Early Identification and Management of Sepsis in Nursing Facilities: Challenges and Opportunities

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In this issue of JAMDA, Sloane and collaborators share the results of a retrospective study among 236 patients in 31 nursing facilities (NFs) that examines signs and symptoms prior to a hospitalization related to sepsis.1 The authors compared the frequency of various clinical parameters among patients diagnosed with sepsis and those diagnosed with other conditions. They also compared the accuracy of 4 different tools and 2 different temperature thresholds to screen for sepsis.

This article is timely for a number of reasons. The human and financial costs of emergency department visits, hospital admissions, and readmissions from NFs are substantial, and a significant proportion of them are considered potentially avoidable.2-11 As the Centers for Medicare and Medicaid (CMS) continues to move toward value-based payment models, skilled NFs (SNFs) will be under increasing pressure to manage acute changes in condition without hospital transfer when it is clinically safe and feasible to do so.12,13 Infections that can lead to sepsis represent at least one-third of all readmissions from SNFs, and sepsis is the most common admitting diagnosis for patients transferred to the hospital from SNFs.13 The increasing incidence of sepsis, especially among older adults, its high mortality rate, and its often subtle and rapid progression make its prompt recognition and treatment imperative. To add to these challenges, new federal regulations require NFs to have an infection control practitioner and an antimicrobial stewardship program. Criteria and definitions for various infections common in NFs are available (see Table 1), but the identification and management of sepsis in NFs have not been well studied. Better strategies are needed for the early identification of sepsis, and for distinguishing between patients who should stay in the NF for treatment versus transfer to a higher level of care.

Over the last 3 decades, there have been several attempts to define sepsis and the best way to treat it. Although criteria have changed over the years, early identification and treatment have been consistently considered as beneficial.16-20 Criteria to identify sepsis have been based on changes in physiologic parameters as well as laboratory values. Screening tools such as the Systemic Inflammatory Response Syndrome (SIRS),20 the Logistic Organ Dysfunction System,21 and the Sequential [Sepsis-related] Organ Failure Assessment (SOFA)22 scores were developed in an effort to simplify screening for sepsis and identification of a patient’s mortality risk. One limitation of these scoring systems is the need for laboratory data to assess risk, thus limiting their rapid use at the bedside. A simplified version of the SOFA (the quick or “qSOFA”; Table 2)23 does not require laboratory data and it appears to identify high-risk patients with suspected sepsis, thus necessitating a thorough assessment for organ dysfunction.23 The heterogeneity and atypical nature of clinical presentations of infection in the NF population makes the diagnosis of sepsis even more challenging. Because of the atypical way that NF residents with dementia and/or multiple comorbidities present with acute illnesses, using qSOFA to identify SNF patients who need early management of sepsis could result in failure to identify sepsis and suboptimal treatment. On the other hand, the use of qSOFA could falsely identify patients as having sepsis by using physical examination findings that are due to other disease processes prevalent in the SNF population.

Strategies to identify early sepsis in the NF setting must account for the atypical presentations of illness that are common in this patient population. These include the following:

- **Mental status changes:** Many factors can affect mental status, including dementia, prior strokes, medication side effects, and dehydration among others.

- **Respiratory rate:** Tachypnea and other respiratory symptoms may be due to asthma and chronic cough, and/or chronic obstructive pulmonary disease, all of which are common in the NF population. Age-related physiologic changes also affect respiratory rate. As people get older, the alveoli lose their elasticity, the spine becomes more restricted, and muscles stiffen. This causes decreased tidal volume and the need to
Table 1
Examples of Criteria for Selected Infections in Skilled Nursing Facilities

|------------|---------------------------------------|--------------------------------------------------|-----------------------------------------------|
| Temperature/Fever | - Single oral temperature >37.8°C (100°F)  
- Repeated oral temperatures >37.2°C (99°F) or rectal temperatures >37.5°C (99.5°F)  
- Single temperature >1.1°C (2°F) over baseline from any site (oral, tympanic, axillary) | Suspected lower respiratory tract infection:  
≥100°F (38.9°C) (need to check respiratory rate and O₂ saturation)  
100°F (37.9°C) and <102°F (38.9°C) (need to check respiratory rate and pulse)  
Suspected urinary tract infection:  
With indwelling catheter: see McGeer criteria.  
Without indwelling catheter: single temperature of 100°F (37.8°C) | >100.5°F  
INTERACT Fever Care Path uses McGeer definition |
| Apical heart rate or pulse | N/A | | |
| Respiratory rate | Pneumonia and lower respiratory tract (bronchitis/tracheobronchitis) criteria:  
>25 breaths/min | Lower respiratory tract infection:  
≥25 breaths/min | >28/min or <10/min |
| Blood pressure | N/A | Urinary tract infection:  
With indwelling catheter. Hypotension (significant change from baseline BP or a systolic BP <90) | <90 or >200 systolic |
| Oxygen saturation | Pneumonia and lower respiratory tract (bronchitis/tracheobronchitis) criteria:  
O₂ saturation <94% on room air or a reduction in O₂ saturation of >3% from baseline | Lower respiratory tract infection:  
O₂ saturation <94% on room air or a reduction in O₂ saturation of >3% from baseline | <90% |

