Published in final edited form as:

Am J Cardiol. 2009 August 1; 104(3): 377–382. doi:10.1016/j.amjcard.2009.03.045.

Epidemiology of Decompensated Heart Failure in a Single Community in the Northeastern USA

Robert J. Goldberg, PhD^a, Chad Darling, MD^a, Bernard Joseph, MD^a, Jane Saczynski, PhD^a, Marcello Chinali, MD^a, Darleen Lessard, MS^a, Steven Pezzella, MD^b, and Frederick A. Spencer, MD^c

^aDepartment of Medicine, University of Massachusetts Medical School, Worcester, MA

^bDepartment of Cardiology, Fallon Clinic, Worcester, MA

^cDepartment of Medicine, McMaster University, Hamilton, Ontario

Abstract

Limited data are available describing the clinical characteristics, hospital treatment practices, and hospital and long-term death rates of patients hospitalized with decompensated heart failure (HF). To examine the descriptive epidemiology of acute HF in residents of a large New England metropolitan area during the 2 study years of 1995 and 2000, we reviewed the medical records of patients hospitalized with acute HF at 11 medical centers in the Worcester (MA) metropolitan area during 1995 and 2000 for purposes of collecting information about patient's sociodemographic and clinical characteristics, hospital management approaches, and hospital and post-discharge mortality. The mean age of 4,537 residents of the Worcester metropolitan area hospitalized with decompensated HF was 76 years, 57% were women, and the majority of study patients had been previously diagnosed with several comorbidities. The average duration of hospitalization was 6.3 days and 6.8% of patients died during hospitalization. Diuretics (98%) and ACE inhibitors/ARB's (54%) were the most common medications used to treat acutely ill patients. The 1 and 5 year death rates of hospital survivors were 39% and 77%, respectively, with no change observed in these death rates between our 2 study years. In conclusion, the results of this observational study in residents of a central New England metropolitan area provide insights into the characteristics, treatment practices, and short and long-term death rates associated with this increasingly prevalent clinical syndrome.

Keywords

heart failure; population-based investigation

Introduction

Using data from the Worcester Heart Failure Study, an observational study of metropolitan Worcester (MA) residents hospitalized with decompensated heart failure (HF) at all greater

© 2009 Excerpta Medica, Inc. Published by Elsevier Inc. All rights reserved.

Address for reprints: Robert J. Goldberg, Ph.D., Division of Cardiovascular Medicine, Department of Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655, Robert.Goldberg@umassmed.edu, Tel: (508) 856-3991, Fax: (508) 856-4596.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Worcester medical centers (1–3), we describe the overall, and potentially changing, epidemiology of acute HF in residents of this large New England metropolitan area. Data are presented about patient's demographic and clinical characteristics, hospital management practices, and hospital and post-discharge death rates.

Methods

Adult male and female residents of all ages from the Worcester (MA) metropolitan area (2000 census estimate = 478,000) hospitalized for possible HF at all 11 greater Worcester medical centers during the 2 study years of 1995 (n=1,950) and 2000 (n=2,587) comprised the study population.

The medical records of patients with primary and/or secondary International Classification of Disease (ICD)-9 discharge diagnoses consistent with the possible presence of HF were reviewed in a standardized manner (1–3). Patients with a discharge diagnosis of HF (ICD-9 code 428) comprised the primary diagnostic rubric reviewed for the identification of cases of possible HF. In addition, the medical records of patients with discharge diagnoses of other conditions in which HF may have been diagnosed (e.g., hypertensive heart disease, acute cor pulmonale) were reviewed by trained study physicians and nurses to identify patients who may have had new onset HF (1–3).

Confirmation of the diagnosis of HF, based on use of the Framingham criteria, included the presence of 2 major criteria or presence of 1 major and 2 minor criteria (4). Patients who developed HF secondary to admission for another acute illness (e.g., acute myocardial infarction), or after an interventional procedure (e.g., percutaneous coronary intervention) were not included since we were interested in studying de novo cases of decompensated HF.

