

## Original Article

## Characteristics of Heart Failure Patients Readmitted within 28 Days in Saraburi Hospital

Surachai Kobkuechaiyapong M.D.\*

**บทคัดย่อ** การศึกษาหาปัจจัยของการกลับมาอนโรงพยาบาลซ้ำในผู้ป่วยหัวใจล้มเหลว หลังจากออกจากโรงพยาบาลภายใน 28 วัน ในโรงพยาบาลสระบุรี  
สุรชัย กอบเกื้อชัยพงษ์ พ.บ.\*

\* กลุ่มงานอายุรกรรม โรงพยาบาลสระบุรี จังหวัดสระบุรี

วารสารศูนย์การศึกษาแพทยศาสตร์คลินิก โรงพยาบาลพระปกเกล้า 2556;30:35-46

### หลักการและเหตุผล

ภาวะหัวใจล้มเหลวเป็นกลุ่มอาการที่มีอุบัติการณ์สูงในประเทศไทยและทั่วโลก นอกจากนี้ยังมีผู้ป่วยจำนวนมากต้องกลับมาอนโรงพยาบาลซ้ำหลังจากได้กลับออกจากโรงพยาบาลแล้ว ปัญหาดังกล่าวมีผลต่อกระทบทั้งต่อตัวผู้ป่วยเอง ครอบครัวและประเทศชาติ ทั้งในด้านอัตราการครองเตียงในโรงพยาบาลและงบประมาณที่ต้องแลผู้ป่วยกลุ่มนี้

### วัตถุประสงค์

เพื่อศึกษาหาปัจจัยของการกลับมาอนโรงพยาบาลซ้ำในผู้ป่วยหัวใจล้มเหลวหลังจากออกจากโรงพยาบาลภายใน 28 วัน ในโรงพยาบาลสระบุรีทั้งในด้านปัจจัยพื้นฐาน อาการนำ สาเหตุ สิ่งกระตุ้น โรคร่วมและอัตราการเสียชีวิตเพื่อนำข้อมูลมาใช้ประโยชน์ในการป้องกันการกลับมาอนโรงพยาบาลซ้ำและลดอัตราการเสียชีวิตของผู้ป่วย

\* Department of Medicine, Saraburi Hospital, Saraburi Province, Thailand.

## วิธีการศึกษา

เป็นการศึกษาย้อนหลังจากฐานข้อมูลอิเล็กทรอนิกส์ภายหลังจากผู้ป่วยนอนโรงพยาบาลด้วยภาวะหัวใจล้มเหลวแล้ว กลับมานอนโรงพยาบาลซ้ำภายใน 28 วัน ในโรงพยาบาลสระบุรีระหว่าง 1 ตุลาคม พ.ศ. 2553 ถึง 30 กันยายน พ.ศ. 2555

