Original Research Article

PREVALENCE OF PRECIPITATING FACTORS IN REHOSPITALISATION AMONG ACUTE DECOMPENSATED HEART FAILURE PATIENTS AT TERTIARY CARE HOSPITAL

ABSTRACT:

Aims: The purpose of this research was to assess the frequency of precipitating variables that resulted in hospitalisation among ADHF patients who were admitted to the hospital.

Sample: The sample size was calculated using WHO sample size calculator version 2.0 considering 13.22%[7] uncontrolled hypertension among the patients with acute decompensated HF (ADHF), with 95% confidence interval, and 5% of margin of error, the sample size of n = 177 patients was calculated.

Study Design: Cross-sectional study

Place and Duration of Study: National Institute of Cardiovascular Diseases (NICVD) Karachi from 26th October 2018 to 26 April 2019

Methodology: Both male and female patients aged 20 to 80 years with documented HF with EF <40% on echocardiogram presenting with acute decompensated HF (ADHF) in NYHA class II, III or IV were included in this study.

Result: A total of 177 hospitalized patients with acute decompensated HF were included. 107 (60.5%) were males & 70 (39.5%) were females with the mean age of 52.039+14.83887 years. The PF were acute coronary syndrome (ACS) in 64 (36.2%), medication Non compliance in 36(20.3%), atrial fibrillation in 44(24.9%), and uncontrolled hypertension in 47(26.6%).

Conclusion: HF hospitalizations are associated with a significant number of preventable PF. The most prevalent precipitating event in our analysis was acute coronary syndrome (ACS), which occurred in 36.2 percent of participants. Patient HF patients may benefit from the identification of possible triggering factors, which may aid in the optimization of therapy and the provision of counselling.

Keywords: heart failure, exacerbation, Precipitating Factors, atrial fibrillation

INTRODUCTION:

Heart Failure (HF) is a chronic, complicated, and severe ailment that may have a significant influence on a patient's quality of life and ability to function. HF continues to be the result of the majority of cardiac illnesses [1]. HF is a serious and rising public health concern in the United States, accounting for more than one million hospital admissions each year and affecting around 6 million people [2]. HF is the most common reason for hospitalization in people under the age of 65 years. With 30-day death rates nearing 10%, among the admitted patients to the hospital with acute decompensated HF (ADHF) face a substantial risk of mortality [3]. According to the ARIC Study Community Surveillance Report from 2005 to 2014 among 04 US communities, they commented HF decline stats of those patients who had reduced Ejection Fraction (rEF) as compared to preserved Ejection Fraction (pEF) from 2000 to 2010. They also added that the median survival rate is still 05 years of age in comparison with 25 years ago. They observed high mortality rate was found in the male gender and with the patients who had HF with Ref [4]. Despite the fact that HF mortality has decreased, new medicines have Absent led in a reduction in the number of people admitted to hospitals. With a high event rate (> 50 percent), a death rate between 10 and 15 percent, as well as a 30- to 40% incidence of readmission within 6 months

following discharge, patients hospitalized with HF face serious risks have been observed throughout the literature. Patients with HF are more likely to be readmitted to the hospital for a variety of reasons, three of which being comorbidities, congestion, and a target-organ lesion [5].

Non-compliance with medications, myocardial ischemia (MI), arrhythmias, infection, anaemia, alcohol, pregnancy, worsening hypertension, acute valvular insufficiency, and the use of certain medications such as calcium antagonists, beta-blockers, NSAIDs, thiazolidinediones, and class I anti-arrhythmic drugs are all thought to contribute to the development of HF decompensation [6]. The discovery that infections may be the major and most prevalent triggering events leading in decompensated HF in Pakistan has been attributed to suboptimal infection management practices, over prescription of antibiotics, and a lack of health education [6]. That study showed infections being a precipitant factor in 57.6% of cases followed by drug Non-compliance in 17.4% [6]. Another local study showed Non-compliance with drugs as an important HF precipitating factor, responsible for approximately 25.98% of cases [7]. Because the majority of the causes are essentially changeable, accurate identification may lead clinicians to treat these concerns in a systematic manner. The proportionate distribution of many precipitating variables in our environment, on the other hand, remains a mystery due to a scarcity of data. As a result, the purpose of this research was to assess the frequency of precipitating variables that resulted in hospitalization among ADHF patients who were admitted to the hospital.

