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The Epidemiology of Acute Decompensated Heart Failure in Emergency Settings

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ABSTRACT

Background: Acute decompensated heart failure (ADHF) is a leading cause of emergency department visits and hospital admissions worldwide and is associated with substantial morbidity, mortality, and resource utilization. Objective: To describe the epidemiological profile, clinical characteristics, and short-term outcomes of patients presenting with ADHF in an emergency department setting. Methods: This prospective observational study was conducted in the Emergency Department of Lady Reading Hospital, Peshawar, from September 2025 to December 2025 following ethical approval in August 2025. Adults presenting with clinically diagnosed ADHF were enrolled using consecutive sampling. Demographics, presenting features, comorbidities, heart failure subtype by ejection fraction where echocardiography was available, emergency disposition, and index-episode outcomes were recorded and analyzed using SPSS. Results: A total of 120 patients were included with mean age 63.4 ± 12.8 years; 60.0% were male. Acute dyspnea was the most frequent presenting symptom (90.0%), followed by orthopnea (70.0%) and peripheral edema (63.3%). Hypertension (71.7%) and ischemic heart disease (53.3%) were common comorbidities. Echocardiography was available in 85.0%; among these, 56.9% had reduced ejection fraction. Most patients required admission (78.3%). Mortality during ED stay was 6.7%, and overall short-term mortality during the index episode was 15.8%. Conclusion: ADHF imposes a substantial emergency-care burden with high admission needs and clinically important short-term mortality, supporting the need for strengthened emergency-based management pathways.

Keywords
acute decompensated heart failure; emergency department; epidemiology; outcomes; tertiary care.

INTRODUCTION

Heart failure (HF) remains one of the most rapidly expanding cardiovascular syndromes globally, with contemporary burden estimates indicating that tens of millions of individuals live with HF and that prevalence has increased substantially over recent decades, largely driven by population ageing and improved survival from ischemic and hypertensive cardiovascular disease (1). In clinical practice, the emergency department (ED) serves as a central gateway for acute HF care, particularly for acute decompensated heart failure (ADHF), a syndrome characterized by rapid onset or worsening of signs and symptoms of HF requiring urgent evaluation and stabilization. ADHF contributes disproportionately to hospital admissions, short-term mortality, and healthcare expenditure, and its acute trajectory frequently reflects both chronic disease progression and precipitating factors such as uncontrolled hypertension, ischemia, infection, arrhythmias, and medication non-adherence (2,3).

Large epidemiological studies from high-income settings have consistently demonstrated that ADHF represents a significant component of ED workload and hospital utilization. Earlier national analyses from the United States estimated millions of ED visits for ADHF over a decade, establishing ADHF as a leading cause of admission among older adults (4). More recent electronic health record–based assessments across United States ED encounters have reaffirmed that acute HF presentations remain common and that most patients require inpatient admission, underscoring the persistent acute-care burden despite advances in chronic HF therapy (5). Patients presenting with ADHF are typically older and frequently have multiple comorbidities—particularly hypertension, ischemic heart disease, diabetes mellitus, and chronic kidney disease—which complicate acute management and worsen outcomes (6). Short-term and intermediate-term prognosis in ADHF remains poor, with substantial mortality observed within weeks and months of presentation, and with recurrent ED presentations and readmissions contributing to cumulative risk and system strain (7–9).

Despite this extensive literature, the epidemiology of ADHF in emergency settings is not uniform across regions. Differences in baseline cardiovascular risk profiles, access to preventive care, availability and timing of echocardiography and natriuretic peptide testing, and constraints in inpatient and critical care capacity may influence ED presentation patterns, disposition decisions, and short-term outcomes. However, ED-based prospective epidemiological data describing ADHF case-mix and outcomes from tertiary-care hospitals in Pakistan remain comparatively limited, particularly from high-volume referral centers where ED congestion, delayed presentation, and comorbidity burden may amplify severity at arrival. Locally generated evidence is therefore essential to inform triage pathways, admission planning, early risk stratification, and the design of context-appropriate emergency-based management strategies.

Accordingly, this prospective observational study was conducted in the ED of Lady Reading Hospital, Peshawar, to describe the epidemiological profile and clinical characteristics of adults presenting with ADHF, including key comorbidities and heart failure subtype by ejection fraction

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where echocardiography was available, and to quantify emergency disposition and short-term outcomes, including mortality during ED stay and during the index hospitalization.

