IHI Expedition

Treating Sepsis in the Emergency Department and Beyond Session 1

Thursday, September 12

These presenters have nothing to disclose

Sean Townsend, MD
Diane Jacobsen, MPH, CPHQ

Today’s Host

Max Cryns, Project Assistant, Institute for Healthcare Improvement (IHI), assists programming activities for hospital settings including Expeditions (2-4 month web-based educational programs), Passport memberships, and mentor hospital relations. He also supports IHI’s networking and knowledge efforts. Max is currently in the Co-Operative Education Program at Northeastern University in Boston, MA, where he majors in Business Administration with concentrations in Entrepreneurship and Marketing. He enjoys professional and collegiate sports, playing basketball, music, the beach, and trivia.
WebEx Quick Reference

- Welcome to today’s session!
- Please use chat to “All Participants” for questions
- For technology issues only, please chat to “Host”
- WebEx Technical Support: 866-569-3239
- Dial-in Info: Communicate / Join Teleconference (in menu)

When Chatting...

Please send your message to All Participants
What is your goal for participating in this Expedition?

Join Passport to:

- **Get unlimited access to Expeditions**, two- to four-month, interactive, web-based programs designed to help front-line teams make rapid improvements.
- **Train your middle managers** to effectively lead quality improvement initiatives.

... and much, much more for $5,000 per year!

Visit [www.IHI.org/passport](http://www.IHI.org/passport) for details.
To enroll, call 617-301-4800 or email improvementmap@ihi.org.
What is an Expedition?

ex•pe•di•tion (noun)
1. an excursion, journey, or voyage made for some specific purpose
2. the group of persons engaged in such an activity
3. promptness or speed in accomplishing something

Expedition Support

- All sessions are recorded
- Materials are sent one day in advance
- Listserv address: TreatingSepsis@ls.ihi.org
  - Sends an email to all participants and faculty
  - Use only for questions relevant to all participants
  - To add yourself or colleagues, email us at info@ihi.org
Diane Jacobsen, MPH, CPHQ, Director, Institute for Healthcare Improvement (IHI) is currently directing the CDC/IHI Antibiotic Stewardship Initiative, NSLU/IHI Reducing Sepsis Mortality Collaborative. Ms Jacobsen served as IHI content lead and improvement advisor for the California Healthcare-Associated Infection Prevention Initiative (CHAIPi) and directed Expeditions on Antibiotic Stewardship, Preventing CA-UTIs, Reducing *C. difficile* Infections, Sepsis, Stroke Care and Patient Flow. She served as faculty for IHI’s 100,000 Lives and 5 Million Lives Campaign and directed improvement collaboratives on Sepsis Mortality, Patient Flow, Surgical Complications, Reducing Hospital Mortality Rates (HSMR) and co-directed IHI’s Spread Initiative. She is an epidemiologist with experience in quality improvement, risk management, and infection control in specialty, academic, and community hospitals. A graduate of the University of Wisconsin, she earned her master's degree in Public Health-Epidemiology.
Today’s Agenda

- Ground Rules & Introductions
- Clinical Updates to the Surviving Sepsis Campaign Guidelines: The 3 Hour Resuscitation Bundle
- IHI’s Model for Improvement
- Homework for next session

Ground Rules

- We learn from one another – “All teach, all learn”
- Why reinvent the wheel? – Steal shamelessly
- This is a transparent learning environment
- All ideas/feedback are welcome and encouraged!
Expedition Objectives

By the end of the Expedition participants will be able to:

- Describe the latest evidence based care for patients with severe sepsis and septic shock
- Design reliable processes to ensure that each patient receives all elements of the best possible care at each opportunity
- Identify key opportunities and test changes on medical/surgical units to improve early recognition of sepsis in a care context which has been challenging for providers

Schedule of Calls

Session 1 – Clinical Updates to the Surviving Sepsis Campaign Guidelines: The 3 Hour Resuscitation Bundle
Date: Thursday, September 12, 1:00-2:30 PM ET

Session 2 – Key Considerations for Enhancing Reliability with Antibiotic Therapy in the Emergency Department in Inpatient Floor
Date: Thursday, September 26, 1:00-2:00 PM ET

Session 3 – Lactate and Blood Culture Collection: Getting to Results Within One Hour
Date: Thursday, October 10, 1:00-2:00 PM ET

Session 4 – Ensuring Reliable Care from the Patient Perspective
Date: Thursday, October 24, 1:00-2:00 PM ET

Session 5 – Early Recognition and Monitoring of the Sepsis Patient on the Inpatient Floor
Date: Thursday, November 7, 1:00-2:00 PM ET

