Bundle Up! Utilizing Care Bundles for Infectious Diseases

Presentation to: Antimicrobial Stewards
Presented by: Shreena Advani, PharmD
Date: November 29th, 2017
Learning Objectives

Discuss the purpose of utilizing care bundles in clinical practice

Identify specific infectious diseases for which evidence supports the use of care bundles

Recall the benefits of utilizing bundles in the care of patients with infectious diseases

Describe how care bundles can be utilized to enhance antimicrobial stewardship activities
Bundles in Healthcare

• The Institute for Healthcare Improvement (IHI) is one of the main drivers of the bundle concept

• Framework for addressing clinical conditions with evidence-based practices

• Consist of a set of interventions
  • Greater impact when performed together rather than individually

• Aim to ensure that patients receive recommended interventions on a consistent basis
Bundles Versus Checklists

**Bundles**
- Consist of only critical tasks
- Tasks must be evidence-based
- Limited number elements
- Tied to accountability

**Checklists**
- Mixture of nice-to-do and have-to-do tasks
- Not necessarily evidence-based
- Many elements
- No one group/person accountable

http://www.ihi.org/Topics/Bundles/Pages/default.aspx
Successful Bundles

Necessary and Sufficient
- All components are needed
- Removal of a component impacts patient outcomes

Evidence-based
- All components based on level 1 evidence
- No controversy involved in components

Straightforward
- All-or-nothing measurement
- No partial credit for doing some steps

http://www.ihi.org/Topics/Bundles/Pages/default.aspx
Audience Question

• Which of the following is true of bundles in healthcare?
  a. They aim to ensure patients receive recommended interventions on a consistent basis
  b. They generally consist of a long list of necessary tasks
  c. They can be applied successfully to scenarios where a clinical controversy exists
  d. All of the above
Bundles in Infectious Diseases

Infection Prevention

Care/Treatment
Care Bundles in Infectious Disease

- Sepsis
- *Staphylococcus aureus* Bacteremia
- Candidemia
# Sepsis Bundle

<table>
<thead>
<tr>
<th>To Be Completed Within 3 Hours of Time of Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure lactate level</td>
</tr>
<tr>
<td>Obtain blood cultures prior to administration of antibiotics</td>
</tr>
<tr>
<td>Administration of broad spectrum antibiotics</td>
</tr>
<tr>
<td>Administer 30ml/kg crystalloid for hypotension or lactate $\geq 4$mmol/L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To Be Completed Within 6 Hours of Time of Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply vasopressors to maintain a mean arterial pressure (MAP) $\geq 65$mmHg*</td>
</tr>
<tr>
<td>Re-assess and document volume status and tissue perfusion for patients with persistent hypotension (MAP $&lt; 65$mmHg) after initial fluid administration or if initial lactate was $\geq 4$mmol/L</td>
</tr>
<tr>
<td>Re-measure lactate if initial lactate was elevated</td>
</tr>
</tbody>
</table>

*only for hypotension that does not respond to initial fluid resuscitation

[http://www.survivingsepsis.org/SiteCollectionDocuments/SSC_Bundle.pdf](http://www.survivingsepsis.org/SiteCollectionDocuments/SSC_Bundle.pdf)
Sepsis Bundle

• Purpose: Determine association between compliance with the Surviving Sepsis Campaign (SSC) performance bundles and mortality

• Setting: 218 community, academic, and tertiary care hospitals in the United States, South America and Europe

• Methods: enrolled facilities participated in a multi-faceted collaborative change intervention aimed at facilitating adoption of the SSC bundle
Sepsis Bundle

• Primary outcome: compliance with SSC bundles and associated mortality

• Characterized sites as either high or low compliance sites based on proportion of patients in compliance with bundle
Sepsis Bundle

• Results

  • Lower mortality in high versus low compliance sites (29% vs. 38.6%, p<0.001)

  • Mortality rates dropped 0.7% per site for every 3 months of participation (p<0.001)

  • Hospital and intensive care unit length of stay decreased 4% for every 10% increase in site compliance with bundle (p = 0.012)
Sepsis Bundle

Resuscitation bundle

Mortality

Slope = 0.7% drop in mortality/quarter, \( p\)-value < 0.001

Site quarter of SSC participation
Audience Question

• Which of the following effects of bundle compliance were seen in this study?
  a. Decreased mortality
  b. Decrease hospital length of stay
  c. Decrease intensive care length of stay
  d. All of the above
Staph aureus Bacteremia Bundle