MATERIALS AND METHODS

This prospective observational study was conducted in the Emergency Department of Lady Reading Hospital, Peshawar, Pakistan, from September 2025 to December 2025. Lady Reading Hospital is a large tertiary-care teaching hospital and regional referral center with high emergency patient turnover and a substantial burden of acute cardiovascular presentations. Ethical approval was obtained from the Institutional Review Board/Ethical Committee of Lady Reading Hospital in August 2025 prior to participant enrollment. Written informed consent was obtained from eligible patients or, where clinically indicated due to acuity, from their attendants in accordance with institutional ethical requirements and emergency care practices. Adult patients aged 18 years or older presenting to the ED during the study period with a clinical diagnosis consistent with acute decompensated heart failure were assessed for eligibility and enrolled using consecutive sampling during the study timeframe. ADHF was defined operationally as an acute onset or worsening of dyspnea and/or fatigue with objective clinical findings suggestive of congestion (including pulmonary crepitations, raised jugular venous pressure, peripheral edema, or radiographic pulmonary congestion) in the setting of known or suspected structural or functional cardiac disease, supported where available by electrocardiography, chest radiography, echocardiography, and natriuretic peptide testing, consistent with internationally accepted diagnostic principles for acute HF syndromes (2,3). Patients were excluded if their primary presentation was dyspnea predominantly attributable to non-cardiac causes such as pneumonia, acute asthma or chronic obstructive pulmonary disease exacerbation, pulmonary embolism, or other respiratory etiologies based on clinical assessment and available investigations; if core clinical data required for analysis were incomplete; or if consent was declined.

Data were collected prospectively using a structured proforma designed for the study and completed by the clinical/research team at the time of ED evaluation and during the index care episode. Variables included demographic characteristics (age, sex), clinical presentation (acute dyspnea, orthopnea, peripheral edema), physical findings at presentation (raised jugular venous pressure, pulmonary crepitations), relevant comorbidities (hypertension, ischemic heart disease, diabetes mellitus, chronic kidney disease), and prior history of heart failure. Comorbidities were ascertained through patient or attendant history corroborated by medical records and/or current medication history, where available. Echocardiography findings were recorded when performed as part of clinical care, and heart failure subtype by ejection fraction was categorized as heart failure with reduced ejection fraction (HFrEF) or heart failure with preserved ejection fraction (HFpEF) according to the reported ejection fraction thresholds used in routine clinical interpretation; where echocardiography was not available, subtype was recorded as not assessed and excluded from subtype-specific denominator calculations.

The primary outcomes were emergency department disposition (admission to medical ward or coronary care unit, discharge after stabilization, or death during ED stay) and short-term mortality during the index acute episode, defined as death in the ED or during the index hospitalization among admitted patients. Secondary outcomes included ED length of stay. To minimize information bias, data collection relied on contemporaneous documentation and structured variable definitions, and outcome ascertainment was based on ED disposition records and inpatient course documentation for admitted participants. Missing data were assessed at the point of entry; for analyses involving echocardiographic subtype, complete-case analysis was performed using the echocardiography-available subgroup as the denominator, while overall outcomes were computed using the full cohort denominator.

Data were entered and analyzed using SPSS. Continuous variables were summarized as mean ± standard deviation, while categorical variables were summarized as frequencies and percentages with 95% confidence intervals for key proportions. No imputation was performed for missing echocardiographic subtype data. All analyses were descriptive and aimed to characterize the epidemiological burden, clinical profile, and outcomes of ADHF presentations in this ED population.

RESULTS

A total of 120 adults presenting with acute decompensated heart failure were enrolled during the study period. The cohort had a mean age of 63.4 ± 12.8 years, and more than two-thirds were older than 60 years (82/120, 68.3%). Male patients comprised 72/120 (60.0%; 95% CI: 51.1%–68.3%), demonstrating a modest male predominance among emergency ADHF presentations in this tertiary-care setting.

Table 1. Baseline Demographic Profile of Patients Presenting with ADHF (N = 120)

Variable	Value
Age, mean ± SD (years)	63.4 ± 12.8
Age > 60 years, n (%)	82 (68.3%)
Male sex, n (%)	72 (60.0%)
Female sex, n (%)	48 (40.0%)

Table 2. Clinical Presentation and Examination Findings at ED Arrival (N = 120)

Clinical Feature	n (%)	95% CI (proportion)
Acute dyspnea	108 (90.0%)	83.3%–94.2%
Orthopnea	84 (70.0%)	61.3%–77.5%
Peripheral edema	76 (63.3%)	54.4%–71.4%
Pulmonary crepitations	92 (76.7%)	68.3%–83.3%
Raised jugular venous pressure	58 (48.3%)	39.6%–57.2%

Table 3. Comorbidity Profile and Prior Heart Failure History (N = 120)