Lower Respiratory-Tract Infection

|---------------------------------------|--------------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Pneumonia (all 3 criteria must be present) | Criteria are met if 1 of the 4 situations are met:  
1. Resident with a fever of 100°F (38.9°C) or higher and 1 of the following:  
   a. Respiratory rate of >25 breaths/min  
   b. New or worsened cough  
   c. New or increased sputum Production  
   d. O₂ saturation <94% on room air or a reduction in O₂ saturation of >3% from baseline  
   e. New or changed lung examination abnormalities  
   f. Pleuritic chest pain  
   g. Respiration rate of ≥25 breaths/min.  
2. At least 1 of the “constitutional” criteria:  
   a. Fever  
   b. Acute mental status change  
   c. Acute functional decline  
   d. Neutrophilia (>14,000 leukocytes/mm³) or a left shift (>6% bands or ≥1500 bands/mm³)  
   e. New or increased sputum production  
   f. New or worsening shortness of breath  
   g. Chest pain with inspiration or coughing  
   h. New or increased findings on lung examination (rales, wheezes) | 1. Fever >38.9°C (100°F) and at least 1 of the following:  
   a. Respiratory rate >25  
   b. Productive cough  
2. Fever >37.9°C (100°F) or a 1.5°C (2.4°F) increase above baseline temperature, but ≤38.9°C (102°F) and cough and at least 1 of the following:  
   a. Pulse >100  
   b. Rigors  
   c. Delirium  
   d. Respiratory rate ≥25  
3. Afebrile resident with COPD and age ≥65 y and new or increased cough with purulent sputum production | Symptoms of lower respiratory tract infection  
- New or worsened cough  
- New or increased sputum production  
- New or worsening shortness of breath  
- Chest pain with inspiration or coughing  
- New or increased findings on lung examination (rales, wheezes) |
### Urinary Tract Infection

**Residents without an indwelling catheter:**

<table>
<thead>
<tr>
<th>Criteria are met if 1 of these are present:</th>
<th>Criteria are met if 1 of these are present:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Acute dysuria alone</td>
<td>1. Acute dysuria alone</td>
</tr>
<tr>
<td>2. Single temperature of 100°F (37.8°C) and at least 1 new or worsening of the following: urgency, suprapubic pain, frequency, gross hematuria, back or flank pain, urinary incontinence</td>
<td>2. Single temperature of 100°F (37.8°C) and at least 1 new or worsening of the following: urgency, suprapubic pain, frequency, gross hematuria, back or flank pain, urinary incontinence</td>
</tr>
<tr>
<td>3. No fever, but 2 or more of the signs above</td>
<td>3. No fever, but 2 or more of the signs above</td>
</tr>
</tbody>
</table>

**Residents with an indwelling catheter:**

<table>
<thead>
<tr>
<th>Sign or symptoms present:</th>
<th>Sign or symptoms present:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever, rigors, or new-onset hypotension, with no alternate site of infection</td>
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</tr>
<tr>
<td>Either acute change in mental status or acute functional decline, with no alternate diagnosis and leukocytosis</td>
<td>Either acute change in mental status or acute functional decline, with no alternate diagnosis and leukocytosis</td>
</tr>
<tr>
<td>New-onset suprapubic pain or costovertebral angle pain or tenderness</td>
<td>New-onset suprapubic pain or costovertebral angle pain or tenderness</td>
</tr>
<tr>
<td>Purulent discharge from around the catheter or acute pain, swelling, or tenderness</td>
<td>Purulent discharge from around the catheter or acute pain, swelling, or tenderness</td>
</tr>
</tbody>
</table>

