

Case Study: Lessons Learned from Implementing Emergency Heart Failure Mortality Risk Grade (EHMRG) at the University Health Network

EXECUTIVE SUMMARY

This case study summarizes the implementation of the Emergency Heart Failure Mortality Risk Grade (EHMRG) score in the Toronto General Hospital (TGH) and Toronto Western Hospital (TWH) emergency departments (EDs) over two years (September 2022 – September 2024). Its purpose is to outline key considerations to integrating the EHMRG score into Emergency Department workflow, offer recommendations and lessons learned.

The EHMRG score was identified as a key component of personalized, digitally enabled and evidence-based heart failure care to patients presenting to EDs in Toronto, Ontario, Canada as part of Mid-West Toronto Ontario Health Team's Congestive Heart Failure [Quality Based Procedure \(CHF-QBP\)](#) demonstration project, awarded in spring 2022. This multi-faceted heart failure project sought to reduce HF-related hospital admissions and lengths of stay, ensure timely access to follow-up care, and increase patient quality-of-life. The ED pathway incorporating the EHMRG score was one of eight pathways implemented. Its implementation comprised:

- 1) Workflow design with ED team to clarify criteria to generate EHMRG, method and timing of score calculation and process for incorporation into decision-making.
- 2) Dedicated onsite Integrated Care Lead who triaged and calculated the score for cardiac involved patients and brought that information to the ED physician to assist in decision-making regarding patient disposition (i.e., discharge or admission).
- 3) Routine review and evaluation of workflow and results to assess efficiency as well as score fidelity to ED physician disposition decision.
- 4) Integration of the score into TGH and TWH EDs within UHN's electronic medical record (Epic®) so the score is automatically calculated if predetermined parameters are met such as relevant suspected diagnosis and appropriate vital signs.

To successfully integrate the EHMRG score within emergency department workflows and processes, it is important to have dedicated roles responsible for calculating the score, co-develop the EHMRG score integration with ED physicians and information technology specialists, clear criteria and processes for patient selection and care pathways, and support from clinical leadership. Automating the score in an EMR is the ideal state of integration, accompanied by education of ED physicians and appropriate support and tools. Understanding the fidelity of patient disposition to EHMRG score recommendation is an important metric to monitor when evaluating the implementation.

Part 1: The EHMRG Score - Purpose and Use-Cases

The Emergency Heart Failure Mortality Risk Grade (EHMRG) score is a clinical decision support tool designed to help emergency medicine (EM) physicians assess the risk of mortality in patients presenting with acute heart

failure. There are two risk grades, [calculated using parameters such as vital signs and patient history](#), which predict 7-day and 30-day mortality as a percentage ratio (1). The purpose of these scores is to personalize and improve patient outcomes by guiding decision-making related to patient disposition—specifically whether to admit (high risk), discharge (low risk), or apply further diagnostic or therapeutic measures (intermediate risk).

The [COACH \(Comparison of Outcomes and Access to Care for Heart Failure\)](#) trial investigated the efficacy of a clinical decision support strategy, centered on the EHMRG score, in managing acute heart failure in EDs (2). Conducted across 10 hospitals in Ontario, Canada, this stepped-wedge, cluster-randomized trial compared using the EHMRG score against usual care, focusing on risk stratification and subsequent patient disposition.

The COACH trial demonstrated that using the EHMRG tool led to a [statistically significant reduction](#) in the 30-day composite outcome of death or cardiovascular hospitalization compared to usual care. This suggested that systematic risk stratification, coupled with rapid follow-up in an outpatient setting, can improve short-term outcomes for heart failure patients.

With the promising results of the COACH trial, the MWT-OHT team determined to integrate EHMRG within its ED pathway in a systematic and continuous manner as part of its CHF QBP project. The EHMRG score was implemented in two EDs (TGH and TWH) within University Health Network (UHN) that is part of the MWT-OHT.

