Predictors of Survival for Patients With a Diagnosis of Sepsis

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Kim Reina Failla, PhD, RN, NE-BC
Cynthia D. Connelly, PhD, RN, FAAN
Disclosure

• The authors have no conflicts of interest to declare:

  • Kim Reina Failla, PhD, RN, NE-BC
    Sharp Memorial Hospital, San Diego, CA, USA

  • Cynthia D. Connelly, PhD, RN, FAAN
    University of San Diego, San Diego, CA, USA
Learning Objectives

1. Identify factors, patient characteristics, clinical variables, and care management processes affecting patient survival with septic-related diagnoses.

2. Discuss how the implications of the study illustrate the importance of nurses and other providers following evidence-based guidelines.

3. Apply the findings of this study in the care management of patients with septic-related diagnoses in own setting.
Background & Significance

• In the United States (US):

  • Sepsis is the 11th leading cause of death

  • Sepsis mortality is between 30% and 50%

  • Hospitalizations related to sepsis doubled from 2000 - 2008

Leedahl et al., 2014; Levy et al., 2010; Walkey et al., 2015
Resource Implications

- Sepsis was the most expensive condition treated in US hospitals in 2011

- In the US, financial penalties are imposed for the management of Medicare patients diagnosed with severe sepsis and septic shock

CMS, 2014; Rhee et al., 2014; Walkey et al., 2015
Faces of Sepsis

- https://www.youtube.com/watch?v=12Qbnn6XfH0
• To perform a **retrospective descriptive correlational study** to identify patient characteristics and factors, clinical variables, and care management processes that increase the odds for survival for patients with sepsis-related diagnoses.
Conceptual Framework
Healthcare Quality Model and Advancing Health Disparities Research Framework

Structure
- Detecting
  - Define health disparities and vulnerable populations

Process
- Understanding
  - Identify determinants of health disparities

Outcome
- Reducing or Eliminating
  - Intervene, evaluate, change policy

Donabedian, 1980; Donabedian, 2003; Kilbourne et al., 2006
Focused Literature Review

- **Source of Infection**
  - Chest region infections higher in males\(^1\)-\(^4\), \(^6\)-\(^7\)
  - Urinary tract infections higher in females\(^1\)-\(^2\), \(^4\), \(^6\)-\(^7\)

- **Comorbidities**
  - Higher comorbidity scores in males\(^2\)-\(^6\)
  - No difference in comorbidity scores between gender\(^1\), \(^7\)

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(1) Adrie et al., 2007; (2) Esper et al., 2006; (3) Jacobson et al., 2012; (4) Madsen & Napoli, 2014; (5) Madsen et al., 2014; (6) Nachtigall et al., 2011; (7) Pietropaoli et al., 2010
Focused Literature Review

- **Clinical Variables**
  - No difference between gender in antibiotic administration\(^6\)
  - More males receive antibiotics\(^1\)
  - Females experience longer delays to antibiotics\(^4-5\)
  - Males experience longer delays to antibiotics\(^7\)
  - Lactate levels higher in females\(^5\)

- **Care Management Processes**
  - Females less likely to receive deep vein thrombosis prophylaxis\(^6-7\)
  - Females less likely to receive mechanical ventilation\(^1, 6-7\)
  - Females more likely to receive packed red blood cells\(^3, 7\)

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(1) Adrie et al., 2007; (2) Esper et al., 2006; (3) Jacobson et al., 2012; (4) Madsen & Napoli, 2014; (5) Madsen et al., 2014; (6) Nachtigall et al., 2011; (7) Pietropaoli et al., 2010
Focused Literature Review

- **Length of Stay**
  - Longer in males\(^1-2, 5\)
  - No difference by gender\(^3, 6\)

- **Mortality**
  - Higher risk in males\(^1\)
  - Higher risk in females\(^5-7\)
  - No difference between gender\(^2-3\)

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(1) Adrie et al., 2007; (2) Esper et al., 2006; (3) Jacobson et al., 2012; (4) Madsen & Napoli, 2014; (5) Madsen et al., 2014; (6) Nachtingall et al., 2011; (7) Pietropaoli et al., 2010
Study Methods

• **Purpose**
  • What are the factors, patient characteristics, clinical variables, and care management processes that *increase the odds for survival* among a cohort of patients with a discharge diagnosis of severe sepsis, or septic shock?

• **Setting**
  • Non-profit, Magnet® recognized, 368-bed acute care hospital with 90,000 emergency department visits annually
Study Sample

• **Sample**
  • Data extracted from electronic medical records from July 1, 2014 through June 30, 2015

• **Inclusion Criteria**
  • Patients 18 years or older
  • Severe sepsis or septic shock
  • Admitted through the emergency department

• **Exclusion Criteria**
  • End-of-life care patients
Study Variables

- **Independent Variables**
  - Patient Characteristics
  - Clinical Variables
  - Care Management Processes

- **Dependent Variable**
  - Survival (or Mortality)
Study Research Questions

Research Questions

1. **Describe** patient characteristics, clinical variables, care management processes, and survival status among patients admitted through the ED with a discharge diagnoses of severe sepsis, or septic shock.

