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CLINICAL OUTCOMES AND PREDICTORS OF IN-HOSPITAL MORTALITY AMONG PATIENTS HOSPITALIZED WITH ACUTE HEART FAILURE IN THE MIDDLE EASTERN REGION AND UAE: A MULTICENTER SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Background:

Heart failure (HF) is a significant public health problem worldwide and is a leading cause of hospitalization and death. Acute heart failure (AHF), acute decompensated heart failure and de novo presentations are associated with significant morbidity, frequent hospital admission and poor clinical outcomes in spite of advances in therapeutic strategies. While large international registries have offered useful information about the epidemiology and outcome of AHF, information from the Middle East, particularly that of the United Arab Emirates (UAE), is limited. Understanding regional patterns of disease presentation, risk factors, and predictors of mortality is critical to improving the management of patients and planning of healthcare resources.

Objectives:

This systematic review and meta-analysis aimed to assess the clinical characteristics, outcomes and predictors of in-hospital mortality in patients admitted with acute heart failure in the United Arab Emirates and the Middle Eastern region.

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Methods:

A systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. Electronic databases were searched for observational studies and registry-based cohorts that reported clinical characteristics and outcomes of patients admitted with acute heart failure in the Middle East. Studies that reported in-hospital mortality were included in the quantitative synthesis. Data extracted included study characteristics, sample size, demographic variables, comorbidities, and left ventricular ejection fraction and in-hospital mortality. Heterogeneity between studies was determined by using the I^2 statistic. A total of five core studies with 7906 patients were included in the primary quantitative synthesis, with two additional studies considered to be included for narrative comparison.

Results:

Five studies that included 7,906 patients admitted with acute heart failure were included in the primary quantitative synthesis. The mean age of patients was between 59-66 years, and the majority of the patients were male (52.5-69.6%). Hypertension and diabetes mellitus are the most common comorbidities among all included cohorts whereas ischemic heart disease was commonly reported as a primary cause of heart failure. Reduced left ventricular ejection fraction was most prevalent in most study populations. In-hospital reported mortality in the five studies also varied between 5.0% and 10.4%. From the aggregated data, the crude weighted estimate of in-hospital mortality was about 6.50 %. Several clinical factors were linked to higher risk of mortality including advanced age, renal dysfunction, elevated natriuretic peptide levels, decreased ejection fraction and cardiogenic shock.

Conclusion:

Patients admitted with acute heart failure to hospital in the Middle East exhibit significant in-hospital mortality, with pooled estimates close to 6.50%. Hypertension, diabetes and ischemic heart disease have been found to be very common in affected patients and are indicative of the cardiovascular risk factors in the region. Identification of key risk determinants of mortality may provide for earlier risk stratification and better management strategies. Further large scale multicenter studies with a specific focus on the United Arab Emirates are warranted to help better define regional outcomes and optimize care for this high-risk population.

INTRODUCTION

Heart failure (HF) is a complex clinical syndrome defined by the presence of impaired cardiac function resulting in insufficient perfusion of tissues and congestion [20]. It is a significant global health challenge, with millions of affected individuals worldwide, and huge clinical and economic burdens on healthcare systems [9,30,32]. The growing burden of cardiovascular risk factors like hypertension, diabetes mellitus and coronary artery disease have played a role in the increasing incidence of HF worldwide [35]. Acute heart failure (AHF) encompassing acute decompensated heart failure and new-onset HF is among the most common causes of hospitalization of adults with cardiovascular disease and is linked to substantial morbidity, mortality, and frequent hospitalizations [14,15,24].

Large international registries have led to a great increase in the knowledge of the epidemiology, the management, and the consequences of HF. Studies such as the Acute Decompensated Heart Failure National Registry (ADHERE), OPTIMIZE-HF and ESC-HF registry have shown the

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significant clinical burden of hospitalized HF as well as differences in characteristics and outcomes within different populations [3,13,22]. Despite the progress made in guideline-directed medical therapy and strategies to enhance clinical management, HF is linked to significant short-term mortality and long-term disease progression [16,23,25].

