

## Heart Failure with Preserved Ejection Fraction and Systolic Dysfunction in the Community

Marco Aurélio Esposito Moutinho, Flávio Augusto Colucci, Veronica Alcoforado, Leandro Reis Tavares, Mauricio Bastos Freitas Rachid, Maria Luisa Garcia Rosa, Mário Luiz Ribeiro, Rosemery Abdalah, Juliana Lago Garcia, Evandro Tinoco Mesquita

Universidade Federal Fluminense, Fundação Municipal de Saúde de Niterói - Programa Médico de Família, Niterói, RJ - Brazil

### Summary

**Background:** In developed countries, heart failure with preserved ejection fraction (HFpEF) is more prevalent than heart failure with reduced ejection fraction (HFrEF) in the community. However, it has not been completely established if this fact is also observed within our community.

**Objective:** To determine the most prevalent form of heart failure (HFpEF or HFrEF) and whether the prevalence of HFpEF is higher in the community.

**Methods:** This is a cross-sectional study conducted with patients clinically diagnosed with HF who were seen in community-based health care centers from January to December 2005. Echodopplercardiograms were performed for all patients. The form of HF was stratified according to the presence of abnormalities and the shortening fraction observed on the echodopplercardiogram.

**Results:** The study evaluated 170 patients ( $61.0 \pm 13.3$  years of age), most of them women and elderly. HFpEF was the more prevalent form of HF (64.2%,  $p < 0.001$ ), affecting mostly elderly women (62%,  $p = 0.07$ ), whereas the opposite condition, HFrEF, was observed mostly in elderly men (63.6%,  $p = 0.07$ ). Patients with no HF represented one-third of the cases (27.6%). HFrEF patients had more lower-limb edema, coronary disease, diabetes, chronic renal failure, higher Boston scores and hospital readmissions. Use of alcoholic beverages and smoking were also more common among HFrEF patients.

**Conclusion:** HFpEF is the most prevalent form of HF in the community especially among elderly women, whereas HFrEF affects mostly elderly men and is associated with greater clinical severity, main risk factors and no changes in lifestyle. Despite the signs and symptoms of HF, this condition was not confirmed for one-third of the cases. (Arq Bras Cardiol 2008; 90(2):132-137)

**Key words:** Heart failure/epidemiology; ventricular function; stroke volume.

### Introduction

Heart failure (HF) is a complex clinical syndrome with several etiologies and a high prevalence<sup>1-6</sup>. It is a growing concern among different public health systems due to its high economic impact, particularly in terms of hospitalization costs<sup>7,8</sup>.

The known physiopathologic models are heart failure with reduced ejection fraction (HFrEF) and heart failure with preserved ejection fraction (HFpEF). Physiopathology associated with systolic dysfunction has been well studied, and the clinical assays and guidelines set by different medical associations address this specific group of patients<sup>9-12</sup>. From a clinical point of view, HF evolves in many different ways – different phenotypes – according to a complexity of interactions with factors modifying the syndrome that are

inherent to each individual<sup>13</sup>.

Epidemiological studies in the community show that HFpEF accounts for most cases<sup>2,6,14-17</sup>. Although HFpEF has been considered a disease of lesser severity, current data show the clinical importance of the condition by the 5-8% increase in annual mortality rates (compared to 10 to 15% in HFrEF)<sup>18</sup>.

In Brazil, HF is an emerging epidemic cardiovascular disease and the third leading cause among all-causes, and the first cause among cardiovascular diseases, for hospitalization in the Unified Health System (SUS) for patients above 65 years of age, raising costs with hospitalization and medication<sup>19,20</sup>.

In Niterói, family physicians (FP) provide primary health care<sup>21,22</sup>. It is well known that FPs have a limited capacity of perceiving and distinguishing between HFpEF and HFrEF<sup>23,24</sup>. Brazilian medical literature lacks epidemiological studies conducted in the community about the prevalence of HFpEF and its associations with risk factors and comorbidities.

The objective of this study is to estimate the prevalence of HF forms (HFrEF and HFpEF) among community patients

**Mailing Address:** Marco Aurélio Esposito Moutinho •  
Rua Alzira Brandão, 11/701 - Tijuca - 20520-070 - Rio de Janeiro, RJ - Brazil  
E-mail: maesposito@cardiol.br  
Manuscript received August 02, 2007; revised manuscript received September 20, 2007; accepted October 08, 2007.

who have been clinically diagnosed with HF and who were seen by FPs, as well as to identify the clinical characteristics of each form of HF. The central hypothesis is that the rate of HFpEF is high in the community.

