Reducing Sepsis Mortality

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Infection at any body site can lead to sepsis, a primary bloodstream infection. Sepsis caused over 34,800 deaths in 2007, and remains the leading cause of death in noncardiac intensive care units (Xu, Dochanek, Murchy, & Tejada-Vera, 2010). Mortality rates due to sepsis have remained unchanged for the last several decades, ranging from 23% to 43% (Durthaler, Ernst, & Johnston, 2009). The cost of sepsis in the United States is over $400 billion annually (Vodovotz & Billiar, 2013; World Health Organization, 2011).

Literature Review

Sepsis is the leading cause of death in hospitalized patients and has substantial impact on health care resources. An evidence-based project reduced mortality rates associated with sepsis through use of a nursing sepsis protocol. Miller and colleagues (2013) found using standard order sets for sepsis reduced mortality for 4,329 adult patients in intensive care units (ICU) from 21.7% to 9.7% in 6 years (2004-2010). As the standard order set compliance increased, a marked reduction in hospital mortality occurred. Similar findings were noted in older adults when the use of standardized order sets for sepsis was associated with reduced mortality and reduced length of stay because of improved initial appropriate therapy (Heppner et al., 2012).

The majority of cases of sepsis are identified in ICUs and emergency rooms; however, management of patients on medical-surgical units can decrease mortality and costs because nurses will identify symptoms and initiate the sepsis bundle early (Daniels, Nutbeam, McNamara, & Galvin, 2011). Signs and symptoms of sepsis include fever, chills, altered white blood count, increased C-reactive protein, tachycardia, altered skin perfusion, and reduced urine output. Because symptoms of sepsis may be recognized late and treated inappropriately, nurses must learn to identify and report them promptly in any care setting (Vincent et al., 2002).

Improvement Needs/Group Oversight

To reduce mortality rates, sepsis must be identified and treated as early as possible. The Surviving Sepsis Campaign (SSC), which was formed in 2002 to reduce sepsis by 25% in 5 years, published evidence-based guidelines for the treatment of patients with sepsis and septic shock (Durthaler et al., 2009). These guidelines provide 17 recommendations; the three most frequently used were prompt ordering of cultures, administration of broad-spectrum antibiotics, and deep vein thrombosis prophylaxis. Deterioration of laboratory values is the most common clue to severe sepsis (Durthaler et al., 2009).

In 2008, leaders of the University of New Mexico Hospital (UNMH) reported 21.7% of patient deaths were related to sepsis, with one-third of these deaths reported by the internal medicine service. Sepsis was also

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the principal diagnosis in 33% of patients who died in 2007 at UNMH. Nurses worked with the internal medicine physicians, members of the quality outcomes department, and the Rapid Response Team (RRT) in developing a sepsis protocol for piloting on two medical-surgical units. Nurses also developed the screening tool for sepsis. Members of this interdisciplinary group called themselves the Sepsis Mortality Improvement Team (SMITe), and their goal was to reduce the number of mortalities due to sepsis on the general units.

CQI Model

The Institute for Healthcare Improvement (IHI) Model used for this program included setting aims, forming teams, establishing measures, and selecting and testing changes. The process included Plan-Do-Study-Act (PDSA), engaging physicians in the improvement and execution, improving capacity and capability, and engaging staff in improvement and quality improvement. The Severe Sepsis Bundle (IHI, 2013) was revised in June 2013 to include the 3-hour resuscitation and the 6-hour septic shock bundles. The 3-hour bundle includes measuring lactate levels, obtaining blood cultures, administering broad-spectrum antibiotics, and infusing crystalloid for hypotension or lactate increases. The 6-hour bundle includes measuring central venous pressure and central venous oxygen, and remeasuring lactate if initial values were elevated. The project hospital is part of the SSC. In this article, findings of the work of the multidisciplinary team and the decreased sepsis-related mortality are described (D’Angelo, Doefler, Parmentier, & Jacobsen, 2013).

