Profile of Patients with Heart Failure: A Multi-Site Thailand Heart Failure Snapshot Study

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Abstract

Background: The prevalence of heart failure (HF) is increasing in many low- and middle-income countries but the limited availability of data on the patient profile and clinical outcomes of patients with HF challenges health services planning.

Methods: The Thai HF Snapshot Study was a multi-site, observational study conducted in Thailand to document demographic, clinical and sociodemographic characteristics, and to compare clinical outcomes by the level of the hospital.

Results: A total of 512 participants: mean age 64.9±15.3 years; female (55.9%) were recruited across Thailand. The most frequently identified admitting diagnosis was ischemic heart disease (45.1%). Most patients (70.3%) were classified as New York Heart Association class II at discharge. Patients in super tertiary care settings were frailer (3.2 vs. 2.9; p=0.015), had more depressive symptoms (8.1 vs. 5.7; p<0.001) and had lower functional status (66.2 vs. 73.3; p<0.001) than patients in tertiary care.

Conclusion: Although HF patients admitted to super tertiary centers have access to advanced technology and healthcare specialists, clinical outcomes were worse. Interventions are urgently needed to ensure improved HF management considering the psychosocial determinants of health in Thailand.

Background

Cardiovascular disease (CVD) is one of the top three causes of death in Thailand [(1)]. Heart failure (HF) is the terminal pathway in CVD and the prevalence is rising globally [(2)]. As a consequence, healthcare utilization is increasing, placing pressure and burden on healthcare systems [(3)].

The healthcare system of Thailand, a low- and middle-income country (LMIC), is funded by the Department of Medical Services at the Ministry of Public Health, which controls public health services, medical services, and government hospitals. Public health facilities are categorized on the level of care: primary, secondary, tertiary, and super tertiary care [(4)]. Although super tertiary care hospitals provide more sophisticated treatments, facilities, and access to evidence-based care, the number of super tertiary care hospitals is limited and insufficient for the large, local populations.

Universal healthcare is provided through three programs in Thailand: the Civil Servants' Medical Benefits Scheme (CSMBS) for civil servants and their families, Social Security for private employees, and the Universal Health Coverage (UHC) scheme that is available to all other Thai nationals [(5)]. The UHC scheme ensures that the Thai population has health insurance, particularly for low-income households, and allows patients to access services in their health district and, if necessary, to be referred for specialist treatment elsewhere.

The outcomes of patients with HF are associated not only with physical symptoms but also with several factors in the health system such as the level of care and health insurance. There is sparse information

on the profile of HF management and sociodemographic characteristics in Thailand [6]. Previous treatment guidelines have been developed without considering the unique characteristics of the Thai population [7–9]. Therefore, the outcomes of patients with HF such as high rehospitalization rates, increased healthcare utilization, and poor quality of life are still not optimal.

The primary objective of this study was to obtain cross-sectional data on management of patients with HF in Thailand and examine sociodemographic and clinical characteristics of patients using the framework of the New South Wales Heart Failure Snapshot Study [10].

Methods

Study population

The Thailand HF Snapshot Study was an observational study of patients in Thailand who were admitted to five hospitals with a verified diagnosis of HF. Each hospital had an attending cardiologist responsible for confirming the admission diagnosis. Participants were recruited by a convenience sampling at the inpatient department of medical units. Inclusion criteria were as follows: (1) 18 years of age and over with HF at admission, (2) admitted to a participating hospital, (3) presented with first-onset HF or acute decompensation of chronic HF by Framingham criteria or echocardiogram. Exclusion criteria were as follows: (1) in critical stage including on mechanical ventilator, (2) history of psychiatric disorders or existing neurological deficit including aphasia; and (3) could not speak or write in the Thai language.

The study proposal was submitted to each participating hospital for ethical approval. Once the researcher received permission to collect data, the researcher or research assistant requested cooperation from the staff of the unit for notification of the admission or discharge of patients in ward for eligible patients regarding inclusion criteria. The researcher or research assistant also requested permission from patients to participate in the study and asked them to sign informed consent forms affirming their willingness to participate in the study.