Information was collected about patient's demographic characteristics, medical history, clinical presentation, physical examination findings, and laboratory test results through the review of information contained in hospital medical records by trained study physicians and nurses. Echocardiographic data obtained during hospitalization for HF were available for only 37% of the study sample based on the review of information contained in hospital medical records.

Physician's progress notes and daily medication logs were reviewed for the prescribing of selected cardiac medications (1,2). We examined the use of cardiac medications which have been shown to be of benefit in improving the prognosis of patients with HF (e.g., angiotensin converting enzyme [ACE] inhibitors, angiotensin receptor blockers [ARBs], and beta blockers) and medications shown to be effective in improving the symptomatic status of patients with acute HF (digoxin and diuretics). Information about patient's long-term survival status was obtained through the review of hospital records for subsequent hospitalizations and/or medical care contacts and through a statewide and national review of death certificates.

Differences in the characteristics of patients hospitalized with acute HF in 1995, as compared to those hospitalized in 2000, were examined through the use of chi-square and t-tests for categorical and continuous variables, respectively. A logistic regression approach was utilized to identify demographic, medical history, and clinical factors associated with a poor short as well as long-term prognosis after HF. A life table approach was used to examine long-term total mortality for greater Worcester residents discharged from all area medical centers after a validated episode of HF in 1995 and 2000.

Results

The average age of the study population was 76 years and the majority of hospitalized patients were women (57%) and Caucasian (94%).

In examining the demographic and medical history characteristics of the study population, we found a strikingly high prevalence of previously diagnosed hypertension, diabetes, coronary heart disease, and heart failure (Table 1). Patients were also generally overweight and/or obese. Relatively little change was observed in the proportion of patients who presented with these characteristics during 1995 or in 2000; the exception to these trends was in an increasing prevalence of previously diagnosed hypertension in our study sample over the 2 periods under study. The average duration of hospitalization declined by nearly 2 days between 1995 and 2000 and a large proportion of hospitalized patients had a do not resuscitate order placed in their hospital charts.

The vast majority of patients complained of dyspnea at the time of hospital presentation (Table 1). A large proportion of patients presented to all greater Worcester medical centers with edema, followed by complaints of orthopnea and generalized weakness. With the exception of dyspnea, each of these clinical signs and symptoms was more likely to be reported by patients who were hospitalized in 2000 as compared to those who were hospitalized in 1995.

The distribution of various physiologic factors indicated an average ejection fraction in the mid-40's among those in whom this information was available, elevated serum glucose levels, and slightly elevated systolic blood pressure findings in patients hospitalized with acute HF; improvements in each of these physiologic characteristics were noted over time.

Diuretics were administered to virtually all hospitalized patients whereas ACE inhibitors/ARBs and digoxin were administered to slightly more than one half of hospitalized patients (Table 2). We found similar prescribing rates of diuretics in hospitalized patients with decompensated HF during 1995 and 2000, with a significant increase between these 2 study years in the use of ACE inhibitors/ARBs, beta blockers, and preventive cardiac medications including lipid lowering agents and antiplatelet therapy (Table 2). A significant decline was observed in the prescribing of calcium channel blockers, digoxin, and nitrates between 1995 and 2000 (all $p < 0.001$).

Among patients who were not on previously described cardiac medications, the proportion of patients who were prescribed new cardiac medications remained essentially the same for both study years. Approximately one half of hospitalized patients were not initiated on new cardiac drugs during hospitalization for HF. One third had one new drug started and approximately one in 12 had two new cardiac medications prescribed.

In terms of lifestyle recommendations, a majority of hospitalized patients were recommended by a health care provider that they should decrease their salt intake and more than half were recommended to adhere to a low fat diet (Table 2). Recommendations for increased physical activity declined significantly over time, while recommendations for a low fat diet, decreased intake of salt and salty foods, and fluid restriction increased between the 2 years under study.

A total of 6.8% of all patients died during hospitalization for decompensated HF, 8.5% in 1995 and 5.5% in 2000 ($p < 0.001$).