## Methods

This is an observational cross-section study of patients with a clinical suspicion of HF enrolled in the *Programa Médico de Família* (Family Physician Program) in the municipality of Niterói. These patients were referred to the specialized outpatient center from January 3 through December 19, 2005.

During the first visit to the outpatient unit, a structured questionnaire was used to obtain the patient's clinical history with demographic variables, lifestyle, physical examination, anthropometric data, as well as quantification of functional class according to the New York Heart Association (NYHA) criteria. HF was categorized using Boston scores. Blood samples were collected to perform laboratory tests, and patients underwent electrocardiograms, chest X-rays and echodoppler cardiograms.

Inclusion criteria were the presence of symptoms and/or signs of HF (dyspnea and/or fatigue and/or lower-limb edema), electrocardiographic abnormalities and/or chest X-ray associated with Boston scores  $\geq 5$  or therapy with HF medication (diuretics, as a monotherapy and/or combined with ACE-I and/or digitalis).

The variables analyzed on the echodoppler cardiogram were: 1) LV shortening fraction  $< 28\%$ ; 2) significant segment abnormality with LV dilation; 3) LV mass index  $> 134 \text{ g/m}^2$  in men and  $> 110 \text{ g/m}^2$  in women; 4) interventricular septum and LV posterior wall hypertrophy; 5) enlargement of LA diameter<sup>2</sup>. The Devereux formula was used to quantify the mass index, and the Henry formula to quantify interventricular septum and LV posterior wall hypertrophy, as well as LA diameter according to age, gender and body surface<sup>25-27</sup>.

Patients were classified according to the structural and functional abnormalities detected on the echodoppler cardiogram in the following forms of HF: 1) HFrEF: shortening fraction  $< 28\%$  or presence of significant segment abnormality with LV dilation; 2) HFpEF: shortening fraction  $\geq 28\%$  with no segment abnormality and LV dilation, or increase in the rate of LV mass, or interventricular septum and LV posterior wall hypertrophy when there was no mass rate; 3) absence of HF (AHF): non-identification of morphological and functional abnormalities.

With the objective of verifying if there was a significant relationship between the clinical variables and HF, the following methods were applied:

1) to compare ratios (qualitative variables), the prevalence odds ratio was calculated using the chi-square test ( $\chi^2$ ) or Fisher's exact test, according to the number of cases; and

2) To compare age (in years) between two categories, Student's t-test was used for independent samples; and to compare three categories, the one-way analysis of variance was used.

The statistical analysis was performed with SAS v.6.04 software.

A 5% level was the criterion applied to determine significance.

The study was approved by the Institutional Review Board of the University's Medical School, and all participants provided written informed consent.

## Results

A total of 239 patients with a clinical suspicion of HF enrolled in the Family Physician Program. One-hundred-seventy patients were selected who completed the evaluation performed through the echodoppler cardiogram at the university hospital. The mean age was  $61 \pm 13.3$  years, 58% of patients were women, 54% were elderly ( $\geq 60$  years), 84% had systemic arterial hypertension (SAH), 25% had diabetes mellitus (DM) and 21% had coronary artery disease (CAD).

The echodoppler cardiogram showed structural abnormalities in 123 patients, of which 79 (64.2%) had HFpEF, the most prevalent physiopathologic model of HF. Table 1 displays differences between AHF, HFpEF and HFrEF. Indicators of severity, according to NYHA III/IV functional classes, were at least one hospitalization in the preceding year and Boston scores  $\geq 5$ . From a demographic point of view, there were no significant differences among the forms of HF, despite the higher percentage of HFpEF cases among women in comparison with HFrEF. As to signs and symptoms, edema was the sign that most discriminated HF patients (HFpEF and HFrEF), with a higher odds ratio (OR) for those with HFrEF. As to risk factors and comorbidities, the differences were statistically significant only for the presence of CAD, DM and chronic renal failure (CRF) in HFrEF. As to the indicators of severity, there was a greater chance of their being present in HFrEF than in AHF, which did not happen in HFpEF cases except when Boston scores  $\geq 5$ .