For quality control and to ensure data standardization, all research assistants were trained to use the questionnaire and to collect data. Research assistants were evaluated by reviewing ten patients' medical records and the data recording on the questionnaire. The principal investigator checked for inter-rater agreement and reviewed the results together with the research assistants.

Measurement

During hospitalization, participants completed the questionnaire including demographic data, quality of life, comorbidity index, frailty, and depression. Other treatment, demographic and clinical data were collected by chart review.

The Charlson Comorbidity Index is a method of categorizing comorbidities of patients based on the International Classification of Diseases (ICD) diagnosis codes. Each comorbidity category has an

associated weight (from 1 to 6) based on the adjusted risk of mortality or resource use; the sum of all the weights results in a single comorbidity score for a patient. A score of zero indicates that no comorbidities were found. The higher the score, the more likely the predicted outcome will result in higher resource use or mortality [11].

Frailty—an entity recognized by clinicians, with multiple manifestations and with no single symptom being sufficient or essential in its presentation—was measured by the Survey of Health, Ageing and Retirement in the European Frailty Index (SHARE-FI) [12]. The total frailty score was calculated by an online computer program called DFactor score (DFS). The results were categorized into three groups by the program: not frail, pre-frail, and frail.

Depressive symptoms were assessed using the PHQ-9—a multipurpose instrument for screening, diagnosis, monitoring, and measuring the severity of depression. The instrument rates the frequency of the symptoms as the severity index. The PHQ-9 score can range from 0 to 27, since each of the 9 items can be scored from 0 (not at all) to 3 (nearly every day). A lower score is interpreted as less depression [13]. This study also categorized depression into five levels: minimal or none (0-4), mild (5-9), moderate (10-14), moderately severe (15-19), and severe (20-27). In this study, the internal consistency using Cronbach's alpha was 0.81.

The NSW HF Snapshot Study questionnaire was developed in English and this methodology has been undertaken in Nepal and Lebanon [14]. In this study, the questionnaire was translated into Thai. A back-translation technique was selected to translate from the original version into Thai [15]. Two bilingual translators were selected: one translating from English to Thai, the second blindly translating Thai to English. The two versions were examined for similarities between the original and target versions. In addition, some parts of the questionnaire were added or deleted due to differences of social and cultural issues. Questions including ethnicity, language spoken, and country of birth were deleted. Marital status, healthcare coverage, religion, educational attainment, income, and depression screening tools (PHQ-9), were added into the Snapshot Heart Failure Study questionnaire.

Statistical Methods

Continuous variables were reported as means (±SD) or medians and ranges where appropriate. Dichotomous variables were reported as prevalence percentage. We compared levels of hospitals (super tertiary care vs. tertiary care) with *t*-tests and chi-square tests for continuous and categorical variables, respectively. Dealing with missing data: the analysis will depend on how much missing data occurs in the study [16]. The missing in this study was lower than 15% so complete-case analysis technique was selected. All tests were two-tailed and statistical significance was accepted as a p-value < 0.05. All data were analyzed using the Statistical Package for the Social Sciences (SPSS) 25.

Results

Demographic data (Table 1)

This study comprised 512 participants in five hospitals. All participants were included and analyzed in the study. The mean age was 64.9±15.3 years; most (59.9%) were female. Also, 66.6% did not have a nominated general practitioner, and lived with family members (95.5%). Most were married (65.2%), used universal healthcare coverage (71.9%), and had elementary level educational attainment (53.3%). Almost all (90.4%) were Buddhists. The median income was 4948.3 Thai Baht or 150 US$, ranging from 0 to 100,000 Thai Baht; 17.8% had no income.

In both hospital settings, participants were predominately female and the average age of patients in a super tertiary hospital was slightly higher than those in tertiary care (66 vs. 64.5 years) (p=0.275). Participants in super tertiary hospitals (68%) were more likely to have a general practitioner than in tertiary care hospitals (15.4%) (p<0.001). They were also more likely to live alone, be single/divorced/widowed and report higher educational levels than participants in tertiary care hospitals (all ps<0.001). There was no difference in average income between the super tertiary care and the tertiary care group.