MATERIALS AND METHODS:

This cross-sectional study was conducted in the Department of Adult Cardiology at the National Institute of Cardiovascular Diseases (NICVD) Karachi from 26th October 2018 to 26th April 2019. Both male and female patients aged 20 to 80 years with documented HF with EF <40% on echocardiogram presenting with acute decompensated HF (ADHF) in NYHA class II, III or IV were included in this study. The sample size was calculated using WHO sample size calculator version 2.0 considering 13.22% [7] uncontrolled hypertension among the patients with acute decompensated HF

(ADHF), with 95% confidence interval, and 5% of margin of error, the sample size of n = 177 patients was calculated.

The sampling technique was Non-probability consecutive sampling. Patients were excluded from this study if they refused to give consent or presented with ST-Elevation Myocardial Infarction (STEMI).

Acute Decompensated HF (ADHF) was defined as patients presenting in NYHA class II, III, or IV as per the ACCF/AHA guideline or chest X-ray finding of pulmonary edema, Kerly B lines, and redistribution of the pulmonary vessels.

STEMI was diagnosed in patients presenting with typical chest pain >20 minutes or new ST elevation in at least two contiguous leads >2mm in men or >1mm in women in leads V2 to V3 and/or of >1mm in other contiguous chest leads or limb leads. NSTEMI was diagAbsentsed in patients presenting with typical chest pain lasting >20 minutes with ECG at presentation showing ST depression, transient ST elevation, and/or prominent T-wave inversions or the typical rise of cardiac troponin one value above the upper limit Normal range. Unstable Angina was diagnosed in presence of typical chest pain with negative results of troponins and/or ST-segment depression of 1 mm on limb leads and 2 mm on chest leads.

Acute coronary syndrome (ACS) was considered if the patient presents with either Non-ST-Elevation Myocardial Infarction (NSTEMI) or Unstable Angina. Medication Non-Compliance was considered for the patient with a Morisky Medication Adherence Score (MMAS) of less than 8 (using validated Morisky Medication Adherence Scale: MMAS-8). Atrial fibrillation was considered if electrocardiogram (ECG) of the patients at the time of presentation shows irregular R-R intervals (when atrioventricular [AV] conduction is present), absence of distinct repeating P waves, and irregular atrial activity. Uncontrolled Hypertension was considered when the patient had ≥ 105 mmHg diastolic blood pressure or ≥ 180 mmHg systolic blood pressure on two consecutive readings two hours apart at the time of presentation. Among effect modifiers, Diabetes mellitus of the patients was documented

from a history of DM and on anti-diabetic medication for at least 6 months. A smoking history of smoking 10 to 20 cigarettes per day for the last 5 years was considered.

Following approval from the College of Physicians and Surgeons of Pakistan for the FCPS degree approval, this study was commenced. Prior to inclusion the purpose and benefits of the study were explained to all participants and verbal informed consent was taken by the principal investigator from all patients. Patient demographic data were obtained such as Age (years) and gender. History of the patients was taken regarding diabetic Mellitus and smoking status as per the operational definitions. ECG of the patients was interpreted by electrophysiologists with working experience of more than five years. Validated Morisky Medication Adherence Scale (MMAS-8), presented in Annexure B, was obtained for all the patients and was classified as per the operational definition.

Patients Precipitating Factors such as acute coronary syndrome (ACS), medication Non compliance, atrial fibrillation, and uncontrolled hypertension were recorded and assessed as per the operational definitions. All of the information gathered was entered into a proforma that had been previously developed. Confounding factors and biasness were kept under control by closely adhering to inclusion and exclusion criteria as well as stratification procedures and practices. Patient information was kept safe and only accessible to those who were authorized to have access to it.

Data was entered and analyzed using SPSS version-21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Age of the patient (years) was expressed as mean ± SD, maximum and minimum. Frequency and percentages were calculated for categorical variables such as gender, age group, diabetic Mellitus, smoking status, and PF such as acute coronary syndrome (ACS), medication non compliance, atrial fibrillation, and uncontrolled hypertension.