Patients who died during hospitalization for HF were more likely to be older, Caucasian, underweight, to not have a history of coronary heart disease, diabetes, or hypertension, to present with generalized weakness, but not with orthopnea or recent weight gain, and have lower blood pressure findings and a lower eGFR than patients who survived (Table 3). The

results of our multivariable adjusted logistic regression analysis showed that older age was significantly associated with an increased risk of dying during the acute hospitalization.

Death rates were approximately 39%, 54%, and 77%, respectively, at 1, 2, and 5 years after hospital discharge in the total study sample. These death rates did not change over the 2 periods under study ($p = 0.14$, Figure 1).

In examining the characteristics of patients who survived the first 1 and 5 years after hospital discharge, as compared to those who did not, decedents were significantly older, more likely to be Caucasian, to be markedly underweight, to have had a history of COPD and heart failure, and to present to greater Worcester medical centers with edema and generalized weakness (Table 3). Patients with a history of diabetes or stroke had a poorer odds of 5-year, but not 1-year, survival following hospital discharge.

The results of our multivariable adjusted regression analysis showed that older age, having a body mass index $<25 \text{ kg/m}^2$ at the time of hospital presentation, a history of COPD or heart failure, higher serum levels of blood urea nitrogen, and lower blood pressure findings were associated with an increased risk of dying during the first 1 and 5 years after discharge. A history of stroke and diabetes were associated with an increased risk of dying at 5 years, but not during the first year, after hospital discharge. Essentially similar findings were observed when we restricted our analyses to patients with an initial (incident) episode of acute HF.

Discussion

The results of this population-based study provide insights into the demographic and clinical characteristics, treatment practices, and hospital and long-term outcomes of patients hospitalized with decompensated HF.

There are several large registry databases, including the Acute Decompensated Heart Failure National Registry (ADHERE), and the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure (OPTIMIZE-HF), that have provided insights into the clinical characteristics, treatment practices, and outcomes of patients hospitalized with HF. Patients were enrolled in these registries between 2001 and 2004, and 2003 and 2004, respectively (5–8), postdating the present periods under study.

In the present study, the average age of hospitalized patients was in their mid-70's and the majority of hospitalized patients were women. These patient characteristics are similar to those observed in the ADHERE and OPTIMIZE registries (5,6,8,9). A higher proportion of women was noted in our study relative to these registries perhaps reflecting its population-based design.

The majority of greater Worcester residents hospitalized with HF had been previously diagnosed with coronary heart disease, diabetes, hypertension, as well as HF. These results are similar to those reported in the OPTIMIZE-HF registry where approximately 40% of study patients were diabetic and almost three quarters had been previously diagnosed with hypertension (8). In the ADHERE registry, slightly more than one half of patients had a history of coronary disease and three-quarters had a prior diagnosis of HF (5,6). The advanced age of study patients, in conjunction with the high frequency of other serious comorbidities, makes the management of patients with decompensated HF on an acute as well as long-term basis all the more complex.

While there were encouraging increases noted in the use of several effective cardiac medications over time, the acute treatment of patients hospitalized with HF, even during 2000, was less than optimal and adherence to various performance measures in each of our study cohorts was relatively poor. It is important to note, however, that the emphasis on following

these guidelines began in 2002 with initial results of intervention efforts designed to increase the use of these treatment measures not published until the mid-2000's (10).

Approximately 1 in every 14 greater Worcester residents hospitalized with acute HF died during hospitalization with a decline in hospital death rates noted between 1995 and 2000. While these findings are similar to the results of the Euro-Heart Failure Survey (11), short-term mortality was somewhat lower in the ADHERE (5) and OPTIMIZE-HF registries (8). Our data demonstrated a trend toward improved hospital prognosis over time, findings which are consistent with data from the ADHERE study between 2002 and 2004 (6).

In examining the characteristics of patients who survived on a long-term basis after hospital discharge, those who died were more likely to be older and have preexisting HF and COPD; being overweight was associated with decreased mortality. This latter counterintuitive result is consistent with other published data suggesting an "obesity paradox" in patients with this clinical syndrome and other manifestations of cardiovascular disease (12,13).