Part 2: Implementation of the EHMRG score as part of the CHF QBP project

Developing the ED pathway

In spring 2022, the Mid-West Toronto Ontario Health Team (MWT-OHT) received funding through Ontario Health to improve heart failure care for patients. There were eight pathways developed at UHN, Sinai Health, Women's College Hospital and with two community health centres (Parkdale Queen West Community Health Centre and Unison Health and Community Services). The ED pathway was endorsed by the ED Medical Director and ED Deputy Medical Director who were part of the project steering committee. An interdisciplinary team began developing the ED pathway outlining steps, transitions and services from the moment a patient arrives at the ED to outpatient care to palliative or community-based care.

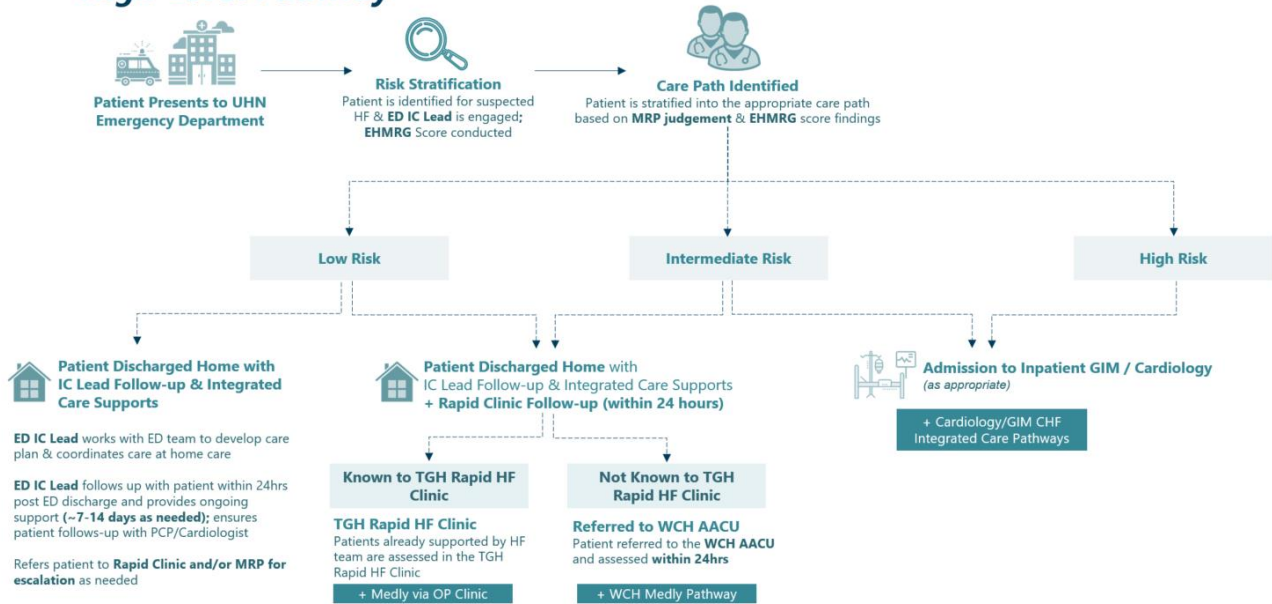
An ED registered nurse was hired to serve as the ED Integrated Care (IC) Lead, pivotal to enabling the pathway and located in the emergency department. Working closely with a Project Manager within UHN's Integrated Care (IC) Program and ED leadership, each step of the patient's journey was mapped out and key processes, decision points and relationships were established.

