MORTALITY REDUCTION ASSOCIATED WITH SURVEILLANCE USING AN EMR-BASED ACUITY SCORE AT AN ACADEMIC MEDICAL CENTER

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Background Early detection of subtle changes in a patient’s condition is critical to patient safety, but is difficult to achieve, even with electronic medical records.

Objectives To identify at-risk patients and reduce in-hospital mortality through the implementation of surveillance protocols based upon a patient acuity score.

Methods The Rothman Index (RI) is a validated patient acuity score, integrated into the EHR, updated in real-time, computed using: vital signs, laboratory values, and nursing assessments. In a nurse-driven initiative at Houston Methodist Hospital, a surveillance system based on RI was implemented on 11 clinical units. On each unit, RI-time-graphs, one for each patient, color-coded by severity, organized so that patients with poor or deteriorating scores were highlighted, were displayed. Graphs were reviewed by nurses at shift-change, during safety huddles, at least 5 times per day. Nurse practitioners rounded on those patients whose RI graphs were highlighted as high risk. Protocols were established for bedside nurses, and charge nurses, specifying actions (e.g. increased monitoring, notification of physicians) required upon triggering of a high risk alert level.

Results Risk adjusted mortality (using the UHC mortality model) fell 32% in the 9-months following the intervention as compared to prior 9-months (historical control). Also there was a coincident control group, the remainder of the hospital, where risk-adjusted mortality was unchanged during the 18-months.

Conclusions Enhanced surveillance reduced mortality, and the nursing-based protocols were subsequently implemented throughout the hospital, and are being implemented throughout the 8-hospital system. Implications are that this approach will also aid in improving the general quality of care.

Figure 1 Monitoring protocols by clinician role for patient surveillance at Houston Methodist Hospital “Graphs” below refer to Rothman Index graphs displayed on kiosks (monitors) at each nursing station, and in the EMR.

Figure 1a A Rothman Index (RI) graph for a single patient. RI is on the y-axis, scale 0-100. For calibration: 100 is unimpaired, 65 is the acuity level typical for a patient discharged to a SNF, 40 is the acuity level when a physician might consider moving the patient to an ICU. Each dot reflects the score and the time when a new piece of data has been entered into the EMR and the RI was recalculated. Graphs are color-coded by the most recent score; below 40 the background of the graph is red, 40-65 it is yellow, and above 65 it is blue. Vertical lines are at midnights. This patient graph shows a 5-day history. RI has just fallen below 20, which triggered a “Very High Risk” alert.

Figure 1b Nursing unit or array view of seven RI graphs. Each graph shows a patient’s condition over the previous 5-days. Note that the graph for any patient who has triggered a Very High Risk alert is displayed in a special area at the top of the screen.

Figure 2 Rothman Index graphs are updated whenever new data is entered into the electronic medical record and a customized set of rules are evaluated to determine if a patient meets the criteria for an alert.

Figure 2a RI-time-graphs, one for each patient, color-coded by severity, organized so that patients with poor or deteriorating scores were highlighted, were displayed.

Figure 2b The Rothman Index (RI) is on the y-axis, scale 0-100. For calibration: 100 is unimpaired, 65 is the acuity level typical for a patient discharged to a SNF, 40 is the acuity level when a physician might consider moving the patient to an ICU. Each dot reflects the score and the time when a new piece of data has been entered into the EMR and the RI was recalculated. Graphs are color-coded by the most recent score; below 40 the background of the graph is red, 40-65 it is yellow, and above 65 it is blue. Vertical lines are at midnights. This patient graph shows a 5-day history. RI has just fallen below 20, which triggered a “Very High Risk” alert.

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<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN, PCA</td>
<td>Vital Signs</td>
</tr>
<tr>
<td>RN, CM, JW, Mgr, Director</td>
<td>Review Graphs</td>
</tr>
<tr>
<td>Nurse Practitioners</td>
<td>RN, CM, JW, Mgr, Director</td>
</tr>
<tr>
<td>Physician Staff</td>
<td>RN</td>
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Table 1b Nursing unit or array view of seven RI graphs. Each graph shows a patient’s condition over the previous 5-days. Note that the graph for any patient who has triggered a Very High Risk alert is displayed in a special area at the top of the screen.
Figure 2  Mortality Index for 11 nursing units as computed with the University HealthSystem Consortium mortality model for the 9-months prior to initiation of surveillance protocols (historical control) and for the 9-months intervention period. Also shown is a second concurrent control, the mortality index from non-intervention nursing units (20 units) through the entire 18-month period. Risk-adjusted mortality decreased 32% (0.7 to 0.48), p-value < 0.001. The study included 33,797 patient visits from Houston Methodist Hospital (889 beds).
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