Improving Pediatric Sepsis Outcomes (IPSO)

A Multicenter Quality Improvement Collaborative
Hosted by The Children’s Hospital Association

Pacific Northwest Sepsis Conference – 6/16/2020
Dr. Matthew Niedner, MD
(CHA has >220 Children’s Hospitals)
IPSO High-level Overview

MOBILIZE
- Form teams
- Partnerships
- Resources
- Train staff

MEASURE
- Data sources
- Validate
- Submit data
- Reports

IMPLEMENT
- IPSO bundles
- 5 key processes
- Rapid cycle improvement

COLLABORATE
- Peer-to-peer sharing
- Web-based library
- Direct coaching
March 2020 – Inclusion in Aggregate Status

- **50 Sites Actively Submitting Data**
  - **47 Sites Included in Aggregate**
  - **3 Sites Excluded from Aggregate**

<table>
<thead>
<tr>
<th>Minimum Data Submission Met</th>
<th>March 2020 Reports</th>
<th>April 2018 Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of Data Quality Issues</td>
<td># of Data Quality Issues</td>
</tr>
<tr>
<td></td>
<td>0 1 2 3</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Minimum Data Submission Met</td>
<td>47</td>
<td>17 4 2 2</td>
</tr>
<tr>
<td>Minimum Baseline Submission Not Met</td>
<td>1 3</td>
<td>1 1 3 3</td>
</tr>
<tr>
<td>Minimum Prospective Submission Not Met</td>
<td>2 3</td>
<td>6 3 3 3</td>
</tr>
<tr>
<td>Neither Baseline nor Prospective Minimum Met</td>
<td>1 3</td>
<td>1 1 3 3</td>
</tr>
</tbody>
</table>
Terminology

IPSO Suspected Infection (ISI)

Blood culture & antibiotic within 24 hours and inpatients or intent to admit (ED)

8 ways to meet inclusion from treatments to ICD (sensitivity > specificity)

IPSO Critical Sepsis (ICS)

Highly correlated to Goldstein Criteria for Severe Sepsis / Shock

IPSO Non-Critical Sepsis (INS)

Subset not meeting IPSO Critical criteria

n over 3 yrs

>200k

>15k

>30k

>200k

>15k

>30k

>200k

>15k

>30k
Reduce Hospital-Onset “IPSO Critical Sepsis” by 25%

Reduce Sepsis-Attributable “IPSO Critical Sepsis” Mortality by 25%

I Prevention: Appropriate & timely treatment of IPSO Suspected Infection that may progress to IPSO Sepsis

II Recognition: Sensitive, specific, efficient, and timely recognition of IPSO Sepsis

III Diagnostic Evaluation: Appropriate and timely diagnostic evaluation of IPSO Sepsis

IV Resuscitation / Stabilization: Appropriate, timely, and effective treatment of IPSO Sepsis

V De-escalation: Appropriate and timely de-escalation of care

VI Patient and Family Engagement

VII Optimize Performance

Reduce Hospital-Onset “IPSO Critical Sepsis” by 25%

Reduce Sepsis-Attributable “IPSO Critical Sepsis” Mortality by 25%
Cumulative Sepsis Episodes Submitted

By Episode Type

- Baseline IPSO Sepsis Episodes - 12,426
- Prospective IPSO Sepsis Episodes - 45,038
- IPSO Sepsis (not critical) Episodes - 29,748
- IPSO Critical Sepsis Episodes - 15,290
- IPSO Suspected Infection Episodes - 201,860

Total Episodes - 259,324
% Overall Submission Progress 4.25.20

> 90% of total IPSO Sepsis months possible have been submitted

<table>
<thead>
<tr>
<th>Submission Month</th>
<th>Target</th>
<th>Baseline IPSO Sepsis</th>
<th>Prospective IPSO Sepsis</th>
<th>IPSO Suspected Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
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<tr>
<td>2019</td>
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</tr>
<tr>
<td>2020</td>
<td></td>
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</tbody>
</table>
IPSO’s 5 Key Processes

