Development of a Hospital Standardized Mortality Ratio for Emergency Department Care

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Study objective: Experts have recommended including measures of mortality in emergency department (ED) performance evaluation frameworks. This study aims to develop a hospital standardized mortality ratio (HSMR) for patients admitted to the hospital with conditions for which ED care may reduce mortality (emergency-sensitive conditions).

Methods: Data were extracted from Canadian hospital discharge databases from April 1, 2009, to March 31, 2012. The ED HSMR is the ratio of the observed deaths among patients with emergency-sensitive conditions in a hospital during a year to the expected deaths for the same patients during the reference year (2009-2010). The expected deaths were estimated with predictive models fitted for different hospital peer groups (teaching hospitals and large, medium, and small community hospitals).

Results: The data set included 1,770,809 admissions (9.2% deaths). The ED HSMR was calculated for 47% (294/629) of all Canadian hospitals. The majority of exclusions (98%) were for small community hospitals with fewer than 20 expected deaths. Predictive models had good calibration and discrimination, with areas under the curve ranging from 0.80 to 0.81. In comparisons of 2010-2011 and 2011-2012, the classification of hospitals by ED HSMR quartile was stable, with the majority remaining within the same quartile (43.5%) or moving up or down a single quartile (40.2%). Peer-group-level comparisons between ED HSMR measured at different points after admission (2, 7, and 30 days, and hospital discharge) did not demonstrate any significant differences.

Conclusion: The ED HSMR appears to be a reliable measure with high discrimination, calibration, and forecasting properties that can be used to guide assessment of ED performance. [Ann Emerg Med. 2016;67:517-524.]

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INTRODUCTION

Background

For decades, crowding and access block in the emergency department (ED) have posed major threats to quality and safety of care.[1-4] As a result, performance assessment reviews and guidelines have focused on access-to-care indicators and waiting times.[5] Although access to care is important, it is a single dimension of health care performance.[6] In fact, overrepresentation of time-based measures has been associated with unintended consequences in some jurisdictions.[7,8] Consequently, a more comprehensive evaluation of ED performance is needed.

Importance

Overall or condition-specific mortality rates have been suggested as quality-of-care indicators that should be included in a comprehensive ED performance assessment framework.[6,9-11] Mortality has been successfully used as a quality indicator to measure and improve quality of care in diverse settings (eg, rural hospital care[12]), circumstances (eg, budget reduction[13]) and clinical conditions (eg, sepsis,[14] acute myocardial infarction[15]). However, to our knowledge, a risk-adjusted performance measure to monitor death after an ED care episode has not been previously developed and published.

Goals of This Investigation

To address this gap, we adapted the Canadian Hospital Standardized Mortality Ratio (HSMR) methodology to the ED setting. We hypothesized that by focusing only on those conditions in which ED management may improve outcomes (emergency-sensitive conditions), we could calculate an HSMR variant (ED HSMR) that measured the quality of emergency care. We previously reported a study using consensus methods to identify potential

Editor's Capsule Summary

What is already known on this topic

Emergency-sensitive conditions have been used as a proxy for the quality of emergency department (ED) care for admitted patients, but no standardized mortality measure exists.

What question this study addressed

Can an ED hospital standardized mortality ratio (HSMR) be calculated according to emergency-sensitive conditions as an accurate quality measure of ED care?

What this study adds to our knowledge

In this study of 1.7 million admissions across all Canadian hospitals, the ED HSMR remained consistent with repeated measurements.

How this is relevant to clinical practice

The use of the ED HSMR within hospitals may be an effective tool to trend performance over time. Outlier institutions may also warrant external review.

emergency-sensitive conditions[16] and a national survey of ED providers to test the face validity of the conditions proposed.[17] In this article, we report the calculation of an ED HSMR risk-adjustment model and calculate an ED HSMR specific to emergency-sensitive conditions.

MATERIALS AND METHODS

Study Design and Setting

We conducted a retrospective cohort study using deidentified data provided by the Canadian Institute for Health Information and extracted from national hospital discharge databases. These databases hold clinical and administrative statistics captured from all hospitalizations in Canadian acute care facilities. Data were provided for patients discharged between April 1, 2009, and March 31, 2012, for 9 provinces and 3 territories, and between April 1, 2009, and March 31, 2011, for the province of Quebec. The Canadian Institute for Health Information, a publicly funded organization, complies with high standards of data collection, cleaning, and quality assessments described elsewhere.[18]

We included all Canadian acute care institutions with an ED and capacity for hospital admission and inpatient care. We excluded cancer centers, children's hospitals, and heart institutes because they treat specific populations with nonaverage case mix. For risk-adjustment purposes, hospitals were classified into one of 4 peer groups (teaching hospitals and large, medium, and small community hospitals) according to academic designation, patient complexity, and volume[19] (Appendix E1, available online at http://www.annemergmed.com).

Selection of Participants

Admissions meeting the following criteria were included in the analyses: (1) discharge or death from a hospital satisfying the hospital selection criteria between April 1, 2009, and March 31, 2012; (2) admission through the ED to an acute care facility; (3) discharge from the hospital with an emergency-sensitive diagnosis group as the most responsible diagnosis (Appendix E2, available online at http://www.annemergmed.com); (4) age at admission between 29 days and 120 years; (5) hospital length of stay equal to or less than 365 days; and (6) Canadian resident. Admissions meeting the following criteria were excluded: (1) death at ED arrival; (2) discharge against medical advice; and (3) brain death (ICD-10CA code G93.81) and palliative care (ICD-10CA code Z51.5) as most responsible diagnosis. Inclusion and exclusion criteria were directly derived from the Canadian Institute for Health Information's HSMR methodology to facilitate comparisons between the Canadian HSMR and our ED variant.[19]

Primary Data Analysis

ED HSMRs were calculated for the fiscal years (April to March) 2010-2011 and 2011-2012, using the following equation:

$$\frac{\text{Actual number of deaths among patients with emergency-sensitive DGs in one year (2010-11 or 2011-12)}}{\text{Expected number of deaths among same patients based on mortality probabilities in the reference year (2009-10)}} \times 100$$

The ratio was calculated at hospital discharge with the Canadian Institute for Health Information methodology for the Canadian HSMR.[19] From the 72 diagnosis groups included in the Canadian HSMR, an expert panel previously selected 37 conditions (eg, sepsis) for which ED management may reduce mortality (Appendix E3, available online at http://www.annemergmed.com).[16] These 37