Effect modifiers like gender, age group, diabetic Mellitus, and smoking status stratification were used to keep the numbers under control. Following stratification, the appropriate chi-square test or Fisher exact test was used to determine the results. It was determined that a two-sided p-value of less than

0.05 was statistically significant. Bar graphs and pi-charts were utilised to portray the data in a graphical format.

RESULTS:

A total of 177 hospitalized patients with acute decompensated HF were selected to conduct this study. The mean age of 52.03+14.83 years. 107 patients (60.5%) were males & 70 patients (39.5%) were females. Diabetes mellitus was noted in patients 57 (32.2%), 34 patients (19.2%) were smokers. Acute coronary syndrome (ACS) was the most common precipitating reason for admission among patients with acute decompensated heart failure. A total of 64 individuals with ACS were admitted to the hospital (36.2 percent), medication Non compliance in 36(20.3%), atrial fibrillation in 44(24.9%), and uncontrolled hypertension in 47(26.6%).

In patients with acute decompensated HF who were admitted to the hospital, the frequencies of age groups, gender, diabetes, and hypertension were estimated in accordance with the precipitating causes that led to their admission. In our study the PF leading to hospitalization among the patients hospitalized with acute decompensated heart failure, acute coronary syndrome (ACS), and medication Non compliance were common in age groups of 25-55 years while atrial fibrillation and uncontrolled hypertension were common in the age group of 56-80 years, all the PF were predominant in the male gender, Absent difference of PF was notted in patients with DM & smokers (Table 1-4)

Table 1: PF leading to hospitalization among the patients hospitalized with acute decompensated HF according to age

Age	Acute coronary syndrome (ACS)		Total	*P-VALUE*
	Present	Absent		
25-55Years	37(20.90%)	76(42.93%)	113(63.84%)	*.01*
56-80Years	27(15.25%)	37(20.90%)	64(36.15%)	
Total	64(36.2%)	113(63.8%)	177(100%)	

	Medication Non Compliance		Total	*P-VALUE*
	Present	Absent		
25-55Years	27(15.25%)	86(48.58%)	113(63.84%)	
56-80Years	9(5.08%)	55(31.07%)	64(36.15%)	*.18*
Total	36(20.3%)	141(79.7%)	177(100%)	
	Atrial Fibrillation		Total	*P-VALUE*
	Present	Absent		
25-55Years	8(4.51%)	89(50.28%)	97(54.80%)	
56-80Years	36(20.33%)	44(24.85%)	80(45.19%)	*.04*
Total	44(24.9%)	133(75.1%)	177(100%)	
	Uncontrolled Hypertension		Total	*P-VALUE*
	Present	Absent		
25-55Years	18(10.16%)	96(54.23%)	114(75.70%)	
56-80Years	29(16.38%)	34(19.20%)	63(35.59%)	*.01*
Total	47(26.6%)	130(73.4%)	177(100%)	

*Chi-square test was applied

Table 2: PF leading to hospitalization among the patients hospitalized with acute decompensated HF according to gender

Gender	Acute coronary syndrome (ACS)		Total	*P-VALUE*
	Present	Absent		
Male	44(24.9%)	63(35.6%)	107(60.45%)	*.08*
Female	20(11.3%)	50(28.2%)	70(39.54%)	
Total	64(36.2%)	113(63.8%)	177(100%)	

	Medication Non-Compliance		Total	*P-VALUE*
	Present	Absent		
Male	18(10.2%)	89(50.3%)	107(60.45%)	
Female	18(10.2%)	52(29.4%)	70(39.54%)	*.15*
Total	36(20.3%)	141(79.7%)	177(100%)	
	Atrial Fibrillation		Total	*P-VALUE*
	Present	Absent		
Male	27(15.3%)	80(45.2%)	107(60.45%)	
Female	17(9.6%)	53(29.9%)	70(39.54%)	*.18*
Total	44(24.9%)	133(75.1%)	177(100%)	
	Uncontrolled Hypertension		Total	*P-VALUE*
	Present	Absent		
Male	31(17.5%)	76(42.9%)	107(60.45%)	
Female	16(9%)	54(30.5%)	70(39.54%)	*.36*
Total	47(26.6%)	130(73.4%)	177(100%)	