Quality Indicators and Data Collection

To reach the goal of reducing sepsis-related mortality, members of the SMITe realized laboratory and hemodynamic variables were needed to recognize patients with systemic inflammatory response syndrome (SIRS) in response to infection and associated with acute organ dysfunction at the earliest possible stage. Differentiating them from patients with sepsis, severe sepsis, or septic shock was also critical. The UNMH Rapid Response Team would assess, monitor, and target patients for more aggressive treatment and appropriate nursing care. The method used by the SMITe was innovative and different from other national programs because pilots were begun on medical-surgical units rather than

### FIGURE 1.

#### Sepsis Screening Tool Performed Twice Daily

<table>
<thead>
<tr>
<th>Instructions</th>
<th>Use this tool to screen patients for sepsis on the floors, in the ICU, or ED. Sections A, B, C: Unit RN complete Sections D, E: RRT/ICU/ED staff complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: <strong>/</strong>/</td>
<td>Time: ____________ RN Initials: ____________</td>
</tr>
<tr>
<td>□ Sepsis Order Set initiated within last 24 hours – STOP screening – Reassess at next shift</td>
<td></td>
</tr>
</tbody>
</table>

#### A. INFECTION (Has the patient had a documented, or do you suspect infection?)

- □ Suspected/Documented infection: ____________ No infection

#### B. SIRS Criteria – Assess for two or more of the following (check all that apply):

- □ Temp ≥ 38 C or ≤ 36 C
- □ Resp rate ≥ 20 or PaCO2 ≤ 32
- □ HR ≥ 90
- □ WBC ≥ 12K or ≤ 4K or ≥ 10% bands
- □ Less than two of above. STOP screening – Reassess at next shift.

#### C. SEPSIS

If you checked the box that an infection is present in Part A and at least two boxes in Part B, patient has screened positive for sepsis:

1. Draw lactate.
2. Notify the MD – request orders to initiate Sepsis Order Set.

- □ Sepsis Order Set NOT initiated, per physician. STOP screening – Reassess at next shift

Reason:

- □ Sepsis Order Set initiated (preprinted order set is required) – Continue to Step 3

3. Notify the RRT, 555-1234, to follow patient if order set initiated or if lactate is abnormal (>2)

Time: ____________ RRT/ICU/ED Initials: ____________

#### D. ORGAN DYSFUNCTION

- □ No organ dysfunction –
  - Patient on the P YELLOW PATHWAY
  - Acutely altered mental status
  - SBP < 90 or MAP < 65 mmHg
  - SpO2 < 90% on room air
  - or supplemental O2
  - Creatinine > 2 mg/dl or urine output < 0.5 ml/kg/hr for > 2 hours

- □ GREEN PATHWAY
  - Platelet count >100,000
  - Bilirubin >2 mg/dl, AST >90, ALT >90
  - Lactate >4 mol/L

#### E. SEVERE SEPSIS – RED PATHWAY

If at least one box checked in section D, patient has screened positive for SEVERE SEPSIS.

- □ Contact MD to continue severe sepsis resuscitation bundle.

- □ Severe sepsis bundle not implemented per physician. Reason: ____________

* Remind MD to document in chart the reason for not initiating order set.

Patient Label
in intensive care and emergency settings. Medical-surgical units were chosen because nurses in those areas are the primary responders to deterioration. The sepsis bundle comprises basic care elements that can be delivered in these areas as well as more complex tasks requiring critical care. The most effective interventions - rapid delivery of fluids and administration of intravenous antibiotics within 1 hour - can reduce mortality by 30%-50% (Daniels et al., 2011; Vincent et al., 2002).

