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**Original Research Article**

# The HEART Score: Application in Emergency Departments and Patient Outcomes

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## Abstract

***Background:*** Chest pain is a prevalent complaint in emergency departments (EDs) and is associated with significant clinical decision-making challenges. The HEART score is a validated tool used for risk stratification of patients with suspected acute coronary syndrome (ACS). ***Objective:*** This study evaluates the effectiveness of the HEART score in risk stratification and patient outcomes at Northern Emirates Hospital, UAE. ***Methods:*** A retrospective analysis was conducted on 79 patients who presented with chest pain at Northern Emirates Hospital in January 2021. From the available date in patient record, the patients were classified into three risk categories based on the HEART score, and their actual dispositions were compared. ***Results:*** Of the 79 patients, 70.8% had a low HEART score (0–3), 25.3% had a moderate score (4–6), and 3.7% had a high score (>7). Discharge rates were 83.9% for low-risk, 70% for moderate-risk, and 33% for high-risk patients while the actual major adverse cardiac event (MACE) rates available from available data were 0%, 15%, and 66.6% for low, moderate, and high-risk patients, respectively. ***Conclusion:*** If used, the HEART score can useful in effectively stratifying chest pain patients, aiding in decision-making regarding discharge and admission. Its implementation in EDs could enhance patient care and resource allocation.

***Keywords:*** HEART Score, Emergency Department, Chest Pain, Acute Coronary Syndrome, Risk Stratification, MACE.



## INTRODUCTION

Chest pain is among the most common reasons for ED visits worldwide (Bhuiya et al., 2010). Given its potential to indicate life-threatening conditions such as ACS, timely and accurate risk stratification is essential for optimizing patient outcomes and resource utilization. Over the years, various risk assessment tools have been developed, but the HEART score has emerged as one of the most reliable decision-support tools in ED settings (Six *et al.*, 2008).

### Development of the HEART Score

The HEART score was developed and first introduced in 2008 by Six, Backus, and Kelder in the Netherlands as a clinical decision tool to stratify patients presenting with chest pain into low, moderate, and high-risk categories (Six *et al.*, 2008). It evaluates five parameters: History, ECG findings, Age, Risk factors, and Troponin levels, assigning a score of 0–2 for each component (Backus *et al.*, 2010). Research has demonstrated that a score of 0–3 is associated with a low risk of MACE, 4–6 with a moderate risk, and 7–10 with a high risk (Backus *et al.*, 2013).

Despite its clinical utility, some physicians remain hesitant to discharge low-risk patients without further evaluation due to concerns regarding missed diagnoses. Consequently, a 'HEART Pathway',

incorporating serial troponin measurements, has been developed to enhance decision-making (Mahler *et al.*, 2015). This study evaluates the use of the HEART score at Northern Emirates Hospital and compares outcomes with unstructured physician assessment. This tool was designed to facilitate earlier ED discharge within 30 days of presentation for low-risk patients while ensuring high-risk patients receive appropriate intervention

Since its inception, the HEART score has been extensively validated in both retrospective and prospective studies (Backus *et al.*, 2013). However, concerns arose regarding the use of a single troponin measurement rather than serial testing, especially in patient presenting early after the onset of chest pain, which could increase the risk of missing a troponin rise (Mahler *et al.*, 2015).

The HEART Pathway was developed as an enhancement of the HEART score, incorporating an additional troponin measurement at 3 hours. Patients were initially classified as either low-risk (HEART score <4) or high-risk (≥4). If a repeat troponin test at 3 hours remained negative for low-risk patients, early discharge was recommended. High-risk patients with positive troponin levels required hospital admission and further cardiac evaluation (Mahler *et al.*, 2015).

Studies have shown that a 'HEART Pathway' can further improve sensitivity and negative predictive value for MACE compared with the HEART score alone, reducing unnecessary hospital admissions while maintaining patient safety (Mahler *et al.*, 2015). Implementing this protocol in ED settings has demonstrated reductions in hospital length of stay and improved patient flow (Mahler *et al.*, 2015).

