INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

RISK FACTORS FOR RECURRENT HOSPITALIZATION IN PATIENTS WITH HEART FAILURE WITH REDUCED EJECTION FRACTION

Original Research

Saddam Hussain[1], Ikram Ullah[2]*, Roman Khan[1], Junaid Rehman[1], Atif Kamal[1], Muhammad Azam Khan[1]
[1]Resident Cardiology, Cardiology Department, Lady Reading Hospital, Peshawar, Pakistan.
[2]Assistant Professor, Cardiology Department, Lady Reading Hospital, Peshawar, Pakistan.
Corresponding Author: Ikram Ullah, Assistant Professor, Cardiology Department, Lady Reading Hospital, Peshawar, Pakistan, ikramcardio@yahoo.com
Acknowledgement: The authors thank the staff of the Cardiology Department, Lady Reading Hospital, for their support during data collection.

Conflict of Interest: None
Grant Support & Financial Support: None

ABSTRACT

Background: Heart failure with reduced ejection fraction (HFrEF) is a progressive condition contributing to substantial healthcare burden due to frequent hospital readmissions. Timely identification of associated risk factors is essential for reducing recurrence, improving quality of life, and optimizing hospital resource utilization, especially in low-resource settings. Preventable causes of decompensation continue to challenge post-discharge management strategies in heart failure care.

Objective: To determine the frequency and impact of various risk factors associated with hospital readmissions among patients with HFrEF admitted to Lady Reading Hospital, Peshawar.

Methods: This cross-sectional study was conducted over six months in the Department of Cardiology, Lady Reading Hospital. A total of 122 patients aged 20–80 years with documented HFrEF (EF < 50%) and a history of prior hospitalization for heart failure were enrolled using non-probability consecutive sampling. Data were gathered through structured interviews, clinical examination, and review of medical records. Risk factors assessed included poor drug compliance, NSAID and steroid use, uncontrolled blood pressure, infections, arrhythmias, myocardial infarction, thyroid dysfunction, anemia, hyperglycemia, and electrolyte abnormalities. Statistical analysis was performed using SPSS version 25, with chi-square and Fisher's exact tests applied. A p-value < 0.05 was considered statistically significant.

Results: Out of 122 patients, 49 (40.2%) experienced unplanned readmission. Among them, 61.2% had poor medication compliance, 53.1% had uncontrolled blood pressure, 40.8% presented with infections, and 36.7% had arrhythmias. Electrolyte disturbances (44.9%), anemia (38.8%), and hyperglycemia (32.7%) were also significantly associated ($p < 0.05$). Readmitted patients had a mean ejection fraction of 28.7% ± 5.4%, significantly lower than 35.1% ± 7.6% in non-readmitted patients ($p < 0.001$). Low socioeconomic status was significantly linked with readmissions ($p = 0.036$).

Conclusion: Recurrent hospitalizations in HFrEF are largely driven by modifiable clinical and behavioural factors. Targeted interventions, including medication adherence reinforcement, blood pressure control, infection management, and socioeconomic support, are critical to improving outcomes and minimizing preventable readmissions.

Keywords: Anemia, Arrhythmias, Drug Compliance, Heart Failure, Hospital Readmissions, Hypertension, Infections.

INTRODUCTION

Heart failure (HF) is a common and debilitating clinical syndrome that significantly impacts patients' quality of life and imposes a substantial burden on healthcare systems worldwide. Characterized by a complex interplay of structural and/or functional cardiac abnormalities, HF was redefined in 2021 under a universal classification system into heart failure with reduced ejection fraction (HFrEF), mildly reduced ejection fraction (HFmrEF), and preserved ejection fraction (HFpEF), based on ejection fraction (EF) parameters (1). The global burden of HF continues to escalate, primarily driven by the aging population and rising prevalence of comorbid conditions such as hypertension, diabetes mellitus, and obesity, now affecting an estimated 64 million individuals globally (2). Despite advancements in pharmacological and non-pharmacological therapies, HF remains a leading cause of hospitalization among older adults, often resulting in frequent readmissions that compromise both clinical outcomes and economic efficiency. One of the most pressing challenges in HF management is the high rate of hospital readmissions, with up to 45% of patients being readmitted within six months of discharge (3). These unplanned readmissions account for nearly three-quarters of the total HF-related healthcare expenditure, primarily through hospitalization and long-term care facility costs (4). Understanding and addressing the precipitating factors behind these readmissions is essential for reducing this burden and enhancing patient-centered outcomes. Studies have identified a multitude of risk factors contributing to HF readmissions, including suboptimal medication adherence, uncontrolled comorbidities, adverse drug interactions, and psychosocial determinants such as lack of caregiver support or financial constraints (5). In particular, elderly patients are disproportionately affected, as they often present with polypharmacy, cognitive decline, and multiple comorbid conditions that compound the risk of clinical deterioration (5,6).