The long-term prognosis of greater Worcester residents discharged from all central New England medical centers after HF was guarded. Our observed rates are higher than those described by the Framingham Heart Study for patients diagnosed with HF between 1950 and 1999 (14).

It is possible that increases in the use of beta blockers, and to a lesser extent ACE inhibitors, played a role in our observed decline in hospital mortality, though given the nonrandomized nature of the present study we are unable to systematically examine this association. That said, long-term mortality in our study did not significantly change, reflecting the difficulties inherent to the long-term management of these high-risk complex patients.

The strengths of our community-wide study include the large sample of patients hospitalized with decompensated HF. We were able to examine the predictive utility of several factors that could affect hospital and long-term prognosis after acute HF, but there were other factors that may have affected patient's long-term prognosis, such as smoking patterns after hospital discharge, that we did not collect information on. One important limitation of this study was the small percentage of minorities who were hospitalized with acute HF. Ejection fraction findings were not determined in a large proportion of patients and it was not possible to determine the proportion of, and management and outcomes associated with, patients with systolic as compared to diastolic HF nor of changes in EF after hospital discharge.

Acknowledgements

This study was made possible through the cooperation of Worcester metropolitan area hospitals.

References

1. Goldberg RJ, Spencer FA, Farmer C, Meyer TE, Pezzella S. Incidence and hospital death rates associated with heart failure: a community-wide perspective. *Am J Med* 2005;118:728–734. [PubMed: 15989906]
2. Goldberg RJ, Farmer C, Spencer FA, Pezzella S, Meyer TE. Use of nonpharmacologic treatment approaches in patients with heart failure. *Int J Cardiol* 2006;110:348–353. [PubMed: 16503057]
3. Goldberg RJ, Ciampa J, Lessard D, Meyer TE, Spencer FA. Long-term survival after heart failure: a contemporary population-based perspective. *Arch Intern Med* 2007;167:490–496. [PubMed: 17353497]
4. McKee PA, Castelli WP, McNamara PM, Kannel WB. The natural history of congestive heart failure: the Framingham study. *N Engl J Med* 1971;285:1441–1446. [PubMed: 5122894]