Admission details and known medical history and cardiac investigation (Table 2)

Most participants in this study were admitted to tertiary hospitals (65.8%). In both hospital settings, the most frequently identified diagnoses at admission included ischemic heart disease (45.1%). The first recorded rhythms on admission were sinus rhythm (68.9%). The first recorded mean systolic and diastolic blood pressures were 136.9±29.3 and 79.9±17.3 mmHg. Patients in super tertiary care had more comorbidities than those in tertiary care including chronic HF 72.6% versus 31.8% (p<0.001), renal disease 45.1% versus 19% (p<0.001), diabetes 52% versus 29.7% (p<0.001), and apnea 6.9% versus 3% (p = 0.04). The mean Charlson comorbidity index of patients in super tertiary care was higher (3.4) than for those in tertiary care (1.6) (p<0.001).

In the advanced investigation, 78.5% of patients were assessed by echocardiogram and the mean EF was 47.9±18.9; 28.3% were assessed by cardiac catheterization; most patients were found to have multi-vessel disease (55.9%). Patients in super tertiary care had greater access to advanced cardiac investigation than those in tertiary care including echocardiogram 90.9% versus 73.3% (p<0.001) and coronary angiography 48% versus 18.8% (p<0.001). Individuals in super tertiary care patients had better cardiac function than patients in tertiary care without statistical significance of 48.2 versus 47.8 (p=0.816).

Treatment received during admission and discharge medication (Table 3)

The most common therapies received by patients during their hospital stay included oxygen therapy (95.1%), intravenous diuretics (93.6%), invasive ventilation and cardiopulmonary resuscitation (16.8%), and intravenous glyceryl trinitrate and inotropic agents (12.3%). During the admission, patients in super tertiary care received more complicated treatment and advanced technology than patients in tertiary care

(all ps<0.001) such as nitroglycerine infusion 35.4% versus 15.1%, inotrope infusion 25.1% versus 5.6%, dialysis 10.3% versus 2.4%, CPAP or BiPAP 27.4% versus 1.8%, and invasive mechanical ventilation 26.9% versus 11.6%.At discharge, participants were mostly prescribed loop diuretics (69.9%), lipid-lowering agents (62.1%), antiplatelet (60.4%), and beta blockers (52.9%). The average diuretic dose was 78.7±120 mg/day and the average number of medications was 8±3.3 agents/day. Tertiary care providers (64%) prescribed more diuretics than super tertiary care providers (75.5%) (p=0.007); however, the average diuretic dose was lower (92.1 and 72.5 mg/day, respectively) but not statistically significant (p=0.226). Other medications included antihypertensive, vasodilator and lipid-lowering agents; patients in super tertiary settings received more medications, respectively, such as beta blockers (73.8% and 44.8%) (p<0.001), vasodilators (39.6% and 14.9%) (p<0.001), and lipid- lowering agents (72.6% and 59.4%) (p=0.004), so the total number of medications per day was higher (9.9 and 7.1 agents/day, respectively) (p<0.001).

Discharge clinical status and functional status (Table 4)

The mean length of stay was 8.6±9.1 days. Most patients (70.3%) were classified as New York Heart Association class II (mild symptoms) at discharge, and the majority (95.3%) were discharged home, 92.0% stayed with relatives as caregivers, and 3.5% died during hospitalization. Rehospitalization within one month after discharge was 13·7%. After discharge home, patients in super tertiary care were more likely to stay alone than those in tertiary care (p<0.001). Mortality was higher in super tertiary care (6.9%) than in tertiary care hospitals (1.8%) (p=0.003), and rehospitalization was higher in super tertiary care (16.7%) than in tertiary care hospitals (12.2%) but not statistically significant (p=0.161).