% of Hospitals Showing Improvement*

*Last 12 data points improved over first 12 data points

<table>
<thead>
<tr>
<th>Process</th>
<th>% of Hospitals Improving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen</td>
<td>62%</td>
</tr>
<tr>
<td>Huddle</td>
<td>65%</td>
</tr>
<tr>
<td>Order Set</td>
<td>63%</td>
</tr>
<tr>
<td>Bolus</td>
<td>58%</td>
</tr>
<tr>
<td>ABX</td>
<td>50%</td>
</tr>
<tr>
<td>Improving in at least one key process</td>
<td>94%</td>
</tr>
</tbody>
</table>
IPSO’s 5 Key Processes

Number of Hospitals Showing Improvement*

*Last 12 data points improved over first 12 data points

<table>
<thead>
<tr>
<th>Number of Hospitals</th>
<th>Improved in at least 1</th>
<th>Improved in at least 2</th>
<th>Improved in at least 3</th>
<th>Improved in at least 4</th>
<th>Improved in all 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>49</td>
<td>43</td>
<td>33</td>
<td>19</td>
<td>10</td>
</tr>
</tbody>
</table>
Trigger Activations (IPSO Sepsis) - Aggregate Wave 1 January 2017 thru March 2020

Percent of Episodes

41.8%  46.3%  53.5%

2017  2018  2019  2020

Numerator: Count of IPSO Sepsis episodes that had a positive initial sepsis screen (“triggered”). Denominator: Count of IPSO Sepsis episodes.

- Centerline
- UCL
- LCL
- Trigger Activations (IPSO Sepsis)
- Target
Huddle Activations (IPSO Sepsis) - Aggregate Wave 1 January 2017 thru March 2020

Numerator: Count of IPSO Sepsis episodes that had a positive huddle. Denominator: Count of IPSO Sepsis episodes.

- Centerline
- UCL
- LCL
- Huddle Activations (IPSO Sepsis)
- Target

2017: 11.4%
2018: 17.2%
2019: 31.7%
2020:
Order Set Utilization (IPSO Sepsis) - Aggregate Wave 1
January 2017 thru March 2020

37.7%
42.1%

Numerator: Count of IPSO Sepsis episodes where order set was initiated. Denominator: Count of IPSO Sepsis episodes.

Centerline, UCL, LCL, Order Set Utilization (IPSO Sepsis), Target
Recognition Tool Utilization (IPSO Sepsis) - Aggregate Wave 1
January 2017 thru March 2020

Numerator: Count of IPSO Critical Sepsis episodes that had a positive screen or huddle or where order set was used. Denominator: Count of IPSO Critical Sepsis episodes.

- Red: Centerline
- Dotted Red: UCL
- Dashed Red: LCL
- Blue: Recognition Tool Utilization (IPSO Sepsis)
- Green: Target

2017: 61.0%
2018: 66.6%
2019: 69.3%
Rate per 1000 Hospital Admissions (IPSO Sepsis) - Aggregate Wave 1
January 2017 thru March 2020

Episodes per 1000 Admissions

2017 2018 2019 2020

Numerator: Count of IPSO Sepsis episodes. Denominator: Hospital admissions divided by 1000.
Time to First Fluid Bolus (IPSO Sepsis) - Aggregate Wave 1
January 2017 thru March 2020

Numerator: Sum of time from time zero to initiation of first fluid bolus. Denominator: Count of IPSO Sepsis episodes. (Exclude episodes where bolus 1 time was time zero or was not reported or where time zero could not be determined.)

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
</table>

Centerline | UCL | LCL | Time to Bolus (IPSO Sepsis) | Target
Time to First IV Antibiotic (IPSO Sepsis) - Aggregate Wave 1 January 2017 thru March 2020

Numerator: Sum of time from time zero to initiation of first IV antibiotic. Denominator: Count of IPSO Sepsis episodes. (Exclude episodes where antibiotic time was time zero or was not reported or where time zero could not be determined.)

Centerline UCL LCL Time to Antibiotic (IPSO Sepsis) Target

2016 2017 2018 2019 2020
30-Day Sepsis-Attributable Mortality (IPSO Sepsis) - Aggregate Wave 1
January 2017 thru March 2020

Mortality at Day 30


Centerline | UCL | LCL | 30-Day Sepsis Mortality (IPSO Sepsis)
What do we mean by “IPSO Critical Sepsis”?  