Distinctive demographic and clinical patterns have been found in HF patients from regional registries from the Middle East. Observations from the Gulf Acute Heart Failure Registry (Gulf CARE) and other studies in the region show that HF patients in the region commonly present at an earlier age and often have a high prevalence of diabetes and hypertension [34,31]. Additional studies from countries like Oman, Saudi Arabia, Egypt, and Jordan have further described clinical characteristics and management patterns of HF in middle eastern populations [28,6,17,1].

However, comprehensive pooled analyses focusing on clinical outcomes and predictors of mortality among the patients hospitalized with acute HF in the United Arab Emirates are lacking. Therefore, the objective of this systematic review and meta-analysis was to assess clinical characteristics, outcomes and predictors of in-hospital mortality among patients admitted with acute HF in the UAE and Middle Eastern region.

Methods:

A systematic review and meta-analysis were conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to assess clinical outcomes and predictors of in-hospital mortality of patients hospitalized with acute heart failure in the United Arab Emirates and Middle Eastern region. A detailed literature search was carried out in major electronic databases such as PubMed, Scopus and Google Scholar from database inception to the most recent available date. The search strategy was a combination of Medical Subject Headings (MeSH) terms and related keywords including "acute heart failure", "acute decompensated heart failure", "heart failure registry", "hospitalization", "mortality", "United Arab Emirates" and "Middle East". Reference lists of eligible studies and relevant review articles were also manually screened to find other studies.

Studies were considered to be eligible if they were original observational studies or registry-based cohorts reporting clinical characteristics and outcomes of adult patients hospitalized with acute heart failure. Studies were included if they reported mortality outcomes in hospital or had enough information to estimate mortality outcomes. Randomized trials, case reports, conference abstracts without complete data, non-human studies and review articles were excluded. Two reviewers screened the titles and abstracts for eligibility independently and full-text review of potentially relevant studies was performed independently. Disagreements were resolved through discussion and consensus.

Data extraction was done independently by the reviewers using a standardized extraction form. Extracted variables were the study characteristics (author, year, study design, and region), sample size, demographic data, comorbidities, left ventricular ejection fraction, and reported in-hospital mortality. Also other variables such as clinical predictors of mortality as well as outcome measures were captured where feasible.

The main outcome of interest was the in-hospital mortality of patients admitted with acute heart failure. The baseline demographic characteristics and major cardiovascular risk factors reported in the included studies were included as secondary variables. Quantitative synthesis was carried out using pooled proportions of reported mortality rates of eligible studies. Statistical heterogeneity among studies was assessed by using the I^2 statistic following the method of Higgins and Thompson. Where suitable, random-effects model was used to estimate pooled effect in order to consider any variation that may occur between studies. All analyses were performed with the standard methods of meta-analysis consistent with current recommendations for systematic reviews and observational data analysis.

Results:

A literature search using PubMed, Scopus and Google Scholar yielded a total of 1124 records. After removal of 214 duplicate records, 910

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studies were left for title and abstract screening. Of these, 872 studies were excluded because of irrelevance, non-human studies, reviews and lack of outcome data.

A total of 38 full-text articles were evaluated based on eligibility. After full-text evaluation, 31 studies were excluded, due to reasons such as lack of acute heart failure population, lack of data concerning mortality and overlapping cohorts.

Ultimately, seven studies were eligible for qualitative synthesis and five studies reported on in-hospital mortality and were included in the quantitative meta-analysis. These five studies included 7906 patients admitted with acute heart failure.