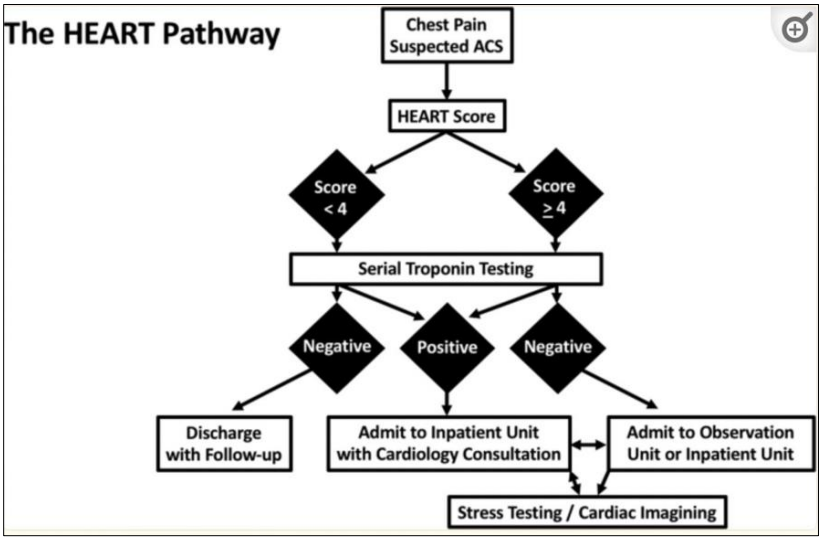


**Figure 1: The Heart Pathway**

## METHODOLOGY & MATERIALS

This study was conducted using a retrospective observational design to analyze the effectiveness of the HEART score in risk stratification among patients presenting with chest pain at Northern Emirates Hospital. The study population included patients aged 18 years and older who were assessed in the emergency department in January 2021. Data were collected from electronic medical records, including clinical presentations, HEART score parameters, hospital admissions, referrals, and MACE outcomes. The HEART score components—History, ECG, Age, Risk Factors, and Troponin—were evaluated for each patient and classified into low, moderate, or high-risk categories.

A standardized data extraction process was used to minimize bias and ensure consistency in analysis. Each patient's outcome was documented, including whether they were discharged, admitted, referred for cardiology evaluation. Records were reviewed to check if patients who were admitted experienced a MACE event as per hospital records or on return to the hospital. Ethical approval for the study was obtained from the hospital's research ethics committee, and all patient data were anonymized before analysis to maintain confidentiality.

**Selection Criteria**

- **Inclusion Criteria**:
  - Patients aged 18 years and older.
  - Patients presenting to the ED with chest pain.
  - Patients with complete medical records and ECG findings.
  - Patients with available troponin test results.

- **Exclusion Criteria**:
  - Patients with incomplete or missing data.
  - Patients diagnosed with non-cardiac causes of chest pain.
  - Patients transferred from another facility with prior treatment.

**Data Collection**

Patient records were reviewed retrospectively to extract demographic data, clinical presentation, ECG findings, risk factors, and troponin levels. Patients were categorized into low (0–3), moderate (4–6), and high-risk (>7) groups based on the HEART score. Outcomes, including hospital admission, referral, and major adverse cardiac events (MACE) in those admitted or returned were recorded.

**Statistical Data Analysis**

Descriptive statistics were used to summarize the characteristics of the study population. Chi-square tests were applied to compare categorical variables among risk groups. A p-value of <0.05 was considered statistically significant. Data analysis was performed using SPSS software.

## RESULTS

The study identified 79 patients who presented to the ED with chest pain. Among them, 70.8% were classified as low-risk (HEART score 0-3), 25.3% as moderate-risk (HEART score 4-6), and 3.7% as high-risk (HEART score >7). The analysis showed that all with all low-risk score discharged safely with no recorded cases of MACE. In contrast, 15% of moderate-risk patients experienced MACE, and 66.6% of high-risk patients had significant adverse cardiac events requiring urgent medical intervention.

Hospital admission rates varied significantly between risk categories. 16% of low-risk patients were admitted, whereas 30% of moderate-risk and 66.6% of high-risk patients required hospitalization.

A concerning observation was that 70% of moderate-risk patients were discharged, with 60% of those referred to cardiology failing to attend follow-up appointments. This suggests a potential gap in post-discharge care that could impact patient outcomes.

**Interpretation Results**

A comparison of the HEART score with unstructured physician assessment at Northern Emirates Hospital revealed similar MACE rates across risk categories:

- **Low-risk patients (HEART Score 0–3):**
  - MACE rate: **0%** (compared to 0.9%-1.7% in previous studies).
  - Discharge rate: **83.9%**.
  - Referral to cardiology OPD: **34%**, with **25%** no-show rate.
- **Moderate-risk patients (HEART Score 4–6):**
  - MACE rate: **15%** (consistent with the reported 12%-17%).
  - Discharge rate: **70%**, with **40%** discharged regularly and **30%** LAMA.
  - Referral to cardiology OPD: **35.7%**, with **60%** no-show rate in OPD.
- **High-risk patients (HEART Score >7):**
  - MACE rate: **66.6%** (within the expected range of 50%-65%).
  - Hospital admission: **66.6%**, with 100% seen by cardiology.

This data suggests that while the HEART score provides accurate risk stratification, improvements in follow-up care, particularly for moderate-risk patients, are necessary.