[Third Bolus or Pressor] Plus Treatment

Note: “IPSO Critical Sepsis” cannot be identified from IPSO baseline data set; baseline for IPSO Critical Sepsis is defined as the first 12 months of IPSO prospective data set (2017 for Wave 1).
Incidence Comparison (per 1000 admissions)

Better and/or earlier recognition of sepsis syndrome earlier in continuum

IPSO Non-Critical Sepsis (INS)

IPSO Critical Sepsis (ICS)

IPSO Suspected Infection (ISI) = 120/1000 admissions
30-Day Sepsis-Attributable Mortality Comparison

IPSO Non-Critical Sepsis (INS)

IPSO Critical Sepsis (ICS)

1.8%

3.6%

All-Cause Mortality ~Double
Sepsis-Attributable Mortality (30-Day)
By Care Setting Onset/Recognition (1/2017 – 6/2019)

**ED**
- Jan 2017: 2.5%
- Jul 2018: 5%
- Dec 2018: 3%
- Jun 2019: 3%

**ICU**
- Jan 2017: 8.5%
- Oct 2017: 10%
- Feb 2018: 15%
- Dec 2018: 20%

**Gen Floor**
- Jan 2017: 5.3%
- Jun 2018: 20%
- Mar 2019: 30%

**Hem Onc**
- Jan 2017: 10.5%
- Sep 2017: 50%
- Feb 2019: 70%
- Jun 2019: 80%
Hmmm...

So we have evidence-based practices (such as it is)...

And we are improving recognition, process compliance, and timeliness...

But we aren’t seeing the mortality needle move as we had hoped...

So time to revisit if we’re doing the right things and looking at it the right way.
Definition: All-or-None Compliance

Episodes are compliant when:
- There is a positive screen OR positive huddle OR order set is used
- Bolus was administered in specified timeframe
- Antibiotic was administered in specified timeframe

Episodes are non-compliant when:
- There is no positive screen AND no positive huddle AND no order set is used
- Bolus was not administered in specified timeframe
- Antibiotic was not administered in specified timeframe
Bundles Evaluated

Bolus 20 min / ABX 60 min / Recognition*

- Reflects Original IPSO-specific targets

Bolus 60 min / ABX 180 min / Recognition*

- Reflects Modified IPSO targets (tripled); also updated to more closely match current Surviving Sepsis Guidelines and Internal Data Analyses

*Recognition = positive screen, positive huddle or order set use
## 2019 Compliance by Bundle—IPSO Sepsis

<table>
<thead>
<tr>
<th>Bundle</th>
<th>N, IPSO Sepsis</th>
<th>Any Recognition</th>
<th>Bolus, &lt; Target</th>
<th>Abx, &lt; Target</th>
<th>Overall Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolus 20 min –</td>
<td>12,329</td>
<td>72%</td>
<td>53%</td>
<td>57%</td>
<td>22%</td>
</tr>
<tr>
<td>Antibiotic 60 min –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolus 60 min –</td>
<td>12,329</td>
<td>72%</td>
<td>78%</td>
<td>83%</td>
<td>49%</td>
</tr>
<tr>
<td>Antibiotic 180 min –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
## 2019 Compliance by Bundle—IPSO Critical Sepsis

<table>
<thead>
<tr>
<th>Bundle</th>
<th>N, IPSO Critical Sepsis</th>
<th>Any Recognition</th>
<th>Bolus, ≤ Target</th>
<th>Abx, ≤ Target</th>
<th>Overall Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolus 20 min –</td>
<td>3,829</td>
<td>71%</td>
<td>64%</td>
<td>64%</td>
<td>30%</td>
</tr>
<tr>
<td>Antibiotic 60 min – Recognition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolus 60 min –</td>
<td>3,829</td>
<td>71%</td>
<td>88%</td>
<td>88%</td>
<td>58%</td>
</tr>
<tr>
<td>Antibiotic 180 min – Recognition</td>
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</tr>
</tbody>
</table>
## Bundle Compliance ➔ Outcomes

### All Bundles below include PLUS recognition

<table>
<thead>
<tr>
<th>Description</th>
<th>SA Mortality</th>
<th>% Diff</th>
<th>Hospital Days</th>
<th>% Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bol 20 min/ABX 60 min (comp)</td>
<td>3.1%</td>
<td>-14%</td>
<td>10.0</td>
<td>-11%</td>
</tr>
<tr>
<td>Bol 20 min/ABX 60 min (non-comp)</td>
<td>3.6%</td>
<td></td>
<td>11.2</td>
<td></td>
</tr>
<tr>
<td>Bol 60 min/ABX 180 min (comp)</td>
<td>2.5%</td>
<td>-49%*</td>
<td>9.5</td>
<td>-25%*</td>
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<tr>
<td>Bol 60 min/ABX 180 min (non-comp)</td>
<td>4.8%</td>
<td></td>
<td>12.7</td>
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* Statistically Significant (p<0.05)
## Recognition Compliance ➔ Timeliness