*Chi-square test was applied

Table 3: PF leading to hospitalization among the patients hospitalized with acute decompensated HF according to Diabetes Mellitus (DM)

Diabetic Mellitus	Acute coronary syndrome (ACS)		Total	*P-VALUE*
	Present	Absent		
Diabetic	23(13%)	34(19.2%)	57(32.20%)	
Non Diabetic	41(23.2%)	79(44.6%)	120(67.79%)	*.42*
Total	64(36.2%)	113(63.8%)	177(100%)	

	Medication Non-Compliance		Total	*P-VALUE*
	Present	Absent		
Diabetic	18(10.2%)	39(22%)	57(32.20%)	
Non Diabetic	18(10.2%)	102(57.6%)	120(67.79%)	*.01*
Total	36(20.3%)	141(79.7%)	177(100%)	
	Atrial Fibrillation		Total	*P-VALUE*
	Present	Absent		
Diabetic	9(5.1%)	48(27.1%)	57(32.20%)	
Non Diabetic	35(19.8%)	85(48%)	120(67.79%)	*.05*
Total	44(24.9%)	133(75.1%)	177(100%)	
	Uncontrolled Hypertension		Total	*P-VALUE*
	Present	Absent		
Diabetic	17(9.6%)	40(22.6%)	57(32.20%)	
Non Diabetic	30(16.9%)	90(50.8%)	120(67.79%)	*.49*
Total	47(26.6%)	130(73.4%)	177(100%)	

*Chi-square test was applied

Table 4: PF leading to hospitalization among the patients hospitalized with acute decompensated HF according to Smoking

Smoking	Acute coronary syndrome (ACS)		Total	*P-VALUE*
	Present	Absent		
Smoker	12(6.8%)	22(12.4%)	34(19.20%)	
Non Smoker	52(29.4%)	91(51.4%)	143(80.79%)	*.91*
Total	64(36.2%)	113(63.8%)	177(100%)	

	Medication Non-Compliance		Total	*P-VALUE*
	Present	Absent		
Smoker	4(2.3%)	30(16.9%)	34(19.20%)	
Non Smoker	32(18.1%)	111(62.7%)	143(80.79%)	*.16*
Total	36(20.3%)	141(79.7%)	177(100%)	
	Atrial Fibrillation		Total	*P-VALUE*
	Present	Absent		
Smoker	10(5.6%)	24(13.6%)	34(19.20%)	
Non Smoker	34(19.2%)	109(61.6%)	143(80.79%)	*.49*
Total	44(24.9%)	133(75.1%)	177(100%)	
	Uncontrolled Hypertension		Total	*P-VALUE*
	Present	Absent		
Smoker	8(4.5%)	26(14.7%)	34(19.20%)	
Non Smoker	39(22%)	104(58.8%)	143(80.79%)	*.66*
Total	47(26.6%)	130(73.4%)	177(100%)	

*Chi-square test was applied

DISCUSSION:

Clinically, CHF could well be defined by periods of remission that are followed by periods of exacerbation. Even while it is probable that decreasing ventricular function in persons with previously stable compensated HF is the cause of CHF in these individuals, many other triggering events have been found [8]. Only a few investigators, however, have focused their attention on the acute precipitants and drivers of clinical deterioration in the elderly patient in particular. In CHF, the frequency of PF varies from country to country and from population to population, according to the study's sample population of participants [9]. Because these patients are more likely to comply with

medication recommendations and receive more frequent follow-up than patients receiving standard care, patient selection bias is a concern when diagnosing PF of CHF exacerbation in the context of a clinical trial [10] or specialist heart failure program [11].

In our study, the PF leading to hospitalization among the patients hospitalized with acute decompensated HF were acute coronary syndrome (ACS) in 36.2%, medication Non compliance in 20.3%, atrial fibrillation in 24.9%, and uncontrolled hypertension in 26.6%, as compared to Kaler et Al [12] studies New onset myocardial ischemia was the next most common factor leading to acute decompensated HF, a huge number, i.e., 71 patients had evidence of new-onset myocardial ischemia 47.3% (interestingly both kinds of patients with or without prior history of myocardial ischemia were seen in this subset). In Kaler et al [12] study dietary indiscretion was seen in 45.3% of the patients. And when Noncompliance to drugs was also taken into account (18.7%), Noncompliance to the treatment regimen attributed to 64% of all the decompensations.