**Resident with an indwelling catheter:**

<table>
<thead>
<tr>
<th>The criteria are met to initiate antibiotics if 1 of the below is met:</th>
<th>The criteria are met to initiate antibiotics if 1 of the below is met:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fever of 100°F (37.8°C) or repeated temperatures of 99°F (37°C)</td>
<td>1. Fever of 100°F (37.8°C) or repeated temperatures of 99°F (37°C)</td>
</tr>
<tr>
<td>2. New back or flank pain</td>
<td>2. New back or flank pain</td>
</tr>
<tr>
<td>4. New dramatic change in mental status</td>
<td>4. New dramatic change in mental status</td>
</tr>
<tr>
<td>5. Hypotension (significant change from baseline BP or systolic BP &lt;90)</td>
<td>5. Hypotension (significant change from baseline BP or systolic BP &lt;90)</td>
</tr>
</tbody>
</table>

**Resident without an indwelling catheter:**

<table>
<thead>
<tr>
<th>Symptoms and signs for immediate notification:</th>
<th>Symptoms and signs for immediate notification:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cough with or without sputum production</td>
<td>• Cough with or without sputum production</td>
</tr>
<tr>
<td>• Abnormal lung sounds</td>
<td>• Abnormal lung sounds</td>
</tr>
<tr>
<td>• Edema</td>
<td>• Edema</td>
</tr>
<tr>
<td>• Change in mental status</td>
<td>• Change in mental status</td>
</tr>
<tr>
<td>Laboratory results for notification:</td>
<td>Laboratory results for notification:</td>
</tr>
<tr>
<td>• Critical values in blood count or metabolic panel</td>
<td>• Critical values in blood count or metabolic panel</td>
</tr>
<tr>
<td>• WBC &gt;14,000 or neutrophils &gt;90%</td>
<td>• WBC &gt;14,000 or neutrophils &gt;90%</td>
</tr>
<tr>
<td>Urinary or pneumonia on chest radiograph</td>
<td>Urinary or pneumonia on chest radiograph</td>
</tr>
</tbody>
</table>

(continued on next page)
### Gastrointestinal Tract Infection

**McGeer Criteria 2012 for Surveillance**

**INTERACT 4.0 CARE PATH Gastrointestinal Symptoms**

<table>
<thead>
<tr>
<th>Definition of diarrhea substitutes “liquid or watery stools” for “loose or watery stools.” Additionally, the definition of diarrhea as “3 or more stools above what is normal for a resident in a 24-hour period” was standardized across GI infections to simplify surveillance activity.</th>
</tr>
</thead>
</table>

**Definition of vomiting:** 2 or more episodes in a 24-h period

**Gastroenteritis (at least 1 of the following criteria must be present)**

1. **Diarrhea**
2. **Vomiting**
3. Both of the following signs or symptoms subcriteria:
   b. At least 1 of the following GI subcriteria
      i. Nausea
      ii. Vomiting
      iii. Abdominal pain or tenderness
      iv. Diarrhea

**Norovirus gastroenteritis (both criteria 1 and 2 must be present):**

1. At least 1 of the following GI subcriteria:
   a. Diarrhea
   b. Vomiting
2. A stool specimen for which norovirus is positively detected by electron microscopy, enzyme immunoassay, or molecular diagnostic testing such as polymerase chain reaction (PCR).

[Note: The Kaplan Criteria, which have been useful in identifying outbreaks of acute gastroenteritis due to norovirus. In the absence of laboratory confirmation (“Kaplan Criteria”): (a) vomiting in more than half of affected persons; (b) a mean (or median) incubation period of 24-48 h; (c) a mean (or median) duration of illness of 12-60 h; and (d) no bacterial pathogen is identified in stool culture.]

**Clostridium difficile infection (both criteria 1 and 2 must be present):**

1. One of the following GI subcriteria:
   a. Diarrhea:
   b. Presence of toxic megacolon (abnormal dilatation of the large bowel, documented radiologically)
2. One of the following diagnostic subcriteria:
   a. A stool sample yields a positive laboratory test result for *C. difficile* toxin A or B, or a toxin-producing *C. difficile* organism is identified from a stool sample culture or by a molecular diagnostic test such as PCR.
   b. Pseudomembranous colitis is identified during endoscopic examination or surgery or in histopathologic examination of a biopsy specimen.

