The Utility of Pediatric Asthma Severity Scores in Disposition Decisions for Status Asthmaticus

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Background
- Annually in the United States, asthma accounts for:
  - 700,000 emergency room (ER) visits
  - 200,000 hospital admissions
- Pediatric Asthma Severity Scores (PASS) is a scoring metric designed for research stratification
- Though broadly used for in-patient protocolized clinical care, PASS has only been validated for distinguishing appropriate initial ER disposition (home vs. inpatient)

Knowledge Gap
- To date, there are no data to suggest PASS identifies children at risk for unplanned hospital readmission or can discriminate a suitable inpatient level of care

Hypotheses
1. Median PASS values prior to intrafacility unit transfer and hospital discharge will differ between cohorts with and without hospital readmission or subsequent increased level of care (defined below)
2. PASS cut off values prior to intrafacility unit transfer and hospital discharge exist that discriminate cohorts with and without hospital readmission or subsequent increased level of care

Methodology
- Study Design: a retrospective cohort study
- Inclusion Criteria: children admitted between May 2015 – May 2017 with age ≥ 5 years and primary diagnosis of status asthmaticus
- Exclusion Criteria: pulmonary hypertension, chronic lung disease, cystic fibrosis, tracheostomy, or absent PASS data.
- Primary Outcomes:
  - **Hospital Readmission**: <30d of discharge
  - **PICU Bounce-Back**: <24hr readmission after PICU to floor transfer
  - **Floor Late Rescue**: <24hr PICU transfer after ER to floor admission
- Statistical Analyses:
  - PASS data, general outcomes, and cohort characteristics were assessed using Fisher's exact, student's t, and Wilcoxon rank-sum tests
  - Receiver operator characteristic (ROC) curves yielded area under the curve (AUC) values and PASS cutoffs used to discriminate unplanned hospital readmission, PICU bounce-back, and late rescue
  - Type I error was set at 0.05
  - All data were analyzed with Stata v15.1

Pediatric Asthma Severity Score

Clinical Finding	Definition	0	1	2
Wheezing	High-pitched expiratory sound on auscultation	None or mild	Moderate	Severe wheezing or absent wheezing due to poor air exchange
Work of breathing	Observed use of accessory muscles, retractions	None or mild	Moderate	Severe
Prolonged expiration	Ratio of duration of expiration to inspiration	Normal or mildly prolonged	Moderately prolonged	Severely prolonged

Adapted from Gorelick et al.[7]

Figure 1. Sample characteristics and primary outcomes. Cohorts did not differ with respect to demographics, anthropometrics, NLHBI class, comorbidities, 2nd diagnoses, or lengths of stay.
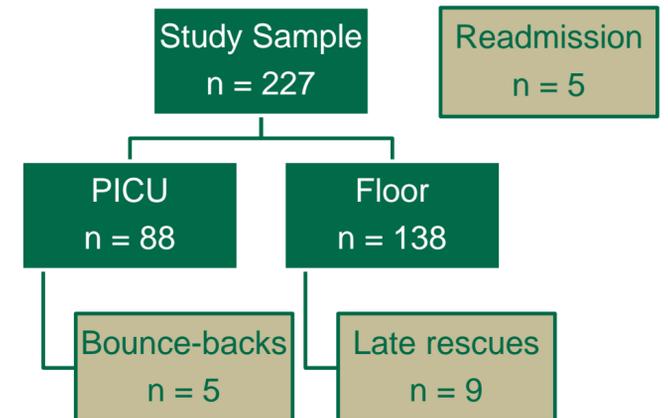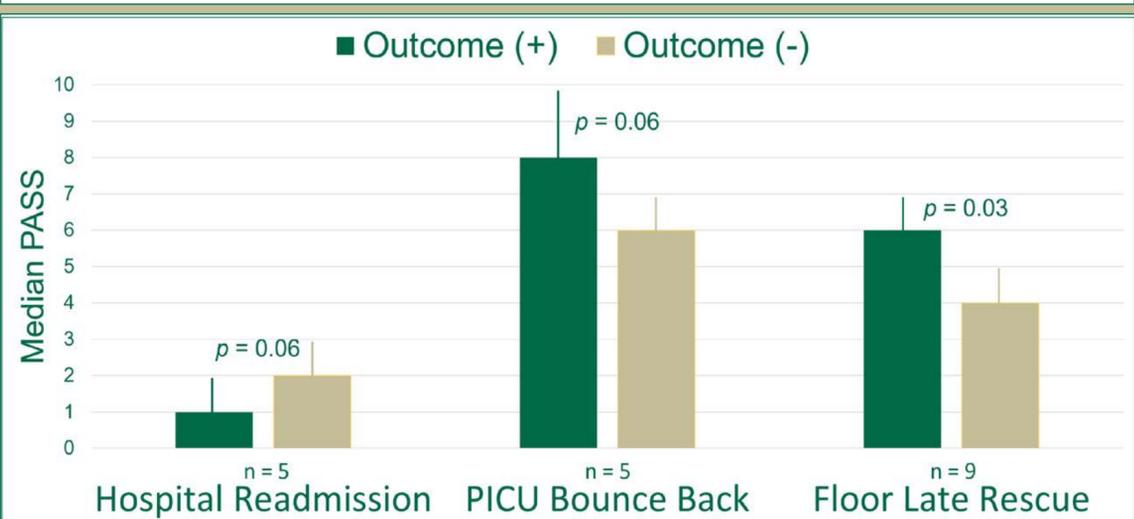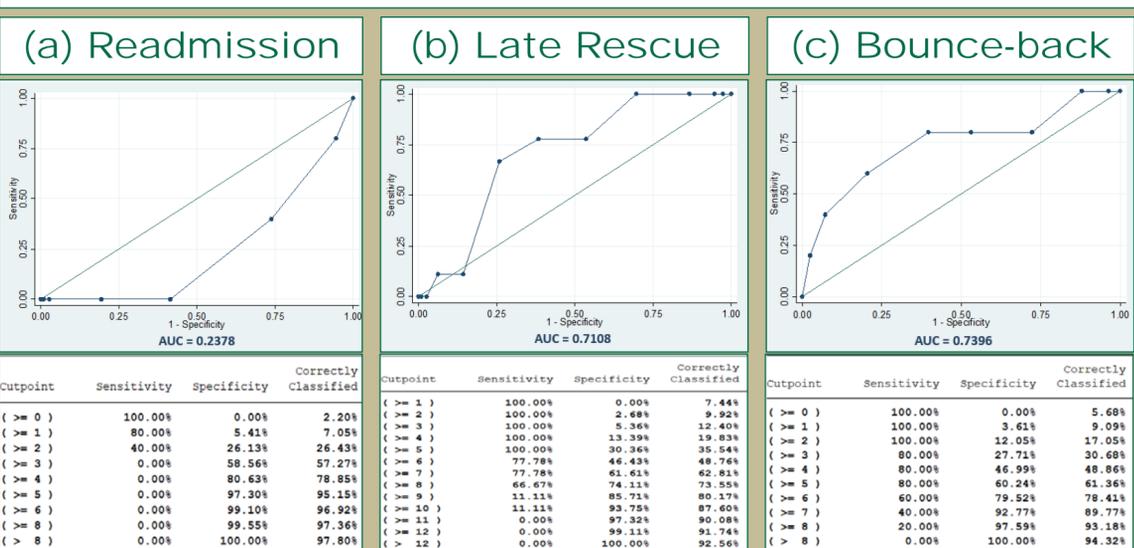