Considering just the two physiopathologic models of HF as displayed on Table 2, no statistically significant difference was observed between demographic and lifestyle variables. However, it is worthy mentioning that the chance of an alcoholic beverage drinker developing HFrEF was three times that of his developing HFpEF, whereas the chance of a smoker developing HFpEF was 1.77-fold. Similarly, no statistically significant differences were observed as to signs and symptoms between the two forms of HF, and there was a tendency towards a greater chance of edema in HFrEF. Considering risk factors and comorbidities, the chances of patients with HFrEF developing CAD and CRF were significantly greater (OR 2.40 and 4.79, respectively). The chance of these conditions being more severe was also greater among HFrEF patients, with an OR of 2.9 for hospitalization and 2.35 for Boston scores  $\geq 5$ .

In comparing HFpEF and HFrEF, a tendency was observed toward a higher percentage of HFpEF among elderly women (26 patients, 62% versus 8 patients, 36%  $p = 0.07$ ), whereas HFrEF was more common among elderly men (14 patients, 63.6% versus 16 patients, 38.1%  $p = 0.07$ ). The analysis of non-elderly patients ( $< 60$  years) showed that the presence of CAD (10 patients, 45% versus 22 patients, 8%  $p = 0.05$ ) and DM (11 patients, 50% versus 6 patients, 16%  $p = 0.007$ ) was more common in HFrEF. In

**Table 1 - Clinical differences between the forms of AHF and HF (HFpEF and HFrEF)**

|   | AHF         | HFpEF       | HFrEF       | HFpEF versus AHF  | HFrEF versus AHF  | P value <sup>2</sup> |
|---|-------------|-------------|-------------|-------------------|-------------------|----------------------|
| Total   | 47 (27.6)   | 79 (46.5)   | 44 (25.9)   | OR (95% CI)       | OR (95% CI)       | <0.001               |
| Age (years)   | 58.4 ± 14.6 | 61.5 ± 12.4 | 62.7 ± 13.2 | -                 | -                 | 0.26                 |
| <b>Demographic characteristics and lifestyle habits</b> |             |             |             |                   |                   |                      |
| Elderly patients  | 22 (46.8)   | 42 (53.2)   | 22 (50.0)   | 1.29 (0.63-2.66)  | 1.14 (0.50-2.59)  | 0.78                 |
| Women   | 29 (61.7)   | 48 (60.8)   | 21 (47.7)   | 0.96 (0.43-2.15)  | 0.57 (0.25-1.30)  | 0.30                 |
| Smoking   | 15 (31.9)   | 10 (12.7)   | 9 (20.5)    | 0.31 (0.12-0.76)  | 0.55 (0.21-1.43)  | 0.03                 |
| Alcohol consumption                                     | 6 (12.8)    | 3 (3.8)     | 5 (11.4)    | 0.27 (0.06-1.13)  | 0.88 (0.25-3.11)  | 0.14                 |
| <b>Signs and symptoms</b>                               |             |             |             |                   |                   |                      |
| Edema   | 11 (23.4)   | 34 (43.0)   | 24 (54.5)   | 2.47 (1.10-5.55)  | 3.93 (1.60-9.65)  | 0.01                 |
| Dyspnea   | 22 (46.8)   | 49 (62.0)   | 29 (65.9)   | 1.86 (0.89-3.86)  | 2.20 (0.94-5.12)  | 0.13                 |
| Fatigue   | 43 (91.5)   | 66 (83.5)   | 37 (84.1)   | 0.47 (0.14-1.54)  | 0.49 (0.13-1.81)  | 0.43                 |
| <b>Risk factors</b>                                     |             |             |             |                   |                   |                      |
| SAH   | 37 (78.7)   | 68 (86.1)   | 38 (86.4)   | 1.67 (0.65-4.30)  | 1.71 (0.56-5.19)  | 0.49                 |
| CAD   | 6 (12.8)    | 14 (17.7)   | 15 (34.1)   | 1.47 (0.52-4.14)  | 3.53 (1.22-10.20) | 0.03                 |
| DM  | 6 (12.8)    | 21 (26.6)   | 16 (36.4)   | 2.47 (0.92-6.70)  | 3.91 (1.36-11.20) | 0.03                 |
| <b>Comorbidities</b>                                    |             |             |             |                   |                   |                      |
| COPD  | 7 (14.9)    | 11 (13.9)   | 5 (11.4)    | 0.92 (0.33-2.58)  | 0.73 (0.21-2.50)  | 0.88                 |
| CVA   | 7 (14.9)    | 7 (8.9)     | 6 (13.6)    | 0.56 (0.18-1.70)  | 0.90 (0.28-2.93)  | 0.54                 |
| CRF   | 1 (2.1)     | 3 (3.8)     | 7 (15.9)    | 1.82 (0.18-17.98) | 8.70 (1.02-73.93) | 0.01                 |
| <b>Indicators of severity</b>                           |             |             |             |                   |                   |                      |
| III/IV functional classes                               | 13 (27.7)   | 30 (38)     | 21 (47.7)   | 1.60 (0.73-3.51)  | 2.39 (1.00-5.70)  | 0.14                 |
| Hospital admissions                                     | 4 (8.5)     | 13 (16.5)   | 16 (36.4)   | 2.12 (0.65-6.92)  | 6.14 (1.86-20.28) | 0.01                 |
| Boston score ≥ 5  | 15 (31.9)   | 42 (53.2)   | 32 (72.7)   | 2.42 (1.14-5.16)  | 5.69 (2.30-14.04) | <0.01                |