In the Euro HF Survey II, 3580 patients hospitalized for acute HF were recruited by 133 centers in 30 European countries, and it was observed that coronary heart disease, hypertension, and atrial fibrillation were the most common underlying conditions. Moreover, arrhythmias, valvular dysfunction, and ACS were each present as PF in one-third of the cases [13]. In most of the early studies done the world over, a range of 21%–64% of patients had Noncompliance as the precipitating factor of HF exacerbation, sometimes leading to hospitalization [14]. Michalsen et al. had similar observations in a study done in Berlin, Germany [15] Diaz et al. published in a study on the South American population that Noncompliance with diet was identified in 52 percent of the patients, and noncompliance with prescribed medications was identified in 30 percent of the patients. Other factors such as infections, arrhythmias, and ACS were identified in 29 percent, 25 percent, and 22 percent of the patients, respectively, according to the findings [16].

In other studies [17], it has been discovered that infections are quite common, and that their effect on HF patients is unpredictably negative in cold settings. 182 It is possible that infections might cause

CHF to deteriorate, and that the mechanism responsible for the worsening of CHF is increased total body oxygen demand owing to fever [18]. As a result of the decreased capacity of the congestive HF patient's lungs to evacuate respiratory secretions, people with CHF are more vulnerable to respiratory infection [19]. Among arrhythmias, atrial fibrillation was the most common arrhythmia leading to acute decompensated HF. Uncontrolled hypertension was seen in 11.3% of the patients, and most of the patients were in Stage 1 hypertension (JNC 7 guidelines) [20].

In one-quarter of our patients, arrhythmias were deemed to be directly responsible for their HF decompensation, according to our findings. The detrimental influence on hemodynamics presented by supraventricular arrhythmias occurring in a failing heart is well-known as a predictor of poor outcomes in HF patients with a failing heart. In our study, the most common precipitating factor was ACS notted in 36.2% of patients as compared to Diaz et al [21] studies one-fifth of the patients had myocardial ischemia, according to the findings. There has been much research on the detrimental effects of myocardial ischemia on ventricular function, especially in the setting of non-ischemic heart failure. Subendocardial ischemia has been proposed as the primary cause of myocardial infarction (heart failure) [22]. In older patients experiencing an abrupt aggravation of CHF, it is important to identify if they have silent or symptomatic ischemia. As a result, it seems that decompensated HF is usually related with concurrent variables. Absence of anything that is directly connected to the progression of the heart illness. Knowing about possible triggering factors may aid in the optimization of therapy and the provision of counselling to individuals suffering from heart failure. It is recommended that individuals who present with CHF have their risk factors for the condition assessed on a regular basis.

CONCLUSION:

HF hospitalizations are associated with a significant number of preventable PF. The most prevalent precipitating event in our analysis was acute coronary syndrome (ACS), which occurred in 36.2 percent of participants. Patient HF patients may benefit from the identification of possible triggering factors, which may aid in the optimization of therapy and the provision of counselling.

ETHICAL APPROVAL:

This research was taken from a dissertation that was submitted to the College of Physicians and Surgeons of Pakistan (CPSP). Prior to data collection, the Institutional Review Board-National Institute of Cardiovascular Disease gave its clearance, which was followed by the collection of data (IRB-NICVD).

PATIENT CONSENT

Before enrolling patients in the study, informed permission was obtained from them in both written and verbal form.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

REFERENCES:

1. Thiam A, Doulgou AS, Samadoulougou AK, Zabsonré P. PF of acute decompensated HF in hospitalized patients in cardiology in Burkina Faso. Open J Cardiol. 2017 Mar 27;6(1).
2. Eaton C, Pettinger M, Rossouw J, Martin L, Foraker R, Quddus A et al. Risk Factors for Incident Hospitalized HF With Preserved Versus Reduced Ejection Fraction in a Multiracial Cohort of Postmenopausal Women. Circulation: Heart Failure. 2016;9(10).
3. Lagu T, Pekow P, Shieh M, Stefan M, Pack Q, Kashef M et al. Validation and Comparison of Seven Mortality Prediction Models for Hospitalized Patients With Acute Decompensated Heart Failure. Circulation: Heart Failure. 2016;9(8).

