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Mortality Reduction Associated with Surveillance Using an EMR-Based Acuity Score at an Academic Medical Center

Katherine Walsh, Houston Methodist St. John Hospital, Shannan Hamlin, Houston Methodist Hospital, Belimat Askary, Houston Methodist Hospital.

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

Katherine Walsh,¹ Shannan Hamlin,² Belimat Askary². ¹Houston Methodist St. John Hospital, USA; ²Houston Methodist Hospital, USA

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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

| Who | What | When |
|---------------------------|---------------------------------|---|
| Nursing Staff (RN, PCA) | Vital Signs | Unit frequency guideline (8a, 12p...) Document immediately or within 1 hr |
| RN | Assessments | Document immediately – or by noon/midnight |
| RN | Review Graphs | Bedside report, after vitals, mid shift, change in condition |
| RN, CM, SW, Mgr, Director | Review Graphs | Care Coordination Rounds - |
| Nurse Practitioners | Review Graphs in assigned units | Beginning of shift and as needed |
| Physician Staff* | Review Graphs | Review graphs when rounding and documenting. |

Figure 1 Monitoring protocols by clinician role fore 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.

| PeraTrend/Rothman Index | Definition | Nurse Action |
|--|---------------------------------------|--|
| Very High Risk | RI ≤ 20 | <ol style="list-style-type: none"> 1. Assess the patient 2. Explore the data – what has changed? 3. Consider RRT call if patient meets criteria 4. Notify Clinician/charge nurse 5. Notify physician/PA/NP 6. Monitor closely 7. Document intervention/action taken |
| High Risk (sensitive to slower changes) | Falls 40% within last 24 hours | <ol style="list-style-type: none"> 1. Assess the patient 2. Explore the data – what has changed? 3. Consider RRT if patient meets criteria 4. Notify Clinician/charge nurse 5. Notify physician/PA/NP 6. Monitor closely 7. Document intervention/action taken. |
| Medium Risk (sensitive to rapid changes) | Falls 30% within last 6 hours | <ol style="list-style-type: none"> 1. Assess the patient 2. Explore the data – what has changed? 3. Consider RRT if patient meets criteria 4. Notify Clinician/charge nurse 5. Review with physician/PA/NP during rounds |

Figure 2 Houston Methodist alert rules and required nursing action. 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.

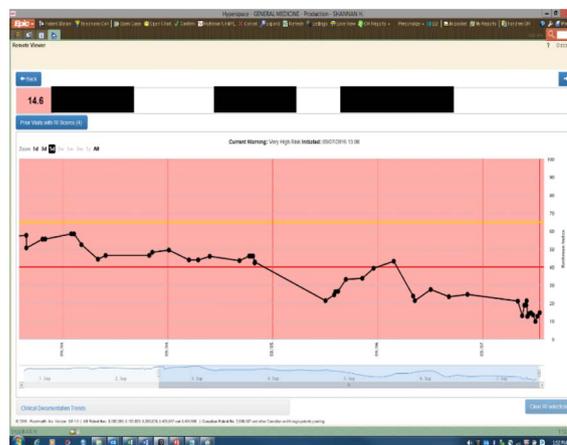


Figure 1a A Rothman Index (RI) graph for a single patient. RI is on the y-axis, scale 0-100. For calibration: 100 is unimpaired, 65 is the acuity level typical for a patient discharged to a SNF, 40 is the acuity level when a physician might consider moving the patient to an ICU. Each dot reflects the 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.

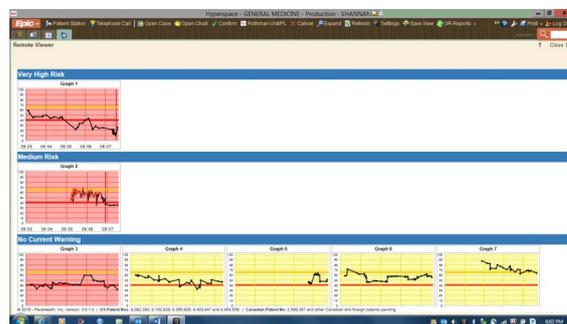


Figure 1b Nursing unit or array view of seven RI graphs. Each graph shows a patient's condition over the previous 5-days. Note that the graph for any patient who has triggered a Very High Risk alert is displayed in a special area at the top of the screen.

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.

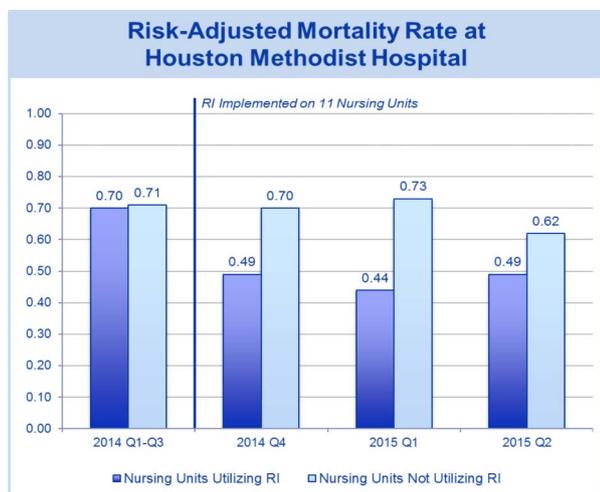


Figure 2 Mortality Index for 11 nursing units as computed with the University HealthSystem Consortium mortality model for the 9-months prior to initiation of surveillance protocols (historical control) and for the 9-months intervention period. Also shown is a second concurrent control, the mortality 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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