Sepsis
Identifying and Preventing a Life-Threatening Illness

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EVP & Chief Medical Officer
UnitedHealthcare Employer & Individual
Agenda

- Knowledge Assessment
- Statistics
- Sepsis-3 Definition
- Program Accomplishments
- Sepsis Initiatives
- Knowledge Assessment Answers
- Prevention and Early Identification
- Appendix
Knowledge Assessment

1. The Sepsis-3 definition describes sepsis as a life-threatening organ dysfunction caused by a bacterial infection of the blood.
   a. True
   b. False

2. How often are deaths recorded from sepsis?
   a. One person every 20 minutes
   b. One person per day
   c. One person every two minutes

3. Sepsis cases are most likely on the rise due to:
   a. Decreased adherence to infection control measure in a long-term care (LTC) setting
   b. Coding abuse using non-specific definitions of sepsis
   c. Antibiotic resistance in high-risk patients

4. Sepsis is a disease and there are specific immunizations to prevent infection.
   a. True
   b. False

5. What is the percentage of hospital readmissions after an index hospitalization for sepsis?
   a. 40 percent
   b. 18 percent
   c. 65 percent
Statistics

Sepsis is a complication caused by the body’s overwhelming and life threatening response to infection. It can lead to tissue damage, organ failure and death\(^1\).

- 1.7 million adult sepsis cases occur annually in the United States\(^2\).
- 750,000 sepsis hospitalizations result in 1 in 3 hospital deaths, 1 person every two minutes\(^2\).
- 20 percent of sepsis cases occur during hospitalization.
- 80 percent of sepsis cases begin outside the hospital.
- Average cost per stay for sepsis cases was $18,000 in 2013 – 70 percent more expensive than the average stay\(^3\).

<table>
<thead>
<tr>
<th>Who and When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis most often occurs in:</td>
</tr>
<tr>
<td>- Adults &gt; age 65</td>
</tr>
<tr>
<td>- Children &lt; age 1</td>
</tr>
<tr>
<td>- Patients with a weakened immune system</td>
</tr>
<tr>
<td>- Patients with chronic medical conditions</td>
</tr>
<tr>
<td>Infections leading to sepsis include:</td>
</tr>
<tr>
<td>- Pneumonia 35%</td>
</tr>
<tr>
<td>- UTI 25%</td>
</tr>
<tr>
<td>- Gut 11%</td>
</tr>
<tr>
<td>- Skin 11%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiple Paths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community-acquired and health care associated sepsis accounts for 80 percent of cases</td>
</tr>
<tr>
<td>Hospital cases drive significant cost</td>
</tr>
<tr>
<td>- Hospital cases: $38,000 median cost</td>
</tr>
<tr>
<td>- Health care associated: $9,000 median cost</td>
</tr>
<tr>
<td>- Community acquired: $7,000 median cost</td>
</tr>
</tbody>
</table>

\(^1\)CDC Vital Signs 2016-August  
\(^2\)Clinical Infectious Diseases, Volume 67, Issue 8, 28 September 2018, Pages 1300–1302, https://doi.org/10.1093/cid/ciy342  
\(^3\)sepsis.org/sepsis-alliance-news/new-u-s-government-report-reveals-annual-cost-of-hospital-treatment-of-sepsis-has-grown-by-3-4-billion/
## Sepsis-3 Definition – Timeline

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sepsis</strong></td>
<td>Systemic Inflammatory Response Syndrome (SIRS)</td>
<td>Known/suspected infection and &gt; two SIRS criteria</td>
<td>Defined as: Life-threatening organ dysfunction caused by host immunologic response to infection. Organ dysfunction is reflected in a Sequential Organ Failure Assessment (SOFA) score of &gt; two points above baseline.</td>
</tr>
<tr>
<td><strong>Severe Sepsis</strong></td>
<td>Sepsis and end organ dysfunction</td>
<td>Not a category</td>
<td></td>
</tr>
<tr>
<td><strong>Septic Shock</strong></td>
<td>Sepsis and refractory hypotension</td>
<td>Vasopressors and lactate &gt; 2 mmol/L</td>
<td></td>
</tr>
</tbody>
</table>

Source: Healthcare Cost and Utilization Project (HCUP) and the Agency for Healthcare Research and Quality (2016)
## Sequential Organ Failure Assessment (SOFA) Score

Please use the following chart to identify patients with sepsis.