**Note**

“Primary episode” of *C. difficile* infection is defined as one that has occurred without any previous history of *C. difficile* infection or that has occurred >8 wk after the onset of a previous episode of *C. difficile* infection. “Recurrent episode” of *C. difficile* infection is defined as an episode of *C. difficile* infection that occurs 8 wk or sooner after the onset of a previous episode, provided that the symptoms from the earlier (previous) episode have resolved. Individuals previously infected with *C. difficile* may continue to remain colonized even after symptoms resolve.

**AHRQ, Agency for Healthcare Research and Quality; BP, blood pressure; CFU, colony-forming unit; COPD, chronic obstructive pulmonary disease; GI, gastrointestinal; INTERACT, Interventions to Reduce Acute Care Transfers; PVR, postvoid residual; UTI, urinary tract infection; WBCs, white blood cells.**
Table 2
Examples of Screening Tools for Sepsis

<table>
<thead>
<tr>
<th>qSOFA Criteria</th>
<th>Specifity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate &gt;2 breaths/min = 1 point</td>
<td>99.0</td>
</tr>
<tr>
<td>Altered mentation = 1 point</td>
<td>100.2</td>
</tr>
<tr>
<td>Systolic blood pressure &lt;100 mmHg = 1 point</td>
<td>100</td>
</tr>
</tbody>
</table>

“100/100/100” Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Specifity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature above 100</td>
<td>100</td>
</tr>
<tr>
<td>Heart rate above 100</td>
<td>100</td>
</tr>
<tr>
<td>Blood pressure below 100</td>
<td>100</td>
</tr>
</tbody>
</table>

qSOFA, quick Sepsis Related Organ Failure Assessment.

increase basal respiratory rate to maintain ventilatory volumes. On the other hand, older adults have a decreased sensation of dyspnea and diminished ventilator response to hypoxia, making them less likely to respond to high-demand states such as sepsis.25–27

- **Hypotension**: NF patients are commonly treated with cardiovascular drugs for hypertension, heart failure, and other conditions when combined with poor oral intake and the potential for volume depletion, age-related changes in baroreceptor reflexes, and psychotropic medications, these drugs can precipitate hypotension in the absence of an infection and early sepsis.

- **Tachycardia**: NF patients may not exhibit tachycardia because of cardiac conduction system disease and/or the use of beta-blockers.

- **Fever**: NF patients with bacterial infections may present without fever and may also have lower baseline temperatures than younger adults. Thus, different criteria for fever are recommended in this population.28

There are a limited number of studies on early sepsis recognition outside the hospital setting, particularly in NFs, that can provide guidance to post-acute and long-term care clinicians working in the NF setting. The Sepsis Early Recognition and Response Initiative (SERRI) was established at the Houston Methodist Hospital System and affiliated post-acute facilities where nurses acted as first responders and completed a screening using the SIRS criteria in less than a minute after varying intervals of time. If the patient received a score equal or greater to 4, further workup was warranted.29 The most valuable lesson from this initiative was the reinforcement of how critical the nursing staff is in order to build a team working on early sepsis screening and identification. Algorithms for the management of sepsis in SNFs are currently available, but they are not consistent with each other, and they have not been validated.24,30 The Minnesota Hospital Association has developed tools for sepsis in long-term care and recommends the “100/100/100 Rule” in evaluating patients with possible sepsis (Table 2).30 Although this is useful because of its simplicity, it must be interpreted with the above-described atypical presentations in mind.

The article by Sloane and colleagues is a very helpful start in developing the evidence-based underpinnings for identifying early sepsis in the NF population.1 They found that among the 236 records of patients hospitalized from the NF, vital signs were missing in up to 34%. Although vital signs do not tell the whole story and may be deceiving in this population, they should be the initial component of any assessment of an NF patient because significant hypotension, tachycardia, tachypnea, and hypoxia would indicate an emergent need to transfer the patient to the hospital. The findings highlight the importance of vital signs, as the 100/100/100 criteria had the highest sensitivity (79%) when measured less than 12 hours before hospitalization for identifying patients with a hospital diagnosis of sepsis. Other tools had a much lower sensitivity, including the SIRS (36%) and the qSOFA (27%), as did a temperature of >99.0°F (51%) and >100.2°F (40%). The SIRS and the qSOFA had a higher specificity (86% and 88% respectively) than the 100/100/100 criteria (69%); a temperature of >100.2°F had the highest specificity (93%). We agree with the authors that, in contrast to the hospital setting, the sensitivity of tools and criteria to identify sepsis are more important than the specificity, as clinicians would want to minimize the risk of missing a patient who is likely to develop sepsis within 12 hours. On the other hand, there are also risks to tools that have low specificity, because false positives would result in potentially unnecessary hospitalizations and the associated discomforts, complications, and costs.

