EPICA - Niterói. *Arq Bras Cardiol* 2004; 82: 121-4.
6. Ho KKL, Pinsky JL, Kannel WB et al. The epidemiology of heart failure: The Framingham study. *J Am Coll Cardiol* 1993; 22 (Suppl A): 6A-13A.
7. Philbin FE, Dec GW, Jenkins PL et al. Socioeconomic status as an independent risk factor for hospital readmission for heart failure. *Am J Cardiol* 2001; 87: 1367-71.
8. Berry C, Murdoch DR, McMurray JJV. Economics of chronic heart failure. *The European Journal of Heart Failure* 2001; 3: 283-91.
9. Cline CMJ, Boman K, Holst M et al. The management of heart failure in Sweden. *The European Journal of Heart Failure* 2002; 4: 373-6.
10. DATASUS 2002 ([www.datasus.gov.br](http://www.datasus.gov.br))
11. American Heart Association. Heart and Stroke Statistical Update. Dallas, Texas 2001. ([www.americanheart.org](http://www.americanheart.org))
12. Stewart S, Jenkins A, Buchan S et al. The current cost of heart failure to the National Health Service in the UK. *The European Journal of Heart Failure* 2002; 4: 373-6.
13. Rydén-Bergsten T, Andersson F. The health care cost of heart failure in Sweden. *J Intern Med* 1999; 246: 275-84.