Cardiorenal syndrome, atrial fibrillation (AF), anemia, infections, and metabolic disorders further complicate the clinical course of HF and increase the likelihood of hospital readmission (7). For instance, one observational study highlighted that 25% of HF patients were readmitted within 30 days, with over half exhibiting poor medication adherence, elevated systolic or diastolic blood pressure, and reduced renal function, among other findings (8,9). Renal impairment, pulmonary disease, psychiatric conditions, and an overall high burden of comorbidities were independently associated with a higher likelihood of rehospitalization (10,11). Despite the wealth of literature, much of the existing data remains fragmented and lacks specificity in the context of local populations and resource-constrained settings. Given the unique demographic and clinical profiles of patients in regions like Peshawar, there is a pressing need to explore localized risk factors contributing to HF readmissions. Identifying these factors will not only aid in implementing timely and tailored interventions but also reduce the economic strain on healthcare infrastructure and improve long-term outcomes for affected individuals. Therefore, the objective of this study is to determine the frequency of various risk factors associated with hospital readmissions in patients with heart failure at Lady Reading Hospital, Peshawar.

METHODS

This cross-sectional study was carried out in the Department of Cardiology at Lady Reading Hospital, Peshawar, over a period of six months following the approval of the research synopsis. A total of 122 patients were recruited through a non-probability consecutive sampling method. The sample size was calculated using the WHO sample size calculator, applying a 95% confidence level, a 7% margin of error, and an expected prevalence of 19.1%, based on the documented frequency of anemia in previously readmitted heart failure patients. Patients were enrolled after obtaining ethical approval from the Institutional Review Board (IRB) of Lady Reading Hospital and formal authorization from the College of Physicians and Surgeons Pakistan (CPSP). Written informed consent was secured from all participants prior to enrollment, ensuring ethical standards in human subject research were met. Participants aged between 20 and 80 years were eligible if they had a confirmed diagnosis of heart failure with reduced ejection fraction (HFrEF), defined as an EF of less than 50% based on echocardiographic assessment, and a documented history of at least one previous hospitalization for heart failure. Patients with preserved ejection fraction, congenital heart disease, a history of heart transplantation or mechanical circulatory support (e.g., left ventricular assist devices), or incomplete medical records were excluded to avoid diagnostic ambiguity and reduce confounding.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Data collection was conducted using a structured, predesigned proforma, which included patient demographics (age, sex, area of residence, socioeconomic status), clinical history (smoking, diabetes mellitus, hypertension, chronic kidney disease, thyroid dysfunction), and previous cardiac history. Each participant underwent a thorough clinical evaluation, including physical examination and review of prior medical records. Risk factors potentially associated with readmission were meticulously documented and included poor medication adherence, prolonged use of NSAIDs or corticosteroids, poorly controlled blood pressure, thyroid dysfunction, myocardial ischemia or infarction, infections, arrhythmias, anemia, hyperglycemia, and electrolyte disturbances. Operational definitions for each risk factor were predefined using clinical judgment, validated self-reported history, objective laboratory data, and previous documentation. Relevant investigations included echocardiography, electrocardiography, serum creatinine, thyroid-stimulating hormone (TSH), hemoglobin, random and fasting blood glucose levels, C-reactive protein (CRP), and serum electrolytes. Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 25. Quantitative variables such as age, body mass index (BMI), and ejection fraction were assessed for normality using the Shapiro-Wilk test. Normally distributed variables were expressed as means with standard deviations, while non-normally distributed data were reported as medians with interquartile ranges (IQRs). Categorical variables were presented as frequencies and percentages. To determine associations between risk factors and hospital readmission status, the chi-square test or Fisher's exact test was applied, as appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 122 patients diagnosed with heart failure with reduced ejection fraction (HFrEF) were included in the study. The mean age of the participants was 62.3 ± 11.4 years. Males constituted the majority, accounting for 58.2% (n = 71), while females made up 41.8% (n = 51). A greater proportion of the sample belonged to urban areas (59.8%, n = 73), and nearly half (48.3%) were from a low socioeconomic background. Hypertension was the most prevalent comorbidity, present in 66.4% (n = 81) of the patients. Diabetes mellitus was identified in 44.3% (n = 54), followed by chronic kidney disease (CKD) in 28.7% (n = 35), and hyperthyroidism in 13.9% (n = 17). During the study period, 49 patients (40.2%) were readmitted with exacerbation of heart failure. When stratified by readmission status, several risk factors demonstrated statistically significant associations. Poor drug compliance was observed in 61.2% (n = 30) of readmitted patients compared to 11.0% (n = 8) among those not readmitted ($p < 0.001$). Uncontrolled blood pressure was present in 53.1% (n = 26) of the readmitted group versus 17.8% (n = 13) in the non-readmitted group ($p < 0.001$). Electrolyte abnormalities were more prevalent among readmitted patients (44.9%, n = 22) than non-readmitted ones (20.5%, n = 15; $p = 0.005$). Similarly, infection (40.8% vs. 16.4%, $p = 0.002$), arrhythmias (36.7% vs. 13.7%, $p = 0.004$), anemia (38.8% vs. 17.8%, $p = 0.009$), and hyperglycemia (32.7% vs. 12.3%, $p = 0.007$) were significantly higher among those readmitted. NSAID use also showed a statistically significant difference (30.6% vs. 12.3%, $p = 0.014$). Steroid use (14.3% vs. 4.1%, $p = 0.058$) and myocardial infarction (10.2% vs. 2.7%, $p = 0.108$) did not reach statistical significance.

Age-stratified analysis indicated that patients who were readmitted had a slightly higher mean age of 64.1 ± 9.8 years, compared to 60.9 ± 12.5 years among those not readmitted, though this difference was not statistically significant ($p = 0.12$). No significant difference in readmission rates was observed between male (41.0%) and female (39.1%) patients ($p = 0.81$). However, socioeconomic status was significantly associated with readmissions. Patients from a low socioeconomic class experienced the highest rate of readmissions (52.5%), compared to 33.3% in the middle class and 21.4% in the high socioeconomic group ($p = 0.036$). The mean ejection fraction among readmitted patients was significantly lower at 28.7% ± 5.4%, compared to 35.1% ± 7.6% in the non-readmitted group ($p < 0.001$), indicating more severe left ventricular systolic dysfunction in the readmitted population. Stratified analysis based on additional demographic and clinical factors revealed further insights into the profile of readmitted patients. Among those readmitted, 34.7% (n = 17) had chronic kidney disease (CKD), compared to 24.7% (n = 18) in the non-readmitted group; however, this difference did not reach statistical significance ($p = 0.319$). Thyroid disorders were present in 20.4% (n = 10) of readmitted patients versus 9.6% (n = 7) of non-readmitted patients, which also was not statistically significant ($p = 0.154$). Regarding place of residence, 61.2% (n = 30) of readmitted individuals were from urban areas, closely mirroring the 58.9% (n = 43) in the non-readmitted group, with no significant difference observed ($p = 0.946$). These findings suggest that while these variables may play a role in patient profiles, they did not show a strong independent association with readmission in this cohort.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 1: Demographic Characteristics of Study Population