The average frailty score was 2.9±1.4; a large proportion of patients (75.8%) were assessed as being frail. The mean depression score was 6.5±5.3; a large proportion of patients (43.6%) were minimally or non-depressed, followed by 35.2% who were mildly depressed; 14.3% reported suicidal ideation. The AKPS mean score at discharge was 70.9±16.3.

Patients in super tertiary care were likely to have worse health outcomes; for example, more frail (3.2) than patients in tertiary care (2.9) (p=0.015); more depressive symptoms 8.1 versus 5.7 (p<0.001), respectively. Patients treated in super tertiary care setting reported more suicidal ideation (22.9%) than tertiary care patients (9.8%) (p<0.001). Performance status was also lower 66.2 and 73.3 (p<0.001), respectively.

Discussion

General characteristics of patients with heart failure

This study found was found to be mostly similar with previous studies in patients with HF. For instance, women suffered from HF more than men [17-21]. The mean age ranged from 60-67 years and more than 60% were married. Approximately three quarters used UHC coverage and had elementary educational attainment or below. The average income was less than 260 US$. Moreover, compared with the Thai

ADHERE registry, the only published study on HF epidemiology in Thailand, the demographic data were similar in the current study [22]. The majority of patients with HF in Thailand have been found to have low education, income, and used the UHC scheme.

However, our study provided more information regarding the changing of the community toward urbanization. Thai government administrations have traditionally invested and developed infrastructure mostly in urban areas such as Bangkok, with outlying provinces and rural communities significantly underfunded [23]. As a result, many people migrate toward Bangkok to work and support their family members who are left behind in rural areas. Moreover, the family structure has changed from extended to nuclear families or single in Bangkok [24]. Hence, the findings in our study aligned with the population structures in urban areas—that patients in super tertiary care were more likely to reside alone due to the high percentage of single, divorced, or widowed marital status compared with other tertiary care settings. However, patients in super tertiary care had higher educational attainment and income than tertiary care patients due to the opportunity to pursue higher education and higher paying jobs.

The Thai ADHERE registry [22] found that 66.5% of participants had a prior admission for HF while our study found 45.7%. The most common underlying diseases in the Thai ADHERE registry included ischemic heart disease, diabetes mellitus, chronic kidney disease, and previous stroke or transient ischemic attack, which concurred with our study. Previous studies have shown increasing risks of CVD among rural-urban migrants [24-27]. Urban area residence and migrant lifetime exposure to urban environments were both related to greater odds of hypertension, diabetes, and overweight. These comorbidities can develop into HF in the future. Therefore, our study found that patients in super tertiary care had higher average Charlson comorbidity index scores than patients in tertiary care settings. Moreover, the prevalence of each comorbidity was also greater, such as the prevalence of HF, renal disease, malignancy, and diabetes.

Availability of modern technology, heart failure guidelines and specialist multidisciplinary teams

The super tertiary hospitals in Bangkok are some of the largest hospital systems in Thailand. Since the super tertiary hospitals provide advanced treatment, modern technology, evidence-based practice applying to routine care, and are excellent healthcare centers with specialized multidisciplinary teams, they are routinely referred to as “university hospitals.” These hospitals are equipped with the best resources in Thailand, considering that they are medical schools for teaching and research. Hence, healthcare providers in super tertiary care in this study were able to assess patients’ medical conditions with more advanced technology than tertiary care hospitals, such as echocardiography and coronary angiography. Patients in super tertiary hospitals were treated by modern technology and complicated treatments such as nitroglycerine and inotrope infusion, and invasive mechanical ventilation more than patients in the tertiary care hospitals. In addition, a higher percentage of patients in super tertiary care were treated by nominated general practitioners than in tertiary care hospitals.

According to HF guidelines, treating comorbidities are important in HF management [28]. Poorly controlled comorbidities affect treatment of HF and worsen the symptoms. The current guidelines identify where the presence of HF should change the way a comorbidity would normally be treated. In this study, most of the admissions for HF were caused by ischemic heart disease. The guidelines recommend the use of a beta blocker as the first line drug to relieve symptoms and advise avoiding the use of calcium channel blockers in patients with ischemic heart disease. In addition, the treatment should focus on controlling blood pressure because hypertension is related to an increased risk of developing HF. ACE-inhibitors and beta blockers are recommended for controlling blood pressure and calcium channel blocker groups are to be avoided [28].