Study Sample n = 227 → PICU n = 88, Floor n = 138
Readmission n = 5
Bounce-backs n = 5
Late rescues n = 9

Figure 2. PASS Data By Outcome

Outcome (+) / Outcome (-). Median PASS.
- Hospital Readmission: $p = 0.06$, n = 5
- PICU Bounce Back: $p = 0.06$, n = 5
- Floor Late Rescue: $p = 0.03$, n = 9

Figure 3. ROC Curve Data For PASS on Outcomes

(a) Readmission
AUC = 0.2378

Cutpoint	Sensitivity	Specificity	Correctly Classified
(>= 0)	100.00%	0.00%	2.20%
(>= 1)	80.00%	5.41%	7.05%
(>= 2)	40.00%	26.13%	26.43%
(>= 3)	0.00%	58.56%	57.27%
(>= 4)	0.00%	80.63%	78.85%
(>= 5)	0.00%	97.30%	95.15%
(>= 6)	0.00%	99.10%	96.92%
(>= 8)	0.00%	99.55%	97.36%
(> 8)	0.00%	100.00%	97.80%

(b) Late Rescue
AUC = 0.7108

Cutpoint	Sensitivity	Specificity	Correctly Classified
(>= 1)	100.00%	0.00%	7.44%
(>= 2)	100.00%	2.68%	9.92%
(>= 3)	100.00%	5.36%	12.40%
(>= 4)	100.00%	13.39%	19.83%
(>= 5)	100.00%	30.36%	35.54%
(>= 6)	77.78%	46.43%	48.76%
(>= 7)	77.78%	61.61%	62.81%
(>= 8)	66.67%	74.11%	73.55%
(>= 9)	11.11%	85.71%	80.17%
(>= 10)	11.11%	93.75%	87.60%
(>= 11)	0.00%	97.32%	90.08%
(>= 12)	0.00%	99.11%	91.74%
(> 12)	0.00%	100.00%	92.56%

(c) Bounce-back
AUC = 0.7396

Cutpoint	Sensitivity	Specificity	Correctly Classified
(>= 0)	100.00%	0.00%	5.68%
(>= 1)	100.00%	3.61%	9.09%
(>= 2)	100.00%	12.05%	17.05%
(>= 3)	80.00%	27.71%	30.68%
(>= 4)	80.00%	46.99%	48.86%
(>= 5)	80.00%	60.24%	61.36%
(>= 6)	60.00%	79.52%	78.41%
(>= 7)	40.00%	92.77%	89.77%
(>= 8)	20.00%	97.59%	93.18%
(> 8)	0.00%	100.00%	94.32%

Discussion / Conclusions
- Median PASS prior to ER → floor admission were greater in those with late rescue (8 vs. 6, $p = 0.03$)
- Based on ROC data, a cutoff PASS value of 8 (SP > 80%) prior to intrafacility unit transfer can discriminate suitable level of care
- Use of PASS to determine patients suitable for discharge is not recommended at this time