In early phases (February 2022-February 2024), the pathway was live only at TGH with TWH coming live in March 2024. The IC lead routinely scanned the ED electronic medical record for eligible patients based on if the patient had suspected cardiac involvement when presenting to ED triage, as well as hallmark HF symptoms like shortness of breath, fatigue, and edema, and their clinical judgement. Using patient information routinely collected at ED triage, they calculated the EHMRG score via the [publicly available web-based calculator](#) and brought the 7-day mortality risk (low, intermediate, or high) and resulting recommendation to the attention of the EM physician either through secure messaging within the EMR, or by discussing it with them in person in the ED. Calculation of the score had unexpected benefits in facilitating consultations between emergency medicine and

other specialties which accept HF patients, such as general internal medicine and cardiology. Further to ED physician disposition decision, the ED IC Lead supported the patient’s transition to admission or facilitated their referral to outpatient heart function clinic at either TGH or Women’s College Hospital.

Figure 1 is a visual depiction of the ED pathway with its component elements and the patient’s journey from presentation in the ED and transitions back to community.

UHN CHF QBP ED Integrated Care Pathway High-Level Pathway



Early results of EHMRG implementation at TGH

Over five fiscal quarters (Q4 2022-2023 – Q4 2024-2024) data regarding score volumes, sensitivity, and fidelity was collected and summarized in **Table 1**.

TGH EHMRG Data	Q4 2022-2023	Q1 2023-2024	Q2 2023-2024	Q3 2023-2024	Q4 2023-2024
Volume of scores calculated (N)	6	181	196	171	147
Sensitivity of score calculation (% of patients eligible for EHMRG score calculation who had score calculated)	6/6, 100%	175/181, 97%	191/196, 98%	164/171, 96%	141/147, 96%
Fidelity of score calculation (% of patients whose disposition matched the score recommendation (admit, discharge, further workup))	5/6, 83%	146/181, 81%	166/196, 85%	140/171, 82%	113/147, 77%

Table 1: Volume, sensitivity, and fidelity data of EHMRG score integration at the TGH ED over 5 fiscal quarters. Overall, the sensitivity and fidelity were high, varying between 96% - 100% and 77%-85% respectively.

The routine implementation of the EHMRG score in the TGH ED, facilitated and supported by an IC lead, showed promising results. There was a consistently high sensitivity of score calculation to eligible patients (never less than 96% of eligible HF patients had the EHMRG score calculated) high fidelity of score recommendation to ED disposition decision (between 77% and 85% fidelity).

The integration of the EHMRG score into standard practice with the support of an IC lead calculating the score through the web-based calculator was effective. Based on the first year of implementation, a lessons learned exercise and review of results produced number of recommendations.

RECOMMENDATIONS

Web-Based EHMRG Score Integration

- 1) Collaborative **workflow design** involving ED team members and other services to map of all potential steps in a HF patient's journey.
- 2) Have **dedicated clinical personnel** responsible for assessing and applying clinical criteria for appropriate HF patients, and for calculating the score is critical to ensuring high sensitivity to the calculation process.
- 3) Bring the score and its disposition recommendation to the attention of the EM physician and care team is important to improve fidelity to the recommendation.
- 4) The score should **never be patient facing** – it should only be used to inform clinical decision-making.
- 5) **Incorporate feedback sessions with relevant stakeholders**, such as the IC lead, clinical leadership and project team, should occur at least quarterly to address challenges and facilitate transparent problem solving to any issues as they arise.
- 6) **Socialize the score with other relevant specialties** such as cardiology and general internal medicine, not just emergency medicine, to support smooth care transitions, shared understanding of mortality risk and disposition decisions.

Part 3: Integration of the EHMRG score into clinical information systems – example of Epic®

In June 2022, UHN launched a new electronic medical record, Epic, across all institutions and programs. The CHF QBP team – including the ED pathway leads as well as collaborators from other pathways – identified the opportunity to automate EHMRG score calculation to improve utilization and uptake of the score. This notion was also a recommendation by partners of the COACH trial and the team was aware of one US institution – Tower Health – who successfully automated within Epic.

A dedicated UHN team, comprising the ED IC lead, a research planning associate, UHN Digital, Epic leads on the ED team and staff scientist developed a project plan with support from ED leadership. Dr. Doug Lee, UHN staff cardiologist and creator of the EHMRG score served as expert consultant. The UHN team approached Tower Health, who graciously shared their code to give the UHN Epic team a solid foundation to build on.