**Table 1: HEART scores for Northern Emirates Hospital, UAE ER Department Patients January 2021**

| HEART Score Category | Patients Count | Percentage (%) |
|---|---|---|
| 0-3 (Low Risk) | 56 | 70.8 |
| 4-6 (Moderate Risk) | 20 | 25.3 |
| 7+ (High Risk) | 3 | 3.7 |

**Table 2: Demographic of this cohort of patients**

| Nationality | # | % |
|---|---|---|
| UAE | 56 | 70.9 |
| Indian subcontinent (India, Pakistan, Bangladesh) | 16 | 20.3 |
| Arab nationalities (Egypt, Jordan) | 3 | 3.8 |
| Miscellaneous (Philippines, Iran, Ghana, unrecorded) | 4 | 5 |

**Table 2: Northern Emirates Hospital, UAE Hospital ER Department January 2021**

| HEART Score Category | Patients Count | Discharged (%) | Regular Discharge (%) | Discharge LAMA (%) | Referred to Cardiology OPD (%) | No Show Cardio OPD (%) | Total Admitted | Medical Ward Admission (%) | ICU Admission (%) | Cardiologist Seen (%) | MACE in admitted patients |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-3 (Low Risk) | 56 | 83.9 | 75 | 8.9 | 34 | 25 | 16 | 8.9 | 7.14 | 100 | 0 |
| 4-7 (Moderate to High Risk) | 20 | 70 | 40 | 30 | 35.7 | 60 | 30 | 10 | 20 | 100 | 15 |

**Table 3: Distribution of HEART Score Among Patients**

| HEART Score | Number of Patients (N=79) | Percentage (%) |
|---|---|---|
| 0-3 (Low) | 56 | 70.8 |
| 4-6 (Moderate) | 20 | 25.3 |
| >7 (High) | 3 | 3.7 |

**Table 4: Patient Disposition and Referral Based on HEART Score**

| HEART Score | Discharge (%) | Admitted (%) | Referred to Cardiology OPD (%) |
|---|---|---|---|
| 0-3 (Low) | 83.9 | 16 | 34 |
| 4-6 (Moderate) | 70 | 30 | 35.7 |
| >7 (High) | 33 | 66.6 | 100 |

**Table 5: MACE Rates by HEART Score Category in admitted patients**

| HEART Score | MACE Incidence (%) |
|---|---|
| 0-3 (Low) | 0 |
| 4-6 (Moderate) | 15 |
| >7 (High) | 66.6 |