Abbreviations: AHF - absence of heart failure; HFpEF - heart failure with preserved ejection fraction; HFrEF - heart failure with reduced ejection fraction; SAH - systemic arterial hypertension; DM - diabetes mellitus; CAD - coronary artery disease; COPD - chronic obstructive pulmonary disease; CVA - cerebrovascular accident; CRF - chronic renal failure; OR - odds ratio; 95% CI - 95% confidence interval. & p value < 0.05 for Pearson's chi-square test. \* Data are displayed in n (%), except when otherwise specified.

**Table 2 - Odds ratio of exposure to clinical variables between patients with HFrEF and HFpEF**

|   | OR ( 95% CI)      | P value <sup>2</sup> |
|---|-------------------|----------------------|
| <b>Demographic characteristics and lifestyle habits</b> |                   |                      |
| Elderly patients  | 0.88 (0.42-1.84)  | 0.851                |
| Women   | 0.59 (0.28-1.24)  | 0.19                 |
| Smoking   | 1.77 (0.66-4.77)  | 0.30                 |
| Alcohol consumption                                     | 3.25 (0.74-14.30) | 0.13                 |
| <b>Signs and symptoms</b>                               |                   |                      |
| Dyspnea   | 1.18 (0.55-2.56)  | 0.70                 |
| Fatigue   | 1.04 (0.38-2.84)  | 1.0                  |
| Edema   | 1.59 (0.76-3.33)  | 0.26                 |
| <b>Risk factors</b>                                     |                   |                      |
| SAH   | 1.02 (0.35-2.99)  | 1.0                  |
| CAD   | 2.40 (1.03-5.62)  | 0.048                |
| DM  | 1.58 (0.71-3.48)  | 0.307                |
| <b>Comorbidities</b>                                    |                   |                      |
| COPD  | 0.79 (0.26-2.45)  | 0.785                |
| CVA   | 1.62 (0.51-5.18)  | 0.542                |
| CRF   | 4.79 (1.17-19.60) | 0.034                |
| <b>Indicators of severity</b>                           |                   |                      |
| III/IV functional classes                               | 1.49 (0.71-3.14)  | 0.342                |
| Hospital admissions                                     | 2.90 (1.23-6.82)  | 0.016                |
| Boston score ≥ 5  | 2.35 (1.06-5.21)  | 0.037                |

Abbreviations: HFrEF - heart failure with reduced ejection fraction; HFpEF - heart failure with preserved ejection fraction; SAH - systemic arterial hypertension; DM - diabetes mellitus; CAD - coronary artery disease; COPD - chronic obstructive pulmonary disease; CVA - cerebrovascular accident; CRF - chronic renal failure; OR - odds ratio; 95% CI - 95% confidence interval. & p value < 0.05 for Pearson's chi-square test.

the analysis of elderly patients, hospitalization (7 patients, 32% versus 4 patients, 9%  $p = 0.03$ ) and Boston scores  $\geq 5$  (17 patients, 77% versus 20 patients, 48%  $p = 0.02$ ) were more common in HFrEF.