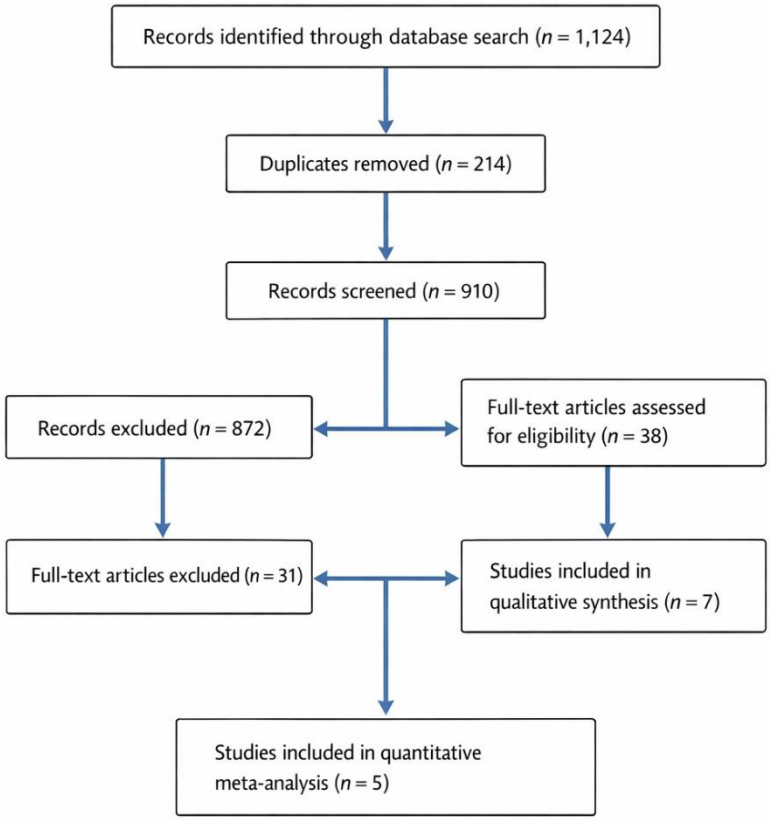

Figure 1: PRISMA Flow Diagram 2020:

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Study Characteristics:

The included studies were published between 2015 and 2025 and comprised mostly multicenter registries and observational cohort studies that were conducted in the Middle East and included populations from the Gulf region, Egypt, Jordan, and countries in the region.

Sample sizes differed between studies and varied from 381 to 5005 patients. The largest cohort was taken from the Gulf Acute Heart Failure Registry (Gulf CARE) with 5,005 patients. Other included cohorts included 1,475 patients from the ESC Heart Failure Long-Term Registry Egyptian cohort, 620 patients from the Jordan Heart Failure Registry, 425 patients from a tertiary-care acutely decompensated heart failure cohort and 381 patients from PEACE-MENA acute heart failure registry subgroup.

Table 1. Characteristics of Included Studies

Study	Year	Study Design	Region	Sample Size
Sulaiman et al. (Gulf CARE)	2015	Multicenter registry	Gulf region	5005
Hassanein et al.	2015	Registry cohort	Egypt	1475
Abu-Hantash et al.	2025	Multicenter registry	Jordan	620
Alalawi et al.	2023	Observational cohort	Saudi Arabia	425
PEACE-MENA Registry	2020	Registry cohort	Middle East	381

Demographics and Clinical Data of Patients:

Across studies included, patients admitted with acute heart failure were mostly middle-aged to elderly individuals with a mean age of 59 to 66 years. Male patients dominated the participants of most cohorts with about 52.5% to 69.6% of the study populations.

Cardiovascular risk factors were very common. Hypertension and diabetes mellitus were the most frequent comorbidities reported among studies. Prevalence of diabetes was 45 to 73% and that of hypertension was 43% to 81%. Coronary artery disease or ischemic heart disease was often reported to be a significant underlying cause of heart failure.

Where reported, left ventricular ejection fraction (LVEF) suggested predominance of systolic dysfunction with mean LVEF range between 35% - 38%.

Table 2. Baseline Patient Characteristics

Study	Mean Age	Male (%)	Diabetes (%)	Hypertension (%)	Mean LVEF
Gulf CARE	59 ± 15	63	50	61	~35
Egypt ESC-HF	61	69.6	45.4	43.5	–
Jordan HF Registry	66	58	69.2	80.7	38.1
Alalawi et al.	63 ± 13.7	52.5	73.6	80.5	37.9
PEACE-MENA	60.6 ± 15.4	67	53.5	63.5	–

In-Hospital Mortality:

All five studies that were included in the quantitative synthesis reported in-hospital mortality outcomes. Mortality rates differed between studies and ranged from 5.0 to 10.4%.