5. Adams KF Jr, Fonarow GC, Emerman CL, LeJemtel TH, Costanzo MR, Abraham WT, Berkowitz RL, Galvao M, Horton DP. Characteristics and outcomes of patients hospitalized for heart failure in the United States: rationale, design, and preliminary observations from the first 100,000 cases in the Acute Decompensated Heart Failure National Registry (ADHERE). *Am Heart J* 2005;149:209–216. [PubMed: 15846257]
6. Fonarow GC, Heywood JT, Heidenreich PA, Lopatin M, Yancy CW. Temporal trends in clinical characteristics, treatments, and outcomes for heart failure hospitalizations, 2002 to 2004: findings from Acute Decompensated Heart Failure National Registry (ADHERE). *Am Heart J* 2007;153:1021–1028. [PubMed: 17540205]
7. Fonarow GC, Corday E. Overview of acutely decompensated congestive heart failure (ADHF): a report from the ADHERE registry. *Heart Fail Rev* 2004;9:179–185. [PubMed: 15809815]
8. Fonarow GC, Abraham WT, Albert NM, Gattis Stough W, Gheorghiade M, Greenberg BH, O'Connor CM, Pieper K, Sun JL, Yancy CW, Young JB. Influence of a performance-improvement initiative on quality of care for patients hospitalized with heart failure: results of the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure (OPTIMIZE-HF). *Arch Intern Med* 2007;167:1493–1502. [PubMed: 17646603]
9. Gheorghiade M, Abraham WT, Albert NM, Greenberg BH, O'Connor CM, She L, Stough WG, Yancy CW, Young JB, Fonarow GC. OPTIMIZE-HF Investigators and Coordinators. Systolic blood pressure at admission, clinical characteristics, and outcomes in patients hospitalized with acute heart failure. *JAMA* 2006;296:2217–2226. [PubMed: 17090768]
10. Williams SC, Schmaltz SP, Morton DJ, Koss RG, Loeb JM. Quality of care in U.S. hospitals as reflected by standardized measures, 2002–2004. *N Engl J Med* 2005;353:255–264. [PubMed: 16034011]
11. Cleland JG, Swedberg K, Follath F, Komajda M, Cohen-Solal A, Aguilar JC, Dietz R, Gavazzi A, Hobbs R, Korewicki J, Madeira HC, Moiseyev VS, Preda I, van Gilst WH, Widimsky J, Freemantle N, Eastaugh J, Mason J. The EuroHeart Failure survey programme-- a survey on the quality of care among patients with heart failure in Europe. Part 1: patient characteristics and diagnosis. *Eur Heart J* 2003;24:442–463. [PubMed: 12633546]
12. Curtis JP, Selter JG, Wang Y, Rathore SS, Jovin IS, Jadbabaie F, Kosiborod M, Portnay EL, Sokol SI, Bader F, Krumholz HM. The obesity paradox: body mass index and outcomes in patients with heart failure. *Arch Intern Med* 2005;165:55–61. [PubMed: 15642875]
13. Fonarow GC, Srikanthan P, Costanzo MR, Cintron GB, Lopatin M. An obesity paradox in acute heart failure: analysis of body mass index and in-hospital mortality for 108,927 patients in the Acute Decompensated Heart Failure National Registry. *Am Heart J* 2007;153:74–81. [PubMed: 17174642]
14. Levy D, Kenchaiah S, Larson MG, Benjamin EJ, Kupka MJ, Ho KK, Murabito JM, Vasan RS. Long-term trends in the incidence of and survival with heart failure. *N Engl J Med* 2002;347:1397–1402. [PubMed: 12409541]

Figure 1.
Long-Term Survival After Heart Failure

Table 1
 Characteristics of the Study Population (Worcester Heart Failure Study)

Characteristic	Total Sample (n=4,537)	Patients Hospitalized in 1995 (n=1,950)	Patients Hospitalized in 2000 (n=2,587)	P Value
Age (mean) (years)	76.0 (11.8) [†]	75.6 (11.0)	76.3 (12.3)	<0.05
Male	43.2%	42.9%	43.3%	0.78
Caucasian	94.2%	96.1%	92.7%	<0.01
<u>Body mass index (kg/m²)</u>				
<18.5	5.8%	6.3%	5.4%	<0.01
18.5–24.9	39.4%	41.9%	37.5%	
25–29.9	27.1%	26.4%	27.5%	
≥30	27.8%	25.4%	29.6%	
Length of stay (mean) (days)	6.3 (7.3)	7.4 (8.1)	5.5 (6.6)	<0.001
Do not resuscitate order	29.6%	29.5%	29.6%	0.94
Coronary heart disease	56.8%	57.0%	56.7%	0.84
Chronic obstructive pulmonary disease	34.8%	35.4%	34.3%	0.44
Diabetes mellitus	39.9%	39.7%	39.9%	0.90
Hypertension	65.2%	62.3%	67.3%	<0.01
Peripheral vascular disease	18.2%	20.2%	16.7%	<0.01
Stroke	14.6%	14.3%	14.8%	0.66
<u>Acute Signs and Symptoms</u>				
Dyspnea	94.6%	96.5%	93.1%	<0.001
Edema	67.5%	63.8%	70.3%	<0.001
Generalized weakness	26.9%	24.9%	28.5%	<0.01
Nausea/vomiting	14.6%	14.2%	14.9%	0.52
Orthopnea	33.5%	29.2%	36.7%	<0.001
Recent weight gain	8.0%	6.8%	8.9%	<0.01
<u>Laboratory findings at the time of hospital admission (mean)</u>				
Blood urea nitrogen (mg/dl)	34.4 (24.7)	33.3 (23.7)	35.2 (25.4)	<0.01
Estimated GFR (ml/min/1.73 ²)	63.1 (33.7)	64.4 (35.3)	62.2 (32.4)	<0.05
Glucose (mg/dl)	166.2 (82.1)	169.5 (87.5)	163.7 (77.7)	<0.05
Hematocrit (%)	12.3 (2.6)	12.4 (2.3)	12.1 (3.1)	<0.05
Sodium (mg/dl)	137.2 (5.5)	137.7 (5.1)	136.9 (5.7)	<0.001
<u>Physiologic findings at the time of hospital admission (mean)</u>				
Systolic blood pressure (mmHg)	144.6 (32.7)	146.3 (33.6)	143.4 (31.9)	<0.01
Diastolic blood pressure (mmHg)	76.8 (19.4)	79.1 (18.9)	75.0 (19.6)	<0.001
Ejection fraction (%)	45.2 (31.5)	42.8 (29.2)	46.5 (32.5)	<0.05
Heart rate (bpm)	90.7 (22.6)	92.5 (22.6)	89.4 (22.4)	<0.001