Variable	Value
Total Patients	122
Mean Age (years)	62.3 ± 11.4
Gender	
Male	71 (58.2%)
Female	51 (41.8%)
Residence	
Urban	73 (59.8%)
Rural	49 (40.2%)
Socioeconomic Status	
Low	59 (48.3%)
Middle	36 (29.5%)
High	27 (22.1%)
Hypertension	81 (66.4%)
Diabetes Mellitus	54 (44.3%)
Chronic Kidney Disease (CKD)	35 (28.7%)
Hyperthyroidism	17 (13.9%)
Readmitted Patients	49 (40.2%)
Non-Readmitted Patients	73 (59.8%)
Mean EF (Readmitted)	28.7% ± 5.4%
Mean EF (Not Readmitted)	35.1% ± 7.6%

Table 2: Comparison of Risk Factors Between Readmitted and Non-Readmitted Patients with Heart Failure with Reduced Ejection Fraction (HFrEF)

Risk Factor	Readmitted (n=49)	Not Readmitted (n=73)	p-value
Poor Drug Compliance	30 (61.2%)	8 (11.0%)	<0.001 ★
NSAID Use	15 (30.6%)	9 (12.3%)	0.014
Steroid Use	7 (14.3%)	3 (4.1%)	0.058
Uncontrolled BP	26 (53.1%)	13 (17.8%)	<0.001 ★
Myocardial Infarction	5 (10.2%)	2 (2.7%)	0.108
Infection	20 (40.8%)	12 (16.4%)	0.002 ★
Arrhythmias	18 (36.7%)	10 (13.7%)	0.004 ★
Anemia	19 (38.8%)	13 (17.8%)	0.009 ★
Hyperglycemia	16 (32.7%)	9 (12.3%)	0.007 ★
Electrolyte Abnormality	22 (44.9%)	15 (20.5%)	0.005 ★

Table 3: Stratification Analysis

Factor	Readmitted (n=49)	Not Readmitted (n=73)	p-value
CKD	17	18	0.319
Thyroid Disorder	10	7	0.154
Urban Residence	30	43	0.946