<table>
<thead>
<tr>
<th>SOFA Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO2/FIO2 (mm Hg) ratio</td>
<td>&lt;400</td>
<td>&lt;300</td>
<td>&lt;220</td>
<td>&lt;100</td>
</tr>
<tr>
<td>SaO2/FIO2</td>
<td>221-301</td>
<td>142-220</td>
<td>67-141</td>
<td>&lt;67</td>
</tr>
<tr>
<td>Platelets ×103/mm3</td>
<td>&lt;150</td>
<td>&lt;100</td>
<td>&lt;50</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Bilirubin (mg/dL)</td>
<td>1.2-1.9</td>
<td>2.0-5.9</td>
<td>6.0-11.9</td>
<td>&gt;12.0</td>
</tr>
<tr>
<td>Hypotension</td>
<td>MAP &lt;70</td>
<td>Dopamine ≤5 or dobutamine (any)</td>
<td>Dopamine &gt;5 or norepinephrine ≤0.1</td>
<td>Dopamine &gt;15 or norepinephrine &gt;0.1</td>
</tr>
<tr>
<td>Glasgow Coma Score</td>
<td>13-14</td>
<td>10-12</td>
<td>6-9</td>
<td>&lt;6</td>
</tr>
<tr>
<td>Creatinine (mg/dL) or urine output (mL/d)</td>
<td>1.2-1.9</td>
<td>2.0-3.4</td>
<td>3.5-4.9 or &lt;500</td>
<td>&gt;5.0 or &lt;200</td>
</tr>
</tbody>
</table>
Sepsis-3 Adoption

Sepsis-3 is defined as a life-threatening organ dysfunction caused by host immunologic response to underlying infection.

- Increases in sepsis diagnoses are partially due to increased coding of sepsis based on outdated definitions of sepsis.
  - Starting Jan. 1, 2019, UnitedHealthcare adopted the Sepsis-3 definition in our post-payment claim reviews
- We also use the Surviving Sepsis Campaign International Guidelines for Management of Sepsis and Septic Shock¹ (SSC) to assess member care
  - The SSC guidelines were developed in 2016 by a consensus committee of 55 international experts representing 25 international organizations
- Adherence to management guidelines can result in improved clinical outcomes
  - Reduces the relative risk of death by 46.6%
  - 1 additional life saved for every 5 care episodes
  - Mortality reduced from 44% to 20%

### Statistics – UnitedHealthcare Data

<table>
<thead>
<tr>
<th>Line of Business</th>
<th>Sepsis Admissions</th>
<th>Sepsis Admission Rate</th>
<th>Non-POA(^1) Sepsis Count</th>
<th>Non-POA(^1) Sepsis Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>18,743</td>
<td>1.87%</td>
<td>2,505</td>
<td>13.36%</td>
</tr>
<tr>
<td>Medicaid</td>
<td>10,218</td>
<td>2.14%</td>
<td>1,348</td>
<td>13.19%</td>
</tr>
<tr>
<td>Medicare</td>
<td>32,863</td>
<td>5.40%</td>
<td>4,257</td>
<td>12.95%</td>
</tr>
<tr>
<td>Overall</td>
<td>123,648</td>
<td>2.96%</td>
<td>16,220</td>
<td>13.12%</td>
</tr>
</tbody>
</table>

