The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/2586-940X.htm

Readmission after hospitalization for heart failure in elderly patients in Chapidze Emergency Cardiology Center, Georgia

Received 20 July 2020
Revised 9 November 2020
2 December 2020
10 December 2020
Accepted 21 December 2020

Tengiz Verulava
School of Medicine and Healthcare Management, Caucasus University, Tbilisi, Georgia and
Faculty of Social and Political Sciences, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
Revaz Jorbenadze
Chapidze Emergency Cardiology Center, Tbilisi, Georgia
Ana Lordkipanidze
Faculty of Social and Political Sciences, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia
Ana Gongadze
School of Medicine and Healthcare Management, Caucasus University, Tbilisi, Georgia, and
Michael Tsverava and Manana Donjashvili
Chapidze Emergency Cardiology Center, Tbilisi, Georgia

Abstract

Purpose – Heart Failure (HF) is one of the leading mortality causes in elderly people. The purpose of this study is to assess readmission rates and reasons in elderly patients with HF.

Design/methodology/approach – The authors explored medical records of elderly patients with HF (75 years and more) at Chapidze Emergency Cardiology Center (Georgia) from 2015 to 2019. The authors analyzed the structure of the cardiovascular diseases and readmission rates of hospitalized patients with HF (I50, I50.0 I50.1). A multivariate logistic regression model was used to identify factors, associated with readmission for any reason during 6–9 months after the initial hospitalization for HF.

Findings – The major complication of cardiovascular diseases in elderly patients is HF (68.6%). Hospitalization rates due to HF in elderly patients have increased in recent years, which is associated with the population aging process. This trend will be most likely continue. Despite significant improvements in HF treatment, readmission rates are still high. HF is the most commonly revealed cause of readmission (48% of all readmissions). About 6–9 months after the primary hospitalization due to HF, readmission for any reason was 60%. Patients had concomitant diseases, including hypertension (43%), myocardial infarction (14%), diabetes (36%) and stroke (8%), affecting the readmission rate.

Originality/value – HF remains an important problem in public health. During HF-associated hospitalizations, both cardiac and non-cardiac conditions should be addressed, which has the potential for

© Tengiz Verulava, Revaz Jorbenadze, Ana Lordkipanidze, Ana Gongadze, Michael Tsverava and Manana Donjashvili. Published in *Journal of Health Research*. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at http://creativecommons.org/licences/by/4.0/legalcode

Journal of Health Research
Vol. 36 No. 3, 2022
pp. 575-583
Emerald Publishing Limited
e-ISSN: 2586-940X
p-ISSN: 0857-4421
DOI 10.1108/JHR-07-2020-0294

health problems and disease progression. Some readmissions may be prevented by the proper selection of medicines and monitoring.

Keywords Heart failure, Readmission, Hospitalization, Aging, Georgia
Paper type Research paper

Introduction

Heart failure (HF) is a large and increasing problem worldwide, causing high morbidity and mortality and requiring expensive treatment. Around 17.0 million people died from cardiovascular diseases in 2016, accounting for 31.4% of mortality [1]. Approximately 66,670 patients have HF in Georgia (150 per 100,000 population), annually more than 7,330 people are initially diagnosed with it and the mortality rate is 1% [2].

The studies report that HF incidence and mortality risk from initial hospitalization is higher in males than in females [3]. The outcomes for patients with HF are unfavorable. Half the patients die within four years, and in the case of a severe form of HF, 50% of patients die within the first year.

The achievements in HF diagnostics and treatment during the past decade resulted in an increase in life expectancy and population aging, which, in turn, increased prevalence. Studies prove that HF incidence and mortality have reduced since the 1990s [4]. This is significantly because of the use of medicines such as angiotensin-converting enzyme inhibitors, beta-blockers and aldosterone antagonists. After the initial diagnosis of HF, the estimated life expectancy during one year is 72–75%, and in five years is 35–52% [5].

An increase in patients' life expectancy and accordingly, the population aging process, progress in ischemic heart disease and hypertension treatment have promoted an increase in the number of patients with HF during the past two decades [6]. In patients with HF, age is associated with an increased risk of cardiovascular diseases and mortality rate. Studies report that the hospitalization rate of patients with HF is higher above 65 years [7]. Low degrees of physical activity and depression and anxiety in elderly patients increase disease risk and aggravates its clinical results [8].