## ผลการศึกษา

พบจำนวนการกลับมาอนโรงพยาบาลซ้ำในผู้ป่วยหัวใจล้มเหลวหลังจากออกจากโรงพยาบาลภายใน 28 วัน จำนวน 131 ครั้ง ในผู้ป่วย 52 คน ผู้ป่วยส่วนใหญ่อายุ 60-79 ปี เป็นผู้ป่วยชายจำนวน 28 คน (ร้อยละ 53.8) อาการนำของผู้ป่วยที่มานอนโรงพยาบาลครั้งแรกได้แก่เหนื่อย (ร้อยละ 97.7) บวม (ร้อยละ 85.5) อ่อนเพลีย (ร้อยละ 71.8) แน่นหน้าอก (ร้อยละ 65.6) ไอ (ร้อยละ 15.3) และซีมี (ร้อยละ 4.6) สาเหตุของภาวะหัวใจล้มเหลวได้แก่ โรคหลอดเลือดหัวใจ (ร้อยละ 53.8) โรคลิ้นหัวใจ (ร้อยละ 21.2) ความดันโลหิตสูง (ร้อยละ 15.4) และโรคกล้ามเนื้อหัวใจ (ร้อยละ 7.7) ปัจจัยกระตุ้นภาวะหัวใจล้มเหลวได้แก่ การขาดความรู้เรื่องรับประทานอาหาร (ร้อยละ 28.2) อาการหัวใจขาดเลือด (ร้อยละ 20.6) และการได้รับยาไม่เต็มที่ (ร้อยละ 11.5) ความสม่ำเสมอของการรับประทานยา (ร้อยละ 9.2) ภาวะโลหิตจาง (ร้อยละ 6.9) การติดเชื้อ (ร้อยละ 5.3) ภาวะหัวใจเต้นผิดจังหวะ (ร้อยละ 4.3) ไม่รู้สาเหตุและไม่มีข้อมูล (ร้อยละ 15.3) โรคร่วมที่พบบ่อยได้แก่เบาหวาน (ร้อยละ 48.1) ไขมันในเลือดผิดปกติ (ร้อยละ 44.2) สูบบุหรี่ (ร้อยละ 21.1) โรคไตเสื่อมเรื้อรัง (ร้อยละ 23.1) โรคหลอดเลือดสมอง (ร้อยละ 9.6) โรคถุงลมโป่งพองเรื้อรัง (ร้อยละ 3.8) ต่อมแอดกอลฮอลล์มาก (ร้อยละ 3.8) และ ติดเชื้อไวรัสที่ทำให้เกิดภูมิคุ้มกันบกพร่อง (ร้อยละ 1.9) ผู้ป่วย 6 คน (ร้อยละ 11.5) เสียชีวิตหลังจากกลับมาอนโรงพยาบาลซ้ำ ผู้ป่วยที่เสียชีวิตทุกคนมีโรคหลอดเลือดหัวใจ

## สรุป

ผู้ป่วยภาวะหัวใจล้มเหลวจำนวนมากต้องกลับมาอนโรงพยาบาลซ้ำหลังจากได้กลับออกจากโรงพยาบาลแล้ว ปัจจัยที่พบได้บ่อยในผู้ป่วยกลุ่มนี้ได้แก่อายุมากกว่า 60 ปีขึ้นไป อาการนำเช่น แน่นหน้าอกและบวมมาก สาเหตุจากโรคหลอดเลือดหัวใจ ปัจจัยกระตุ้น เช่น การขาดความรู้เรื่องรับประทานอาหาร ความสม่ำเสมอของการรับประทานยา อาการหัวใจขาดเลือดและการได้รับยาไม่เต็มที่ ซึ่งแพทย์และบุคลากรที่เกี่ยวข้องของควรตระหนักถึงปัจจัยเหล่านี้ เพื่อป้องกันการกลับมาอนโรงพยาบาลซ้ำและลดอัตราการเสียชีวิตของผู้ป่วยให้มากที่สุด

**คำสำคัญ** หัวใจล้มเหลว การกลับมาอนโรงพยาบาลซ้ำ

**Background :** Heart failure (HF) is one of the leading causes of hospital admission. This syndrome is associated with high rates of mortality and morbidity, including hospital readmission.

**Objectives :** The objectives of this study are to assess the age, sex, clinical presentation, causes of heart failure, precipitating causes of heart failure and in-hospital mortality of patients due to heart failure readmitted in Saraburi Hospital within 28 days. Identifying patient characteristics in common will help physicians to improve risk stratification for preventing readmission and improvement of mortality.

**Materials and Methods :** All admission records with diagnosis of heart failure readmission (ICD 10 codes I50) from Department of Internal Medicine of Saraburi Hospital in 2-year period (October 1st, 2010 through September 30th, 2012) were evaluated.