Larger studies are needed to build on the work of Sloane and colleagues in order to validate and optimize the accuracy of screening criteria for signs and symptoms of infections that can lead to sepsis in the NF population. Until such studies are done, what can NF staff and clinicians do to reduce the morbidity and mortality associated with sepsis, and at the same time not increase unnecessary emergency department visits, hospitalizations, and hospital readmissions? INTERACT (Interventions to Reduce Acute Care Transfers) is a quality improvement program that focuses on the management of acute changes in condition among older adults in NF and other long-term care settings. The program includes a set of tools that are based on evidence, expert opinion, clinical practice guidelines (where applicable), strategies to implement the tools, and related resources.31 Effective implementation of INTERACT has been associated with substantial reductions in all-cause and potentially avoidable hospitalizations.17,32,33 The INTERACT program is free for clinical use and can be downloaded at www.interact-pathway.com. Criteria relevant to the early identification of sepsis are embedded in the INTERACT Care Paths that address 10 of the most common reasons for transfer of SNF patients to hospitals. Any 1 of these 10 conditions could be the manifestation of early sepsis. In addition to definitions of infection in NFs (Table 1),15,16,34 guidance on the management of possible sepsis in the NF setting has been posted on the INTERACT website (Figure 1) in response to several requests from NF staff and clinicians. The guidance includes the following key points:

1. Because symptoms and signs are nonspecific in older patients, especially those with multiple comorbidities and/or cognitive impairment, virtually any acute change in condition could represent possible sepsis due to an infection.

2. The INTERACT team recommends that all patients/residents with a suspected or confirmed infection and possible sepsis be considered for transfer to an acute care hospital, unless a. the patient/resident has a “do not hospitalize” order, is on or placed on a comfort or palliative care plan, or is on hospice; or b. the patient/resident or decision maker wants the condition treated, but not in the acute hospital, and understands the risks of not being treated in the hospital; and the facility has the capability of managing sepsis according to recommended interventions.

Although some NFs may have enough well-trained registered nurses, on-site availability of physicians, nurse practitioners, and physician assistants on a daily basis; rapid availability of laboratory, imaging, and pharmacy services; and the capability to initiate and maintain intravenous fluids, administer parenteral medications, and monitor patients on an every-2- to 4-hour basis, the vast majority of NFs do not have all of these capabilities necessary to manage severe infections and possible sepsis. Current recommendations for the management of sepsis are illustrated in Table 3.

3. If sepsis is being considered and the patient/resident is not being immediately transferred to the acute hospital, the following lab tests should be added to routine blood work recommended to evaluate acute changes in condition: a. blood cultures (2 sets); b. lactate level; c. platelet count;
d. coagulation tests (INR or PTT); and
e. comprehensive metabolic panel.

In addition, serum procalcitonin may be useful in evaluating the need for antibiotics in patients with suspected respiratory infections.35

4. Principles of antimicrobial stewardship should be adhered to when antibiotics are prescribed.36–41

Figure 1 illustrates the approach to identifying possible sepsis using INTERACT tools, including the “STOP and WATCH” early warning tool, the nursing change in condition evaluation (SBAR Communication Form and Progress Note), and the INTERACT Care Paths. If the patient meets criteria for an infection, and is suspected of having possible sepsis by the 100/100/100 or other clinical criteria, they should be transferred to an acute hospital unless they fit the criteria noted in the Figure.

The STOP and WATCH is a set of nonspecific criteria that reflect early changes in condition that are associated with early stages of acute illness in language that can be easily understood by direct care NF staff as well as family members. Potentially, the use of tools such as STOP and WATCH will have high sensitivity to identify patients with sepsis and, based on the study by Sloane and colleagues, might be made more sensitive by combining with the 100/100/100 criteria, and more specific by combining with SIRS and/or qSOFA criteria. By building further criteria onto the use of tools such as the STOP and WATCH and the INTERACT Care Paths, a new approach for early identification of sepsis can be developed. With the implementation of

Fig. 1. Management of possible sepsis using INTERACT tools. *Refer to INTERACT Guidance on Infections (Table 1).
Electronic Health Records (EHR) in NFs, it is possible to collect large amounts of clinical data related to the events preceding the development of sepsis in SNF patients. Analyses of such data may provide more sensitive and specific strategies to identify infections that may progress to sepsis in this population and lead to earlier and more effective management of this common, morbid, and expensive condition.

References