2. **Examine** the relationships between patient characteristics, clinical variables, care management processes, and survival status among patients admitted through the ED with a discharge diagnoses of severe sepsis, or septic shock.

3. **Identify** factors, patient characteristics, clinical variables, and care management processes that increase the odds for survival among patients admitted through the ED with a discharge diagnoses of severe sepsis, or septic shock.
## Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Male (n = 248)</th>
<th>Female (n = 234)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>51.5%</td>
<td>48.5%</td>
<td>ns</td>
</tr>
<tr>
<td>Age, mean (SD), years</td>
<td>67.9 (15.6)</td>
<td>67.8 (17.5)</td>
<td>ns</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (%)</td>
<td>54.0%</td>
<td>47.9%</td>
<td></td>
</tr>
<tr>
<td>Hispanic (%)</td>
<td>15.7%</td>
<td>17.5%</td>
<td></td>
</tr>
<tr>
<td>Asian (%)</td>
<td>12.5%</td>
<td>17.5%</td>
<td></td>
</tr>
<tr>
<td>Black (%)</td>
<td>4.8%</td>
<td>6.8%</td>
<td></td>
</tr>
<tr>
<td>All Others (%)</td>
<td>12.9%</td>
<td>10.3%</td>
<td></td>
</tr>
<tr>
<td>Discharge Diagnosis</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Severe Sepsis (%)</td>
<td>36.7%</td>
<td>38.9%</td>
<td></td>
</tr>
<tr>
<td>Septic Shock (%)</td>
<td>63.3%</td>
<td>61.1%</td>
<td></td>
</tr>
<tr>
<td>Source of Infection</td>
<td></td>
<td></td>
<td>.002</td>
</tr>
<tr>
<td>Chest (%)</td>
<td>42.7%</td>
<td>28.3%</td>
<td></td>
</tr>
<tr>
<td>Urinary tract (%)</td>
<td>21.1%</td>
<td>37.1%</td>
<td></td>
</tr>
<tr>
<td>Intra-Abdominal (%)</td>
<td>19.5%</td>
<td>17.5%</td>
<td></td>
</tr>
</tbody>
</table>

ns = not statistically significant, N = 482
## Patient Characteristics

<table>
<thead>
<tr>
<th>Type of inpatient unit:</th>
<th>Male (n = 248)</th>
<th>Female (n = 234)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive care (%)</td>
<td>54.6%</td>
<td>49.1%</td>
<td>ns</td>
</tr>
<tr>
<td>Progressive care (%)</td>
<td>30.0%</td>
<td>32.1%</td>
<td></td>
</tr>
<tr>
<td>Acute care (%)</td>
<td>15.4%</td>
<td>18.8%</td>
<td></td>
</tr>
<tr>
<td>Length of hospital stay, median (IQR), days</td>
<td>8 (4-16)</td>
<td>7 (3-14)</td>
<td>.005</td>
</tr>
<tr>
<td>Charlson Comorbidity Index Score, mean (SD)</td>
<td>3.0 (0.2)</td>
<td>2.3 (0.2)</td>
<td>.002</td>
</tr>
<tr>
<td>Time to inpatient unit, median (IQR), minutes</td>
<td>149 (105-208)</td>
<td>182 (120-252)</td>
<td>.001</td>
</tr>
</tbody>
</table>
### Clinical Variables

<table>
<thead>
<tr>
<th></th>
<th>Male (n = 248)</th>
<th>Female (n = 234)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Lactate measured (%)</td>
<td>89.5%</td>
<td>88.0%</td>
<td>ns</td>
</tr>
<tr>
<td>Initial Lactate level, mean (SD), mmol/L</td>
<td>3.1 (2.8)</td>
<td>3.6 (3.1)</td>
<td>ns</td>
</tr>
<tr>
<td>Time of initial Lactate&lt;sup&gt;a&lt;/sup&gt;, median (IQR), minutes</td>
<td>51 (31-137)</td>
<td>57 (32-140)</td>
<td>ns</td>
</tr>
<tr>
<td>Blood culture before antibiotics (%)</td>
<td>87.5%</td>
<td>78.6%</td>
<td>ns</td>
</tr>
<tr>
<td>Time of blood culture&lt;sup&gt;a&lt;/sup&gt;, median (IQR), minutes</td>
<td>53 (34-150)</td>
<td>69 (37-161)</td>
<td>ns</td>
</tr>
<tr>
<td>Time ABX prescribed&lt;sup&gt;a&lt;/sup&gt;, median (IQR), minutes</td>
<td>128 (67-252)</td>
<td>161 (89-313)</td>
<td>.035</td>
</tr>
<tr>
<td>Time ABX administered&lt;sup&gt;a&lt;/sup&gt;, median (IQR), minutes</td>
<td>179 (106-348)</td>
<td>226 (142-396)</td>
<td>.001</td>
</tr>
<tr>
<td>Adequate fluid (%)</td>
<td>41.6%</td>
<td>58.4%</td>
<td>.003</td>
</tr>
<tr>
<td>Fluids administered, mean (SD), ml/kg</td>
<td>20 (21.5)</td>
<td>27 (24.7)</td>
<td>.004</td>
</tr>
<tr>
<td>Vasopressor administered (%)</td>
<td>63.3%</td>
<td>53.8%</td>
<td>.035</td>
</tr>
</tbody>
</table>