- **Purpose:** Evaluate the impact of a quality-of-care indicator based bundle on the management and prognosis of *Staph aureus* bacteremia

- **Setting:** 12 Spanish hospitals
  - 287 patients in the pre-intervention group
  - 221 patients in intervention group

- **Methods:** Bundle was developed based on systematic review of literature
  - Bundle’s impact was assessed using a quasi-experimental study design

# Staph aureus Bacteremia Bundle

<table>
<thead>
<tr>
<th>Quality-of-Care Indicator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up blood cultures</td>
<td>Repeat blood cultures 48-96h after antimicrobial therapy is initiated</td>
</tr>
<tr>
<td>Early source control</td>
<td>Removal of nonpermanent vascular catheter or drainage of an abscess in &lt; 72h</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>Echocardiogram performed in patients with complicated bacteremia</td>
</tr>
<tr>
<td>Early use of beta-lactam therapy for methicillin-sensitive Staph aureus (MSSA)</td>
<td>Definitive therapy of beta-lactam started within first 24h after MSSA identified</td>
</tr>
<tr>
<td>Adjustment of vancomycin dose to target trough levels</td>
<td>Measure trough levels in patients treated for at least 3 days, with adjustments made to achieve trough level between 15 and 20mg/L</td>
</tr>
<tr>
<td>Treatment duration according to complexity of infection</td>
<td>At least 14 days of therapy for uncomplicated cases and 28 days for complicated cases</td>
</tr>
</tbody>
</table>
Staph aureus Bacteremia Bundle

• Primary outcome: adherence to bundle components and mortality

• Intervention: consisted of a set of written recommendations provided in a structured form by an infectious disease specialist at each hospital

**Staph aureus Bacteremia Bundle**

<table>
<thead>
<tr>
<th>Quality-of-Care Indicator</th>
<th>Preintervention Period</th>
<th>Intervention Period</th>
<th>Median Improvement in Percentage of Adherence to QCI (IQR)</th>
<th>Relative Risk for Adherence to CQI (95% CI)</th>
<th>P Value</th>
<th>Adjusted OR for Adherence to QCI (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up blood culture</td>
<td>131/214 (61.2)</td>
<td>159/198 (80.3)</td>
<td>25 (5.9–54.4)</td>
<td>1.31 (1.15–1.49)</td>
<td>&lt;.001</td>
<td>2.83 (1.78–4.49)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Source control</td>
<td>86/122 (70.2)</td>
<td>105/115 (91.3)</td>
<td>22 (10.2–50)</td>
<td>1.29 (1.13–1.49)</td>
<td>&lt;.001</td>
<td>4.56 (2.12–9.79)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>76/144 (52.8)</td>
<td>74/101 (73.3)</td>
<td>18.8 (0–65.7)</td>
<td>1.38 (1.13–1.68)</td>
<td>.001</td>
<td>2.50 (1.42–4.41)</td>
<td>.002</td>
</tr>
<tr>
<td>Early cloxacillin in MSSA</td>
<td>120/211 (56.9)</td>
<td>124/174 (71.3)</td>
<td>11.1 (0–51.1)</td>
<td>1.25 (1.07–1.45)</td>
<td>.014</td>
<td>1.79 (1.15–2.78)</td>
<td>.009</td>
</tr>
<tr>
<td>Vancomycin dosing</td>
<td>23/49 (46.9)</td>
<td>30/54 (55.6)</td>
<td>20 (0–54.3)</td>
<td>1.18 (0.80–1.73)</td>
<td>.38</td>
<td>1.42 (0.65–3.10)</td>
<td>.38</td>
</tr>
<tr>
<td>Treatment duration</td>
<td>151/207 (72.9)</td>
<td>161/189 (85.2)</td>
<td>10.2 (2–20.2)</td>
<td>1.16 (1.05–1.29)</td>
<td>.003</td>
<td>2.13 (1.24–3.64)</td>
<td>.006</td>
</tr>
</tbody>
</table>

Staph aureus Bacteremia Bundle

• Results
  • Intervention independently associated with improved adherence to:
    • Follow up blood cultures (OR 2.83, CI 1.78-4.49)
    • Early source control (OR 4.56, CI 2.21-9.79)
    • Early beta-lactam therapy for MSSA (OR 1.79, CI 1.15.3.78)
    • Appropriate treatment duration (OR 2.13, CI 1.24-3.64)
  • Decrease in 14-day mortality in post-intervention group (OR 0.47, CI 0.26-0.85)
  • Decrease in 30-day mortality in post-intervention group (OR 0.56, CI 0.34-0.93)