**Results :** Total of 52 patients were responsible for 131 readmissions. The majority of readmitted patients were 60-79 years of age. 53.8 percent were male patients. Complaints at initial admission visit were dyspnea (97.7 percent), edema (85.5 percent), weakness (71.8 percent), chest discomfort (65.6 percent), cough (15.3 percent) and drowsiness (4.6 percent). Underlying cardiac diseases were coronary artery disease (53.8 percent), valvular heart disease (21.2 percent), hypertensive heart disease (15.4percent) and cardiomyopathy (7.7 percent). Precipitating factors of heart failure were noncompliance with dietary (28.2 percent), myocardial infarction or ischemia (20.6 percent), inadequate drug therapy (11.5 percent), noncompliance with medication (9.2percent), anemia (6.9 percent), infection (5.3 percent), cardiac arrhythmia (3.1 percent) and unknown (15.3 percent). Concomitant diseases or conditions were diabetic mellitus (48.1 percent), dyslipidemia (44.2 percent), chronic kidney disease (23.1 percent), smoking (15.4 percent), stroke (9.6 percent), chronic obstructive pulmonary disease (3.8 percent), heavy alcohol drinking (3.8 percent) and human immunodeficiency virus (1.9 percent). 6 Patients (11.5 percent) died during readmission and all of them had the underlying coronary artery disease.

**Conclusions :** This study demonstrates that the majority of readmitted patients were 60-79 years of age. Coronary artery disease, valvular heart disease and hypertensive heart disease were major underlying cardiac diseases. Non-compliance (medication and diet), myocardial infarction or ischemia and

**inadequate drug therapy were common precipitating factors. Specifically pay attention to heart failure patients with these characteristics might lead to major improvement of early readmission and mortality.**

**Keywords : Heart failure, Readmission**

### **Introduction**

Heart failure (HF) is a prevalent and morbid chronic illness. According to the European Society of Cardiology and the American Heart Association, HF affects approximately 15 million Europeans and over 5 million Americans<sup>1,2</sup>. In Thai ADHERE study, from March 2006 to November 2007, there were 1,612 patients with 2,041 HF admissions in 18 cardiovascular centers<sup>3</sup>. HF is not only burdensome to the patient, but also to the healthcare systems. Studies evaluating the economic burden of HF among several countries reveal estimated direct HF costs of 1-2 percent of total healthcare expenditures, with approximately two-thirds of costs attributable to hospitalization<sup>4</sup>. While HF poses a significant burden to healthcare systems worldwide, the most abundant data and literature comes from the United States. In the United States a reported \$37.2 billion was spent in direct and indirect costs in 2009, with \$20.1 billion dollars of the expenditure relating to hospitalization<sup>2</sup>. Repeat hospitalization contributes significantly to the hospitalization expenditure as HF patients are rehospitalized at an alarmingly high rate, with approximately 50 percent of patients requiring readmission in the 6 months after initial hospitalization<sup>5</sup>. In the study of Boonrat S, et al found 191

patients hospitalized episodes were enrolled from the Police General Hospital, 91 patients died or were readmitted during the 6-month follow up<sup>6</sup>. Public reports from Medicare data reported by Ross et al<sup>7</sup> revealed that all-cause 30-d readmission rates after HF hospitalization have shown no improvement over the past several years with rates of 23.0 percent in 2004, 23.3 percent in 2005, and 22.9 percent in 2006, indicating that this persistent public health problem must be addressed more aggressively.

Although there is information about factors related to rehospitalization at 6 months, there is little information regarding rehospitalizations that occur soon after discharge. Most of these prior studies focused on readmission intervals of either 6 months or 1 year, with only a few studies focusing on the 30-day readmission interval<sup>8</sup>.

### **Objectives**

The objectives of this study are to assess the age, sex, clinical presentation, causes of heart failure, precipitating causes of heart failure and in-hospital mortality of patients with heart failure readmitted to Saraburi Hospital within 28 days, definition by The Australian development of national quality indicators in

health care<sup>9</sup>. Identifying common patient characteristics will help physicians to improve risk stratification for preventing readmission and improvement of mortality.