GFR = glomerular filtration rate

[†]
 standard deviation

Table 2
Hospital Treatment Practices (Worcester Heart Failure Study)

<u>Medication</u>	<u>n</u>	<u>Total Sample</u> (n=4,537)	<u>n</u>	<u>Patients Hospitalized in 1995</u> (n=1,950)	<u>n</u>	<u>Patients Hospitalized in 2000</u> (n=2,587)	<u>P Value</u>
ACE inhibitors/ARBs	4537	53.6%	1950	50.4%	2587	55.9%	<0.01
Antiplatelet therapy	4537	51.7%	1950	42.2%	2587	58.9%	<0.001
Beta blockers	4537	40.8%	1950	26.2%	2587	51.8%	<0.001
Calcium channel blockers	4537	36.1%	1950	40.2%	2587	33.0%	<0.001
Digoxin	4537	50.5%	1950	54.9%	2587	47.2%	<0.001
Diuretics	4537	97.8%	1950	97.9%	2587	97.7%	0.79
Lipid lowering agents	4537	14.5%	1950	5.8%	2587	21.0%	<0.001
Nitrates	4537	64.8%	1950	67.9%	2587	62.5%	<0.001
<u>Newly Initiated Medications</u>							
ACE inhibitors/ARBs	2738	27.0%	1228	24.8%	1510	28.7%	<0.05
Antiplatelet therapy	2963	31.7%	1403	25.3%	1560	37.5%	<0.001
Beta blockers	3047	14.7%	1552	9.5%	1495	20.1%	<0.001
Calcium channel blockers	3240	13.5%	1311	15.3%	1929	12.3%	<0.01
Digoxin	2851	23.8%	1152	26.5%	1701	22.1%	<0.01*
Diuretics	1464	93.7%	623	94.1%	841	93.5%	0.64
Lipid lowering agents	3927	2.1%	1839	0.8%	2018	3.4%	<0.001
Nitrates	2919	48.1%	1176	49.9%	1743	46.9%	0.11
<u>Lifestyle recommendations</u>							
Consume a low fat diet	4537	57.8%	1950	46.2%	2587	66.5%	<0.001
Decrease fluid restriction	4537	21.3%	1950	19.9%	2587	22.4%	<0.05
Decrease salt intake	4537	80.3%	1950	78.1%	2587	81.9%	<0.01
Increase physical activity	4537	41.6%	1950	54.0%	2587	32.3%	<0.001

Table 3
 Characteristics of Hospital and Long-Term Post Discharge Decedents as Compared to Survivors (Worcester Heart Failure Study)