## Discussion

In this cross-sectional study conducted with patients suspected of having HF at the primary evaluation, most of them were identified as having HFpEF and more than half were women and elderly. This was the first study to identify this fact in Brazil. The mean age of HF patients was at least 10 years lower than the results of studies conducted in communities in other countries, indicating that our population is more exposed to factors associated with the development of HF<sup>2,6,10,11,28-31</sup>. Several studies have shown an increased prevalence of HFpEF with aging, especially in populations of elderly women<sup>2,6,10</sup>. This may be attributed to a greater control of diseases and risk factors involved in HF which has reduced the number of HFrEF cases. The predominance of HFpEF among elderly women is probably associated with the loss of the protective effect of estrogen on the cardiovascular system after menopause<sup>10</sup>.

The EPICA study, conducted in inland Portugal to evaluate the prevalence of HF, showed a greater prevalence of HFpEF than HFrEF (40% versus 30%), especially among women aged 60 years or more. Most patients were classified as I/II functional class (NYHA). Arterial hypertension (66%) and coronary artery disease (37%) were the main risk factors involved in HF<sup>2</sup>. The EPICA-RAM study conducted in Portugal in the Autonomous Madeira region confirmed the same results of the EPICA study, with a lower rate of HFrEF (16%) and a higher rate of HFpEF (58%), which could be related to a higher rate of SAH (79.4%) and a lower rate of CAD (19.0%)<sup>6</sup>. These results are consistent with the results in the present study.

The prevalence of arterial hypertension (three times that of CAD), observed especially among HF patients, was greater than that observed in developed countries<sup>2,6,10,17,31-33</sup>. Arterial hypertension had a high prevalence in both forms of HF (HFrEF and HFpEF), with no differences between them. This contrasts with the results from other studies which showed a greater prevalence of arterial hypertension in HFpEF, indicating that within our environment the inadequate control of hypertension is one of the factors directly involved in the prevalence of HF, both HFpEF and HFrEF<sup>2,6,32-35</sup>.

The larger number of cases of lower-limb edema identified among HFrEF patients was due to the greater severity of HFrEF in this population, confirmed by the presence of advanced functional classes (NYHA III/IV). Other factors involved in HFrEF were the presence of coronary artery disease, diabetes, chronic renal failure, greater number of hospital admissions and Boston scores  $\geq 5$ , confirming a more advanced and severe clinical presentation. In the elderly population, factors associated with HFrEF were hospitalization and Boston scores  $\geq 5$ , whereas in the population under 60 years of age, the factors

were the significant presence of coronary artery disease and diabetes. These results are not consistent with those from other studies, showing that this population has its own characteristic progression of HFrEF<sup>32-35</sup>. The association of these risk factors in patients less than 60 years of age shows that such factors are involved in the early onset and in the genesis of heart dysfunction in this population. Alcohol consumption and smoking were frequent lifestyle habits, especially in HFrEF, and played an important role in the development of this form of HF.

The homogeneous distribution of chronic obstructive pulmonary disease reduced the chance that this could be a decompensation factor for HF patients, although, due to the limitations of the study, no spirometry was performed.

Studies that evaluate the prevalence and forms of HF differ according to the criteria used to measure ventricular function (Table 3). The type of measurement used for ventricular function – the modified biplanar Simpson method or shortening fraction – and the cutoff level in these methods differ among the studies, determining a variance in the results of prevalence of HFrEF and HFpEF<sup>10,14</sup>. The assessment of the ventricular function measured by the LV shortening fraction, using a 28% cutoff level which corresponds to an ejection fraction of 45% as per the Simpson method, proves to be the ideal choice for epidemiological studies in the community<sup>2,6,14,27</sup>. The limitations of the shortening fraction method would apply to cases of myocardial structural abnormalities, either in the walls corresponding to the LV measurements or in apical dysfunction. Therefore, these measurements would not represent the actual measurement of the ventricular function. In these cases, structural abnormalities classify HF as systolic dysfunction since it is an important segment deficit responsible for the ventricular dysfunction which could not be expressed exclusively by the LV shortening fraction.