Studies report that patients hospitalized for HF have a high risk of readmission [9]. The major reason for most of the readmission cases were other, non-cardiovascular diseases, like respiratory tract infections, kidney disorders, indicating the spread of concomitant diseases in patients with HF. Elderly patients with HF are mostly observed to have concomitant chronic diseases (hypertension, atrial fibrillation, peripheral vascular disease, coronary artery disease, valvular disease, respiratory tract disease, kidney failure) [10].

The prognosis of the elderly patients with HF emphasizes the importance of the methods of prevention strategies, early detection and treatment, which can prevent myocardial disfunction, especially for people with a high risk of developing HF due to hypertension, diabetes or myocardial infarction.

The major problems in elderly patients with HF are not adhering to modern clinical recommendations, incomplete usage of medicines or inaccurate dosage [11]. Therefore, patients with HF frequently do not benefit from effective treatment regimens due to the above. In this regard, adherence to the proper treatment conditions is essential for patients with HF. It is also important that patients should be involved in the clinical decision-making process regarding their treatment.

Comprehensive planning of discharge, including consultation regarding taking medications and their revision, improved communication between patient and doctor and further continuous surveillance, can promote a readmission reduction. However, usage of cardiac implants together with optimal medicinal treatment successfully reduces hospitalization rates for patients with HF [12].

Studies report that elderly patients with HF are rarely included in randomized controlled trials [13]. Therefore, data about them are limited. Despite the important changes in HF

management during recent years, little is known about the outcomes in elderly patients with HF. The goal of our study was the assessment of readmission in elderly patients with HF.

Methodology

We obtained all hospital claims records of 75-year-old and older patients with cardiovascular diseases treated in Chapidze Emergency Cardiology Center (Tbilisi, Georgia) between 2015 and 2019. Hospital claims included admission and discharge dates, sex, age and International Classification of Diseases (ICD-9) I00–I99 codes for cardiovascular diseases.

Readmission rates for hospitalized patients with HF were studied by the following codes: I50 HF, I 50.0 congestive heart failure, I50.1 left ventricular heart failure, I50.9 HF, not specified. Readmission rates of elderly patients with HF were assessed by the age group and hospitalization years. Readmission was assessed since the discharge day.

Patients were divided into categories by age group (75–80 years old, 81–85 years old, 86–90 years old and more than 90 years old), to compare within the elderly age group.

Besides the age, patient features included hospitalization for cardiovascular diseases (I00–I99), hospitalization for HF (I50, I50.0, I50.1, I50.9), hospital stay duration, concomitant diseases.

A multivariate logistic regression model was used to identify factors, associated with readmission for any reason during 6–9 months after the initial hospitalization for HF. Readmission for any reason during 6–9 months after the initial hospitalization for HF was taken as a dependent variable. Independent variables included: age, gender, length of stay during the initial hospitalization, concomitant diseases, cardiac device implantation during initial hospitalization for HF, hospitalization during 6–9 months period before the initial hospitalization for HF and hospitalization for HF during the previous calendar year.

Statistical analyses were done on the basis of the social statistics program SPSS.

Ethical issue

This study passed the ethical review from the Health Research Ethics Committee of the Health Policy Institute numbered 36/5/12/2019.

Results

Our study showed that between 2015 and 2019, 8,623 patients aged 75 years and older with cardiovascular diseases (ICD10 – I00–I99) had received treatment in the Emergency Cardiology Center. Further, 9,916 hospitalization cases occurred within this period. From the cardiovascular system diseases, angina pectoris (43.83%) and acute myocardial infarction (12.54%) were mostly observed in elderly patients (Table 1). Most patients were aged 75–80

	Nosological groups	*n*	%
I20	Angina (angina pectoris)	3,780	43.83
I21	Acute myocardial infarction	1,082	12.54
I35	Non-rheumatic lesions of the aortic valve	605	7.02
I25	Chronic ischemic heart disease	593	6.87
I11	Hypertensive heart disease	511	5.93
I08	Simultaneous damage to several valves	430	4.99
I34	Non-rheumatic lesions of the mitral cells	426	4.94
	Other diseases	1,196	13.88
	Total cases of cardiovascular system diseases	8,623	100

Table 1. Cardiovascular system diseases (I00–I99) by nosological groups in elderly patients (2015–2019)

years (64.6%) and were male (63.6%); however, with age, the number of female patients increased.