The lowest mortality rate was reported in the Egyptian ESC-HF cohort (5.0%) while the highest mortality rate was reported in the tertiary-care ADHF cohort (10.4%).

Mortality rates reported in the other studies included; 6.3% in the Gulf CARE registry, 5.4% in the PEACE-MENA registry, and 9.6% of Jordan Heart Failure Registry. Table 3 summarized the

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number of events obtained in the incorporated studies.

Table 3. In-Hospital Mortality Events

Study	Deaths	Total	Mortality (%)
Gulf CARE	315	5005	6.3
Egypt ESC-HF	74	1475	5.0
Jordan HF Registry	60	620	9.7
Alalawi et al.	44	425	10.4
PEACE-MENA	21	381	5.5

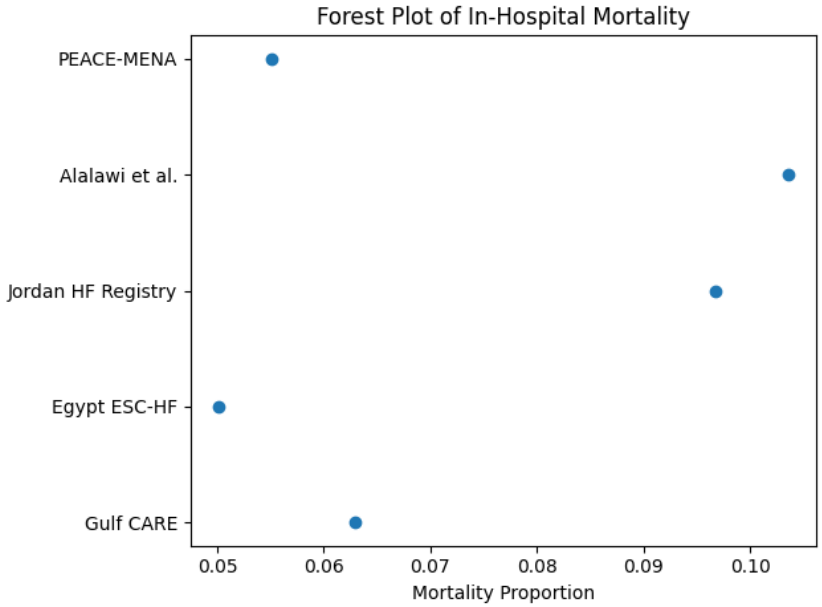

Figure 2. Forest Plot of In-Hospital Mortality

Publication Bias

Assessment of publication bias was not formally performed due to the limited number of studies included in the quantitative synthesis (n = 5), as funnel plot interpretation and statistical tests for publication bias are considered unreliable when fewer than ten studies are available.

Predictors of Mortality:

Several studies reported clinical predictors of increased risk of in-hospital death. Common factors included; advanced age, renal dysfunction, elevated serum creatinine, cardiogenic shock at the time of admission, and reduced left ventricular ejection fraction.

In addition, biomarkers such as increased levels of natriuretic peptides and comorbid conditions such as diabetes mellitus and cardiorenal anemia syndrome were seen to be associated with adverse clinical outcomes in patients hospitalized with acute heart failure.

Summary of Quantitative Findings:

Overall, the included studies show that patients admitted to acute heart failure in the Middle Eastern region have a high burden of cardiovascular risk factors and high in-hospital mortality.

Among the 7,906 patients that were part of the quantitative synthesis the mortality rates ranged between 5.0% and 10.4% with a crude weighted

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mortality of approximately 6.5%, as it was clearly established in the abstract.

Discussion:

This systematic review and meta-analysis assessed clinical characteristics and in-hospital outcome of patients hospitalized with acute heart failure in the United Arab Emirates and Middle Eastern region. The reported in-hospital mortality in 5 studies that included a total of 7906 patients was 5.0% to 10.4%, with an estimated pooled mortality of 6.50 %. These results indicate that acute heart failure represents a condition with a substantial clinical burden and that better risk stratification and risk management strategies are required in this group.

