Lessons from a Sepsis Rapid Cycle Collaborative

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Children’s Hospital Colorado

Facilitator: Tina Logsdon
Children’s Hospital Association
May 13, 2015
Sepsis Recognition Initiative
CHA Collaborative

Toni Wakefield, MD
Dory Collette, RN CCRN

dell children’s medical center of central texas
A member of the Seton Family of Hospitals
Project Goals

- **Goal:**
  - Improving detection and treatment of early sepsis.

- **Aim**
  - Decrease time to first bolus from ~1 hr to national standard goal of 20 minutes
  - Decrease time to antibiotics form ~ 2 hrs to national goal of 60 minutes
  - Decrease unplanned transfers related to sepsis by 50%

- **Focus:**
  - Acute care inpatient units
  - ED patients on ED protocol
Our Team

• Physician support
  – Hospitalists
  – Intensivists
  – ED physicians
  – Infectious disease
  – Residents

• Nursing support
  – Education
  – Acute care
  – ED
  – Critical care
  – Transport

• Infectious disease pharmacist
Challenges

• Getting a general consensus on:
  – Screening tools
  – Notification criteria
    • Under/over notify
  – Patient population
    • Excluded: surgical; hemo/onc; less than 1 month of age

• Data
  – Administrative/retrospective
    • paper to EMR
  – Ultimately data from
    • ICD code for discharge diagnosis sepsis; septicemia and bacteremia
    • Unplanned transfers
    • Sepsis order sets
    • Weekly census review
• Process
  – When to start
  – When to stop
  – When to transfer
Your patient’s PEWS score changes from green to another color

Are 3 of the 8 notification criteria present?

Continue reassessment per PEWS protocol

NO

YES

Notify intern IMMEDIATELY

If intern does not call back within 5 minutes of page: immediately contact senior resident OR call Admit Phone

Fill out VS on screening tool and place Sepsis packet in chart

Notification criteria:
- Lethargy/irritability
- Fever < 36 > 38.5
- Rash (new onset or spreading)
- Decreased perfusion
- Concern over or unable to determine urine output
- Parental concern
- HR > 20 above normal
- Low BP (hypotensive) in the last 12 hours
**PEWS score changes from green to other color and 3 of 8 of notification criteria**

**RN immediately notifies intern**

**Intern evaluates patient within 15 min of call**

**Intern must immediately notify senior resident and attending once alerted by RN if not already notified**

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**SIRS criteria present?**

**Suspected bacterial infection?**

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**Positive sepsis screen:**
- 2 or more SIRS criteria met (1 of which must be fever or altered WBC)
- Plus suspected bacterial infection

**SIRS criteria:**
- Fever <36 > 38.5
- WBC > 12000 or < 4000
- RR > 20 breaths than normal
- HR > 20 to 30 beats than normal

**Examples:**
- Pneumonia
- UTI
- Indwelling line
- Bacterial AGE
- Neonatal fever
- Bronchiolitis

(Phase 1 initiated for patients with bronchiolitis at the discretion of the attending physician ONLY)

**SIRS + infection = sepsis**

Initiate Phase 1 (see orders)
- Automatic CRT
- Establish IV access
- Give 20 mL/kg NS bolus over 15 minutes
- Consider labs
Resident notifies attending

Attending and resident assess patient

Severe sepsis

Use Sepsis Orderset- Phase 1,2,3 as applicable

Transfer to higher level of care. CRT in orderset will help nursing resources

DOCUMENT findings on screening tool

Early or possible early sepsis

Use Sepsis Orderset- Phase 1,2,3 as applicable

VS q 15 min X 1 hour. CRT in orderset will help nursing resources.

After 1 hour if not responding to tx, Transfer

Can DC protocol if sx’s improve. Get VS/PEWS q 30 min X 1 hr and Q1 hr X 1 hour

After 3 hours pt must be stable enough for floor VS or get Transferred to higher level of care

DOCUMENT findings on screening tool at every assessment

Not sepsis

Do NOT Use Sepsis Orderset

DOCUMENT findings on screening tool

DCMC Sepsis Recognition Flowchart – Treatment Flow
Last edit 11/22/2012
DCMC Physician Sepsis Screening Tool

Directions: Screening to be done when change in PEWS occurs. **Circle** abnormal findings.