### Materials and Methods

All initial admission records with diagnosis of HF readmission (ICD 10 codes I50) from Department of Internal Medicine of Saraburi Hospital in 2-year period (October 1st, 2010 through September 30th, 2012) were evaluated. Ethical approval of the Institutional Review Board was obtained prior to data analysis. Diagnosis of heart failure was based on the criteria modified from Framingham study<sup>10</sup>. (Table1)

Only hospital readmissions within 28 days of discharge were included in this study. The admission records with incorrect diagnostic code and did not fulfill the criteria were excluded. In each admission visit chart, an attempt was made to collect data: the age, sex, clinical presentation, causes of heart failure, precipitating causes of heart failure. In-hospital mortality of patients with heart failure were collected from readmission visit chart. The definitions used in the study were as follows:

1) Acute myocardial infarction, with at least two of the following criteria<sup>11</sup> a) Acute typical chest pain of > 15 minutes duration b) Elevation of myocardial enzymes c) Electrocardiographic signs of acute myocardial infarct.

2) Noncompliance with medication, defined to represent patients who stopped taking their medications or took them irregularly.

3) Noncompliance with dietary, defined to represent patients who were not restricted salt and water.

4) Anemia, defined as severe reduced hemoglobin concentration which required blood transfusion during initial admission.

5) Valvular heart disease, with all such diagnoses considered to be potential cause of heart failure except for mitral and tricuspid regurgitation caused by ventricular dilatation.

6) Hypertensive heart disease, defined as definite hypertension accompanied by cardiomegaly on chest x-rays or left ventricular hypertrophy on echocardiography.

7) Cardiomyopathies, defined as primary myocardial disease.

8) Cor pulmonale, defined as pulmonary disease plus objective signs of right heart enlargement.

**Table 1** Criteria for heart failure\*

Major criteria	Minor criteria
Orthopnea or paroxysmal nocturnal dyspnea	Bilateral ankle edema
Neck vein distension	Nocturnal cough
Rales	Dyspnea on ordinary exertion
S3 gallop	Hepatomegaly
Hepatojugular reflux	Pleural effusion by x-ray
Radiographic cardiomegaly	Tachycardia > 120/min
Acute pulmonary edema	
Increase central venous pressure (> 16 cm water at the right atrium)	

\* The diagnosis of heart failure required that two major or one major and two minor criteria be present concurrently. Minor criteria were acceptable only if they could not be attributed to other medical condition.

### Results

All those hospitalized patients who were readmitted for HF in Saraburi Hospital within 28 days between October 1st, 2010 through September 30th, 2012. From total of 139 initial admission visit charts, 131 charts were eligible for this study (2 charts with incorrect diagnostic code and 6 patients did not fulfil the criteria). Total of 52 patients were responsible for 131 readmissions, 28(53.8 percent) patients had 1

readmission, 12 (23.1 percent) patients had 2 readmissions and the others had 3-14 readmissions, summarized in Table 2. The majority of readmitted patients were 60-79 years of age. There was nearly an equal number of male and female patients (M:F = 53.8 percent:46.2 percent). The highest age was 90 years and the lowest age was 24 years. Age and sex distributions of patients were summarized in table 3

**Table2.** Readmission (No. of times)

Readmission(No. of times)	Number of patients(percent)
1	28(53.8)
2	12(23.1)
3	2(3.8)
4	2(3.8)
5	3(5.8)
8	3(5.8)
12	1(1.9)
14	1(1.9)

**Table 3** Age and sex distributions of patients

Age(years)	Male	Female	Total(percent)
20-29	2	1	3(5.8)
30-39	1	0	1(1.9)
40-49	3	1	4(7.7)
50-59	6	3	9(17.3)
60-69	7	7	14(26.9)
70-79	6	7	13(25)
80-89	2	5	7(13.4)
≥90	1	0	1(1.9)
<b>Total</b>	<b>28</b>	<b>24</b>	<b>52</b>

The clinical presentations of initial admission are summarized in table 4. The underlying cardiac diseases are summarized in table 5. Dyspnea (97.7 percent), edema and weigh gain (85.5 percent), weakness, easy fatigability (71.8 percent) were the three most

common symptoms. The three most common causes were coronary artery disease (53.8 percent), valvular heart disease (21.2 percent) and hypertensive heart disease (15.4 percent) respectively.