Of the patients with cardiovascular diseases, 5,912 patients (68.6%) had complications due to HF. Further, 7,508 hospitalization cases for HF were observed within this period. The intrahospital mortality rate associated with initial hospitalization for HF was 1.8%. The results reported in the study are based on survived patients after the initial hospitalization for HF.

In the 6–9-month period before the initial hospitalization, 43% of patients (n = 2,542) had one or more hospitalizations for any reason. Hospitalization for HF during the previous calendar year was observed in 14% of patients (n = 828). The data of hospitalized patients with HF are presented in Table 2. The majority of the patients with HF were people aged 75–80 years (n = 3,614, 61%) and males (n = 3,665, 62%). The average length of stay of the hospitalized patients with HF was 5.2 ± 5.1 days, approximately 82% of patients (n = 4848) were hospitalized for ≤ 7 days. Also, 56% of patients had coronary arteries disease, 47% – hypertension, 35% – diabetes. 0.8% of patients had cardiac implants during the hospitalization for HF.

Most of the HF-associated diseases were reported for left ventricular failure (n = 3,843, 65%). The study reported that the number of hospitalizations of elderly patients with HF increased, but the dynamics had a more wavy pattern (Table 3). Further, 6–9 months after the hospitalization for HF in 56% of patients (n = 3,311), minimum of one readmission was observed, with an average of 1.9 readmissions per each patient (Table 4). The most common cause for readmission during this period was HF (48% of all readmissions). Also, 6–9 months after the initial hospitalization for HF, readmission for any reason was 60%. The second and

	n	%
Age (years)		
75–80	3,614	61
81–85	1,579	27
86–90	628	11
≥ 90	91	1
Total	5,912	100
Sex		
Female	2,247	38
Male	3,665	62
Initial hospital stay duration		
Average ± SD		
≤ 7 days	5.2 ± 5.1 4848	82
> 7 days	1,064	18
Concomitant diseases (respondent could have more than one disease)		
Diabetes	2,069	35
Hypertension	2,779	47
Myocardial infarction	1,005	17
Stroke	355	6
Coronary arteries disease	3,311	56
Peripheric vascular disease	296	5
Cardiac device implantation during initial hospitalization for HF***	47	0.8
Hospitalization during 6–9 months before the initial hospitalization for HF	2,542	43
Hospitalization for HF during the previous calendar year	828	14

Note(s): ***Pacemaker implantation, cardioverter defibrillator implantation, resynchronizer implantation

Table 2.
HF complications in elderly patients with cardiovascular system diseases, by age

	All (n = 5,912; 100%)	75–80 y/o (n = 3,614; 61%)	81–85 y/o (n = 1,579; 27%)	86–90 y/o (n = 628; 11%)	>90 y/o (n = 91; 1%)
I50.0 congestive heart failure	*578 (9.8)*	*412 (11.4)*	*116 (7.3)*	*43 (6.8)*	*7 (7.7)*
2019	198 (100)	112 (56.6)	64 (32.3)	18 (9.1)	4 (2)
2018	83 (100)	48 (57.7)	22 (26.6)	11 (13.3)	2 (2.4)
2017	57 (100)	35 (61.4)	11 (19.3)	11 (19.3)	0
2016	166 (100)	166 (100)	0	0	0
2015	74 (100)	51 (68.9)	19 (25.7)	3 (4.1)	1 (1.3)
I50.1 left ventricular heart failure	*3,843 (65)*	*2,217 (61.3)*	*1,137 (72)*	*441 (70.2)*	*48 (52.7)*
2019	825 (100)	405 (49.1)	301 (36.5)	103 (12.5)	16 (1.9)
2018	763 (100)	494 (64.7)	190 (24.9)	76 (10)	3 (0.4)
2017	900 (100)	586 (65.1)	217 (24.1)	84 (9.3)	13 (1.5)
2016	940 (100)	462 (49.1)	331 (35.2)	139 (14.8)	8 (0.9)
2015	415 (100)	270 (65.1)	98 (23.6)	39 (9.4)	8 (1.9)
I50.9 HF, not specified	*1491 (25.2)*	*985 (27.3)*	*326 (20.7)*	*144 (23)*	*36 (39.6)*
2019	262 (100)	165 (63)	74 (28.2)	18 (6.9)	5 (1.9)
2018	348 (100)	219 (62.9)	82 (23.6)	40 (11.5)	7 (2)
2017	412 (100)	258 (62.6)	92 (22.3)	51 (12.4)	11 (2.7)
2016	134 (100)	117 (87.3)	0	9 (6.7)	8 (6)
2015	335 (100)	226 (67.5)	78 (23.3)	26 (7.7)	5 (1.5)

Table 3. Types of HF complications in elderly patients with cardiovascular system disease, by age and years

third most common causes of readmission were pneumonia and aggravated chronic obstructive pulmonary disease, respectively.

