Using Technology to Address Sepsis

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Learning Objectives

• Review the use of technology in the management of sepsis.
• Describe the screening for the sepsis patient population in order to provide early identification.
• Explain the steps for antimicrobial surveillance.
• Discuss how the technology is operationalized to activate a multidisciplinary team including pharmacy.

Overview and Northwestern System

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Chicago, IL

What is Sepsis?

- SIRS (two or more of the following)
  - Body temp >101, <96.8
  - HR >90, RR >20 per min., PaCO2 <32 mmHg
  - High, low white count, >10% bands

- Sepsis
  - SIRS
  - Confirmed infection

- Severe Sepsis
  - Sepsis

- Septic Shock
  - Severe sepsis
  - Organ dysfunction (pulmonary, hepatic, renal, coagulation, etc.)
  - Other organ dysfunction
  - Extremely low BP that does not respond to fluid replacement

Sepsis Treatment: Early Goal-Directed Therapy (EGDT)

• Agreement that early diagnosis and antibiotics improve patient survival however methods of initial resuscitation and hemodynamic monitoring are still debated.

- ProCESS Investigators, 2014
  - Unable to replicate Rivers’ conclusions
  - No significant differences in 90-day, 1-year mortality, or need for organ support.
CMS Severe Sepsis and Septic Shock: Management Bundle Measure

• Beginning Oct. 1, 2015 CMS requires that hospitals who participate in Inpatient Quality Reporting (IQR) Program collect data for Severe Sepsis and Septic Shock: Management Bundle Measure

• Developed from recent clinical studies, Surviving Sepsis Campaign and NQF endorsed sepsis bundle measure

• Evaluates care provided to patients with Severe Sepsis and Septic Shock

• Consists of measuring lactate level, blood cultures, broad spectrum antibiotics, fluid bolus if lactate elevated or hypotensive

• Begins with ‘time of presentation’ with 3 hour and 6 hour clocks

NMH Strategies to Improve Sepsis Management

• Utilize the EHR for Measure Documentation
  - PowerChart notifications/tools
  - Order sets
  - Physician documentation

• Defining Time Zero (presentation)

• Appropriate Antibiotic Selection

• Educate all members of interdisciplinary team

• Provide clinician support for bundle elements

Cerner Predictive Model

At least 2 SIRS Criteria
- Temperature > 101°F or < 96°F
- Heart Rate > 95
- Respirations > 22
- Glucose >160 or <200 mg/dL
- WBC >12,000 or < 4,000

WITH

Any 1 criteria of organ dysfunction
- Systolic BP < 90 or MAP < 65
- Lactate ≥2.4
- Bilirubin between 2 – 10
- Creatinine increase of >0.5 over last 72 hours
- “Shock Index” as indicated in Sepsis alert

NMH “SEPSIS ALERT”

Always Launch Early Rapid Treatment

1. Cerner predictive model indicates sepsis risk

2. Sepsis alert fires to primary RN; RN evaluates patient

3. RN pages managing MD

4. 5-5555 “Sepsis ALERT” called (RRT, Pharmacy paged)

5. Goal directed therapy begins

6. “Sepsis ALERT” checklist and MD “Sepsis Note” completed

Northwestern Medicine

CLINICAL PROTOCOL

<table>
<thead>
<tr>
<th>Subject</th>
<th>Protocol</th>
<th>Effective Date</th>
<th>Revision Date</th>
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<tr>
<td>SEPSIS CARE</td>
<td>Protocol # 47.85.46</td>
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I. PURPOSE:
To ensure appropriate early goal directed therapy for patients with clinical indication of sepsis, severe sepsis and septic shock.

II. PERSONS AFFECTED/SCOPE:
All inpatients under and clinicians caring for patients 18 years and older, suspected or diagnosed with sepsis/severe sepsis/septic shock.