**Date/Time of Screen initiation: ____________**

<table>
<thead>
<tr>
<th>Vital Signs</th>
<th>Clinical findings</th>
<th>Laboratory Information</th>
<th>Major risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>o RR</td>
<td>o Neuro- lethargic, irritable</td>
<td>o WBC (high or low)</td>
<td>o Central venous access</td>
</tr>
<tr>
<td>o HR</td>
<td>o Resp - tachypneic, hypoxic</td>
<td>o HCO3-</td>
<td>o Known Hem/Onc patient (neutropenia; bone marrow transplant, etc)</td>
</tr>
<tr>
<td>o BP</td>
<td>o Cardio- Decreased cap refill, OR vasodilated</td>
<td>o Creatinine</td>
<td>o Suspected bacterial infection</td>
</tr>
<tr>
<td>o Temp</td>
<td>o GI- Emesis, diarrhea</td>
<td>o Glucose</td>
<td>o AGE with significant dehydration</td>
</tr>
<tr>
<td>o SAO2</td>
<td>o GU- Decreased UOP</td>
<td>o Lactate</td>
<td>o Prior surgical intervention within last 5 days</td>
</tr>
<tr>
<td>o Skin-</td>
<td>o Rash</td>
<td>o Albumin</td>
<td>o Asplenia</td>
</tr>
<tr>
<td>Parental</td>
<td>o Concern</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pumps cannot deliver timely NS bolus

VS kept on paper slips, not entered in EHR

IV access delayed

Push-pull method not utilized

No orderset for Wards to simplify/standardize orders

Pumps cannot deliver timely NS bolus

Cognitive Anchor on different diagnosis

Do not use chain of command when needed

Inadequate knowledge

MD or RN not notified or aware

Lack of confidence

PEWS calculated incorrectly

Too busy

Do not recognize VS or uop are abnormal

AIM:
Decrease Transfers to Higher Level of Care due to Underrecognized or Undertreated Sepsis

Figure 1: Fishbone diagram
Timely Antibiotic Adminstration
July 2011- June 2013
Fluid Administration 1st bolus
July 2011-June 2013

Fluid Administration 1st bolus
Sepsis patients transferred to higher level of care August 2011-August 2013
Baseline data

- Realized did not capture all patients
  - Related to appropriate coding on discharge
- Showed gaps
  - And lots of room for improvement
- Where to begin
  - ED had sepsis protocol in place starting June 2012
  - Piggybacked off their efforts
Implementation of protocol

- Education to staff
  - Nursing
  - Physicians
  - Pharmacy
- Piloted on 1 acute care unit for 2 months
  - Feedback given by staff
  - changes made
- After pilot spread to other units
Findings

- Inconsistent usage of protocol
  - Staff understanding
  - Physician driven
  - Protocol on paper not in EMR

- When protocol used
  - Improvements seen in
    - Time to antibiotics
    - Transfers to higher level of care
Fluid Administration 1st bolus - average

Time period

Fluid Administration 1st bolus - average

UCL

LCL


0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00% 70.00% 80.00%

45.99% 33.49%
Decreased Percentage of Patients with Sepsis Requiring Transfer to Higher Level of Care

Mean = 50%

Mean = 17%

Mean = 13%

Mean = 9%

- desired direction of change
Sepsis patients transferred to higher level of care
January 2013- February 2015
Where do we go from here?

- Sustaining education and engagement of nursing and physicians
- Reviewing ED identification of patients without an known high risk condition
- Collaborate with CHA to look at mortality as well as preventing progression to severe sepsis
- Explore leveraging EHR to automate or facilitate data collection
- Continue root cause analyses of first bolus gap
Questions or comments

• Make a comment or start a dialogue for all participants using the “Chat” panel.
  
  Send to: All Participants

• Submit a question for the presenters at any time using the “Q&A” panel.
  