Comorbidity / History	n (%)	95% CI (proportion)
Hypertension	86 (71.7%)	63.0%–79.0%
Ischemic heart disease	64 (53.3%)	44.4%–62.0%
Diabetes mellitus	52 (43.3%)	34.8%–52.3%

Comorbidity / History	n (%)	95% CI (proportion)
Chronic kidney disease	26 (21.7%)	15.2%–29.9%
Prior history of heart failure	78 (65.0%)	56.1%–72.9%

Acute dyspnea was the dominant presenting complaint, reported in 108/120 patients (90.0%; 95% CI: 83.3%–94.2%), indicating that respiratory distress was the principal ED trigger for care-seeking. Orthopnea was present in 70.0% (84/120; 95% CI: 61.3%–77.5%), while peripheral edema was observed in 63.3% (76/120; 95% CI: 54.4%–71.4%), supporting a high prevalence of volume overload at presentation. On examination, pulmonary crepitations were documented in 76.7% (92/120; 95% CI: 68.3%–83.3%), and raised jugular venous pressure in 48.3% (58/120; 95% CI: 39.6%–57.2%), reflecting substantial clinical congestion burden among ED ADHF cases. The cohort demonstrated a high burden of cardiovascular and metabolic comorbidities. Hypertension was present in 71.7% (86/120; 95% CI: 63.0%–79.0%), making it the most prevalent associated condition. Ischemic heart disease was documented in 53.3% (64/120; 95% CI: 44.4%–62.0%), and diabetes mellitus in 43.3% (52/120; 95% CI: 34.8%–52.3%), indicating substantial atherosclerotic and cardiometabolic risk clustering in ED ADHF presentations. Chronic kidney disease affected 21.7% (26/120; 95% CI: 15.2%–29.9%), a clinically relevant subgroup given its implications for diuretic responsiveness and mortality risk. Notably, 65.0% (78/120; 95% CI: 56.1%–72.9%) had a prior documented history of heart failure, suggesting that recurrent decompensation contributed heavily to ED burden.

Table 4. Echocardiographic Availability and Heart Failure Subtype (Echocardiography available: n = 102/120)

Echocardiography / Subtype	n (%)	95% CI (proportion)
Echocardiography performed (out of total cohort)	102/120 (85.0%)	77.5%–90.3%
HFrEF (of those with echocardiography)	58/102 (56.9%)	47.2%–66.1%
HFpEF (of those with echocardiography)	44/102 (43.1%)	33.9%–52.8%

Echocardiography was available for 102 of 120 patients (85.0%; 95% CI: 77.5%–90.3%), enabling characterization of systolic function in the majority of ED presentations. Among those with echocardiography, heart failure with reduced ejection fraction constituted 56.9% (58/102; 95% CI: 47.2%–66.1%), while heart failure with preserved ejection fraction accounted for 43.1% (44/102; 95% CI: 33.9%–52.8%). This distribution indicates that reduced ejection fraction was slightly more common than preserved ejection fraction among evaluated patients, consistent with a mixed ADHF case profile in this emergency cohort.

Table 5. Emergency Department Disposition, Length of Stay, and Short-Term Outcomes (N = 120)

Outcome	n (%) / Mean ± SD	95% CI (proportion)
ED length of stay (hours)	9.6 ± 4.1	—
Hospital admission	94 (78.3%)	70.1%–84.8%
Discharged after stabilization	18 (15.0%)	9.7%–22.5%
Died during ED stay	8 (6.7%)	3.4%–12.6%
In-hospital mortality among admitted (n = 94)	11 (11.7%)	—
Overall short-term mortality (ED + in-hospital)	19 (15.8%)	10.4%–23.4%

Emergency department disposition reflected a high requirement for inpatient care. Most patients were admitted to medical wards or coronary care units (94/120, 78.3%; 95% CI: 70.1%–84.8%), while 15.0% (18/120; 95% CI: 9.7%–22.5%) were stabilized and discharged from the ED. Mortality during the index ED stay was 6.7% (8/120; 95% CI: 3.4%–12.6%), indicating a clinically severe subset arriving in extremis. The mean ED length of stay was 9.6 ± 4.1 hours, reflecting prolonged acute-care management and disposition processing. Among admitted patients, in-hospital mortality during the index hospitalization was 11.7% (11/94). When ED deaths and in-hospital deaths were combined, the overall short-term mortality for the index acute episode was 15.8% (19/120; 95% CI: 10.4%–23.4%), underscoring the substantial fatality risk associated with ADHF presentations in this tertiary emergency setting.