**Sepsis Mortality Rate**
- 15% mortality rate (1.6%)

**Sepsis 30-Day Readmit Rate**
- 16% 30-day readmit rate (8.2%)

**Sepsis Admission Cost**
- 3% inpatient admissions related to sepsis
  - Average cost $34,000/admission ($15,000)

Source: Healthcare Cost and Utilization Project (HCUP) and the Agency for Healthcare Research and Quality (2016)

\(^1\)Present on admission
### Program Accomplishments

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Sub-Initiatives</th>
<th>Sepsis Cases Prevented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunizations</td>
<td>Vaccine (Flu and Pneumonia) Campaign Buy Up by <em>Commercially Insured/Employer Clients</em></td>
<td>471</td>
</tr>
<tr>
<td></td>
<td>Member Communication (Medicare &amp; Retiree) – Patient education on sepsis awareness</td>
<td>134</td>
</tr>
<tr>
<td>Sepsis-3 Definition Deployment</td>
<td>Post-Pay Post-Service Clinical Audit Review – Adopting the Sepsis-3 clinical criteria in a practice guideline to align and assist in the clinical review of sepsis cases that may be inappropriately documented as sepsis.</td>
<td>10% increase in accuracy due to Sepsis-3 adoption</td>
</tr>
</tbody>
</table>
# Sepsis Initiatives

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Sub-Initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunizations</td>
<td>1. Communications to educate on sepsis awareness and the importance of immunizations</td>
</tr>
<tr>
<td></td>
<td>2. Transitional care management collaboration to ensure appropriate vaccination(s) prior to discharge</td>
</tr>
<tr>
<td>Post-Hospitalization Care and Potential Prevention of Re-Hospitalization</td>
<td>3. Observational study: Biometric device monitoring of members discharged from hospitals with sepsis diagnosis</td>
</tr>
<tr>
<td>Population Health Management</td>
<td>4. Focused outreach for high-risk sepsis</td>
</tr>
<tr>
<td>Predictive Modeling of Sepsis</td>
<td>5. Condition based analysis – Identify splenectomy population</td>
</tr>
<tr>
<td>Sepsis Hospital Recognition</td>
<td>6. Value-based care initiative</td>
</tr>
</tbody>
</table>
Top priorities for management/communication for at-risk UnitedHealthcare Medicare members include:

• Ensure vaccinations are updated
• Provide education on sepsis prevention:
  - Hand washing
  - Hygiene
  - Wound management
  - Chronic disease management
• Ensure routine care provider follow up
• Ensure members are aware of sepsis signs and symptoms requiring immediate evaluation
• Assess member for recurrent infections and risk management (e.g., if a member with chronic obstructive pulmonary disease (COPD) has recurrent pneumonia and bronchitis, ensure they’re educated on management and prevention of underlying infection, if they smoke, advise they discontinue tobacco, etc.)
Immunizations

• Transitional Care Management team to ensure post-acute and LTC populations all receive appropriate vaccinations prior to discharge
• Integrate sepsis into Advanced Care Planning within the Medicare population
Predictive Modeling of Sepsis

A sepsis condition-based analysis is currently being used to identify and manage high-risk sepsis populations starting with the post-splenectomy population.

Suggested inclusion criteria* for performance boost in sepsis predictive model:

1. **Select Conditions**
   - Diabetes
   - Cancer (Active)
   - Heart Disease
   - Chronic Kidney Disease
   - Tobacco Use
   - Immunosuppressive Medication

2. **Age (< 4 or ≥ 65)**
   
   * Applied criteria for 2016

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### Prevalence

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Overall Prevalence</th>
<th>Condition Criteria Prevalence</th>
<th>Age Criteria Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.21%</td>
<td>0.60%</td>
<td>0.64%</td>
</tr>
</tbody>
</table>

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### Prevalence on Select Conditions

- **Diabetes**: 0.9% cases, 30% covered
- **Cancer**: 0.8% cases, 20% covered
- **Heart**: 1.6% cases, 18% covered
- **CKD**: 2.5% cases, 15% covered
- **Tobacco**: 0.5% cases, 2% covered
- **Immunocompromised**: 1.4% cases, 1% covered