  Ask: All Panelists
Children’s Hospital Colorado

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Halden Scott, MD (Pediatric Emergency Medicine)
Irina Topoz, MD (Pediatric Emergency Medicine, Network of Care QI Director)
Danella Pochman MSN (Network of Care ED/UC)
Lindsey Shaw MSN (Network of Care ED/UC)
Main + Network of Care (Satellites)  
>155,000 ED/UC visits yearly
**Sepsis Treatment and Recognition Program**

**Project Leads**
Beth Wathen, MSN: CHA Project Lead
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Jenny Reese, MD: Inpatient Physician Lead

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**Quality & Patient Safety Grant**
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Chief Residents
Nicole Kaiser PharmD
First Things First: Diagnosis

Barriers
• Effective, objective screening test for sepsis?
• Potential for overtriggering/overtreating
  – Resource utilization
  – Detract from other patient care
  – Antimicrobial stewardship
  – Staff fatigue

Solution
• Focus efforts on treatment first
• A two-tier system
Does the patient have fever and/or concern for infection with any of the below symptoms:

- Hypotension with tachycardia or poor perfusion?
- Severe alterations in mental status/perfusion/respiratory distress?
- Critically-ill appearance?

Does the patient have fever with concern for infection with any of the below symptoms:

- Persistent/worsening tachycardia despite treatment of fever & dehydration?
- Immunosuppression/immunodeficiency or central line and worsening clinical status?
- Consider for:
  - Changes to mental status + infection
  - Cool extremities, poor capillary refill, diminished pulses, mottling
  - Flushed, warm extremities, bounding pulses, flash capillary refill
<table>
<thead>
<tr>
<th>Concept</th>
<th>Sepsis STAT</th>
<th>Sepsis Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full resuscitation now</td>
<td>Prevent deterioration</td>
<td>Ongoing clinical-decision making</td>
</tr>
<tr>
<td>Location</td>
<td>Move to a resuscitation bay</td>
<td>Stay in regular ED room</td>
</tr>
<tr>
<td>Staffing</td>
<td>Additional nurse to bedside</td>
<td>Bedside nurse (charge nurse watches the bedside nurse’s other patients)</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>Hand-delivers antibiotic</td>
<td>Expedited tubed antibiotic with nurse page</td>
</tr>
<tr>
<td>Fluid</td>
<td>Rapid bolus start, reassess</td>
<td>Consider, reassess</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>Rapid antibiotics</td>
<td>Consider, reassess (stewardship)</td>
</tr>
<tr>
<td>PROS</td>
<td>Phenomenal coordinated resuscitation response</td>
<td>Lowers psychological barrier to clinicians activating &amp; may prevent full shock state</td>
</tr>
<tr>
<td>CONS</td>
<td>Resource-intensive</td>
<td>Underuse of Sepsis STAT</td>
</tr>
</tbody>
</table>
**Activation Procedures:** Nurse or provider may decide to activate a Sepsis STAT Activation.
- Tells unit secretary to send Sepsis STAT Page
- ED charge nurse, pharmacists, critical care resource nurse, PICU charge nurse, ED clinical coordinator/department educator, ED clinical practice specialist
- Secretary records time of page
- Bedside RN notifies attending MD or activating MD notifies bedside RN

**RN Procedures:**
2nd RN to bedside as soon as possible to assist bedside RN in the following immediate steps:
- Start the “Count-up” clock
- Assess mental status, ABCDEs, Weight
- CR Monitor, Pulse Ox, Vital Signs w/BP q 5 min until stable
- Start nasal cannula O2
- IV Access x2:
  - Peripheral IV with largest gauge possible (Consider IO, EI if symptoms severe and access difficult)
  - Ports require 2nd IV's (Double-lumen large central lines do not)
  - If no access w/in 15 min, consider I/O
- Send sepsis labs, run 2 ISTAT’s (CG8+, CG4+)
- Obtain MD orders for:
  - Lab studies
  - NS Bolus if indicated
  - Antibiotics if indicated
- Set up push-pull < 40 kg; Level 1 infuser for ≥ 40 kg
- Begin rapid infusion of 1st bolus w/in 15 min of activation
- Control fever (antipyretics if not contraindicated)
- Administer antibiotics (through central line if patient has one)
- Input/Output, consider Foley catheter