Both settings followed the HF guidelines by prescribing not only diuretics but also antihypertensive, lipid-lowering agents, and other medications for controlling comorbidities. Super tertiary hospitals prescribed more beta blockers, vasodilators, lipid-lowering agents, and nitrates than tertiary hospitals. The average total number of medications per day on discharge were higher in super tertiary care settings.

Health outcomes

Both hospital groups had almost the same symptom severity such as low ejection fraction and HF stages and functional classifications; however, patients in super tertiary care had worse health outcomes than patients in tertiary care hospitals. Patients in super tertiary care were found to be more frail, depressed, and poorer functional status than patients in tertiary care. In addition, super tertiary care hospitals also had higher rates of death during hospitalization and rehospitalization after discharge and tended to live alone after discharge.

Our findings could be partially explained by changes in cultural values, family structure, and lifestyle. According to Thai culture, citizens live with extended family members who are often caregivers for the sick family members [29]. In addition to assisting with healthcare needs, extended family members may also provide psychological, instrumental and informational social support in the form of preparing meals, reminding to take medication, supporting exercise and transferring to hospital [30]. Urbanization has completely changed this culture. People in metropolitan areas now live alone or in nuclear families. As family members become more self-reliant, sick family members become vulnerable to adverse health outcomes.

Heart failure treatment, social determinants of health and health outcomes

Patients in super tertiary care are exposed to modern treatment, clinical practice guidelines, and technology with healthcare provider specialists. However, the intensive treatment and care from multidisciplinary teams in super tertiary care are not completely effective for improving the outcome of patients with HF in urban areas. Urbanization is considered a determinant of health and one of the key drivers of non-communicable diseases, especially in low- and middle-income countries [27]. HF is a complex system in which behavior is affected by multiple individual-level and socioenvironmental

factors. These factors are heterogeneous and interdependent, and they interact dynamically [31]. Health behavior is consistent with biological, social, and environmental influences in that people are assumed to engage based on their preferences and attitudes. It becomes multilevel in that a person is constrained by factors that exert regulatory controls on their behaviors [6].

Interventions targeted directly at patients alone may not be beneficial for long-term outcomes. Shifting healthcare systems from hospital-based care toward community-based care is a potential strategy [32]. Using the strength of Thai culture by integrating family and caregivers into healthcare planning may improve the outcomes of patients with HF in Thailand. Thai patients with HF need family and caregivers to fulfill their healthcare planning for controlling the symptoms and avoiding the exacerbation due to the limitation of patient demographics including elderly, low-education, and low-income [33].

Limitation

The sample from this study were not able to include patients from all regions in Thailand. The study omitted one region due to the IRB application process, and budgetary limitations. However, this study presented data by level of hospital (super tertiary and tertiary care) providing a review of the spectrum of care. Moreover, social determinants of health of Thai patients may not vary regionally since as many cultures and beliefs are shared nationwide.

Conclusions

Although advanced technology and healthcare specialists are available in the hospitals, the outcomes of patients with HF are still not optimal. Patients spend most of their time at home, so the interventions should focus on developing sustainable healthy behavior. Social support and community-based interventions may help resolve this issue; however, additional research is still needed, particularly in urban settings because most of patients stay alone without caregivers.

Abbreviations

HF
Heart failure, CVD:Cardiovascular disease, LMIC:Low- and middle-income country, CSMBS:The Civil Servants' Medical Benefits Scheme, UHC:Universal Health Coverage, ICD:The International Classification of Diseases, SHARE-FI:The Survey of Health, Ageing and Retirement in the European Frailty Index, PHQ-9:The Patient Health Questionnaire-9, The NSW HF Snapshot:New South Wales Heart failure Snapshot, AKPS:The Australia-modified Karnofsky Performance Status, ADHERE:Thai Acute Decompensated Heart Failure Registry, ACE-inhibitors:Angiotensin-converting enzyme inhibitors

Declarations

Ethics approval and consent to participate

This study was reviewed and approved by Siriraj Institution Review Board protocol number 367/2560 (EC1). Written informed consent was obtained from the participant enrolled in this study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Conflicts of interest

The authors report no relationships that could be construed as a conflict of interest.