IL instagram: @NMH_SEPSIS

ILppg: @NMH_SEPSIS

IL twitter: @NMH_SEPSIS

IL facebook: @NMH_SEPSIS

IL linkedin: @NMH_SEPSIS

IL google+: @NMH_SEPSIS

IL youtube: @NMH_SEPSIS
Cerner: Sepsis Note
• Image removed due to proprietary content

Cerner: Sepsis Care Order Set
• Image removed due to proprietary content

Cerner: Checklist
• Image removed due to proprietary content

Sepsis Alert: Pharmacist Role
• Sepsis Alert pager covered by a pharmacist 24/7
• Pharmacist to go to bedside (except overnight)
• Expedite antibiotic selection and administration
  • GOAL: Antibiotic administration within 1 hour from time zero
• Common Pharmacist Interventions
  – Antibiotic selection
  – Compatibilities
  – Loading dose/infusion time adjustment
  – Prioritizing empiric gram-negative coverage with limited intravenous access

At NMH, how does the pharmacist become aware of a sepsis alert?
A. Pop up within Cerner
B. Automated phone call to the pharmacy
C. An automatic page to the sepsis alert pager
D. Automated communication order within PharmNet

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**OSF System**

Heather Harper, PharmD, BCPS
OSF Healthcare
Peoria, IL

No conflicts of interest to disclose

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**Sepsis Best Practice Advisory (BPA)**

- Clinical alert based on patient data
- Rules calculate a Sepsis Score

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**Sepsis BPA**

- **Trigger**
  - ED Sepsis score greater than 2
  - Fires when ED patient chart opened
- **Suppressed if patient on abx**
  - Looks for active inpatient anti-infective order
  - Will not be satisfied by abx on the prior list

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**Sepsis BPA - RN**

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**Sepsis BPA - Provider**

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OSF ConstantCare - eICU

- Critical care RNs and MDs remotely monitor patients in 14 ICUs
- Equipped with remote camera technology and monitor feeds
- Patient identification
  - Sepsis BPA
  - Sepsis surveillance in Philips eCare Manager
- Virtual rounds on septic patients with eICU MD

OSF ConstantCare - eICU

- Study underway in rural EDs
- Goals
  - Assess impact of simulation training
  - Adoption of technology
  - Enhance safety and impact outcomes for sepsis
- Mobile carts equipped with camera

Sepsis Explorer - Metrics

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Which of the following criteria is used to screen patients to provide early identification of sepsis?

A. WBC less than 4,000, above 12,000 or bands >10%
B. Positive blood culture
C. Scr above 2
D. Lactic acid less than 2

Pharmacist Role in Addressing Sepsis

- Epic Antimicrobial Stewardship (AMS) tool
- Scoring System
  - Pushes data to pharmacists in patient lists
  - Prioritizes patients
- Documentation
  - Records recommendations
  - Tracks time since last review

AMS Navigator

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The OSF AMS system identifies patients with the following antimicrobial issue...

- Bug-drug mismatches
- Supratherapeutic trough levels
- Patients on broad spectrum therapy over 48 hours
- A and C

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- Toni Bortell - RN, Manager OSF ConstantCare
- Michelle Geurink - Pharmacist, Informatics

HSHS System

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Speaker has no conflicts of interest to disclose

AMS Navigator - Triggers

<table>
<thead>
<tr>
<th>Drug-Drug Mismatch</th>
<th>Susceptibility</th>
<th>Possible Trigger</th>
<th>Probability</th>
<th>Potential Agent</th>
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<td>Candida in specimen on Amoxicillin</td>
<td>Broad Spectrum agent (≥4h)</td>
<td>Meropenem/AMS Inhibitor/Flucloxacillin, DM Monoplasma</td>
<td>Amoxicillin</td>
<td>Vancomycin/Fosfomycin</td>
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<tr>
<td>Cellulitis MC &gt; 4 to enterobacteriaceae scored</td>
<td>Asymptomatic</td>
<td>Levofloofoxin/AMS Inhibitor/Flucloxacillin, DM Monoplasma</td>
<td>Levofloofoxin</td>
<td>Erythromycin/Metronidazole</td>
</tr>
<tr>
<td>Listeria/MC &gt; 3 to</td>
<td>Pharyngitis/Drug Resist/Pharyngitis</td>
<td>Levofloofoxin/AMS Inhibitor/Flucloxacillin, DM Monoplasma</td>
<td>Levofloofoxin</td>
<td>Erythromycin/Metronidazole</td>
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<tr>
<td>Vancomycin MC &gt; 2 to MRSA</td>
<td>Vancomycin Infection</td>
<td>Vancomycin</td>
<td>Vancomycin</td>
<td>Vancomycin/Fosfomycin</td>
</tr>
</tbody>
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AMS Navigator - Documentation