Session 6 – Considerations and Challenges with Fluid Resuscitation
Date: Thursday, November 21, 1:00-2:00 PM ET
Faculty

Sean R. Townsend, MD, Vice President of Quality and Safety, California Pacific Medical Center (CPMC), is also a practicing intensivist in the Division of Pulmonary and Critical Care at CPMC. Previously, he was Assistant Professor of Medicine at the University of Massachusetts and at Brown University Medical School. Dr. Townsend has been faculty advisor to IHI’s 100,000 Lives and 5 Million Lives Campaigns for the ventilator-associated pneumonia and catheter-related bloodstream infections interventions. He led IHI’s work on sepsis as part of the Improving Outcomes for High-Risk and Critically Ill Patients Learning and Innovation Community, and he is current faculty for the Reducing Sepsis Mortality Collaborative. A member of the Surviving Sepsis Campaign (SSC) executive committee, he is an author of the 2008 SSC International Guidelines on the Management of Severe Sepsis and Septic Shock and 2010 SSC Results of an International Guideline-based Performance Improvement Program Targeting Severe Sepsis.

Faculty

John D’Angelo, MD, FACEP, Chairman, Department of Emergency Medicine, Glen Cove Hospital, North Shore-Long Island Jewish Health System, has worked as an emergency physician for 15 years. Dr. D’Angelo also serves as the co-chair for the North Shore-LIJ Sepsis Task Force tasked with improving sepsis recognition and management across the health system.
Faculty

Andy Odden, MD, is a hospitalist at the University of Michigan and the Ann Arbor VA. His research focuses on the management and outcomes of severe sepsis on the general inpatient ward. He is the founder and Director of the Hospitalist Program at the Ann Arbor VA, where he serves as Chief of the Hospital Medicine Section and Director of the Inpatient Care Coordinator Program at that institution. He is a faculty mentor for the Michigan Transitions of Care Collaborative and an active member of the Society of Hospital Medicine. As a member of the IHI faculty, he is working with the North Shore–Long Island Jewish Health System to reduce inpatient sepsis mortality.

Faculty

Terry P. Clemmer, MD, Director of Critical Care Medicine, LDS Hospital, Intermountain Healthcare (IHC), is also Professor of Medicine and Adjunct Professor of Biomedical Informatics at the University of Utah School of Medicine. He is the Medical Lead over the Intermountain Medicine Clinical Program’s Critical Care Team. Dr. Clemmer is Faculty Chair for the Institute for Healthcare Improvement (IHI) Reducing Sepsis Mortality Collaborative and he previously coached several IHI Adult ICU Breakthrough Series Collaboratives, the Idealized Design of the ICU project, and the Improving Outcomes for High-Risk and Critically Ill Patients Learning and Innovation Community. He has been active with the Surviving Sepsis Campaign and in the formulation of the Sepsis Bundles. An active researcher with numerous publications, he is a recognized speaker on critical care, medical informatics, telemedicine, standardization of care, and quality improvement.
Poll Question – Who is in the room?

- Please select the roles or departments represented on the call today from your organization. Check all that apply:
  - Nursing
  - Physicians
  - Infection Prevention
  - Quality Improvement
  - Leadership
  - Pharmacy
  - Allied Health Professional

Please chat any additional roles into the chat box.

3-Hour Bundle: Guidelines & Evidence

Sean Townsend, MD
Session Objectives

- Discuss the rationale for the upcoming changes to the surviving sepsis campaign guidelines for 2013.
- Apply the upcoming clinical updates to the surviving sepsis campaign guidelines at the bedside.
- Understand key controversies around lactate clearance, quantitative resuscitation, and fluid resuscitation.

Severe Sepsis vs. Current Care Priorities

<table>
<thead>
<tr>
<th>Care Priorities</th>
<th>U.S. Incidence</th>
<th># of Deaths</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI (1)</td>
<td>900,000</td>
<td>225,000</td>
<td>25%</td>
</tr>
<tr>
<td>Stroke (2)</td>
<td>700,000</td>
<td>163,500</td>
<td>23%</td>
</tr>
<tr>
<td>Trauma (3)</td>
<td>2.9 million (Motor Vehicle)</td>
<td>42,643</td>
<td>1.5%</td>
</tr>
<tr>
<td>Severe Sepsis (4)</td>
<td>751,000</td>
<td>215,000</td>
<td>29%</td>
</tr>
</tbody>
</table>

Hospitalization rates for sepsis or septicemia were similar for males and females and increased with age.