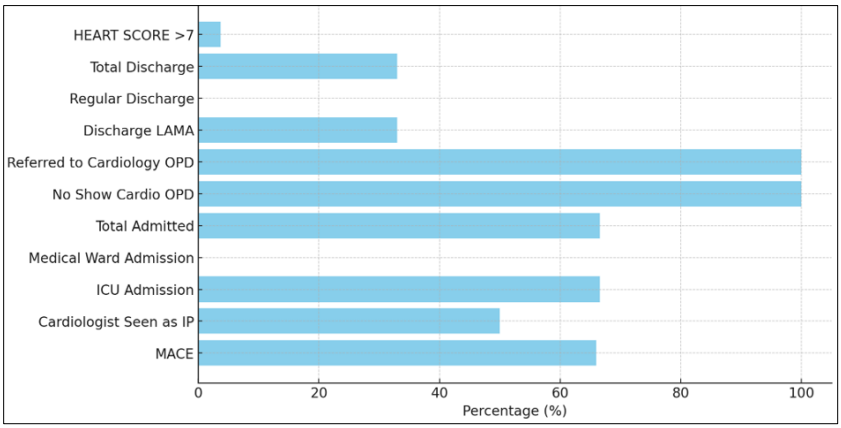


**Figure 2: Northern Emirates Hospital, UAE Hospital ER Department January 2021**

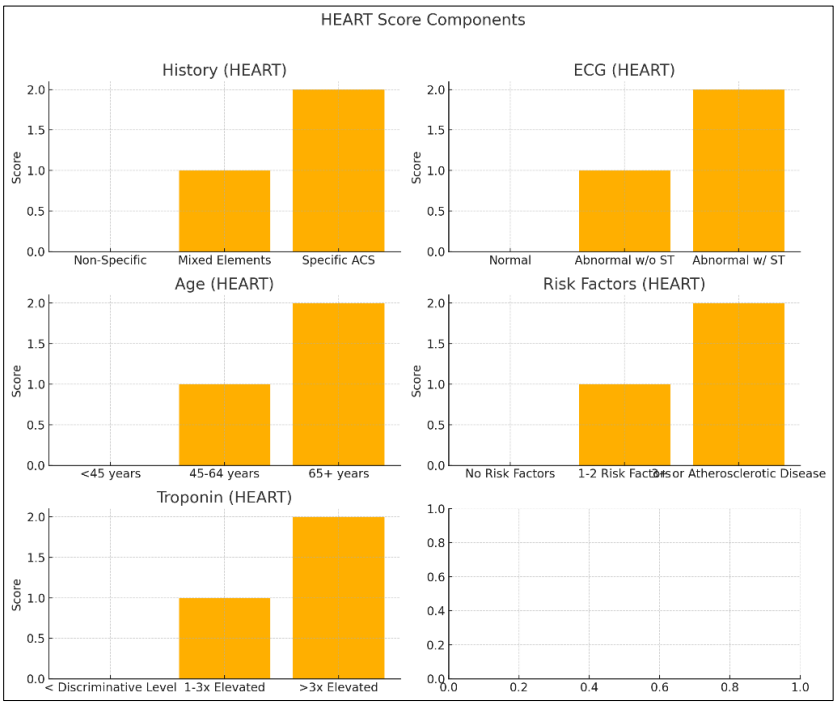


**Figure3: Matplotlib Chart**

## DISCUSSION

The findings of this study align with existing literature on the predictive accuracy of the HEART score. Low-risk patients (HEART score 0–3) had a MACE incidence of 0%, supporting the safety of early discharge (Than et al., 2013). Moderate-risk patients (HEART score 4–6) had a MACE incidence of 15%, which falls within the range of prior studies (12%–17%) (Six et al., 2013). High-risk patients (HEART score >7) exhibited the highest MACE rate (66.6%), further emphasizing the necessity for early evaluation and intervention (Mahler et al., 2015).

One key observation was the significant number of moderate-risk patients discharged (70%), with only 35.7% referred to cardiology, and 60% of these referrals resulting in no-show visits. This raises concerns about the adequacy of follow-up care in this subgroup (Poldervaart et al., 2017). Additionally, 16% of low-risk patients were admitted despite a 0% MACE rate, suggesting a potential overuse of hospital resources. Implementing the HEART Pathway may enhance discharge decisions and reduce unnecessary admissions (Mahler et al., 2015).

**Action Plan**

To enhance clinical outcomes and adherence to evidence-based risk stratification, the following measures are proposed:

1. **Adoption of the HEART Pathway:** Implementing serial troponin testing at 0 and 3 hours in moderate-risk patients will reduce unnecessary admissions while improving sensitivity for MACE detection (Mahler et al., 2015).
2. **Enhanced Physician Training:** Conducting periodic training sessions to improve compliance with the HEART score and its documentation in patient records.
3. **Avoid Discharging Patients with HEART Score >4:** Patients with moderate and high HEART scores should be further evaluation with repeat Troponins and potentially Specialty review, with those >7 admitted for monitoring, cardiology consultation and further workup to prevent missed ACS cases.
4. **Implementation of HEART Score Checklists and Posters:** Placing HEART score checklists in patient files and posters in ED settings to remind physicians of its importance in clinical decision-making.
5. **Improving Referral Compliance:** Strategies to increase cardiology OPD attendance, such as patient education, written leaflets explaining ris,, appointment reminders, and physician follow-ups, should be implemented.
6. **Continuous Data Monitoring:** Regular audits of HEART score adherence and patient outcomes should be conducted to identify trends and areas for improvement.

## CONCLUSION

This study reinforces the utility of the HEART score in ED settings. It successfully stratifies patients by risk level and correlated patients well with MACE incidence. The findings highlight the potential for optimizing discharge decisions, particularly for moderate-risk patients, to ensure proper follow-up and prevent missed ACS cases (Melki & Jernberg, 2013).

Future research should focus on standardizing history-taking to improve physician agreement and investigating additional clinical parameters that may refine the score's predictive accuracy (Dubin et al., 2017). Ultimately, while the HEART score is a powerful tool, it should be used in conjunction with clinical judgment and shared decision-making to maximize patient safety and efficiency in emergency care (Wu et al., 2017).

**Limitations of the Study**

Despite the significant findings, this study has some limitations. The retrospective nature of data collection poses a risk of selection bias, as missing or incomplete records could affect accuracy. Additionally, the study was conducted at a single medical center, limiting its generalizability to other populations and healthcare settings. Another limitation is lack of follow-up of all patients after 30 days to ensure accuracy of MACE events in patients, which have over-estimated the safety of the pathway in low-risk patients who were discharged. Another potential limitation is the majority of patients were nationals, which does not reflect the over-all population distribution in the Emirate where the hospital is situated and may reflect the demographic of patients attending the hospital's Emergency department.

Another limitation is the variability in physician interpretation of the HEART score, particularly regarding history-taking, which could impact consistency in risk stratification. Further studies with larger, multi-center cohorts and standardized protocols and subgroup analysis by ethnicities could enhance the reliability and applicability of these findings.

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