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Authors' contributions

Literature review, TT; Study design, TT, SS, PD; Data collection, TT, SD; Data analysis, TT SD NP, CB; Preparing the manuscript, TT, YC; Review and revise manuscript, WP, CH, PD.

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Tables

Table 1
Patient Demographics

Characteristics	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	p value
Gender No. (%) Female	286 (55.9)	90 (51.4)	196 (58.2)	0.146
Age mean years (SD)	64.9 (15.3)	66 (15.9)	64.5(14.9)	0.275
Nominated general practitioner No. (%) Yes	171 (33.4)	119 (68)	52 (15.4)	< 0.001
Living alone No. (%) Yes	23 (4.5)	18 (10.3)	5 (1.5)	< 0.001
Marital status No. (%)	37 (7.2)	20 (11.4)	17 (5)	< 0.001
Single	334 (65.2)	87 (49.7)	247 (73.3)	
Married	24 (4.7)	20 (11.4)	4 (1.2)	
Divorce	117 (22.9)	48 (27.4)	69 (20.5)	
Widowed				
Health care coverage No. (%)	368 (71.9)	95 (54.3)	273 (81)	< 0.001
UHC	32 (6.3)	10 (5.7)	22 (6.5)	
SSS	105 (20.5)	68 (38.9)	37 (11)	
CSMBS	7 (1.4)	2 (1.1)	5 (1.5)	
Private				
Religion No. (%)	463 (90.4)	166 (94.9)	297 (88.1)	0.02
Buddhism	6 (1.2)	2 (1.1)	4 (1.2)	
Islam	43 (8.4)	7 (4)	36 (10.7)	
Christian				

UHC = Universal health coverage; SSS = Social security scheme; CSMBS = Civil servant medical benefit scheme.

Characteristics	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	p value
Educational attainment No. (%)	77 (15.1)	9 (5.1)	68 (20.2)	< 0.001
No education	273 (53.3)	78 (44.6)	195 (57.9)	
Elementary school	93 (18.2)	40 (22.9)	53 (15.7)	
High school	22 (4.3)	13 (7.4)	9 (2.7)	
Diploma level	47 (9.2)	35 (20)	12 (3.6)	
Undergraduate level and over				
Income mean Thai Baht (SD)	7092.6	8438.9	6396.5	0.126
(1 US$=33 Thai Baht)	(11203.2)	(17042.9)	(6247.4)	
	215 US$	255 US$	194 US$	

UHC = Universal health coverage; SSS = Social security scheme; CSMBS = Civil servant medical benefit scheme.

Table 2
Admission Details, Known Medical History, and Cardiac Investigation

Characteristics	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	*p*-value
Precipitant for admission No. (%)	231 (45.1)	49 (28)	182 (54)	< 0.001
Ischemia	47 (9.2)	17 (9.7)	30 (8.9)	0.763
Infection	95 (18.6)	17 (9.7)	78 (23.1)	< 0.001
Rhythm	20 (3.9)	9 (5.1)	11 (3.3)	0.298
Medication	56 (10.9)	13 (7.4)	43 (12.8)	0.067
Diet or fluid	168 (32.8)	139 (79.4)	29 (8.6)	< 0.001
Other				
Rhythm No. (%)	353 (68.9)	76 (43.4)	277 (82.2)	< 0.001
Sinus rhythm	98 (19.1)	45 (25.7)	53 (15.7)	
Atrial fibrillation	61 (11.9)	54 (30.9)	7 (2.1)	
Other				
SBP mean (SD) n = 507	136.9 (29.3)	142.6 (35.9)	133.9 (24.6)	0.004
DBP mean (SD) n = 507	79.9 (17.3)	81.3 (21.1)	79.3 (14.9)	0.28
Chronic heart failure	234 (45.7)	127 (72.6)	107 (31.8)	< 0.001
Chronic pulmonary disease	26 (5.1)	9 (5.1)	17 (5)	0.962
Ischemic heart failure	155 (30.3)	62 (35.4)	93 (27.6)	0.067
Renal disease	143 (27.9)	79 (45.1)	64 (19)	< 0.001
Hemiplegia	22 (4.3)	8 (4.6)	14 (4.2)	0.825
Diabetes	321 (62.7)	84 (48)	237 (70.3)	< 0.001
None	133 (26)	56 (32)	77 (22.8)	
Yes without end organ damage	58 (11.3)	35 (20)	23 (6.9)	
Yes with end organ damage				