A nursing unit director was approached by an internal medicine physician to initiate this evidence-based sepsis project in collaboration with other nursing unit leaders. The nurse unit directors, physician champion, and quality consultant selected and reviewed the literature and adopted the evidence for early recognition of sepsis. Recognizing the significance of the sepsis diagnosis for the medicine units as well as the impact on mortality for the hospital, nurses on two units volunteered to participate in this quality initiative through their shared governance councils. Nurses on the units were introduced to the Surviving Sepsis Guidelines developed by the European Society of Critical Care Medicine and the Society of Critical Care Medicine (Durthaler et al., 2009), with the goal of improving sepsis diagnosis, management, and survival of affected patients. The nurses took a 4-hour continuing education course titled “Surviving Critical Care Medicine.” Members of the interdisciplinary team developed additional inservice training opportunities for direct-care nursing staff concerning initial resuscitation, screening for sepsis, and performance improvement, diagnosis, and antimicrobial therapy. An intranet site was developed to display data and provide additional educational materials.

Recognizing the importance of rapid continuous improvement cycles, nurses on the units participated in testing the tools and making modifications, using one patient at a time. The tools were tested and modified based on review by two nurses or a nurse and physician who identified signs and symptoms of sepsis in patients and then recommended steps for initiation of the sepsis bundle. The tool was modified until the correlation between reviewers was 0.8 or higher. Feedback helped ensure measurable outcomes and avoid unnecessary steps. Each rapid improvement cycle involved date collection and feedback to nurses so appropriate changes could be made to the process. Direct-care nurses, physicians, and other team members reviewed each cycle and discussed the process, care, and outcomes. Without the input of direct-care nurses, the project would not have succeeded in the early stages.

As an outcome of this process, the SMTe developed several tools to assist staff in the diagnosis and treatment of patients with sepsis. Tools included:

- A sepsis screening tool that allows nurses to review sepsis-related symptoms.
- Outlined steps (bundle) the nurse must take in caring for patient with suspected sepsis.
- An electronic sepsis order set.
- Verbal order telephone scripts to support communication between the physician and nurse.
- Complete protocol.

All patients on medical-surgical units now are screened each shift, serum lactate is drawn for positive screens, and blood cultures are taken prior to initial antibiotic administration. Antibiotics are administered within 1 hour of order initiation, and fluids are administered for all patients on the Red Pathway. The Red Pathway allows the identification of patients who have positive blood cultures and abnormal serum lactates. Serum lactate is used as a marker for a positive screen because it is associated with mortality (Mikkelsen et al., 2009). The tools to assist staff in the diagnosis and treatment of patients with sepsis were put...
FIGURE 3.
Complete Sepsis Protocol

Sepsis Bundle: Early Goal-Directed Therapy Guideline

SIRS Criteria
Assess for two or more of the following:
1. Temp ≥ 38 C or ≤ 36 C
2. HR ≥ 90
3. Resp rate ≥ 20 or PaCO2 ≤ 32
4. WBC ≥ 12K, or ≤4K or ≥ 10% bands

Suspected site of infection?

Yes

No

Reassess Q shift

Early Recognition 6-Hour Goals

1. NURSE: Notify MD & RRT of positive sepsis screen.
2. MD: Confirm sepsis diagnosis and initiate Sepsis Order Set or document reason for NOT initiating Sepsis Order Set.

CHECK LACTATE, LAB RESULTS, AND BLOOD PRESSURE

1. Lactate < 2 and Normotensive and No evidence of acute organ dysfunction
2. Lactate > 4 or SBP < 90 or Decrease in SBP > 30 mmHg
1. Confirm culture drawn.
2. Give appropriate antibiotics.
3. Reassess lactate q8 hours x 1 (repeat as needed).
4. Repeat labs; reassess for signs/symptoms of organ dysfunction q day x 2 days.

SEVERE SEPSIS

1. Give 20 ml/kg IVF bolus
2. Assess for CVP need

Responsive

Unresponsive

SEPTIC SHOCK

1. Notify ICU.
2. If in ED, take patient to Resus Room.
3. Broad-spectrum antibiotics, supplemental O2, large bore IV, Foley, labs, cultures, assess for source control
4. Place arterial line and central line and initiate EGDT/Sepsis Order Set.