Over the course of 2023-24, the project team built the automation and calculation of EHMRG within Epic. Each step of the automation was discussed at regular collaborative meetings, to work through challenges, ensure accuracy of the calculation and confirm placement of the score and its recommendation within the ED Track

Board and Workup tab (i.e., existing ED workflows at UHN). Testing over January-March 2024 validated the accuracy of the automation and confirmed readiness for implementation.

In March 2024, the score was officially launched in Epic at both TGH and TWH. This initial Epic automation generates the 7-day mortality risk (based on 10 key variables) and adheres to COACH Trial cut-off ranges for 7-day risk categorization. As the 30-day mortality risk requires more complex information (i.e., if patients have a left bundle branch block, a ventricular paced rhythm or left ventricular hypertrophy with a strain pattern on the ECG) to enable the 30-day risk categorization, it is not yet available. This limitation is due to how this data is recorded and structured in the EMR, making its extraction into the calculation challenging. The Epic team continues to work on ways to implement the 30-day score.

With the automation, the ED pathway and its associated workflows were re-assessed and adjusted to reflect this new process. The ED IC lead role continues at TGH to support the application of the EHMRG score and recommendation into clinical decision-making. Many steps of the pathway remain, but the actual task of score generation has been simplified such that the score directly appears in the Epic ED Track Board when criteria is met, where the score is displayed under the Workup Tab, and from which the clinician can file once considered. At TWH, there is no ED IC lead to facilitate the consideration, but the ED physicians are aware and the 7-day risk score and recommendation appear in exact same fashion within Epic. At both sites, the EHMRG score can be incorporated into discussions among ED colleagues, with General Internal Medicine or Cardiology consults, and ultimately in their clinical decision-making.

The Epic launch was supported by a detailed knowledge translation plan. It included education (presentation and live demonstration at ED departmental rounds), resource production (e.g., infographic at physician terminals in the emergency department and tip-sheet uploaded into Epic), championing of the project by ED leadership (e.g., announcing launch by email and at staff meetings) and promotion of the launch in [published articles](#).

RECOMMENDATIONS

Automating the EHMRG Score in Epic®

- 1) Build **on the work of other organizations** who have already integrated the score into their EMR.
- 2) **Co-design, co-develop and co-implement** the automation of the score with EM physicians and other providers to ensure it is consistent, accurate and relevant to existing workflows and Epic customization within your ED.
- 3) Ensure **dedicated clinical personnel** are retrained or their responsibilities are otherwise adjusted to reflect the automation of the score in the EMR.
- 4) **Feedback sessions with relevant stakeholders**, such as the IC lead, clinical leadership, and project team, should occur at least monthly to address challenges and facilitate transparent problem solving to any issues as they arise.
- 5) **Evaluate the score and clinicians' interaction with it** through tools available within the EMR or through a QI project.
- 6) Accompany the EHMRG score EPIC launch with a **detailed Knowledge Exchange and/or communications plan to improve awareness** and provide a feedback mechanism to iterate on the build if necessary.

Evaluation of the integration of the score into Epic is ongoing. A Quality Improvement (QI) project has been initiated to assess the impact of the integration of the score, and particularly to better understand those patients where the disposition decision may be discordant with the EHMRG recommendation (e.g., a low-risk patient is admitted, or an intermediate/high-risk patient is discharged). This QI project will seek to understand other factors influencing ED physician decision-making and disposition from the ED and how positive patient outcomes and experience can be supported.

Part 4: Conclusion

This case-study sought to provide descriptive examples of processes and considerations when implementing the EHMRG score in an organizations ED. Its recommendations for implementation of the EHMRG are meant to be pragmatic and general. Each organization will have to adjust their approaches based on their individual context. UHN has had success in implementing the score, contributing to personalized and improved care for HF patients presenting to UHN EDs.

Acknowledgements

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References

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