A COMMERCIALLY AVAILABLE ACUITY SCORE IS A PREDICTOR OF ACUTE CARE TO INTENSIVE CARE TRANSFER

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Introduction

- The Pediatric Rothman Index (pRI) is a commercially available acuity score that is embedded into the electronic medical record. Previous work demonstrated that the pRI is associated with inpatient pediatric medical emergencies.[1]
- This study examines the pRI as a point-of-care predictive tool for identifying patients at risk for significant clinical deterioration, defined as activation of a medical emergency response team (MERT) or transfer to the ICU.

Methods

- In this IRB-approved study, data were collected prospectively from April – July 2015.
- Patients on the acute care floor whose pRI fell below predefined thresholds were identified and characterized, as were all patients requiring transfer from the acute care floor to the PICU in the setting of medical deterioration.
- MERT activations were examined before and after the implementation of a pRI-based alert system.
- Students *t*-test was used to compare means (Excel, Microsoft Corp., Redmond, WA).
- Statistical process control analysis was used to examine the relationship between implementation of a pRI early warning system and frequency of MERT activation (QI Macros, KnowWare Intl, Denver, CO).

Table 1. Pediatric Rothman Index parameters.[2]

Vital Signs	Nursing Assessments (head-to-toe)	Nursing Assessments (other)	Laboratory Tests (blood)
Temperature	Cardiac	Braden Score	Creatinine
Diastolic blood pressure	Respiratory		Sodium
Systolic blood pressure	Gastrointestinal		Chloride
Pulse oximetry	Genitourinary		Potassium
Respiratory rate	Neurological		BUN
Heart rate	Skin		WBC
	Safety		Hemoglobin
	Peripheral Vascular		
	Food/Nutrition		
	Psychological		
	Musculoskeletal		

[2]Rothman MJ, Rothman SI, Beals J. *J Biomed Inform*. 2013;46(5):837-848.

Results

Figure 1. Statistical process control p-chart displaying the number of MERT activations per number of admissions by month.

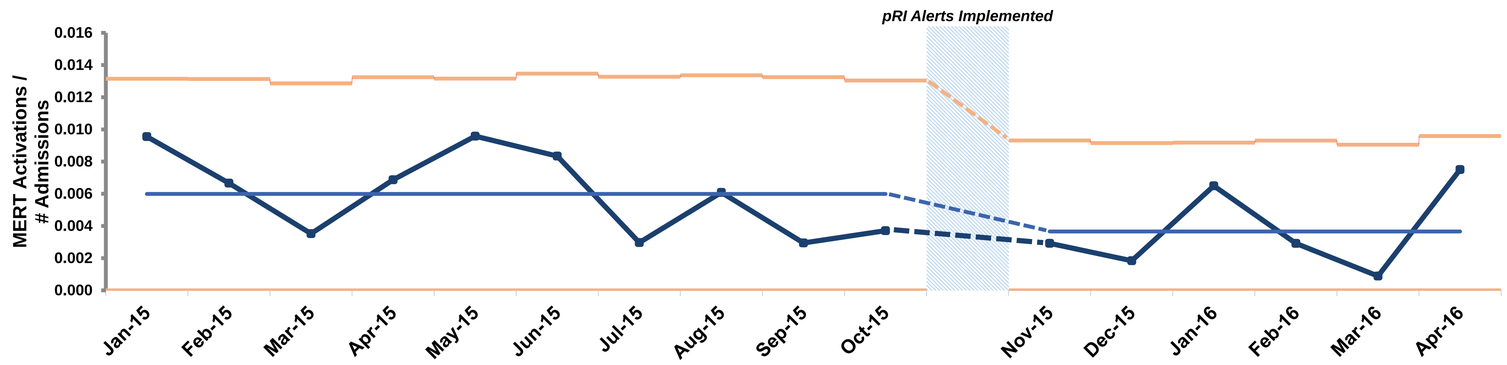

Table 2. Performance of the pRI for detecting MERT activation.[1]

	Medical Emergency Response Team Activation		
pRI	<50	<40	<30
Sensitivity	41%	28%	17%
Specificity	96.6%	98.5%	99.4%
Positive Likelihood Ratio	12.1	18.7	28.3
Negative Likelihood Ratio	0.6	0.7	0.8

[1]Da Silva YS, Fiedor Hamilton M, Horvat C, et al. *Pediatr Crit Care Med*. April 2015.

Table 3. Performance of the pRI for detecting need for PICU transfer.

	Retrospective*			Prospective†	
pRI	<55	<50	<40	<40	<30
Sensitivity	46%	31%	13%	8.6%	4.3%
Specificity	93%	96%	99%	97.9%	99.3%
Positive Predictive Value	23%	26%	41%	15.4%	20.7%
Negative Predictive Value	98%	97%	96%	96.0%	95.9%
Positive Likelihood Ratio	6.9	8.0	15.6	4.1	5.9
Negative Likelihood Ratio	0.57	0.71	0.88	0.93	0.96

*Based on hourly data; †Based on minute data

- Alerts triggered by pRI <40 and pRI <30 while on the acute care floor were associated with positive likelihood ratios for requiring transfer to the PICU of 4.1 and 5.9.
- The median times between an alert and transfer were 7.0 hours (pRI<50) and 6.0 hours (pRI<40).
- Pre-implementation there was an average of 6.0 MERT activations per 1000 admissions per month; in the post-implementation period there was an average of 3.8 MERT activations per 1000 admissions per month (p = 0.12).

Discussion

- Results to-date suggest that utilizing pRI thresholds may improve timeliness of patient care and matching of hospital resources with patient acuity.
- An ongoing interventional phase is evaluating whether staff deployment to patients triggering alerts impacts therapeutic interventions, expedites PICU transfer, and improves quality metrics.
- Next steps will focus on refining alert triggers.

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CRITICAL CARE MEDICINE

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