*Criteria applied: 63%*
This program helps hospitals create programs to improve sepsis quality and outcomes

### CY 2017 Data
SEPSIS MS DRG: 870, 871, 872

**Overall Summary:**

<table>
<thead>
<tr>
<th>Plan</th>
<th>Total Admits</th>
<th>Total Sepsis Admits</th>
<th>Sepsis %</th>
<th>Sepsis Readmit Rate as a% of Total Sepsis</th>
<th>Total Sepsis Paid Amount</th>
<th>Total Paid Amount for 30 Day Readmission of Sepsis Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCR</td>
<td>772,704</td>
<td>62,975</td>
<td>8.1%</td>
<td>13.8%</td>
<td>$713.94M</td>
<td>$101.23M</td>
</tr>
<tr>
<td>CDR</td>
<td>394,354</td>
<td>14,417</td>
<td>3.7%</td>
<td>14.2%</td>
<td>$155.23M</td>
<td>$23.34M</td>
</tr>
<tr>
<td>COM</td>
<td>928,871</td>
<td>29,467</td>
<td>3.2%</td>
<td>11.0%</td>
<td>$644.88M</td>
<td>$115.45M</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>2,095,929</strong></td>
<td><strong>106,859</strong></td>
<td><strong>5.1%</strong></td>
<td><strong>13.1%</strong></td>
<td><strong>$1,514.05M</strong></td>
<td><strong>$240.02M</strong></td>
</tr>
</tbody>
</table>

- Pilot value-based care with high sepsis volume hospital provider systems to improve quality outcomes
- Institutional Special Needs Plans (ISNP) Data
Post-Hospitalization Care & Prevention

Biometric Device Observational Research Study

• Premise: The Journal of the American Medical Association 2015 stated 40 percent of hospital readmissions after an index hospitalization for sepsis are preventable.

  ![Sepsis Readmission Rates](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5044864/)

• Observational study: Biometric device monitoring of discharged with sepsis diagnosis to collect and develop a rich biometric data set for model development.
Post-Hospitalization Care and Prevention Initiative (cont.)

Data Collection Phase

Biometric Sensor Vendor’s AWS Environment

Internet

Biometric Collection

- Heart Rate and Variability
- Pulse Pressure Variation
- Systolic Blood Pressure Variation
- Vascular Resistance
- LV Ejection Time
- Perfusion Index
- Pulse Volume Variation
- Systolic Rise, dV / dt
- Respiration Rate
- Blood Oxygen Saturation (SpO2)
- LF / HF
- Sleep Duration and Efficiency
- Steps / Cadence
- Balance
- Exercise / Activity
- Energy Expenditure
- Skin Temperature Variation

Model Development

Sepsis Risk Scoring

Advanced Analytics

Machine Learning

Arrow thickness indicative of data volume
Prevention and Early Identification

Sepsis is a marker for high-risk mortality, and therefore prevention and early identification is key to successful management. Key aspects of sepsis prevention and early identification include:

- Creating protocols regarding early sepsis identification and management in LTC settings
- Vaccination and infection control in post-acute care settings
- Educating long-term and post-acute care personnel on sepsis identification and early management
- Identifying an advanced care plan to determine appropriate sepsis management in the appropriate setting (i.e., hospital versus LTC)
Knowledge Assessment Answers

1. The sepsis-3 definition describes sepsis as a life-threatening organ dysfunction caused by a bacterial infection of the blood.
   a. True
   b. False

2. How often are deaths recorded from sepsis?
   a. One person every 20 minutes
   b. One person per day
   c. One person every two minutes

3. Sepsis cases are most likely on the rise due to:
   a. Decreased adherence to infection control measure in a LTC setting
   b. Coding abuse using non-specific definitions of sepsis
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5. What is the percentage of hospital readmissions after an index hospitalization for sepsis?
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   c. 65 percent
Thank you.