**Table 4** Complaints at hospital admission

Complaints on initial admission	No.of Readmission times (percent)
DOE/PND/orthopnea	128(97.7)
Edema/Weight gain	112(85.5)
Weakness/Easy fatigability	94(71.8)
Chest discomfort	86(65.6)
Cough	20(15.3)
Confusion/drowsiness	6(4.6)

**Table 5** Underlying cardiac diseases

Underlying cardiac diseases	No. of patients(percent)
Coronary artery disease	28(53.8)
Valvular heart disease	11(21.2)
Hypertensive heart disease	8(15.4)
Cardiomyopathy	4(7.7)
Cor pulmonale	1(1.9)

The precipitating factors could be identified in 84.7 percent of all initial admission visits (Table 6). Noncompliance with dietary was the most commonly identified factor [37(28.2 percent)]. Myocardial infarction or ischemia was identified in 27 patients (20.6 percent). Inadequate drug therapy was believed to be the cause of decompensated heart failure in 15 patients (11.5 percent). Non-compliance with medication was identified in 12 patients (9.2

percent). Anemia led to decompensated heart failure in 9 patients (6.9 percent). Infection was also documented in 7 patients (5.3 percent), respiratory tract infection in 6 patients, urinary tract infection in 1 patients. Cardiac arrhythmia was entirely atrial fibrillation and was detected in 4 patients (3.1 percent). 20 patients (15.3 percent) initial admission visits had no demonstrable precipitating factor.

**Table 6** Precipitating factors of heart failure

Precipitating factors	No. of visits=131 (in Percentage of total visits)
Non-compliance with dietary	37(28.2)
Myocardial infarction or ischemia	27(20.6)
Inadequate drug therapy	15(11.5)
Non-compliance with medication	12(9.2)
Anemia	9(6.9)
Infection	7(5.3)
Cardiac arrhythmia	4(3.1)
Unknown	20(15.3)

Concomitant diseases or conditions were diabetic mellitus (48.1 percent), dyslipidemia (44.2 percent), smoking (15.4 percent), chronic kidney disease (23.1 percent), stroke (9.6 percent) chronic obstructive pulmonary disease (3.8 percent), heavy alcohol drinking

(3.8 percent) and human immunodeficiency virus (1.9 percent) (Table 7).

6 Patients (11.5 percent) died during readmission and all of them had the underlying cardiac disease responsible for coronary artery disease.

**Table 7** Concomitant diseases or conditions on the initial admission.

Concomitant disease or conditions on admission	Male	Female	Total (percent)
DM	11	14	25(48.1)
Dyslipidemia	8	15	23(44.2)
Smoking	7	1	8(15.4)
CKD	5	7	12(23.1)
Stroke	4	1	5(9.6)
Heavy alcohol drinking	2	0	2(3.8)
COPD	1	1	2(3.8)
AIDS/HIV	1	0	1(1.9)

### Discussion

Heart failure remains a common clinical syndrome, major public health problem and economic burdens in Thailand and all over the world and is a common reason for readmission<sup>12</sup>. Successful efforts to reduce preventable readmission rates will improve quality of care while simultaneously decreasing costs. This study revealed that readmitted HF patients in Saraburi Hospital were mostly 60-79 years of age. Thus, the widely recognized "aging of the population" also contributes to the increasing incidence of heart failure, and elderly patients with heart failure are also at increased risk for early rehospitalization<sup>13,14,15</sup>. 12 (23.1 percent) patients had 2 readmissions. The others had 3-14 readmissions. Findings from the CHARM program reported that the risk of dying increased with each additional HF hospitalization<sup>16</sup>. After discharge from a second or third hospitalization there was an associated 30 percent cumulative incremental risk of death<sup>16</sup>. Thus, these patients need

