

Biomarkers and Physician Impression of Disease Severity in Pediatric Pneumonia

Todd A Florin, MD,MSCE, Lilliam Ambroggio, PhD, MPH, Richard M. Ruddy, MD, Samir S Shah, MD,MSCE

CCTST Center for Clinical & Translational Science & Training



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BACKGROUND

Community-acquired pneumonia (CAP) is one of the most common reasons for children to visit the emergency department (ED). Management and disposition decisions are often made using a physician's overall impression of disease severity, however the association between clinician impression and physiologic markers of disease is unknown.

AIM

To determine the association of clinician impression of disease severity and biomarkers in children with CAP evaluated in the ED.

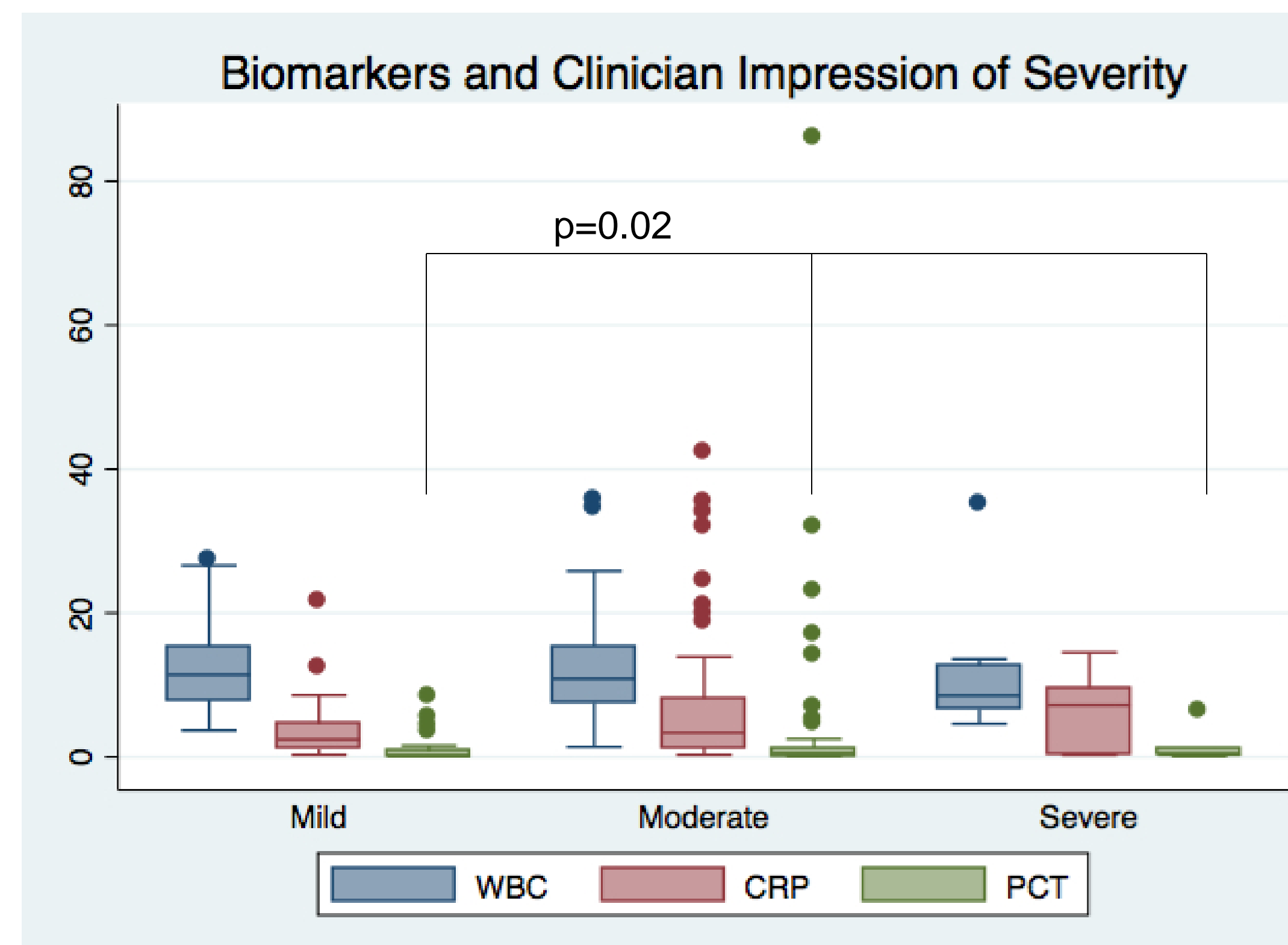
METHODS

- Design: Prospective cohort study -- *Catalyzing Ambulatory Research in Pneumonia Etiology and Diagnostic Innovations in Emergency Medicine (CARPE DIEM)*
- Setting: Urban, tertiary care pediatric ED in freestanding children's hospital
- Population:
 - Inclusion Criteria
 - Age 3 months to 18 years
 - Signs of lower respiratory infection
 - Focal opacity suggestive of CAP on chest radiograph
 - Exclusion Criteria
 - Hospitalization 14 days prior to index visit
 - Chronic or immunocompromising medical conditions
- Biomarkers:
 - White blood cell count (WBC)
 - C-reactive protein (CRP)
 - Procalcitonin (PCT)
- Clinician Impression from the ED clinician:
 - "What is your overall clinical impression of this participant? (i.e., your gestalt feelings on how severely ill the child is when considering your history and exam findings overall)"
 - Mild, moderate, severe, very Severe
 - "How likely is it that this participant will develop severe disease or complications?"
 - Highly unlikely, unlikely, likely, highly likely
 - Analyzed as unlikely vs. likely due to small cell size
- Analysis
 - Kruskal-Wallis
 - Spearman's correlation coefficient