Figure 2. Rates of hospitalization for sepsis or septicemia, by sex and age, 2008

NOTES: Rates are significantly higher for males and females in each successive age group. SOURCE: CDC/NCHS, National Hospital Discharge Survey, 2008.

National Hospital Discharge Database

Hospitalization rates for septicemia or sepsis more than doubled from 2000 through 2008.

Figure 1. Hospitalizations for and with septicemia or sepsis

Evidence Based Medicine

- GRADE Group – Canada
- Quality of Evidence – A(highest), B, C, D(lowest)
- Strength of Recommendation
  - 1 – recommend
  - 2 – suggest

NQF BUNDLE: Sepsis 0500

TO BE COMPLETED WITHIN 3 HOURS OF TIME OF PRESENTATION †:

1. Measure lactate level
2. Obtain blood cultures prior to administration of antibiotics
3. Administer broad spectrum antibiotics
4. Administer 30ml/kg crystalloid for hypotension or lactate ≥4mmol/L

† “Time of presentation” is defined as the time of triage in the Emergency Department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements severe sepsis or septic shock ascertained through chart review.
Poll Questions

- What is your current Serum Lactate order to result time (or estimate) in patients with SS/Septic Shock?
  - Less than 90 minutes
  - 90 minutes – 120 minutes
  - Greater than 120 minutes

- What is your current time from triage to antibiotics for patients with SS/Septic Shock?
  - Less than 1 hour
  - 1-2 hours
  - 2-3 hours
  - Greater than 3 hours

Screening for Sepsis and Performance Improvement

1. Performance improvement efforts in severe sepsis should be employed to improve patient outcomes (1C).
Central venous (superior vena cava) or mixed venous

Mean arterial pressure (MAP)

with sepsis-induced shock, defined as tissue hypoperfusion

induced hypoperfusion should include all of the following as

0.5mL.kg–1.hr –1

4 mmol/L).

This protocol should be

65mm Hg

transfusion of packed red blood cells to achieve a

resuscitation to the central venous pressure target, then

2C).

In patients with elevated lactate levels as a marker of
tissue hypoperfusion we suggest targeting resuscitation
to normalize lactate as rapidly as possible (grade 2C).

3. We suggest that during the first 6 hrs of resuscitation of
severe sepsis or septic shock, if ScvO2 <70% (or SvO2
equivalent of <65%), respectively persisted with fluid
resuscitation to the central venous pressure target, then
transfusion of packed red blood cells to achieve a
hematocrit of 30% and/or administration of a
dobutamine infusion (up to a maximum of 20
µg·kg_1·min_1) be used to achieve this goal (grade
2C).
Lactate Clearance vs Central Venous Oxygen Saturation as Goals of Early Sepsis Therapy
A Randomized Clinical Trial

Noninferiority implies not worse than...

In this study: Power analysis to determine that noninferiority was not due to chance alone (assuming 25% mortality, alpha = 0.05)

- Required 150 patients administered one of the two treatments being compared:
  - 300 patients total should receive treatment via ScvO₂ or lactate clearance
  - 71% power to determine if lactate clearance did not increase mortality by more than 10%
Power to Answer the Question?

- Power analysis = 300 patients requiring one of the two interventions being tested

- Only 10% of patients (n=29) got to the point in the protocol that required one of the two interventions being compared
  - ScvO₂ normalization v lactate clearance

- To recruit 300 patients requiring interventions to optimize ScvO₂ or lactate clearance would have required 3,000 patients

Is 10% lactate clearance sufficient?

- JAMA study: 10% lactate clearance = success

- Clearance does not equal lactate normalization

- Adequate % reduction depends on initial lactate

- Patient presents with a lactate of 10 mmol/L
  - 10% clearance = 1 mmol/L difference
  - Resulting lactate goal = 9 mmol/L
  - Although 10% lactate clearance achieved, still inadequate
Diagnosis

1. To optimize identification of causative organisms, we recommend at least two blood cultures be obtained before antimicrobial therapy is administered as long as such cultures do not cause significant delay (>45 minutes) in antimicrobial administration, with at least one drawn percutaneously and one drawn through each vascular access device, unless the device was recently (<48 hr.) inserted (Grade 1C).

Diagnosis

3. We suggest the use of the 1,3 beta-D-glucan assay (2B), mannan and anti-mannan antibody assays for the early diagnosis of invasive candidiasis. (Grade 2C)
Antibiotic therapy

1. We recommend that intravenous antimicrobial therapy be started as early as possible and within the first hour of recognition of septic shock (1B) and severe sepsis without septic shock (grade 1C).