Characteristics	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	*p*-value
Liver disease	489 (95.5)	163 (93.1)	326 (96.7)	0.21
None	23 (4.5)	12 (6.9)	11 (3.3)	
Yes				
Obstructive sleep apnea	22 (4.3)	12 (6.9)	10 (3)	0.04
Heart failure etiology	122 (23.8)	34 (19.4)	88 (26.1)	0.092
Hypertension	265 (51.8)	58 (33.1)	207 (61.4)	< 0.001
Ischemic heart disease	68 (13.3)	18 (10.3)	50 (14.8)	0.15
Cardiomyopathy	156 (30.5)	111 (63.4)	45 (13.4)	< 0.001
Other				
Charlson comorbidity index mean (SD)	2.2 (2)	3.4 (2.2)	1.6 (1.6)	< 0.001
Echocardiogram No. (%)	402 (78.5)	159 (90.9)	243 (72.3)	< 0.001
Ejection fraction mean (SD)	47.9 (18.9)	48.2 (19.3)	47.8 (18.8)	0.816
	N = 400	N = 157	N = 243	
Coronary angiography No. (%)	145 (28.3)	84 (48)	61 (18.1)	< 0.001
Angiography finding No. (%) n = 145	27 (18.6)	18 (21.4)	9 (14.8)	0.016
Normal	37 (25.5)	14 (16.7)	23 (37.7)	
Single vessel disease	81 (55.9)	52 (61.9)	29 (47.5)	
Multi-vessel disease				

Table 3
Medical Treatment Received During This Admission and Discharge Medications

Characteristics No. (%)	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	*p*-value
Medical treatment received during admission				
IV Diuretics	479 (93.6)	169 (96.6)	310 (92.0)	0.045
IV NTG Infusion	113 (22.1)	62 (35.4)	51 (15.1)	< 0.001
IV inotrope infusion	63 (12.3)	44 (25.1)	19 (5.6)	< 0.001
Dialysis	26 (5.1)	18 (10.3)	8 (2.4)	< 0.001
Oxygen therapy	487 (95.1)	161 (92)	326 (96.7)	0.018
CPAP/BiPAP	54 (10.5)	48 (27.4)	6 (1.8)	< 0.001
Invasive mechanical ventilation	86 (16.8)	47 (26.9)	39 (11.6)	< 0.001
Discharge Medications				
ACE Inhibitor	198 (38.7)	52 (31.7)	146 (43.6)	0.011
ARB	48 (9.4)	14 (8.8)	34 (10.1)	0.637
Beta blocker	271 (52.9)	121 (73.8)	150 (44.8)	< 0.001
Digitalis	32 (6.3)	9 (5.5)	23 (6.9)	0.555
Antiarrhythmic	31 (6.1)	16 (9.8)	15 (4.5)	0.022
Nitrate	157 (30.7)	71 (43.3)	86 (25.7)	< 0.001

IV = Intravenous; NTG = Nitroglycerine; CPAP = continuous positive airway pressure