- Report displays trigger
- Document recommendations and interventions

Hospital Sisters Health System

- Multi-institutional health care system comprised of 14 hospitals and an integrated physician network across Illinois and Wisconsin
- Predominantly utilizing MEDITECH electronic medical record (EMR) across health system
- Transitioning to Epic over the next few years
Our Goals for Sepsis

- Utilize EMR data to immediately identify septic patients for further evaluation
- Sends various team members alerts when septic patients are identified

Identifying Septic Patients

- Used paper-based tick sheet to identify septic patients
  - Problem: lacks prospective monitoring
- MEDITECH was not able to perform background alerts for patient identification
- How can we quickly identify septic patients?

Real-Time Alerts with CDSS

- TheraDoc
  - Clinical Decision Support Software (CDSS)
  - Pulls data from EMR
  - Allows rules to be created on discrete data points
  - Great except lacked discrete vital signs data

Never Accept No for an Answer

- When there is a will, there is a way
- Always ask your vendors if their product is capable
- Creative approaches - we had failures with fake meds - sometime lean on your vendor and you may be surprised
  - No cost to us
  - Before asking the vendor, ask yourself "What can I gain?"
  - Once they developed, it can be turned into functionality for them (development vs. enhancement)
  - Worked with development pharmacist at TheraDoc
- Pros: can combine with other things we already use
  - Why would vendor want to know about something that is very important?
- Cons: maintenance by vendor and us
- Good marketing for them
Customization with TheraDoc

- **Problem**
  - TheraDoc does not have a way to store vital signs in their system discretely
- **Solution**
  - Auto-create a diagnosis that identified vital signs discretely

Building Out the Rules

- **9 Rules in total**

SIRS Patient Identification

Severe Sepsis Identification

Emergency Department Pilot

- When patients met criteria for SIRS/sepsis, message is sent by TheraDoc via email to members of sepsis team
  - Currently, only pharmacists and clinical process nurses
  - These team members have iPads that are set up for push notification of emails
  - Notifications pop up on home screen and allow for users to be alerted

Workflow and Roles

- Clinical Nurse Processor
- Septic Patient does things
- MEDITECH
- Vital Signs Interface
- TheraDoc
- Review medications and contacts provider if anything is missing

Severe Sepsis + Sepsis + Organ Failure

Organ Failure = evidence by ANY ONE of the following:

- **SIRS**
  - Suspected Bacterial Infection + 2 or more SIRS Criteria
  - a. HR > 90
  - b. Temp 36.1°C or 96.8°F or > 38°C (101°F)
  - c. RR > 20
  - d. WBC 12,000 or > 4,000 or > 10% bands

- **Severe Sepsis**
  - Sepsis + Organ Failure
  - Organ Failure = evidence by ANY ONE of the following:
    - Multiorgan dysfunction (MOD) = organ failure in two or more systems
    - Same organ dysfunction = separate dysfunction in at least two organs
    - Ischemic bowel, uncontrollable bleeding, organ failure in the next 48 hours
    - Acute respiratory failure from any cause, regardless of etiology
Sample Email to Providers

Future Directions

- Evaluate alert success and timing success
- Expand into other areas of sepsis monitoring
  - Ex. IV fluid bolus administration

Which of the following is true?

A. It is not possible to receive sepsis alerts if the EHR does not have the built-in functionality for it.
B. CDSS can be utilized to build sepsis alerts if the EHR is not capable of it.
C. New development by the vendor will always cost your organization a lot of money.

Questions for Panel