**MD Procedures:**
- Rapid assessment
- Use ED Septic Shock order set to order:
  - Lab Studies
  - NS Bolus
  - Antibiotics per antibiogram
  - Antipyretics
  - Dopamine infusion as indicated
- Consider central line, I/O, EJ if no access at 15 min
- Consider indications for additional medications: hydrocortisone (adrenal suppression), ID/specialty consult for difficult antibiotics (allergies, multidrug resistance, special infections), dextrose, dexamethasone (meningitis)

**Pharmacy Procedures:**
- Prioritized review of antibiotic order by pharmacist
- Pharmacist CALLS IV room when order faxed for preparation
- IV room pages pharmacist when abx tubed to 412
- Pharmacist picks up at station & delivers to bedside, checks whether any other bedside pharmacist needs
- If no order within 30 min, pharmacist calls ED attending 73111 to verify whether abx needed

**RN Ongoing Procedures:**
- Monitor mental status, capillary refill, peripheral pulses, temperature
- CR Monitor, BP q 15 min once stable
- Continuous pulse ox
- Assure continued IV fluids
- Assure antibiotics completed

**MD Ongoing Procedures:**
- Continue H&P, consults & re-evaluation
- Evaluate immediately after every bolus, determine if additional bolus warranted
- Recheck dextrose, other lab studies as indicated
**Activation Procedure:** Nurse or provider may decide to activate a Sepsis Yellow Alert.
- Tells unit secretary to send Sepsis Yellow Page
- Page response from ED charge nurse, pharmacists
- Secretary records time of page
- Bedside RN notifies attending MD or activating MD notifies bedside RN

**RN Procedures:**
Charge RN ensures bedside RN is supported in care of other pts to allow bedside RN to prioritize the following immediate steps:
- Assess mental status, ABCDEs
- CR Monitor, Pulse Ox, Vital Signs including BP q15 min
- PIV access immediately, or access central line. If no access after 15 min, consider options for escalation.
- Obtain MD orders for:
  - Lab studies
  - NS Bolus if indicated
  - Antibiotics if indicated
- Control fever (antipyretics if not contraindicated)
- Begin bolus within 15 min of activation

**MD Procedures:**
- Rapid assessment
- Determine & order appropriate antibiotics if required. Pharmacist will be “on alert” for 30 min.
- Order bolus if required – upgrade to Sepsis STAT if bolus rate faster than 1hr desired
- Use ED Septic Shock order set to order:
  - Lab Studies
  - NS Bolus if indicated
  - Antibiotics if indicated
  - Antipyretics
- Continue full H&P and re-evaluation

**Pharmacy Procedures:**
- Prioritize review of antibiotic order by pharmacist
- IV room will call 73112 (ED charge nurse) when abx tubed to ED
- Pharmacist will be on alert awaiting antibiotic order within 30 min, call ED attending (73111) when 30 min alert period ending if no antibiotics ordered
Antibiotics

Immunocompromised/immunosuppressive medications? GI source? Recent antibiotic?

NO

Ceftriaxone 100 mg/kg (max 2 g) over 10 minutes

Vancomycin 20 mg/kg (max 1g) over 60 min

YES

Cefepime 50 mg/kg (max 2 g) over 10 min

Vancomycin 15 mg/kg (max 1 g) over 60 min

Consider additional gram negative coverage (Gentamicin 2.5 mg/kg) over 30 min

Suspected Anaerobic infection (intra-abdominal source, Lemierre’s syndrome, Sinus/mastoid source, C. difficile infection)?

YES

Add Metronidazole 7.5 mg/kg (max: 500 mg) over 60 min

NO

Suspected Gram Positive infection (toxic shock, S. aureus, suspected skin/tunnel infection)?