4. Chang P, Wruck L, Shahar E, Rossi J, Loehr L, Russell S et al. Trends in Hospitalizations and Survival of Acute Decompensated HF in Four US Communities (2005–2014). Circulation. 2018;138(1):12-24.
5. Mesquita E, Jorge A, Rabelo L, Souza Jr. C. Understanding Hospitalization in Patients with Heart Failure. International Journal of Cardiovascular Sciences. 2016;.
6. Zahoor S, Arshad MS, Riaz A, Farhan M. precipitants of acute decompensated HF and their correlation with the severity of decompensation in a resource poor country. J Islamabad Med Dent Coll. 2017;6(4):219-23.
7. Fatima M, Niaz N. Factors Precipitating acute heart failure. Ann Pak Inst Med Sci. 2014;10(1):33-8.
8. Arrigo M, Truong QA, Onat D, et al. Soluble CD146 Is a novel marker of systemic congestion in HF patients: an experimental mechanistic and transcardiac clinical study. Clin Chem. 2017; 63:386–93.
9. Kubena P, Arrigo M, Parenica J, et al. GREAT Network. Plasma levels of soluble CD146 reflect the severity of pulmonary congestion better than brain natriuretic peptide in acute coronary syndrome. Ann Lab Med. 2016; 36:300–5.
10. Gayat E, Arrigo M, Littnerova S, et al. GREAT Network. HF oral therapies at discharge are associated with better outcome in acute heart failure: a propensity-score matched study. Eur J Heart Fail. 2017; 18:613.
11. Komajda M, Tavazzi L, Swedberg K, et al. SHIFT Investigators. Chronic exposure to ivabradine reduces readmissions in the vulnerable phase after hospitalization for worsening systolic heart failure: a post-hoc analysis of SHIFT. Eur J Heart Fail 2016; 18:1182–9.
12. Hindricks G, Taborsky M, Glikson M, et al. IN-TIME Study Group. Implant-based multiparameter telemonitoring of patients with HF (IN-TIME): a randomised controlled trial. Lancet. 2014; 384:583–90.

13. Abraham WT, Adamson PB, Bourge RC, et al. CHAMPION Trial Study Group. Wireless pulmonary artery haemodynamic monitoring in chronic heart failure: a randomised controlled trial. Lancet. 2011; 377:658–66.
14. Adamson PB. Pathophysiology of the transition from chronic compensated and acute decompensated heart failure: new insights from continuous monitoring devices. Curr Heart Fail Rep. 2009; 6:287–92.
15. Fonarow GC, Abraham WT, Albert NM, et al. Factors identified as precipitating hospital admissions for HF and clinical outcomes. Findings from OPTIMIZE-HF. Arch Intern Med. 2008; 168:847–854.
16. Tsuyuki RT, McKelvie RS, Arnold JM, et al. Acute precipitants of congestive HF exacerbations. Arch Intern Med. 2001; 161:2337–42.
17. Kaler GP, Mohan B, Gupta D, Kaler NK, Garg M, Wander GS. PF for acute decompensated HF in patients with stable chronic left ventricular systolic dysfunction. J Pract Cardiovasc Sci 2018; 4:21-8
18. Nieminen MS, Brutsaert D, Dickstein K, Drexler H, Follath F, Harjola VP, et al. EuroHF survey II (EHFS II): A survey on hospitalized acute HF patients: Description of population. Eur Heart J 2006; 27:2725-36.
19. Buckle J, Sharkey P, Myriski P, Smout R, Horn S. Improving outcomes for patients hospitalized with CHF. Manag Care Q 2002; 10:30-40.
20. 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
21. Opasich C, Rapezzi C, Lucci D, Gorini M, Pozzar F, Zanelli E, et al. PF and decision-making processes of short-term worsening HF despite “optimal” treatment (from the IN-CHF registry). Am J Cardiol 2001; 88:382-7.

22. Tsuyuki RT, McKelvie RS, ArAbsentld JM, Avezum A Jr., Barretto AC, Carvalho AC, et al. Acute precipitants of congestive HF exacerbations. Arch Intern Med 2001; 161:2337-42.