Table 4 compares data of those patients with readmission during 6–9 months with the data of the survived patients and without readmission. Patients with the readmission after the initial hospitalization for HF had a greater length of stay during the initial hospitalization; they were more often hospitalized during previous years and had coronary artery disease, diabetes, peripheral vascular disease, stroke. These patients had fewer cardiac implants during the initial hospitalization for HF.

A multivariate logistic regression model was used to identify the factors associated with readmission for any reason during 6–9 months after the initial hospitalization for HF (Table 5). Dead patients were excluded from the study. The model demonstrated that age was one of the most important factors in readmission after 6–9 months. Patients aged 75–80 had an increased likelihood of readmission compared with patients between 81 and 90 years of age. Other factors associated with an increase in readmission include males, length of stay for more than seven days, coronary artery disease, hospitalization during 6–9 month period before the initial hospitalization for HF and hospitalization for HF during the previous year.

Discussion

Retrospective analyses of the elderly patients after the initial hospitalization due to HF report that despite important achievements in HF treatment, the readmission rate is still high. The most common reason for readmission is HF (48% of all readmissions). Similar rates are reported by other studies [14]. However, this rate significantly exceeds the rates reported by other studies [15]. The readmission rate for all reasons in 6–9 months after the initial hospitalization due to HF was 60%. Similar results were reported by other studies [16].

	Patients with readmission during 6–9 months (n = 3,311; 56%)	Survived patients and without readmission during 6–9 months (n = 2,601; 44%)
Age (years)		
75–80	1,192 (36%)	1,015 (39%)
81–85	927 (28%)	650 (25%)
86–90	795 (24%)	520 (20%)
≥ 90	397 (12%)	416 (16%)
Total	3,311 (100%)	2,601 (100%)
Sex		
Female	1,035 (31%)	1,212 (47%)
Male	2,276 (69%)	1,389 (53%)
Length of stay during the initial hospitalization		
Average ± SD	5.6 ± 5.8	4.2 ± 3.1
≤ 7 days	2,417 (73%)	2,159 (83%)
> 7 days	894 (27%)	442 (17%)
Concomitant diseases		
(1) Diabetes	1,192 (36%)	884 (34%)
(2) Hypertension	1,424 (43%)	1,353 (52%)
(3) Myocardial infarction	464 (14%)	286 (11%)
(4) Stroke	265 (8%)	208 (8%)
(5) Coronary arteries disease	199 (6%)	104 (4%)
(6) Peripheric vascular disease	232 (7%)	156 (6%)
Cardiac device implantation during initial hospitalization for HF***	26 (0.8%)	34 (1.3%)
Hospitalization during 6–9 months period before the initial hospitalization for HF	1,755 (53%)	1,092 (42%)
Hospitalization for HF during the previous calendar year	795 (24%)	390 (15%)

Table 4.
Comparison of patients' data with readmission with the data of the survived patients and without readmission during 6–9 months since the first hospitalization

The second and third reasons for readmission were pneumonia and exacerbation of chronic obstructive pulmonary disease, respectively. Patients reported concomitant diseases, like hypertension (43%), myocardial infarction (14%), diabetes (36%), peripheral vascular disease (7%) and stroke (8%), affected the readmission rate. Similar results were reported by other studies [17]. This indicates that readmission may be caused by non-cardiac conditions such as pneumonia, kidney failure and chronic obstructive pulmonary diseases. Studies report that non-selective receptor antagonists may aggravate chronic obstructive pulmonary disease and after initiating treatment for systolic heart failure, elderly patients may have more adverse events [18]. Some readmissions caused by non-cardiac reasons may be prevented by the proper selection of medicines and monitoring. Besides, elderly patients are in the high-risk group for hospital-acquired infections. Accordingly, preventive measures against elderly patients may reduce pneumonia-associated readmission cases [19]. Thus, both cardiac and non-cardiac conditions should be considered during HF-associated hospitalization in elderly patients.