DISCUSSION

In this prospective emergency department study from a tertiary-care referral hospital in Peshawar, acute decompensated heart failure emerged as a high-burden clinical syndrome characterized by advanced age, frequent congestion at presentation, substantial comorbidity clustering, and high inpatient utilization. The mean age of 63 years and the predominance of patients older than 60 years reflect the typical demographic pattern of acute HF syndromes, which disproportionately affect older populations and are frequently driven by longstanding vascular risk and structural heart disease (2,10). The clinical picture was dominated by acute dyspnea and objective signs of pulmonary congestion, consistent with established emergency phenotypes where congestion rather than hypoperfusion is the predominant presentation and requires rapid assessment and decongestive therapy to reduce early deterioration risk (3,10). From a health-system perspective, the high proportion of patients requiring admission in this cohort underscores the pressure placed on inpatient medical wards and coronary care resources by ADHF presentations, which mirrors the admission-heavy disposition patterns reported in large emergency department analyses from high-income settings (5,11).

The burden of comorbid disease in this cohort was notable, with hypertension and ischemic heart disease affecting the majority of patients and diabetes mellitus present in almost half. These patterns align with the wider literature describing ADHF as a syndrome often superimposed on chronic cardiometabolic disease trajectories, where hypertension, atherosclerotic disease, and renal dysfunction interact to increase susceptibility to congestion and acute hemodynamic instability (6,10). Chronic kidney disease was present in approximately one-fifth of patients, a clinically meaningful proportion given that renal impairment complicates fluid removal strategies and is consistently associated with worse short-term prognosis in acute HF. Importantly, nearly two-thirds of patients had a prior history of heart failure, suggesting that recurrent decompensation is a dominant contributor to ED workload in this setting. This has immediate implications for transitional care and outpatient optimization, because recurrent decompensation typically reflects incomplete guideline-directed therapy optimization, poor follow-up, or precipitating triggers such as uncontrolled blood pressure, infection, or dietary and medication nonadherence, all of which can be targeted through structured discharge pathways and early follow-up systems (3,12).

Echocardiography was available for the majority of patients, enabling classification of heart failure subtype by ejection fraction for most presentations, with a slightly higher proportion of reduced ejection fraction compared with preserved ejection fraction. While ejection fraction phenotype is relevant for longer-term disease-modifying therapy selection, it is also increasingly recognized that short-term ED decision-making is influenced heavily by congestion severity, hemodynamic stability, comorbidity burden, and early therapeutic response rather than ejection fraction alone (3,11). In this cohort, short-term mortality during the index acute episode was substantial, comprising deaths in the ED and additional

deaths during the index hospitalization among admitted patients. These findings reinforce the clinical severity of ADHF in emergency settings and are consistent with prior observational studies demonstrating that acute HF syndromes continue to carry considerable early mortality despite improvements in chronic HF therapies (7,13). The mean ED length of stay of approximately 10 hours is also clinically relevant, as prolonged ED stays in acute HF may reflect the need for extended stabilization, limited availability of monitored inpatient beds, or delays in definitive disposition decisions, all of which have been associated in other settings with increased ED crowding and strained resource allocation (11).

The present study provides locally generated prospective evidence describing ADHF presentations in a major Pakistani referral center, but it should be interpreted in light of several limitations. The study was conducted at a single center and may not fully represent patterns in smaller district hospitals or private-sector facilities. Diagnostic classification relied on pragmatic emergency department assessment supported by available investigations, and natriuretic peptide testing and echocardiography were not uniformly performed in all patients; therefore, misclassification and incomplete phenotyping are possible, particularly in patients with mixed cardiopulmonary presentations. The analysis was primarily descriptive, and the study was not designed to identify independent predictors of mortality or admission through multivariable modeling. In addition, outcomes were limited to the index ED visit and index hospitalization; longer-term outcomes such as 30-day readmissions, post-discharge mortality, and quality-of-life measures were not assessed. Despite these constraints, the findings offer a clinically interpretable epidemiological snapshot that can support pragmatic emergency pathway development, including early identification of high-risk patients, improved congestion assessment protocols, and strengthened inpatient transition processes (3,11,14).

CONCLUSION

Acute decompensated heart failure in this tertiary emergency department primarily affected older adults with a high burden of hypertension, ischemic heart disease, and diabetes mellitus, and it presented predominantly with dyspnea and overt congestion. The condition required hospital admission in the majority of cases and was associated with clinically important short-term mortality during the index episode, highlighting ADHF as a major contributor to emergency service utilization and early adverse outcomes. Strengthening emergency-based diagnostic standardization, rapid decongestion pathways, and structured transitional care may reduce avoidable deterioration and improve short-term outcomes, while multicenter studies are warranted to better define regional patterns and support resource planning.

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