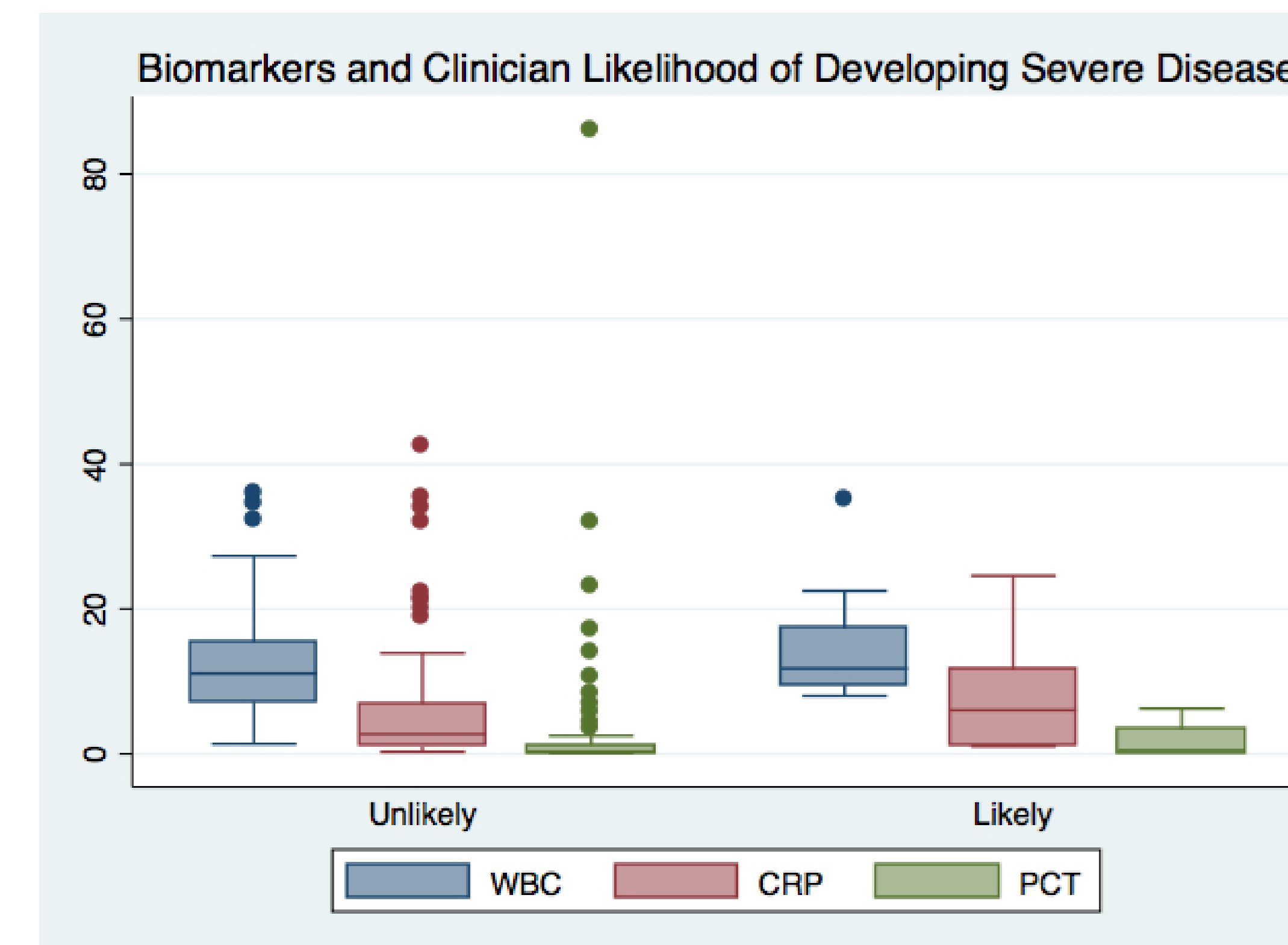
RESULTS

Patient Characteristics

| | Clinician Impression of Disease Severity in ED | | | | Likely to Develop Severe Disease? | | |
|---------------------------------------|--|------------------|------------------|---------|-----------------------------------|------------------|---------|
| | Mild (n=62) | Moderate (n=68) | Severe (n=8) | p-value | Unlikely (n=120) | Likely (n=17) | p-value |
| Historical Factors | | | | | | | |
| Days of Fever, median (IQR) | 3 (2,5) | 3 (2,5) | 2 (2,4.5) | 0.97 | 3 (2,5) | 2.5 (2,4) | 0.3 |
| Days of Current Illness, median (IQR) | 5 (3,8) | 4 (2.5,6) | 2 (1,5) | 0.11 | 4 (3,7) | 5 (2,7) | 0.6 |
| Antibiotics as Outpatient | 27.4% | 26.5% | 22.2% | 0.9 | 24.2% | 41.2% | 0.3 |
| Asthma Diagnosis | 25.8% | 17.7% | 55.6% | 0.04 | 20.8% | 35.3% | 0.2 |
| Altered Mental Status | 56.5% | 75% | 66.7% | 0.08 | 67.5% | 58.8% | 0.5 |
| Apnea | 1.6% | 5.9% | 0% | 0.6 | 4.2% | 0% | 1.0 |
| No PO in 12+ hours | 12.9% | 23.5% | 44.4% | 0.06 | 18.3% | 23.5% | 0.7 |
| Vital Signs | | | | | | | |
| Tachypnea | 61.5% | 80% | 100% | 0.019 | 70.3% | 93.8% | 0.048 |
| Tachycardia | 63.5% | 85% | 100% | 0.007 | 74.3% | 93.8% | 0.09 |
| Hypoxia | 9.7% | 25% | 55.6% | 0.002 | 17.5% | 41.2% | 0.02 |
| Highest Temperature, mean (SD) | 37.8 (1.03) | 38.4 (1.05) | 38.9 (0.9) | 0.4 | 1.1% | 1.1% | 0.02 |
| Physical Examination | | | | | | | |
| Retractions | 22.6% | 58.8% | 77.8% | <0.001 | 43.3% | 52.9% | 0.5 |
| Grunting | 3.2% | 14.7% | 22.2% | 0.02 | 10% | 11.8% | 0.7 |
| Flaring | 3.2% | 20.6% | 55.6% | <0.001 | 15.8% | 12.5% | 1.0 |
| General Appearance | | | | <0.001 | | | 0.2 |
| | Well | 45.2% | 2.9% | 0% | 24.2% | 5.9% | |
| | Mildly ill/distressed | 54.8% | 50% | 11.1% | 50% | 52.9% | |
| | Moderately ill/distressed | 0% | 47.1% | 33.3% | 23.3% | 35.3% | |
| | Severely ill/distressed | 0% | 0% | 55.6% | 2.5% | 5.9% | |
| Altered Mental Status | 0% | 7.4% | 44.4% | <0.001 | 5.8% | 11.8% | 0.3 |
| Capillary Refill >3 seconds | 10% | 23.9% | 75% | <0.001 | 16.2% | 47.1% | 0.003 |