The study reported that more than 80–90% of the patients with HF were discharged home after hospitalization [20]. The intrahospital mortality rate associated with initial hospitalization for HF was 1.8%, and the average length of stay for the initial hospitalization was 5.2 ± 5.1 days. This rate is significantly lower compared to the results of other studies [21].

Variables	β	Odds ratio	95% CI	p-value
Age (years)				
75–80 (reference)		1.00		<0.001
81–85	−0.20	0.81	(0.69, 0.95)	0.012
86–90	−0.40	0.67	(0.56, 0.79)	<0.001
>90	−0.47	0.62	(0.52, 0.75)	<0.001
Male	0.65	1.91	(1.72, 2.13)	<0.001
Length of stay > 7 days	−0.06	0.55	(0.48, 0.62)	<0.001
Diabetes	0.09	1.09	(0.98, 1.21)	0.111
Hypertension	−0.36	0.69	(0.63, 0.77)	<0.001
Myocardial infarction	−1.89	0.15	(0.13, 0.17)	<0.001
Stroke	0.01	1.00	(0.83, 1.20)	0.992
Coronary artery disease	0.43	1.54	(1.20, 1.94)	<0.001
Peripheric vascular disease	0.17	1.18	(0.95, 1.45)	0.120
Cardiac device implementation during initial hospitalization for HF	−0.52	0.60	(0.36, 1.00)	0.049
Hospitalization during the 6–9-month period before the initial hospitalization for HF	0.44	1.56	(1.40, 1.73)	<0.001
Hospitalization for HF during the previous year	0.58	1.79	(1.56, 2.05)	<0.001

Note(s): Nagelkerke $R^2 = 0.52$

Table 5. Multivariate regression of the independent variable on patient's readmission

The study reported that patients without cardiac implants during initial hospitalization for HF had higher rates of readmission and mortality; however, the result was not statistically significant, probably due to the low number of observations.

The research showed that HF is a major complication of circulatory system diseases (68.6%), and the most common of these diseases is HF syndrome due to ventricular failure (65%). The study proved that hospitalization rates in elderly patients with HF increased, which is associated with the population aging process. This trend is likely to continue in the next years.

Conclusion

Our study proves that the number of hospitalizations for HF increased in the elderly population, which is related to the population aging process. This trend is likely to continue in subsequent years. Although clinical outcomes of elderly patients for circulatory system diseases and HF improved during the past years, the readmission rate still remains high. This indicates that HF continues to be a major problem in health care. Considering the fact that the readmission reasons in elderly people may be non-cardiac conditions besides HF, both cardiac and non-cardiac conditions should be considered during hospitalizations for HF. Some readmissions may be prevented by the proper selection of medicines and monitoring.

Our study reported the need to determine the measures to decrease HF-related readmission rates. The study provides new information regarding the features and outcomes in elderly patients with HF in Georgia. The study allows us to determine further areas of research for elderly patients with HF.

Conflict of Interest: None

References

1. World Health Organization [WHO]. Cardiovascular diseases (CVDs): key facts. [updated 2017 May 17; cited 2020 Jun]. Available at: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds).