<table>
<thead>
<tr>
<th>Compliance</th>
<th>Mean Time to ABX</th>
<th>% Diff</th>
<th>Mean Time to Bolus</th>
<th>% Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen compliant</td>
<td>73</td>
<td>-21%</td>
<td>32</td>
<td>-21%</td>
</tr>
<tr>
<td>No Screen</td>
<td>93</td>
<td>-21%</td>
<td>40</td>
<td>-21%</td>
</tr>
<tr>
<td>Huddle compliant</td>
<td>73</td>
<td>-13%</td>
<td>28</td>
<td>-22%</td>
</tr>
<tr>
<td>No huddle</td>
<td>84</td>
<td>-13%</td>
<td>36</td>
<td>-22%</td>
</tr>
<tr>
<td>Order Set compliant</td>
<td>63</td>
<td>-35%</td>
<td>28</td>
<td>-32%</td>
</tr>
<tr>
<td>No order set</td>
<td>97</td>
<td>-35%</td>
<td>42</td>
<td>-56%</td>
</tr>
</tbody>
</table>
Bundle Compliance

Bolus 60 – ABX 180 – Recognition

IPSO Sepsis

2017 2018 2019

43.7% 49.4%

IPSO Critical Sepsis

2017 2018 2019

52.0% 56.7%
Takeaways

Bundle Compliance Matters

- Mortality & hospital days are lower in more compliant episodes
- Time to 1st bolus & IV antibiotic are lower when recognition tools are used
- So we believe we’re doing the “right things”
### Bundle Compliance → Outcomes

All Bundles below include PLUS recognition

<table>
<thead>
<tr>
<th></th>
<th>IPSO Sepsis</th>
<th>IPSO Critical Sepsis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA Mortality</td>
<td>% Diff</td>
</tr>
<tr>
<td>Bol 20 min/ABX 60 min (comp)</td>
<td>1.76%</td>
<td>-19.5%*</td>
</tr>
<tr>
<td>Bol 20 min/ABX 60 min (non-comp)</td>
<td>2.19%</td>
<td></td>
</tr>
<tr>
<td>Bol 60 min/ABX 180 min (comp)</td>
<td>1.24%</td>
<td>-56.9%*</td>
</tr>
<tr>
<td>Bol 60 min/ABX 180 min (non-comp)</td>
<td>2.87%</td>
<td></td>
</tr>
</tbody>
</table>

* Statistically Significant (p<0.05)
<table>
<thead>
<tr>
<th></th>
<th>IPSO Sepsis</th>
<th></th>
<th>IPSO Critical Sepsis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Time to ABX</td>
<td>% Diff</td>
<td>Mean Time to Bolus</td>
<td>% Diff</td>
</tr>
<tr>
<td>Screen compliant</td>
<td>92</td>
<td>-12.7%</td>
<td>35</td>
<td>-13.3%</td>
</tr>
<tr>
<td>No Screen</td>
<td>106</td>
<td>-12.7%</td>
<td>41</td>
<td>-13.3%</td>
</tr>
<tr>
<td>Huddle compliant</td>
<td>93</td>
<td>-6.8%</td>
<td>30</td>
<td>-23.6%</td>
</tr>
<tr>
<td>No huddle</td>
<td>100</td>
<td>-6.8%</td>
<td>40</td>
<td>-23.6%</td>
</tr>
<tr>
<td>Order Set compliant</td>
<td>72</td>
<td>-40.4%</td>
<td>33</td>
<td>-23.5%</td>
</tr>
<tr>
<td>No order set</td>
<td>121</td>
<td>-40.4%</td>
<td>43</td>
<td>-23.5%</td>
</tr>
<tr>
<td>Recognition compliant</td>
<td>86</td>
<td>-36.6%</td>
<td>34</td>
<td>-47.4%</td>
</tr>
<tr>
<td>No recognition</td>
<td>136</td>
<td>-36.6%</td>
<td>64</td>
<td>-47.4%</td>
</tr>
</tbody>
</table>