Antibiotic therapy

4. We suggest the use of low procalcitonin levels to assist the clinician in the discontinuation of empiric antibiotics when no evidence of infection is found (grade 2C).
Surviving Sepsis Campaign:
Data Analysis January 2005-December 2008

- First analysis:
  - 2 years
  - 15,000 pts
  - January 2005-December 2006

- Current analysis:
  - 4 years
  - 28,150 pts
  - January 2005-December 2008

Figure 1. Cumulative effective antimicrobial initiation following onset of septic shock-associated hypotension and associated survival. The x-axis represents time (hrs) following first documentation of septic shock-associated hypotension. **Black bars** represent the fraction of patients surviving to hospital discharge for effective therapy initiated within the given time interval. The **gray bars** represent the cumulative fraction of patients having received effective antimicrobials at any given time point.
Hospital Mortality by Time to Antibiotics

<table>
<thead>
<tr>
<th>Time to ABX(^1), hrs</th>
<th>OR(^2)</th>
<th>95% CI</th>
<th>p-value</th>
<th>Probability of mortality(^3)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (ref)</td>
<td>1.00</td>
<td>---</td>
<td>---</td>
<td>18.7</td>
<td>17.5 19.9</td>
</tr>
<tr>
<td>1</td>
<td>1.05</td>
<td>1.02</td>
<td>1.07</td>
<td>&lt; 0.001</td>
<td>19.3 18.3 20.4</td>
</tr>
<tr>
<td>2</td>
<td>1.09</td>
<td>1.04</td>
<td>1.15</td>
<td>&lt; 0.001</td>
<td>20.0 19.1 21.0</td>
</tr>
<tr>
<td>3</td>
<td>1.14</td>
<td>1.06</td>
<td>1.23</td>
<td>&lt; 0.001</td>
<td>20.8 19.7 21.8</td>
</tr>
<tr>
<td>4</td>
<td>1.19</td>
<td>1.08</td>
<td>1.32</td>
<td>&lt; 0.001</td>
<td>21.5 20.3 22.8</td>
</tr>
<tr>
<td>5</td>
<td>1.25</td>
<td>1.11</td>
<td>1.41</td>
<td>&lt; 0.001</td>
<td>22.3 20.7 23.9</td>
</tr>
<tr>
<td>6</td>
<td>1.31</td>
<td>1.13</td>
<td>1.51</td>
<td>&lt; 0.001</td>
<td>23.1 21.2 25.1</td>
</tr>
</tbody>
</table>

\(^1\)Time to ABX is based on 15,948 observations that are greater than or equal to zero

\(^2\)Hospital mortality odds ratio referent group is 0 hours for the time to ABX and is adjusted by the number of baseline organ failures, infection type (community vs. nosocomial), and geographic region (Europe, North America, and South America)

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<td>1</td>
<td>1.10</td>
<td>1.05</td>
<td>1.15</td>
<td>&lt; 0.001</td>
<td>14.9 13.7 16.1</td>
</tr>
<tr>
<td>2</td>
<td>1.21</td>
<td>1.10</td>
<td>1.32</td>
<td>&lt; 0.001</td>
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</tr>
<tr>
<td>3</td>
<td>1.33</td>
<td>1.16</td>
<td>1.52</td>
<td>&lt; 0.001</td>
<td>17.4 16.2 18.7</td>
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<td>4</td>
<td>1.46</td>
<td>1.22</td>
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<td>1.60</td>
<td>1.28</td>
<td>2.01</td>
<td>&lt; 0.001</td>
<td>20.3 18.0 22.8</td>
</tr>
<tr>
<td>6</td>
<td>1.76</td>
<td>1.34</td>
<td>2.31</td>
<td>&lt; 0.001</td>
<td>21.9 18.8 25.3</td>
</tr>
<tr>
<td>Septic shock group</td>
<td>1.97</td>
<td>1.27</td>
<td>2.76</td>
<td>&lt; 0.001</td>
<td>22.3 19.4 24.3</td>
</tr>
</tbody>
</table>

\(^1\)Time to ABX is based on 15,948 observations that are greater than or equal to zero

\(^2\)Hospital mortality odds ratio referent group is 0 hours for the time to ABX and is adjusted by the number of baseline organ failures, infection type (community vs. nosocomial), and geographic region (Europe, North America, and South America)
Source control

1. We recommend that a specific anatomical diagnosis of infection requiring consideration for emergent source control (e.g., necrotizing soft tissue infection, peritonitis complicated with intra-abdominal infection, cholangitis, intestinal infarction) be sought and diagnosed or excluded as rapidly as possible, and if needed, surgical drainage should be undertaken for source control within the first 12 hr after the diagnosis is made. (Grade 1C).

