Racial Differences in Pediatric Sepsis Alert Performance in a Children’s Hospital Emergency Department

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Quality Improvement, Emergency Medicine
Oral Presentation
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Background

❖ Sepsis is a leading cause of morbidity and mortality
❖ Fever and tachycardia are common indicators of sepsis
❖ Active Sepsis QI program at CHOP since 2012
  • Timely therapies
  • Accurate recognition
    – electronic sepsis alert implemented 2014
Background

- **Equity as key component of quality**
  - Racial disparities in pediatric emergency medicine
  - Underexplored in pediatric sepsis
  - Racial disparities in adult sepsis outcome:
    - higher risk and rate of infection in adult black patients compared to white\(^1\)

- **Racial disparities can lead to**
  - missed diagnoses
  - inequitable testing

Study Objective

- To evaluate sepsis detection differences between non-Hispanic white patients and non-Hispanic black patients at different stages of an existing electronic sepsis alert at a children’s hospital emergency department (ED)
Sepsis alert process

ED encounter

- First Alert

+ First Alert

- Second Alert

+ Second Alert

Sepsis Huddle

No Sepsis Pathway Activation

Sepsis Pathway Activation
Sepsis alert process

ED encounter

- First Alert

+ First Alert

- Second Alert

+ Second Alert

Sepsis Huddle

No Sepsis Pathway Activation

Sepsis Pathway Activation

Abnormal vital signs
- tachycardia
- hypotension
Sepsis alert process

- **ED encounter**
  - No: - First Alert
  - Yes: + First Alert
    - No: - Second Alert
    - Yes: + Second Alert
      - Sepsis Huddle
        - No Sepsis Pathway Activation
        - Sepsis Pathway Activation

- **High risk condition**
- **Abnormal level of consciousness**
- **Delayed capillary refill**
Sepsis alert process

- ED encounter
  - No
  - First Alert
  - Yes
  + First Alert
    - No
    - Second Alert
    - Yes
    + Second Alert
      - Sepsis Huddle
        - No Sepsis Pathway Activation
        - Sepsis Pathway Activation

• Bedside evaluation
Sepsis alert process

ED encounter

- First Alert

+ First Alert

- Second Alert

+ Second Alert

Sepsis Huddle

No Sepsis Pathway Activation

Sepsis Pathway Activation
Sepsis alert process

ED encounter

- First Alert
  No
  - Second Alert
  + First Alert
  Yes
  + Second Alert
  Yes
  Sepsis Huddle
  No Sepsis Pathway Activation
  Sepsis Pathway Activation

Clinician Identified
Hypothesis

- Racial differences would vary by alert stage
- No racial difference in positive first alert frequency
  - Depends on vital signs
- Racial difference in sepsis pathway activation frequency
  - Depends on clinician judgment
Methods

- **Design**: Retrospective cohort study: 6/1/16 to 5/31/17

- **Setting**: Tertiary care, urban, academic pediatric ED with an existing electronic health record vital sign based sepsis alert in place since 2014

- **Data Source**: existing quality improvement data set extracted from electronic health record

- **Inclusion**
  - All Emergency Department patients
  - Race: Black or White

- **Exclusion**
  - Ethnicity: Hispanic
Statistical Analysis

- **Categorical variables**: frequencies, percentages, odds ratios
- **Unadjusted comparisons**: chi squared testing
- **Multivariate analyses**: logistic regression
  - Adjusted for confounders available in existing data set
- **Stata 15.0 (College Station, TX)**
Frequency of sepsis alerts and order set use

ED Visits by Race (N=97338)

- **Black** (N=57985) 59.6%
- **White** (N=24472) 25.1%
- **Other** (N=14881) 15.3%
Frequency of sepsis alerts and order set use

Percentage of Positive First Alerts by Race

- Black: 88.9%
- White: 87.6%

OR (95% CI)
1.1 (1.1, 1.2)

Percentage of Positive Second Alerts by Race

- Black: 17.3%
- White: 6.8%

OR (95% CI)
3.0 (2.5, 3.3)

Note: Y-axis is adjusted to 60%
Frequency of sepsis alerts and order set use

Sepsis Order Set Use using the Alert

- Black: 1.2 (95% CI: 0.9, 1.7)
- White: 3.4

Sepsis Order Set Use outside of the Alert

- Black: 0.36
- White: 1.2 (95% CI: 2.2, 6.1)

Note: Y-axis is adjusted to 60%
### Table 1. Stages of Electronic Sepsis Alert for Patients with Positive First Alert

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<thead>
<tr>
<th>Stage</th>
<th>Black N=6396 (%)</th>
<th>White N=3043 (%)</th>
<th>Total N=12652 (%)</th>
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<td>Positive second alert</td>
<td>435 (6.8)</td>
<td>527 (17.3)</td>
<td>1298 (10.3)</td>
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<td>Sepsis pathway activation with alert to huddle process</td>
<td>74 (1.2)</td>
<td>104 (3.4)</td>
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<td>ICU admission within 24 hours of ED visit</td>
<td>43 (0.67)</td>
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A red star (★) denotes a statistically significant racial difference in sepsis order set use.
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## Sepsis Detection and Treatment

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Table 2. Univariate and Multivariate Logistic Regression for Sepsis Order Set

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<th>White N=527 (%)</th>
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<th>AOR (95% CI)</th>
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<tr>
<td>White race</td>
<td>n/a</td>
<td>n/a</td>
<td>3.0 (2.3, 3.9) ⭐</td>
<td>1.5 (1.0, 2.1) ⭐</td>
</tr>
<tr>
<td>High risk condition</td>
<td>293 (67.6)</td>
<td>374 (71.3)</td>
<td>1.2 (0.90, 1.6)</td>
<td>12.3 (5.4, 18.2)</td>
</tr>
<tr>
<td>Abnormal level of consciousness</td>
<td>161 (37.0)</td>
<td>177 (33.6)</td>
<td>0.86 (0.66, 1.1)</td>
<td>7.3 (5.4, 9.9)</td>
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<td>Delayed capillary refill</td>
<td>42 (9.7)</td>
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<td>Government insurance</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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Conclusions

- Odds of sepsis detection and treatment were higher in white compared to black patients.
- Differences persisted after adjusting for risk factors and insurance.
- More notable in patients treated for sepsis outside of the electronic sepsis alert.
- Possible conclusion is that sepsis detection using the alert reduces racial differences versus detection using clinician judgment alone.
Limitations

- Limited confounders in our current quality improvement data set
- Difficult to distinguish clinical appropriate differences from clinical disparities in care
  - implicit provider bias
  - institutional protocol
  - access to care
- Generalizability may be limited (single center study)
Future Directions

- Collect information on potential confounders
  - triage acuity
  - age
  - gender
  - access to regular primary care

- Expand analyses to compare process and outcome measures of sepsis care across races
  - timely therapy
  - hospital/ICU length of stay
  - organ dysfunction
  - mortality
Acknowledgments

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