In conclusion, HFpEF is the most prevalent physiopathologic model in the community, especially among elderly women, whereas HFrEF affects mostly elderly men, is associated with greater clinical severity, early onset of the main risk factors and no changes in lifestyle. Despite the signs and symptoms of HF, this condition was not confirmed for one-third of the cases.

## Potential Conflict of Interest

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

## Sources of Funding

There were no external funding sources for this study.

## Study Association

This article is part of the thesis of master submitted by Marco Aurelio Esposito Moutinho, from *Universidade Federal Fluminense*.

Table 3 - Prevalence of HFpEF: Population studies

| Country                     | N                    | Mean age (years) | Definition of HFpEF  | HFpEF ratio (%) |
|-----------------------------|----------------------|------------------|--|-----------------|
| Spain (Asturia) (36)        | 391                  | 60               | LVEF > 50%   | 59              |
| Holland (Rotterdam) (10)    | 1,698                | 65               | SF > 25%   | 71              |
| Denmark (Copenhagen) (37)   | 2,158                | ≥50              | SF > 26%   | 71              |
| Sweden (Vasteras) (28)      | 433                  | 75               | LVEF ≥ 43%   | 46              |
| United Kingdom (Poole) (11) | 817                  | 76               | Qualitative (normal; mild, moderate or severe dysfunction) | 68              |
| Finland (Helsinki)* (29)    | 501                  | 75-86            | SF ≥ 25%   | 72              |
| Portugal (EPICA) (2)        | 5,434                | 68               | SF ≥ 28% /absence of segment deficit and LV dilation       | 39              |
| Portugal (EPICA-RAM) (6)    | 686                  | 65               | SF ≥28%/absence of segment deficit and LV dilation         | 58              |
| USA (CHS) (38,39)           | a) 4,842<br>b) 5,888 | 78<br>74         | Qualitative†<br>Qualitative†                               | 55<br>63        |
| USA (SHS) (40)              | 3,184                | 60               | LVEF > 54  | 53              |
| Mayo Clinic (USA) (30)      | 2,042                | 63               | LVEF > 50%   | 44              |
| Canada (Ontario) (33)       | 2,802                | 75               | LVEF > 50%   | 31              |
| Mayo Clinic (USA) (16)      | 6,076                | 74               | LVEF> 50%  | 47              |

\*Fifty-one patients with valve disease were excluded from the study. †Normal (LVFE ≥55%), LV systolic dysfunction: mild (LVFE 45-54%), moderate (LVFE 30-44%) or severe (<30%); a) = reference data 38; b) = reference data 39. Abbreviations: HFpEF - heart failure with preserved ejection fraction; EPICA - epidemiology of heart failure and learning; EPICA-RAM - epidemiology of heart failure and learning in the Autonomous Madeira region; CHS - Cardiovascular Health Study; SHS - Strong Heart Study; USA - United States of America; LVEF - left ventricular ejection fraction; SF - shortening fraction; LV - left ventricle.