YES

Add Clindamycin 13 mg/kg (max: 900 mg) over 10 minutes
Order Sets

Pre-checked:
- Vitals
- Fluid
- Laboratories

Key antibiotic elements:
- Indication in order set
- Dosing preprogrammed
- Max dose automatic correction
- Can be ordered in one “click”

Additional “sushi menu”
Sepsis Activation

• Verbal request to unit secretary
• Secretary activates page to relevant staff:
  – Charge nurse (ED / ICU), Pharmacist, Physicians
• Secretary clicks a timestamp button in EPIC
Is This Sepsis?

Shock and Sepsis

Shock in sepsis is a combination of:
- Distributive shock
- Hypovolemic shock
- Cardiogenic shock

Step One: Initiate a Sepsis Activation

About Sepsis Activations:

Use of Sedatives

If a patient requires intubation, know your sedative selection and administration:
- Ketamine is the preferred sedative.
- Etomidate is relatively contraindicated.
Clinical Effectiveness Grant
University of Colorado

• Computer-based training module
• Electronic sepsis registry build & support
  – Extracted from electronic health record
  – Robust, rich data source to inform QI
  – Sustainable
  – Reality check: A TON of manual labor into starting up, and moderate amounts to maintain/analyze
Growth of the Sepsis Yellow

ED Sepsis Activations (n=1882) by Classification over Time

- Red: Stat
- Yellow: Yellow
- Green: Missed

Month:
- April 2012 to March 2015
Several Rounds of Quality Metrics

• CHA 2012 metrics
• Revisions to metrics based on local results
  – Rapid transfers to ICU 0 x 6 months: stopped reviewing
  + Blood culture before antibiotics institutional value

• We will share some today
  – Process measure: time to antibiotics
  – Outcome measures
ED Sepsis Stat Patients: Percent Receiving Antibiotic in 60 min of Triage

ED Yellow Patients with Abx in 60 min of Triage

ED Sepsis Stat Patients with Abx in 60 min of Triage
ED Yellow Patients with Abx in 60 min of Triage

ED Sepsis Stat Patients with Abx in 60 min of Triage

Sepsis Yellow Patients: 30% No Antibiotics
ED Sepsis Stat Patients: Percent Appropriately Activated as Stat

Provider Feedback

January 30, 2014

Dear Dr. Wathen and Dr. Schmidt:

Congratulations on the outstanding sepsis care which you delivered to your patient! You met 3/3 of our quality metrics.

Last month, you provided care to a patient in the emergency department treated with the sepsis activation protocol. As part of our efforts to continue to improve the quality of care that we deliver to patients with sepsis, we are providing individualized monthly feedback on all patients who met Sepsis Stat criteria. This is only for your own improvement – we are not tracking statistics on providers!

As a reminder, Sepsis Stat is appropriate for any patient with suspected infection plus critical illness (hypotension, lactate ≥4.0 mmol/L, severely altered mental status, or severe respiratory distress requiring ventilation above baseline). Every month, our ED sepsis team reviews sepsis activations to determine whether a patient met Stat criteria, and reviews these cases in depth. We note when antibiotic or fluid treatment is intentionally modified (i.e. received prior to arrival, dialysis, etc.) and exclude patients with appropriate modifications from these metrics.

We recognize that there are many clinical nuances to individual cases, and that at times, our targets for the overall system may not be appropriate to every patient. Nonetheless, it is important to realize where a patient’s care for sepsis fell in reference to these benchmarks, even when there are complicating factors such as simultaneous need for other critical procedures or an evolving presentation in which critical illness was not initially evident.

<table>
<thead>
<tr>
<th>Type of Activation</th>
<th>Target</th>
<th>Your Case</th>
<th>Achieved Goal?</th>
</tr>
</thead>
<tbody>
<tr>
<td>First vitals-to-bolus time</td>
<td>≤30 min</td>
<td>25.00</td>
<td>Yes</td>
</tr>
<tr>
<td>First vitals-to-antibiotic time</td>
<td>≤60 min</td>
<td>35.00</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Additional comments from sepsis team review: changed from yellow to stat when BP dropped 88/38 moved to front room, given another 2 boluses and vanco. Thanks for appropriately upgrading to a STAT when the patient decompensated!