aggressive attention. Dyspnea (97.7 percent) was the most common symptom which was comparable with THAI ADHERE<sup>3</sup> (96.7 percent) and US ADHERE<sup>17</sup> (89 percent). Edema and weight gain were identified in 112 patients (85.4 percent). Chest discomfort was identified in 86 patients (65.6 percent). One study found several clinical predictors of early re-hospitalization (within 30 days) including angina, lower systolic blood pressure, and more extensive edema<sup>18</sup>. In this study, coronary artery disease was the most common underlying cardiac disease (53.8 percent). Specific attention to these heart failure patients could lead to major improvement of early readmission. Noncompliance with diet was explicitly documented in the chart for 37 of all 131 patients (28.2 percent) initial readmission visits. Noncompliance with medication was documented for 12 patients (9.2 percent). Noncompliance [diet or medication (37.4 percent)] was common precipitating factor which same as the study of Ghali et al<sup>19</sup> (37 percent), but higher than the study of

Phankingthongkum R, et al<sup>20</sup>(23.7 percent). Some study found that positive predictors are the patients' noncompliance with medication, diet, and exercise<sup>21,22,23</sup>.

Inadequate drug therapy was documented for 15 patients (11.5 percent). These patients should be given the high intensity of multidisciplinary support, education, early follow-up care and medical optimization.

Respiratory tract infection was correctable precipitating factors (5.3 percent). The clinical manifestation of respiratory tract infection tends to be masked by heart failure. The possibility of infection must be continuously kept in mind because early recognition and prompt treatment may decrease hospitalization from heart failure. Anemia was not common (6.9 percent). This factor is correctable so they should be looked for, especially if no other precipitating factors were identified. In this study, 15.3 percent of patients had no identifiable precipitating causes. This figure may be decreased by careful history taking and physical examination and proper investigation.

The readmitted in-hospital mortality in this study was 11.1 percent. All readmitted patients had coronary artery disease. Specifically attention heart failure patients with underlying coronary artery disease could lead to major improvement of mortality. The most common concomitant disease was diabetic mellitus (48.1 percent). This finding was similar to the data of Hallerbach, et al<sup>8</sup> (51.6 percent) which had shown that diabetic mellitus was the most common concomitant disease.

Finally, the discharge instructions for the HF patient should be noted (eg, medication, diet instructions, exercise instructions, vaccinations status, clinical follow-up information). This information does not refer to the overall quality of the clinical chart documentation but is meant as a medical guide for the patient with heart failure.

### Conclusions

This study demonstrates that the majority of readmitted patients were 60-79 years of age. Coronary artery disease, valvular heart disease and hypertensive heart disease were major underlying cardiac diseases. Noncompliance (medication and diet), myocardial infarction or ischemia and inadequate drug therapy were common precipitating factors. Specifically attention heart failure patients with these characteristics could lead to major improvement of early readmission and mortality.

### Acknowledgements

This study was supported by Clinical Research Department of Saraburi Hospital.

### References

1. Dickstein K, Cohen-Solal A, Filippatos G, McMurray JJ, Ponikowski P, Poole-Wilson PA, et al . ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2008: the Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2008

