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...
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, I50.0 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

| Age (years) | n   | %   |
|------------|-----|-----|
| 75–80      | 3,614| 61  |
| 81–85      | 1,579| 27  |
| 86–90      | 628  | 11  |
| ≥ 90       | 91   | 1   |
| Total      | 5,912| 100 |

| Sex         | n   | %   |
|-------------|-----|-----|
| Female      | 2,247| 38  |
| Male        | 3,665| 62  |

| Initial hospital stay duration | n   | %   |
|--------------------------------|-----|-----|
| ≤ 7 days                       | 4848| 82  |
| > 7 days                       | 1,064| 18  |

| Concomitant diseases (respondent could have more than one disease) | n | % |
|-------------------------------------------------------------------|---|---|
| Diabetes                                                          | 2,069| 35 |
| Hypertension                                                      | 2,779| 47 |
| Myocardial infarction                                            | 1,905| 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**
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].
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 inhospital 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].

| Age (years) | Patients with readmission during 6–9 months (n = 3,311; 56%) | Survived patients and without readmission during 6–9 months (n = 2,601; 44%) |
|-------------|-------------------------------------------------------------|--------------------------------------------------------------------------------|
| 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|                                                            |                                                                              |
| ≤ 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) Peripheral 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 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.

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| Variables | Odds ratio | 95% CI | p-value |
|-----------|------------|--------|---------|
| Age (years) |           |        |         |
| 75–80 (reference) | 1.00 |        | <0.001 |
| 81–85 | -0.20 | 0.81 (0.68, 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.
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