GOAL

CVP 8-12

< 8

Give NS/LF bolus. Repeat until CVP 8-12.
Then continue to monitor CVP.
No action needed – Continue to Step 2

> 12

THEN

Step 1:

CVP 8-12

CVP

MAP <65 or Arterial line, pressors, and Consider baseline cortisol and steroids.

SBP <30

SBP 90-140

CVP 8-12

Step 2

MAP

Goals Achieved

Yes

No

Recheck lactate q 8 hours x 3.
Reassess Steps 1-2 and
Consider mechanical ventilation and sedation.
Continuous Quality Improvement

on the UNMH intranet and have become the standard of practice for all medical-surgical units at UNMH (see Figures 1-3). Understanding the importance of quick recognition and diagnosis, members of the SMITe also developed a Sepsis Lab Bag that contains all blood tubes required for sepsis diagnosis.

The SMITe continues to meet monthly and review the efficacy of the existing protocol for continuous improvement. Outcomes include reduced mortality and morbidity of patients with sepsis at UNMH.

Evaluation and Action Plan

Data are collected through chart abstractions and reviewed by members of the SMITe. Results are presented monthly to the department of internal medicine and annually to the hospital leadership via the quality committee. This information also is available to unit directors on the project’s web page to share with staff. During the first 2 years after initiation of the SMITe initiative, 225 adult patients screened positive for sepsis; less than 112 deaths occurred, representing a 50% decrease in mortality.

Results and Limitations

Through the use of the protocol, and tools developed by the SMITe and staff educators, nurses are able to recognize patients with sepsis, order laboratory tests, and initiate treatment. Daily patient reports are held between the RRT and the unit director to support rapid bed placement and initiation of the sepsis protocol. This process led to early identification of patient deterioration and prompt management using appropriate skills. Nurses had a key role in identifying patients with sepsis or septic shock and providing appropriate treatment. Their knowledge about sepsis and nursing guidelines provided a format for systematic assessment and management.

Between March 2008 and April 2009, 225 patients screened positive for sepsis and 22 (10%) were transferred to a higher level of care as a result. Twenty-one patients were transferred from one of the medical-surgical units to the ICU or a sub-acute (SAC) unit where patients are monitored continuously (nurse-to-patient ratio 1:4). Only one patient was transferred from the second non-monitored medical-surgical unit to a SAC unit. This early intervention reduced the mortality of patients with sepsis by 30% through the fourth quarter of 2012 (see Figures 4 & 5). Over the last 4 years, the project has expanded to all adult inpatient units. The project has experienced tremendous success, and has exceeded its initial goals by reducing observed mortality by over 50%, with more than 400 of 700 patients treated successfully for sepsis.

Nursing Implications

Indirectly, this process has led to greater nurse satisfaction as reported in satisfaction scores which increased from 72% to 78% on the Hospital Consumer Assessment of Healthcare Providers and Systems survey based on staff ability to identify early signs and symptoms of patients sepsis. The sepsis protocol enables nurses to identify symptoms of sepsis, order necessary tests to substantiate a diagnosis of sepsis, and initiate the protocol. Early data, including serum lactate values and blood culture results, indicate time-oriented treatment can reduce mortality associated with sepsis. This
Continuous Quality Improvement

acceptance has helped expedite detection of patients at risk for sepsis, and enhanced early recognition and communication among health care team members.

Conclusion

Results of this project indicated nurses can make a significant contribution to patient care by identifying problems, reviewing the literature, and initiating evidence-based protocols. Other factors that contributed to the project’s success included the use of a highly functional interdisciplinary group, access to relevant literature, the presence of a strong clinical component, and the funding of the University of New Mexico Hospitals.

After completion of the pilot, the SMITE worked with other services in 2009-2013 to expand protocol use to all adult inpatient units and the emergency department. As a result of the sepsis protocol, all physicians and nurses receive the necessary education on the sepsis bundle.

With team support, they are able to recognize the symptoms of sepsis and initiate early and effective treatment.

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ADDITIONAL READINGS


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