## References

- Davies M, Hobbs F, Davis R, Kenkre J, Roalfe AK, Hare R, et al. Prevalence of left-ventricular systolic dysfunction and heart failure in the general population: main findings from ECHOES (Echocardiographic Heart of England Screening) Study. *Lancet*. 2001; 358: 439-44.
- Ceia F, Fonseca C, Mota T, Morais H, Matias F, de Sousa A, et al, on behalf of the EPICA investigators. Prevalence of chronic heart failure in Southwestern Europe: the EPICA study. *Eur J Heart Fail*. 2002; 4: 531-9.
- Cleland JGF, Khand A, Clark A. The heart failure epidemic: exactly how big is it? *Eur Heart J*. 2001; 22: 623-6.
- Remme WJ, Swedberg K, on behalf of the Task Force for the Diagnosis and Treatment of Chronic Heart failure. European society of cardiology: guidelines for the diagnosis and treatment of chronic heart failure. *Eur Heart J*. 2001; 22: 1527-60.
- Cowie MR, Mosterd A, Wood DA, Deckers JW, Poole-Wilson PA, Sutton GC, et al. The epidemiology of heart failure. *Eur Heart J*. 1997; 18: 208-25.
- Ceia F, Fonseca C, Azevedo I, Mota T, Morais H, Matias F, et al, em representação dos investigadores do EPICA-RAM. Epidemiologia da insuficiência cardíaca em cuidados primários na região autónoma da Madeira: o Estudo EPICA-RAM. *Rev Port Cardiol*. 2005; 24: 173-89.
- Senni M, Tribouilloy CM, Rodeheffer RJ, Jacobsen SJ, Evans JM, Bailey KR, et al. Congestive heart failure in the community: trends in incidence and survival in a 10-year period. *Arch Intern Med*. 1999; 159: 29-34.
- O'Connell JB, Bristow MR. Economic impact of heart failure in the United States: time for a different approach. *J Heart Lung Transplant*. 1994; 13 (Suppl 4): S107-12.
- Cowie MR, Wood DA, Coats AJ, Thompson SG, Poole-Wilson PA, Davies SW, et al. Incidence and aetiology of heart failure; a population-based study. *Eur Heart J*. 1999; 20: 421-8.
- Mosterd A, Hoes AW, de Bruyne MC, Deckers JW, Linker DT, Hofman A, et al. Prevalence of heart failure and left ventricular dysfunction in the general population: The Rotterdam Study. *Eur Heart J*. 1999; 20: 447-55.
- Morgan S, Smith H, Simpson I, Liddiard GS, Raphael H, Pickering RM, et al. Prevalence and clinical characteristics of left ventricular dysfunction among elderly patients in general practice setting: cross-sectional survey. *BMJ*. 1999; 318: 368-72.
- Aronow WS. Epidemiology, pathophysiology, prognosis, and treatment of systolic and diastolic heart failure. *Cardiol Rev*. 2006; 14 (3):108-24.
- De Keulenaer GW, Brutsaert DL. Systolic and diastolic heart failure: different phenotypes of the same disease? *Eur J Heart Fail*. 2007; 9 (2): 136-43.
- Hogg K, Swedberg K, McMurray J. Heart failure with preserved left ventricular systolic function. epidemiology, clinical characteristics, and prognosis. *J Am Coll Cardiol*. 2004; 43: 317-27.
- Cleland JG, Cohen-Solal A, Aguilar JC, Dietz R, Eastaugh J, Follath F, et al. Management of heart failure in primary care (the IMPROVEMENT of Heart Failure Programme): an international survey. *Lancet*. 2002; 360: 1631-9.
- Owan TE, Hodge DO, Herges RM, Jacobsen SJ, Roger VL, Redfield MM. Trends in prevalence and outcome of heart failure with preserved ejection fraction. *N Engl J Med*. 2006; 355: 251-9.
- Bursi F, Weston SA, Redfield MM, Jacobsen SJ, Pakhomov S, Nkomo VT, et al. Systolic and diastolic heart failure in the community. *JAMA*. 2006; 296: 2209-16.
- Aurigemma GP, Gaasch WH. Diastolic heart failure. *N Engl J Med*. 2004; 351: 1097-105.