<u>Characteristic</u>	<u>Hospital</u>			<u>1 Year</u>			<u>5 Years</u>		
	<u>Survivors</u> (n=4,229)	<u>Decedents</u> (n=308)	<u>Adjusted</u> <u>O.R.</u>	<u>Survivors</u> (n=2,597)	<u>Decedents</u> (n=1,632)	<u>Adjusted</u> <u>O.R.</u>	<u>Survivors</u> (n=995)	<u>Decedents</u> (n=3,234)	<u>Adjusted</u> <u>O.R.</u>
Age (mean, yrs)	75.8	79.2 *	1.03 (1.02,1.04) [†]	74.4	78.0 *	1.03 (1.02,1.03)	70.6	77.4 *	1.04 (1.04,1.05)
Male	43.1%	44.5%	1.18 (0.90,1.55)	41.9%	44.9%	1.10 (0.95,1.28)	42.5%	43.2%	1.07 (0.90,1.28)
Caucasian	93.9%	97.7% *	2.19 (0.94,5.11)	92.3%	96.5% *	1.49 (1.07,2.07)	89.1%	95.4% *	1.35 (0.99,1.84)
<u>Body mass index</u>									
<18.5	5.6%	9.8% *	1.15 (0.69,1.92)	4.1%	7.9% *	1.80 (1.29,2.51)	1.8%	6.7% *	4.18 (2.35,7.44)
18.5–24.9	39.1%	44.2%	0.72 (0.54,0.96)	34.4%	46.7%	1.27 (1.08,1.48)	29.8%	41.9%	1.36 (1.12,1.66)
25–29.9	27.1%	26.8%	1.0	28.6%	24.6%	1.0	30.3%	26.1%	1.0
≥30	28.3%	19.2%	0.75 (0.51,1.10)	32.9%	20.9%	0.71 (0.59,0.86)	38.1%	25.3%	0.82 (0.67,1.01)
Length of hospital stay (mean, days)	9.7	6.0 *	1.04 (1.03,1.05)	5.7	6.6 *	1.02 (1.01,1.03)	5.5	6.2 *	1.02 (1.01,1.03)
<u>Medical history</u>									
Coronary heart disease	57.3%	50.0% *	0.80 (0.62,1.05)	56.3%	59.0%	0.98 (0.85,1.13)	52.0%	58.9% *	0.87 (0.73,1.03)
Chronic obstructive pulmonary disease	34.7%	35.7%	1.00	32.5%	38.2% *	1.30 (1.13,1.50)	26.9%	37.1% *	1.58 (1.32,1.89)
Heart failure	74.5%	75.0%	1.06 (0.77,1.44)	70.2%	81.5% *	1.47 (1.24,1.75)	58.2%	79.6% *	2.10 (1.75,2.52)
Peripheral vascular disease	18.3%	16.9%	1.02 (0.72,1.43)	17.7%	19.2%	1.00 (0.84,1.20)	14.7%	19.4% *	1.10 (0.88,1.37)

Am J Cardiol. Author manuscript; available in PMC 2010 August 1.

Characteristic	Hospital			1 Year			5 Years		
	Survivors (n=4,229)	Decedents (n=308)	Adjusted O.R.	Survivors (n=2,597)	Decedents (n=1,632)	Adjusted O.R.	Survivors (n=995)	Decedents (n=3,234)	Adjusted O.R.
Sodium (mg/dl)	137.3%	136.8%	0.98 (0.96,1.00)	137.4%	137.1% [*]	0.99 (0.98,1.01)	137.5%	137.2%	1.00 (0.98,1.01)
Systolic blood Pressure (mmHg)	145.6%	130.9% [*]	0.99	149.8%	138.9% [*]	0.99	151.9%	143.7% [*]	1.00
Diastolic blood Pressure (mmHg)	77.3%	70.1% [*]	(0.99,1.00)	79.1%	74.3% [*]	(0.99,0.99)	81.7%	75.9% [*]	(0.99,1.00)
Estimated GFR	63.5%	58.6% [*]	(0.98,1.00)	66.4%	58.8% [*]	(1.00,1.01)	73.9%	60.2% [*]	(0.99,1.00)
			(1.00,1.01)			(1.00,1.01)			(1.00,1.00)

* P<0.05

[†] 95% confidence intervals

GFR = glomerular filtration rate