IQR = Interquartile Range; <sup>a</sup> From emergency room arrival; ns = not statistically significant; N = 482
## Care Management Processes

<table>
<thead>
<tr>
<th></th>
<th>Male (n = 248)</th>
<th>Female (n = 234)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed red blood cell transfusions (%)</td>
<td>16.1%</td>
<td>18.1%</td>
<td>ns</td>
</tr>
<tr>
<td>Central line placed (%)</td>
<td>57.3%</td>
<td>47.9%</td>
<td>.039</td>
</tr>
<tr>
<td>Mechanical ventilation used (%)</td>
<td>43.5%</td>
<td>35.1%</td>
<td>.007</td>
</tr>
</tbody>
</table>

IQR = Interquartile Range; ns = not statistically significant; N = 482
Outcome Measure

<table>
<thead>
<tr>
<th></th>
<th>Male  (n = 248)</th>
<th>Female (n = 234)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival (%)</td>
<td>69.4%</td>
<td>67.9%</td>
<td>ns</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>30.6%</td>
<td>32.1%</td>
<td>ns</td>
</tr>
</tbody>
</table>

IQR = Interquartile Range ; ns = not statistically significant; N = 482
## Logistic Regression

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B (SE)</th>
<th>Wald</th>
<th>p</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge Diagnosis</td>
<td>-.895 (.288)</td>
<td>9.65</td>
<td>.002</td>
<td>2.44</td>
<td>1.39 - 4.31</td>
</tr>
<tr>
<td>Gender</td>
<td>-.520 (.259)</td>
<td>4.03</td>
<td>.045</td>
<td>1.68</td>
<td>1.01 - 2.79</td>
</tr>
<tr>
<td>Age, (years)</td>
<td>-.034 (.009)</td>
<td>14.86</td>
<td>&lt;  .001</td>
<td>1.03</td>
<td>1.02 - 1.05</td>
</tr>
<tr>
<td>Charlson Comorbidity Index(^b)</td>
<td>-.170 (.045)</td>
<td>14.54</td>
<td>&lt;  .001</td>
<td>1.19</td>
<td>1.09 - 1.29</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td>2.277 (.961)</td>
<td>5.61</td>
<td>.018</td>
<td>9.746</td>
<td>2.67 - 11.17</td>
</tr>
<tr>
<td>Intra-Abdominal Infection</td>
<td>1.697 (.365)</td>
<td>21.59</td>
<td>&lt;  .001</td>
<td>5.46</td>
<td>1.48 - 64.09</td>
</tr>
<tr>
<td>Initial Lactate Level, (mmol/L)</td>
<td>-.213 (.050)</td>
<td>18.44</td>
<td>&lt;  .001</td>
<td>1.24</td>
<td>1.12 - 1.36</td>
</tr>
<tr>
<td>Recommended Fluids</td>
<td>.684 (.283)</td>
<td>5.86</td>
<td>.015</td>
<td>1.98</td>
<td>1.14 - 3.45</td>
</tr>
<tr>
<td>Length of Stay, (days)</td>
<td>.032 (.012)</td>
<td>6.65</td>
<td>.010</td>
<td>1.03</td>
<td>1.01 - 1.06</td>
</tr>
</tbody>
</table>

\(\chi^2 = 118.38, df = 12, p < .001\)

Nagelkerke \(R^2 = .345\)

Correctly Classified: 77.3%
Predictors of Survival

- The results indicate an overall model of 8 predictors that significantly predict survival.

- Findings revealed increased odds of survival for patients:
  - Diagnosed with urinary tract or intra-abdominal infections
  - Receiving the recommended amount of fluids
  - With a longer length of hospital stay
Predictors of Survival

Findings revealed decreased odds of survival for patients:

- Who are older (increased age)
- With higher comorbidity scores
- With higher lactate levels
- With a diagnosis of septic shock
- Who are female
Study Limitations

• Single site setting
• Convenience Sample
• Manual abstraction of data
Study Implications

• Educational Opportunities

• Acute Care Setting
  • Differences in the way females (vs. males) experience symptoms
  • Differences in the way females (vs. males) perceive themselves and their illness
  • Awareness of unintentional gender bias
  • Reinforcement of evidence-based guidelines

• Academic Setting: Introduce curricula to inform nursing students about potential inequalities in care delivery

• Future Research: Inequality of care in septic patients
Questions?


Contact Information

Kim Failla, PhD, RN, NE-BC
Manager, Nurse Residency Program
Sharp Memorial Hospital
San Diego, CA
Kim.failla@sharp.com

Cynthia Connelly, PhD, RN, FAAN
Professor and Director of Research
University of San Diego
San Diego, CA
Connellyc@sandiego.edu