| Outcomes | | | | | | | |
| Hospitalization | 29% | 75% | 88.9% | <0.001 | 50% | 82.4% | 0.01 |
| Revisit | 1.6% | 2.9% | 0% | 1.0 | 2.5% | 0% | 1.0 |
| LOS (hours), median (IQR) | 32.8 (24.4,48.4) | 33.6 (23.3,51.5) | 40.4 (22.6,99.3) | 0.9 | 31.5 (23.3,49.3) | 40.1 (25.6,93.8) | 0.2 |



WBC and CRP not significant across strata
WBC units = 10³/mcl CRP units = mg/dL PCT units = ng/mL



WBC, CRP, and PCT not significant across strata
WBC units = 10³/mcl CRP units = mg/dL PCT units = ng/mL

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RESULTS

Correlations

| | Impression of Severity | Likelihood of Developing Severe Disease | WBC | CRP | PCT |
|---|------------------------|---|-------|-------|-----|
| Impression of Severity | | | | | |
| Likelihood of Developing Severe Disease | 0.32* | | | | |
| WBC | 0.03 | 0.14 | | | |
| CRP | 0.09 | 0.2 | 0.35* | | |
| PCT | 0.24* | 0.09 | 0.29* | 0.48* | |

*p<0.05

LIMITATIONS

- Preliminary data – small sample size
- Need more clinical outcomes to examine relationships between clinician impression, biomarkers and outcomes (e.g., empyema, need for intensive care, length of stay, etc)
- Single center study

CONCLUSIONS

- There were not clinically meaningful differences in WBC, CRP or PCT with increasing clinician impression of severity or prediction of development of severe disease.
- Clinician impression of disease severity or the prediction of likelihood of developing severe disease was not correlated with biomarkers.
- Proportion of abnormal vital signs and physical examination findings increased with increasing clinician of severity.
- Clinical decision aids that combine clinical factors and biomarkers may potentially improve upon clinician gestalt in ED decision making for pediatric CAP.

NEXT STEPS

- Continued enrollment
- Evaluate the association of clinician impression with clinically meaningful outcomes
- Examine the role of clinical factors (history, physical examination) and biomarkers in predicting outcomes in pediatric CAP