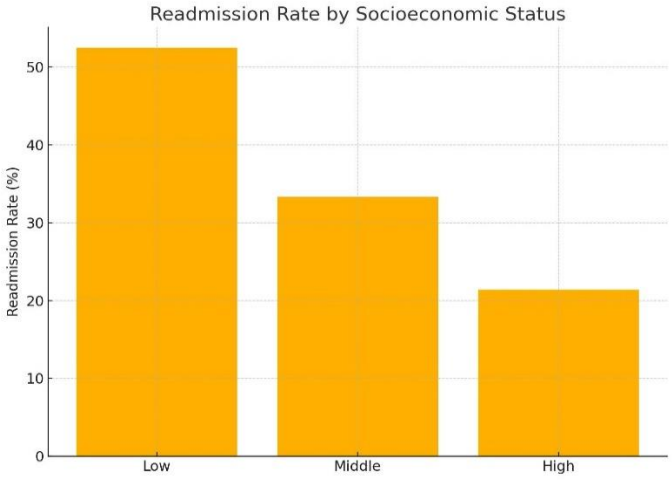

Figure1 Readmission Rate by Socioeconomic Status

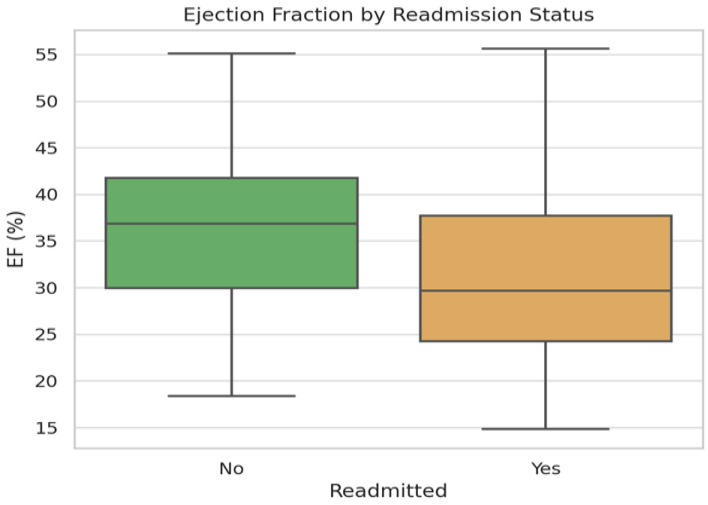

Figure 2 Ejection Fraction by Readmission Status

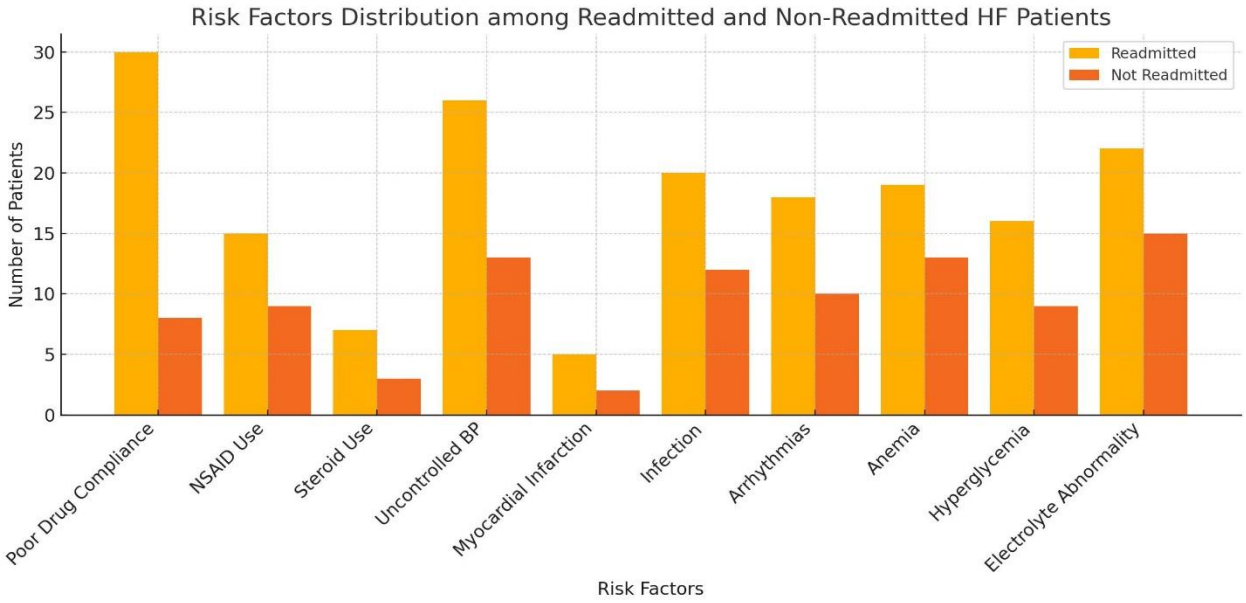

Figure 3 Risk Factors Distribution among Readmitted and Non-Readmitted HF Patients

DISCUSSION

This study explored the frequency and impact of risk factors associated with hospital readmissions among patients with heart failure with reduced ejection fraction (HFrEF) admitted at a tertiary care center in Peshawar. The findings revealed a substantial readmission rate of 40.2%, which is in line with prior studies reporting 30-day and 6-month readmission rates ranging from 25% to 45% among HF patients (10,11). This emphasizes the persistent challenge heart failure poses to healthcare systems, particularly in low-resource settings where risk mitigation strategies are often inconsistently implemented. Poor drug compliance was the most common and statistically significant risk factor identified in the readmitted group, affecting 61.2% of those patients. This trend is well supported by previous literature, where non-adherence to prescribed therapy has consistently been linked to increased morbidity and recurrent decompensation in HF (12,13). Given the modifiable nature of this factor, the results call attention to the importance of reinforcing medication counseling, discharge education, and caregiver involvement. Uncontrolled hypertension was also observed in over half of the readmitted patients

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

(53.1%), reaffirming its role as a potent precipitant of acute decompensation. The association between elevated blood pressure and readmission has been similarly reported in multicenter analyses, where poor BP control was identified in over one-third of recently discharged HF patients (14,15).