BiPAP = Bilevel positive airway pressure; ACE = Angiotensin converting enzyme

ARB = Angiotensin receptor blockers; CCB = Calcium channel blocker

Characteristics No. (%)	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	*p*-value
Aldosterone	92 (18)	30 (18.3)	62 (18.5)	0.954
Loop diuretic	358 (69.9)	105 (64)	253 (75.5)	0.007
Other vasodilator	115 (22.5)	65 (39.6)	50 (14.9)	< 0.001
Lipid lowering agent	318 (62.1)	119 (72.6)	199 (59.4)	0.004
Antiplatelet	309 (60.4)	104 (63.4)	205 (61.2)	0.631
Anticoagulant	98 (19.1)	56 (34.1)	42 (12.5)	< 0.001
CCB	133 (26)	43 (26.2)	90 (26.9)	0.878
Total daily discharge diuretic dose Mean mg/day (SD)	78.7 (120) N = 342	92.1 (154.6) N = 109	72.5 (99.6) N = 233	0.226
Total number of medications per day on discharge mean types (SD)	8 (3.3) N = 497	9.9 (3.2) N = 164	7.1 (2.8) N = 333	< 0.001
IV = Intravenous; NTG = Nitroglycerine; CPAP = continuous positive airway pressure				
BiPAP = Bilevel positive airway pressure; ACE = Angiotensin converting enzyme				
ARB = Angiotensin receptor blockers; CCB = Calcium channel blocker				

Table 4
Discharge Status and Functional Status

Characteristics	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	*p*-value
NYHA No. (%)	74 (14.5)	8 (4.8)	66 (19.6)	< 0.001
I	360 (70.3)	141 (84.4)	219 (65.2)	
II	61 (11.9)	16 (9.6)	45 (13.4)	
III	8 (1.6)	2 (1.2)	6 (1.8)	
IV				
Discharge direction No. (%)	488 (95.3)	161 (92.0)	327 (97.0)	0.011
Home	2 (0.4)	1 (0.6)	1 (0.3)	0.633
Residential facility	4 (0.8)	1 (0.6)	3 (0.9)	0.701
Another medical facility	18 (3.5)	12 (6.9)	6 (1.8)	0.003
Died				
Living arrangement No. (%)	34 (6.6)	30 (17.1)	4 (1.2)	< 0.001
Alone	471 (92)	140 (80)	331 (98.2)	
With relative	7 (1.4)	5 (2.9)	2 (0.6)	
With caregiver				
Length of stay, mean day (SD)	8.6 (9.1)	14.2 (12.2)	5.7 (5.1)	< 0.001
One-month rehospitalization No. (%)	70 (13.7)	29 (16.7)	41 (12.2)	0.161
Frailty score mean (SD)	2.9 (1.4)	3.2 (1.6)	2.9 (1.2)	0.015
Categories No. (%)	388 (75.8)	117 (66.9)	271 (80.4)	0.003
Frail	85 (16.6)	41 (23.4)	44 (13.1)	
Pre-frail	39 (7.6)	17 (9.7)	22 (6.5)	
None-frail				
Depression score mean (SD)	6.5 (5.3)	8.1 (5.6)	5.7 (4.9)	< 0.001

NYHA = New York Heart Association; AKPS = Australia-modified Karnofsky Performance Scale.

Characteristics	Total n = 512	Super Tertiary hospital n = 175	Tertiary hospital n = 337	*p*-value
Categories No. (%)	223 (43.6)	58 (33.1)	165 (49.0)	< 0.001
Minimal or none	180 (35.2)	63 (36.0)	117 (34.7)	
Mild	57 (11.1)	26 (14.9)	31 (9.2)	
Moderate	32 (6.3)	19 (10.9)	13 (3.9)	
Moderately severe	20 (3.9)	9 (5.1)	11 (3.3)	
Severe				
Suicidal idea No. (%)	73 (1.3)	40 (22.9)	33 (9.8)	< 0.001
Yes				
AKPS mean (SD)	70.9 (16.3)	66.2 (16.9)	73.3 (15.5)	< 0.001

NYHA = New York Heart Association; AKPS = Australia-modified Karnofsky Performance Scale.