2. Georgian Society of Cardiology. Diagnostics and management of chronic heart failure. Tbilisi, Georgia: Georgian Society of Cardiology; 2006.
3. Bibbins-Domingo K, Pletcher MJ, Lin F, Vittinghoff E, Gardin JM, Arynchyn A, *et al.* Racial differences in incident heart failure among young adults. N Engl J Med. 2009; 360(12): 1179-90. doi: 10.1056/NEJMoa0807265.
4. Teng TH, Finn J, Hobbs M, Hung J. Heart failure: incidence, case fatality, and hospitalization rates in Western Australia between 1990 and 2005. Circ Heart Fail. 2010; 3(2): 236-43. doi: 10.1161/circheartfailure.109.879239.
5. Levy D, Kenchaiah S, Larson MG, Benjamin EJ, Kupka MJ, Ho KK, *et al.* Long-term trends in the incidence of and survival with heart failure. N Engl J Med. 2002; 347(18): 1397-402. doi: 10.1056/NEJMoa020265.
6. Woodham N, Taneepanichskul S, Somrongthong R, Auamkul N. Medication adherence and associated factors among elderly hypertension patients with uncontrolled blood pressure in rural area, Northeast Thailand. J Health Res. 2018; 32(6): 449-58. doi: 10.1108/JHR-11-2018-085.
7. 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(7): 728-34. doi: 10.1016/j.amjmed.2005.04.013.
8. Sangprasert P, Palangrit S, Tiyoa N, Pattaraarchachai J. Effects of mindfulness-based health education practice on health behaviors and quality of life among hypertensive patients A quasi-experimental research. J Health Res. 2019; 33(3): 186-96. doi: 10.1108/JHR-07-2018-0059.
9. Verulava T, Jincharadze N, Jorbenadze R. Role of primary health care in re-hospitalization of patients with heart failure. Georgian Med News. 2017; 264(3): 135-9.
10. Metra M, Mentz RJ, Chiswell K, Bloomfield DM, Cleland JG, Cotter G, *et al.* Acute heart failure in elderly patients: worse outcomes and differential utility of standard prognostic variables. Insights from the PROTECT trial. Eur J Heart Fail. 2015; 17(1): 109-18. doi: 10.1002/ejhf.207.
11. Verulava T, Maglakelidze T, Jorbenadze R. Hospitalization timeliness of patients with myocardial infarction. East J Med. 2017; 22(3): 103-9. doi: 10.5505/ejm.2017.36854.
12. Cleland JG, Daubert JC, Erdmann E, Freemantle N, Gras D, Kappenberger L, *et al.* The effect of cardiac resynchronization on morbidity and mortality in heart failure. N Engl J Med. 2005; 352(15): 1539-49. doi: 10.1056/NEJMoa050496.
13. Kosiborod M, Lichtman JH, Heidenreich PA, Normand SL, Wang Y, Brass LM, *et al.* National trends in outcomes among elderly patients with heart failure. Am J Med. 2006; 119(7): 616.e1-7. doi: 10.1016/j.amjmed.2005.11.019.
14. Tuppin P, Cuerq A, de Peretti C, Fagot-Campagna A, Danchin N, Juillière Y, *et al.* Two-year outcome of patients after a first hospitalization for heart failure: a national observational study. Arch Cardiovasc Dis. 2014; 107(3): 158-68. doi: 10.1016/j.acvd.2014.01.012.
15. Vader JM, LaRue SJ, Stevens SR, Mentz RJ, DeVore AD, Lala A, *et al.* Timing and causes of readmission after acute heart failure hospitalization-insights from the heart failure network Trials. J Card Fail. 2016; 22(11): 875-83. doi: 10.1016/j.cardfail.2016.04.014.
16. Tuppin P, Cuerq A, de Peretti C, Fagot-Campagna A, Danchin N, Juillière Y, *et al.* Two-year outcome of patients after a first hospitalization for heart failure: a national observational study. Arch Cardiovasc Dis. 2014; 107(3): 158-68. doi: 10.1016/j.acvd.2014.01.012.
17. Krumholz HM, Wang Y, Mattera JA, Wang Y, Han LF, Ingber MJ, *et al.* An administrative claims model suitable for profiling hospital performance based on 30-day mortality rates among patients with heart failure. Circulation. 2006; 113(13): 1693-701. doi: 10.1161/circulationaha.105.611194.
18. Dinsdale C, Wani M, Steward J, O'Mahony MS. Tolerability of spironolactone as adjunctive treatment for heart failure in patients over 75 years of age. Age Ageing. 2005; 34(4): 395-8. doi: 10.1093/ageing/afi104.

19. American Thoracic Society; Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med. 2005; 171(4): 388-416. doi: 10.1164/rccm.200405-644ST.

20. Shah RU, Tsai V, Klein L, Heidenreich PA. Characteristics and outcomes of very elderly patients after first hospitalization for heart failure. Circ Heart Fail. 2011; 4(3): 301-7. doi: 10.1161/circheartfailure.110.959114.

21. Steinberg BA, Zhao X, Heidenreich PA, Peterson ED, Bhatt DL, Cannon CP, *et al.* Trends in patients hospitalized with heart failure and preserved left ventricular ejection fraction: prevalence, therapies, and outcomes. Circulation. 2012; 126(1): 65-75. doi: 10.1161/circulationaha.111.080770.

Corresponding author
Tengiz Verulava can be contacted at: tengiz.verulava@gmail.com

For instructions on how to order reprints of this article, please visit our website:
www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: **permissions@emeraldinsight.com**