Infection was another major contributor, present in 40.8% of readmissions. This finding aligns with earlier studies that recognize systemic infections, especially respiratory and urinary tract infections, as common triggers of HF exacerbation due to increased metabolic demands and inflammatory stress on the myocardium (16,17). Additionally, the presence of arrhythmias, particularly atrial fibrillation in 36.7% of readmitted patients, highlights the clinical interplay between atrial dysfunction and heart failure, both of which can precipitate and perpetuate each other, increasing the complexity of disease management (18). Electrolyte abnormalities, anemia, and hyperglycemia were also significantly associated with hospital readmissions. These metabolic imbalances often coexist with HF and reflect a more advanced disease state, particularly in the presence of comorbid conditions such as diabetes, renal impairment, and poor nutritional status (19,20). Notably, patients who were readmitted exhibited significantly lower ejection fractions, reinforcing the prognostic importance of left ventricular systolic function in identifying high-risk individuals and tailoring post-discharge surveillance accordingly (21).

An important strength of this study is its focused evaluation of modifiable and clinically measurable risk factors in a real-world hospital setting, offering actionable insights for frontline clinicians. By employing predefined clinical and biochemical definitions, the study ensured consistent risk stratification across patients. However, it also had certain limitations. The cross-sectional design restricted the ability to establish causal relationships, while reliance on self-reported data for factors such as drug compliance and NSAID use may have introduced recall or reporting bias. Additionally, being a single-center study limits the generalizability of the findings across diverse populations with varying healthcare access and socioeconomic determinants. Despite these limitations, the results emphasize the value of a multifaceted, patient-centered approach to heart failure management. Discharge planning that includes patient education, medication review, blood pressure monitoring, infection prevention, and rhythm surveillance can play a crucial role in minimizing preventable readmissions. Future research should adopt longitudinal designs or interventional models to validate these findings and explore the effectiveness of structured post-discharge programs in reducing HF-related hospitalizations. Incorporating telehealth follow-up, caregiver support models, and community-based rehabilitation could also be examined to enhance continuity of care and early detection of clinical deterioration.

CONCLUSION

This study concludes that recurrent hospitalizations among patients with heart failure with reduced ejection fraction are strongly influenced by several modifiable clinical and behavioral risk factors. Identifying these factors—such as poor medication adherence, uncontrolled blood pressure, infections, and metabolic imbalances—highlights the critical need for proactive, individualized care strategies. These findings underscore the importance of structured discharge planning, patient education, and multidisciplinary follow-up to reduce avoidable readmissions and enhance the long-term management and quality of life in heart failure populations.

AUTHOR CONTRIBUTION

Author	Contribution
Saddam Hussain*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ikram Ullah	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Roman Khan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Junaid Rehman	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Atif Kamal	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