Fluid therapy

1. We recommend crystalloids be used in the initial fluid resuscitation of severe sepsis (Grade 1A).
2. We suggest adding albumin in the initial fluid resuscitation regimen of severe sepsis and septic shock (Grade 2B).
3. We recommend against the use of hydroxyethyl ethyl starches with molecular weight > 200 Da and or a degree of substitution >0.4 (Grade 1B).
Poll Question

Who currently inserts central lines in your hospital? Check all that apply.
- ED Physician
- Intensivist
- Hospitalist
- PICC nurse
- Other

Fluid therapy

4. We recommend that initial fluid challenge in patients with sepsis-induced tissue hypoperfusion with suspicion of hypovolemia be started to achieve a minimum of 30ml/kg of crystalloids in the first 3 hours. More rapid administration and greater amounts of fluid, may be needed in some patients (see Initial Resuscitation recommendations) (Grade 1B).

5. We recommend that a fluid challenge technique using incremental fluid boluses be applied wherein fluid administration is continued as long as the hemodynamic improvement either based on dynamic (e.g. delta pulse pressure, stroke volume variation…) or static (eg, arterial pressure, heart rate) variables continues (Grade 1C).
Vasopressors

1. We recommend that vasopressor therapy initially target a mean arterial pressure (MAP) of 65 mm Hg (grade 1C).
2. We recommend norepinephrine as the first choice vasopressor (Grade 1B).
3. We recommend epinephrine (added or substituted) when an additional agent is needed to maintain adequate blood pressure (Grade 2B).
4. We suggest vasopressin 0.03 units/minute can be added to and subsequently potentially substituted for norepinephrine (Grade 2A).
5. We suggest dopamine as an alternative vasopressor agent to norepinephrine in highly selected patients at very low risk of arrhythmias and with low cardiac output and/or low heart rate. (Grade 2C).

NQF BUNDLE: Sepsis 0500

TO BE COMPLETED WITHIN 6 HOURS OF TIME OF PRESENTATION:

5. Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation to maintain a mean arterial pressure (MAP) ≥65 mmHg)
6. In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥4 mmol/L (36 mg/dl):
   - Measure central venous pressure (CVP)
   - Measure central venous oxygen saturation (ScvO2)*
7. Remeasure lactate*

* Targets for quantitative resuscitation included in the guidelines are CVP of ≥8 mm Hg, ScvO2 of ≥70% and lactate normalization.
Questions?

Raise your hand

Use the Chat

Model for Improvement

What are we trying to accomplish?

How will we know that a change is an improvement?

What change can we make that will result in improvement?

Act

Plan

Study

Do

Aim of Improvement

Measurement of Improvement

Developing a Change

Testing a Change

Principles & Guidelines for Testing

- A test of change should answer a specific question
- A test of change requires a theory and prediction
- Test on a small scale
- Collect data over time
- Build knowledge sequentially with multiple PDSA cycles for each change idea
- Include a wide range of conditions in the sequence of tests
Repeated Use of the PDSA Cycle

Sequential building of knowledge under a wide range of conditions

Changes That Result in Improvement

Spread

Implementation of Change

Wide-Scale Tests of Change

Follow-up Tests

Very Small Scale Test

Hunches Theories Ideas

Aim: Implement Rapid Response Team on non-ICU unit

Cycle 6: Expand rounds to one unit for one shift seven days a week
Cycle 5: Have Nurse Practitioner respond to calls in addition to RT and RN
Cycle 4: Expand coverage of RRT on unit to one unit for one shift for five days
Cycle 3: Have Respiratory Therapist attend rapid response calls with ICU Nurse
Cycle 2: Repeat cycle 1 for three days
Cycle 1: ICU nurse responds to rapid response team calls on one unit, one shift for one day
Questions?

Raise your hand

Use the Chat

Action Period Assignment

- Identify a unit-based multidisciplinary team (ED, ICU or inpatient floor) to actively test changes, identifying key roles in your organization that may not currently be involved in the process
- Assess your current process for ensuring the elements of the 3 hour bundle to prioritize areas for improvement/focus:
  - Lactate collection
  - Blood cultures prior to antibiotics
  - Antibiotics
  - Fluids
- Come prepared to share your plans at the next session
Expedition Communications

- Listserv for session communications: TreatingSepsis@ls.ihi.org
- To add colleagues, email us at info@ihi.org
- Pose questions, share resources, discuss barriers or successes

Next Session

Thursday, September 26, 1:00-2:00 PM ET
Session 2 – Key Considerations for Enhancing Reliability with Antibiotic Therapy in the Emergency Department in Inpatient Floor