- of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association of the ESC (HFA) and endorsed by the European Society of Intensive Care Medicine (ESICM). *Eur Heart J* 2008; 29: 2388-442.
2. Lloyd-Jones D, Adams R, Carnethon M, De Simone G, Ferguson TB, Flegal K, et.al. Heart disease and stroke statistics-2009 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2009; 119: e21-181.
  3. Laothavorn P, Hengrussamee K, KanjanavanitR, Moleerergpoom W, LaorakpongsD, PachiratO, et.al. Thai Acute Decompensated Heart Failure Registry (Thai ADHERE):CVD. *Prev Control* 2010;5:89-95.
  4. Lee WC, Chavez YE, Baker T, Luce BR. Economic burden of heart failure: a summary of recent literature. *Heart Lung* 2004; 33: 362-71.
  5. Radford MJ, Hennen J. Readmission after hospitalization for congestive heart failure among Medicare beneficiaries. *Arch Intern Med* 1997; 157: 99-104.
  6. Boonrat S .Predictors of 6-month Recurrent Admission or Death in Patients with Acute Decompensated Heart Failure in Police General Hospital.*Thai Heart Journal* 2012;25:87-94.
  7. Ross JS, Chen J, Lin Z, Bueno H, Curtis JP, Keenan PS, et.al. Recent national trends in readmission rates after heart failure hospitalization. *Circ Heart Fail* 2010; 3: 97-103.
  8. Hallerbach M, Francoeur A, Pomerantz SC, Oliner C, Morris DL, Eiger G, et.al. Patterns and Predictors of Early Hospital Readmission in Patients With Congestive Heart Failure. *Am J Med Qual* 2008;23:18-23.
  9. Collopy BT, Balding C. The Australian development of national quality indicators in health care. *Jt Comm J Qual improve* 1993 ;19:510-6.
  10. McKee PA, Castelli WP, McNamara PM, Kannel WB. The natural history of congestive heart failure: The Framingham study. *N Engl J Med* 1971;285:1441-6.
  11. Expert Committee on Cardiovascular Diseases and Hypertension. Hypertension and coronary heart disease: Classification and criteria for epidemiological studies. WHO 1959; 168:3.
  12. Coffey RM, Misra A, Barrett M, Andrews RM, Mutter R, Moy E.. Congestive heart failure :who is likely to be readmitted?. *Med Care Res Rev* 2012 ;69:602-16
  13. Gooding J, Jette AM. Hospital readmissions among the elderly. *J Am Geriatr Soc* 1985;33:595-601.
  14. Rich MW, Freedland KE. Effect of DRGs on three-month readmission rate of geriatric patients with congestive heart failure. *Am J Public Health* 1988;78:680-2.
  15. Vinson JM, Rich MW, Sperry JC, Shah AS, McNamara T. Early readmission of elderly patients with congestive heart

- failure. *J Am Geriatr Soc* 1990;38:1290-5.
16. Solomon SD, Dobson J, Pocock S, Skali H, McMurray JJ, Granger CB, et.al. Influence of nonfatal hospitalization for heart failure on subsequent mortality in patients with chronic heart failure. *Circulation* 2007; 116: 1482-7.
17. Cowie MR, Mosterd A, Wood DA, Poole-Wilson PA, Sutton GC, Grobbee DE. The epidemiology of heart failure. *Eur Heart J* 1997;18:208–25.
18. Muzzarelli S, Leibundgut G, Maeder MT, Rickli H, Handschin R, Gutmann M, et.al. Predictors of early readmission or death in elderly patients with heart failure. *Am Heart J* 2010; 160: 308-14.
19. Ghali JK, Kadakia S, Cooper R, Ferlinz J. Precipitating factors leading to decompensation of heart failure. *Arch Intern Med* 1988;148:2013-6.
20. Phankingthogkum R, Thongtang V, Chaithiraphan S, Chaithiraphan S, Jootar P, Sahasakul Y, Srivanasont N, et al. Heart failure in Siriraj. *Thai Heart J* 1994;4:89-95.
21. Monane A, Bohn R, Gurwitz JH, Glynn RJ, Avorn, J. Noncompliance with congestive heart failure therapy in the elderly. *Arch Intern Med* 1994;154:433-7.
22. Vinson J, Rich MW, Shah AS, Sperry JC. Early readmission of elderly patients with congestive heart failure. *J Am Geriatr Soc*1990;38:1290-5.
23. Rich MW, Gray DB, Beckham V, Wittenberg C. Effect of a multidisciplinary intervention on medication compliance in elderly patients with congestive heart failure. *Am J Med* 1996;101:270-6.