19. Ministério da Saúde [homepage da internet]. Secretaria Executiva. DATASUS: informações de saúde: morbidade e informações epidemiológicas. [acesso em 2006 maio 10]. Disponível em: URL: :<http://www.datasus.gov.br>.
20. Araújo DV, Tavares LR, Veríssimo R, Ferraz MB, Mesquita ET. Custo da insuficiência cardíaca no Sistema Único de Saúde. *Arq Bras Cardiol*. 2005; 84: 422-7.
21. Mesquita ET, Miranda VA. Insuficiência cardíaca na atenção primária. *Rev SOCERJ*. 2005; 18: 342-3.
22. 20 Experiências de Gestão Pública e Cidadania. Luis Mario Fujiwara, Nelson Luiz Nouvel Alessio e Marta Ferreira Santos Farah (orgs.). São Paulo: Programa Gestão Pública e Cidadania; 1998.
23. Hobbs FDR, Korewicki J, Cleland JGF, Eastaugh J, Freemantle N and on behalf of the IMPROVEMENT Investigators: the diagnosis of heart failure in European primary care: The IMPROVEMENT programme survey of perception and practice. *Eur J Heart Fail*. 2005; 7: 768-79.
24. Tavares LR, Velarde LG, de Miranda VA, Mesquita ET. Perceptions of heart failure diagnosis and management: comparison between clinical cardiologists and family doctors. *Arq Bras Cardiol*. 2006; 87 (2): 167-73.
25. Devereux RB, Alonso DR, Lutas EM, Gottlieb GJ, Campo E, Sachs I, et al. Echocardiographic assessment of left ventricular hypertrophy: comparison to necropsy findings. *Am J Cardiol*. 1986; 57: 450-8.
26. Henry WL, Gardin JM, Ware JH. Echocardiographic measurements in normal subjects from infancy to old age. *Circulation*. 1980; 62: 1054-61.
27. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA, et al. Guidelines recommendations for chamber quantification. *Eur J Echocardiogr*. 2006; 7: 79-108.
28. Hedberg P, Lonnberg I, Jonason T, Nilsson G, Pehrsson K, Ringqvist I. Left ventricular systolic dysfunction in 75-year-old men and women; a population-based study. *Eur Heart J*. 2001; 22: 676-83.
29. Kupari M, Lindroos M, Iivanainen AM, Heikkilä J, Tilvis R. Congestive heart failure in old age: prevalence, mechanisms and 4-year prognosis in the Helsinki Ageing Study. *J Intern Med*. 1997; 241: 387-94.
30. Redfield MM, Jacobsen SJ, Burnett JC Jr, Mahoney DW, Bailey KR, Rodeheffer RJ. Burden of systolic and diastolic ventricular dysfunction in the community: appreciating the scope of the heart failure epidemic. *JAMA*. 2003; 289: 194-202.
31. Hershberger RE, Nauman DJ, Byrkit J, Gillespie G, Lackides G, Toy W, et al. Prospective evaluation of an outpatient heart failure disease management program designed for primary care: the Oregon model. *J Card Fail*. 2005; 11 (4): 293-8.
32. Lenzen MJ, Scholte op Reimer WJM, Boersma E, Vantrimpont PJM, Follath F, Swedberg K, et al. Differences between patients with a preserved and a depressed left ventricular function: a report from the EuroHeart Failure Survey. *Eur Heart J*. 2004; 25: 1214-20.
33. Bhatia RS, Tu JV, Lee DS, Austin PC, Fang J, Haouzi A, et al. Outcome of heart failure with preserved ejection fraction in a population-based study. *N Eng J Med*. 2006; 355: 260-9.
34. McMurray J, Ostergren J, Pfeffer M, Swedberg K, Granger C, Yusuf S, et al, and on behalf of the CHARM committees and investigators. Clinical features and contemporary management of patients with low and preserved ejection fraction heart failure: baseline characteristics of patients in the Candesartan in Heart failure – Assessment of Reduction in Mortality and morbidity (CHARM) programme. *Eur J Heart Fail*. 2003; 5: 261-70.
35. Kitzman DW, Little WC, Brubaker PH, Anderson RT, Hundley WG, Marburger CT, et al. Pathophysiological characterization of isolated diastolic heart failure in comparison to systolic heart failure. *JAMA*. 2002; 288: 2144-50.
36. Cortina A, Reguero J, Segovia E, Rodriguez Lambert JL, Cortina R, Arias JC, et al. Prevalence of heart failure in Astúrias (a region in the north of Spain). *Am J Cardiol*. 2001; 87: 1417-9.
37. Nielsen OW, Hilden J, Larsen CT, Hansen JF. Cross-sectional study estimating prevalence of heart failure and left ventricular systolic dysfunction in community patients at risk. *Heart*. 2001; 86: 172-8.
38. Kitzman DW, Gardin JM, Gottdiener JS, Arnold A, Boineau R, Aurigemma G, et al. Importance of heart failure with preserved systolic function in patients > or = 65 years of age. CHS Research Group. Cardiovascular Health Study. *Am J Cardiol*. 2001; 87: 413-9.
39. Gottdiener JS, McClelland RL, Marshall R, Shemanski L, Furberg CD, Kitzman DW, et al. Outcome of congestive heart failure in elderly persons: influence of left ventricular systolic function. The Cardiovascular Health Study. *Ann Intern Med*. 2002; 137: 631-9.
40. Devereux RB, Roman MJ, Liu JE, Welty TK, Lee ET, Rodeheffer R, et al. Congestive heart failure despite normal left ventricular systolic function in a population-based sample: the Strong Heart Study. *Am J Cardiol*. 2000; 86: 1090-6.