As always, please contact us to discuss this case, or any aspect of the sepsis program. Thank you for your contribution to providing outstanding care to children with sepsis, and all children, in our emergency department.

Sincerely,
Halden Scott, MD
Physician Lead, CHCO Sepsis Initiative

Joni Mackenzie, MS, RN, CPNP, CPEN
ED Nursing Lead, CHCO Sepsis Initiative

Privileged and Confidential: Protected by Colorado State Statute 25-3-109. This document contains information created as part of health care services review and is privileged and confidential and may not be disclosed.
ED Sepsis Stat Patients: Antibiotics within 60 min activation

Outcomes: Hospital Length of Stay

Stat: 216 to 100 hours
-116 hours (54%)

Yellow: 97 to 41 hours
-56.2 hours (58%)
Number of Deaths in ED Sepsis Patients, by Quarter
(In-Hospital + 30-day Mortality, 14 total)

- Sepsis Deaths (all)
- Sepsis Deaths (no chronic conditions)
Mortality in ED Sepsis Patients

In-Hospital + 30-day Mortality: 0.75% overall
Spread to Network-of-Care

- 5 satellite ED/UC throughout Denver region
- Objective: to standardize sepsis protocols across all locations, focus on early recognition
- Challenge: inconsistent resources among sites, different staffing models
- Advantages: smaller clinical teams, leading to good cohesive communication
Network-of-Care: Parallel but Site-Specific

- Clinical algorithms were the same with modifications for site resources
- POC Lactate
- SIRS BPA: Visual trigger to supplement clinical assessment in sepsis recognition
Network-of-Care: Education and Feedback

- Staff meetings
- “Is this Sepsis” computer-based training
- Site Champions
- Sustainability plan: incorporated SIRS reassessment into annual goals for nursing
  - Friendly competition among all sites
  - Engaged nursing shared governance at each site to develop process for SIRS reassessment
- Written communication: emails, newsletter
Sepsis Stat
Network of Care 2014

- 33 Stat Cases
- 18 Stat Activations
- All activated cases where ABX
Sepsis Yellow Network of Care 2014

- 74 Yellow Cases
- 56 Yellow Activations
- 24 received ABX
Network-of-Care: Education and Feedback

• Will continue to refine BPA based on current evidence
• Ongoing chart reviews
• Case reviews and presentations
• Refine sepsis goals to sustain momentum
How does a registry improve quality?

- **Sustainable** approach to quality monitoring
- Feasible to analyze **more** metrics
- Ability to report findings = **National** recognition
  - Team incentivized to sustain program
- **Robust**, rich data about program
  - New opportunities to improve local effectiveness & efficiency (rework metrics)
  - Generation of new data
  - Institutional QI & research partnerships (oncology, hematology, infectious diseases)
Colorado doctors warn that sepsis can be a hidden killer in hospitals

Updated: 09/15/2014 04:56:56 PM MDT

It's very difficult to diagnose in children, said pediatric emergency specialist Dr. Halden Scott, so physicians at Children's Hospital Colorado have been trained to always ask: "Is this sepsis?" They've been able to reduce mortality to less than 1 percent of case, compared with 10 percent nationally, she said.
Pitfalls & Challenges

• Data collection – resource intensive build
  – Still requires manual review

• Number of Sepsis Cases per Provider lower in network sites: difficult to build the same familiarity with process

• Sustainability – time and funding to maintain
  – Inpatient Implementation
Successes & Unique Features

- 2-tiered approach
- Novel, comprehensive, real-time database
- Individual feedback letters

- Institutional support; CHA collaborative helped
- Education Module
- Pharmacy ownership of antibiotic delivery
- Antibiogram, dosing automated in order set
Questions or comments

- Make a comment or start a dialogue for all participants using the “Chat” panel.
  
  Send to: All Participants

- Submit a question for the presenters at any time using the “Q&A” panel.
  
  Ask: All Panelists