Audience Question

• Which of the following was NOT a component of the *Staph aureus* bacteremia bundle used in this study?
  a. Beta-lactam definitive therapy for MSSA
  b. Treatment duration of 14 days for uncomplicated cases
  c. Early infectious diseases consultation
  d. Echocardiography for complicated cases
Candidemia Bundle

• Purpose: Evaluate the impact of a nation-wide candidemia management bundle on clinical outcomes

• Setting: nation-wide study in Japan
  • 608 patients analyzed

• Methods: Bundle was developed by a committee under the Mycoses Forum in Japan
  • Compared clinical outcomes in patients with bundle compliance to those without bundle compliance
# Candidemia Bundle

<table>
<thead>
<tr>
<th><strong>To be accomplished at the start of therapy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of central venous catheter within 24h of diagnosis</td>
</tr>
<tr>
<td>Initial appropriate selection of antifungal agent</td>
</tr>
<tr>
<td>Initial appropriate dosing of antifungals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>To be accomplished after initiation of therapy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophthalmological examinations</td>
</tr>
<tr>
<td>Follow-up blood cultures until clearance of candidemia</td>
</tr>
<tr>
<td>Assessment of clinical efficacy on the 3\textsuperscript{rd} or 5\textsuperscript{th} day to consider necessity of alternative therapy</td>
</tr>
<tr>
<td>Appropriate choice of alternative antifungals</td>
</tr>
<tr>
<td>At least 2 weeks of therapy after documented clearance of <em>Candida</em> from blood cultures</td>
</tr>
<tr>
<td>Step-down oral therapy for patients with favorable clinical course</td>
</tr>
</tbody>
</table>
Candidemia Bundle

• Primary outcome: bundle compliance rate and clinical success

• Clinical success was defined as resolution of all attributable signs and symptoms associated with candidemia

J Antimicrob Chemother. 2015 Feb;70(2):587-93
Candidemia Bundle

<table>
<thead>
<tr>
<th>Phase</th>
<th>Elements of the bundles</th>
<th>Population</th>
<th>No. of patients with achievement of the elements (%)</th>
</tr>
</thead>
</table>
| Bundles at the start of therapy | 1. removal of existing CVCs within 24 h of diagnosis  
2. initial appropriate selection of antifungals  
3. initial appropriate dosing of antifungals | patients with CVC placement   | 414/510 (81.2)                                          |
|                              |                                                                                        | all                         | 534/608 (87.8)                                          |
|                              |                                                                                        | all                         | 464/608 (76.3)                                          |
|                              |                                                                                        | all                         | 326/608 (53.6)                                          |
| Bundles after initiation of therapy | 4. ophthalmological examinations  
5. follow-up blood cultures until clearance of candidaemia  
6. assessment of clinical efficacy on the third to fifth day  
7. appropriate choice of alternative antifungals  
8. at least 2 weeks of therapy after documented clearance of Candida from bloodstream  
9. step-down oral therapy | all                         | 327/608 (53.8)                                          |
|                              |                                                                                        | all                         | 148/608 (24.3)                                          |
Candidemia Bundle

• Results
  • Higher rate of clinical success in patients with bundle compliance (92.9% vs 75.8%, p=0.011)

  • Compliance with bundles failed to be an independent factor associated with clinical success
    • Exclusion of step-down oral therapy from elements of compliance

  • Individual bundle elements contributing to clinical success included:
    • Removal of central venous catheters within 24h
    • Assessment of clinical efficacy on day 3 or 5 of treatment
    • At least 2 weeks of therapy after clearance of candidemia

  • Decrease in mortality also noted in bundle compliant group (p=0.054)

J Antimicrob Chemother. 2015 Feb;70(2):587-93
Audience Question

• Which of the following outcomes was associated with bundle compliance in this study?
  a. Decreased hospital length of stay
  b. Decreased infection-related readmission
  c. Increase in clinical success
  d. Increase in infection-free survival
Conclusions

Care bundles aim to ensure that all patients receive recommended interventions on a consistent basis.

Successful care bundles are evidence-based, concise, and straightforward.

Evidence supports use of care bundles for sepsis, *Staph aureus* bacteremia, and candidemia.

Care bundles have been shown to reduce mortality for the above disease states.
Questions?

• Type any questions you have in the chat box and we will address them at the end of the webinar