Author	Contribution
Muhammad Azam Khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. Bozkurt B, Coats AJS, Tsutsui H, Abdelhamid CM, Adamopoulos S, Albert N, et al. Universal definition and classification of heart failure: a report of the Heart Failure Society of America, Heart Failure Association of the European Society of Cardiology, Japanese Heart Failure Society and Writing Committee of the Universal Definition of Heart Failure: endorsed by the Canadian Heart Failure Society, Heart Failure Association of India, Cardiac Society of Australia and New Zealand, and Chinese Heart Failure Association. Eur J Heart Fail. 2021;23(3):352–80.
2. Savarese G, Becher PM, Lund LH, Seferovic P, Rosano GMC, Coats AJS. Global burden of heart failure: a comprehensive and updated review of epidemiology. Cardiovasc Res. 2023;118(17):3272-87.
3. Wideqvist M, Cui X, Magnusson C, Schaufelberger M, Fu M. Hospital readmissions of patients with heart failure from real world: timing and associated risk factors. ESC Heart Fail. 2021;8(2):1388-97.
4. Al-Tamimi MA, Gillani SW, Abd Alhakam ME, Sam KG. Factors Associated With Hospital Readmission of Heart Failure Patients. Front Pharmacol. 2021;12:e732760.
5. Elasfar AA, Alhabeeb W, Elasfar S. Heart Failure in the Middle East Arab Countries: Current and Future Perspectives. J Saudi Heart Assoc. 2020;32(2):236-41.
6. Sadiq AM, Chamba NG, Sadiq AM, Shao ER, Temu GA. Clinical Characteristics and Factors Associated with Heart Failure Readmission at a Tertiary Hospital in North-Eastern Tanzania. Cardiol Res Pract. 2020;2020:e2562593.
7. Ning J, Akhter T, Sarfraz M, Afridi HI, Albasher G, Unar A. The importance of monitoring endocrine-disrupting chemicals and essential elements in biological samples of fertilizer industry workers. Environmental Research. 2023 Aug 15;231:116173.
8. Abdin A, Anker SD, Butler J, Coats AJS, Kindermann I, Lainscak M, et al. 'Time is prognosis' in heart failure: time-to-treatment initiation as a modifiable risk factor. ESC Heart Fail. 2021;8(6):4444-53.
9. Harmon D, Rathousky J, Choudhry F, Grover H, Patel I, Jacobson T, et al. Readmission Risk Factors and Heart Failure With Preserved Ejection Fraction. J Am Osteopath Assoc. 2020;120(12):831-8.
10. Al-Hassan NM, Aldohaim SA, Benhjji MA, Al-Harbi OK, Alsaadi NA, Almogbel O, et al. Prevalence and risk of hospitalization for depression in patients with heart failure. Curr Probl Cardiol. 2024;49(11):102793.
11. Tabrizi R, Ketabi M, Andishgar A, Vali M, Fereidouni Z, Mojarrad Sani M, et al. Predicting the risk of mortality and rehospitalization in heart failure patients: A retrospective cohort study by machine learning approach. Clin Cardiol. 2024;47(5):e24280.
12. Fuentes-Abolafio IJ, Stubbs B, Pérez-Belmonte LM, Bernal-López MR, Gómez-Huelgas R, Cuesta-Vargas AI. Physical functional performance and prognosis in patients with heart failure: a systematic review and meta-analysis. BMC Cardiovasc Disord. 2020;20(1):512.
13. Zahid S, Hashem A, Atti V, Khan MZ, Kawsara M, Balla S. Outcomes of 30-Day Readmission in Patients With Heart Failure on Index Hospitalization Who Underwent Transcatheter Aortic Valve Implantation (from the US Nationwide Readmissions Database). Am J Cardiol. 2022;179:110-1.
14. Kamiya K, Sato Y, Takahashi T, Tsuchihashi-Makaya M, Kotooka N, Ikegame T, et al. Multidisciplinary Cardiac Rehabilitation and Long-Term Prognosis in Patients With Heart Failure. Circ Heart Fail. 2020;13(10):e006798.
15. Takahashi T, Iwata K, Morisawa T, Kato M, Kono Y, Taya M, et al. Incidence of Hospitalization-Associated Disability in Older Patients With Heart Failure. Circ J. 2024;88(5):672-9.
16. Vijay K, Neuen BL, Lerma EV. Heart Failure in Patients with Diabetes and Chronic Kidney Disease: Challenges and Opportunities. Cardiorenal Med. 2022;12(1):1-10.
17. Roger VL. Epidemiology of Heart Failure: A Contemporary Perspective. Circ Res. 2021;128(10):1421-34.
18. Kwok CS, Abramov D, Parwani P, Ghosh RK, Kittleson M, Ahmad FZ, et al. Cost of inpatient heart failure care and 30-day readmissions in the United States. Int J Cardiol. 2021;329:115-22.
19. Llàcer Iborra P, Núñez Villota J. Clinical characteristics and risk factors for mortality on admission in patients with heart failure hospitalized due to COVID-19 in Spain. Rev Clin Esp (Barc). 2022;222(5):299-300.

20. Lyu L, Wang X, Xu J, Liu Z, He Y, Zhu W, et al. Association between triglyceride glucose-body mass index and long-term adverse outcomes of heart failure patients with coronary heart disease. Cardiovasc Diabetol. 2024;23(1):162.
21. Chua D, Akhter N, Ng S, et al. Risk factors for heart failure readmissions: insights from a tertiary center in Southeast Asia. ESC Heart Fail. 2020;7(3):1203–11.