Heart failure is a major health problem worldwide, and one of the leading causes of hospitalization across the globe [9,30,32]. Acute HF is linked to especially high short-term mortality because of hemodynamic instability, comorbid illnesses and disease progression [14,15,24]. Large international registries including ADHERE and OPTIMIZE-HF have found similar mortality estimates in hospitalized heart failure patients (generally between 4 and 11%) [3,13]. Similarly, data from the ESC-HF registry have shown a significant variation in clinical outcomes in different geographic regions [22]. The mortality observed in the present analysis therefore matches the findings from international observational cohorts.

The Middle Eastern population with heart failure has been reported to have specific demographic and clinical trends in the regional studies. Observations from the Gulf Acute Heart Failure Registry (Gulf CARE) show that patients in the Gulf region have a younger age of presentation with heart failure and a high prevalence of cardiovascular risk factors (eg, diabetes mellitus and hypertension) [34]. Similar trends have been observed in studies from Oman, Saudi Arabia, Egypt, and Jordan, indicating the importance of metabolic risk factors contributing to the regional burden of heart failure [28,6,17,1]. The high prevalence of diabetes and hypertension found in these included studies in this meta-analysis is therefore consistent with broader trends of this prevalence in the region in the epidemiological literature.

Several of the predictors of mortality identified in the included studies are consistent with the previous literature. Advanced age, renal dysfunction, and decreased left ventricular ejection fraction were common predictors of poor outcomes in patients hospitalized with acute heart failure. Prior research has shown that cardiorenal interactions and anemia are critically important for mortality risk predisposition in heart failure patients [5], while biomarkers like natriuretic peptides have important prognostic values for being able to stratify these patients for risk [12]. The results highlight the need to carry out a thorough clinical assessment and timely detection of high-risk patients in the hospital.

The modern clinical guidelines have also stressed the significance of early diagnosis, pharmacologic treatment optimization, and multidisciplinary treatment to enhance the outcome of heart failure [16,23,29]. Regional studies have also discussed the importance of proper pharmacologic therapy such as continuation of beta-blockers in hospitalized heart failure patients [2]. Additional studies have shown that precipitating factors of hospitalization for heart failure and structural abnormalities of the heart such as mitral regurgitation may affect clinical outcomes [31,8]. Furthermore, the research in the United Arab Emirates has documented significant morbidity and mortality in patients with acute coronary syndromes complicated by heart failure [33].

Overall, the results of this meta-analysis support the high burden of acute heart failure in the Middle Eastern populations and the need to enhance prevention strategies and clinical management to reduce unfavorable outcomes.

Limitations:

The present analysis has a number of limitations. Firstly, the size of the studies incorporated in the quantitative synthesis was not very large which may reduce the accuracy of pooled estimates. Second, the included studies were all observational and differences in study design and patient population might have led to heterogeneity among cohorts. Third, some studies provided limited information on some clinical variables and predictors of mortality, which limited the ability to

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conduct further subgroup analyses. Finally, publication bias was not formally evaluated because fewer than ten studies were considered in the meta-analysis.

Implications for Further Research:

Future studies should focus on large multicenter prospective registries within the United Arab Emirates to better characterize the epidemiology and outcome of acute heart failure in this population. Standardized regional data collection may help achieve more accurate comparisons of clinical characteristics, treatment strategies and outcomes. Additional research assessments that evaluate the contribution of guideline-directed therapies and multidisciplinary care models may lead to further improved outcomes among patients hospitalized with acute heart failure.

Conclusion:

This systematic review and meta-analysis has shown that patients hospitalized with acute heart failure in the Middle Eastern region are associated with considerable in-hospital mortality with pooled estimates of around 6.5%. The high prevalence of cardiovascular risk factors including diabetes and hypertension and clinical predictors including advanced age and renal dysfunction highlights the need for the development of better prevention strategies and optimized clinical management in order to reduce adverse outcomes in this population.

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