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. 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. 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. 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. The incidence of sepsis, especially among older adults, its high mortality rate, and its often subtle and rapid progression make its prompt identification and management critical.

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. 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), the Logistic Organ Dysfunction System, and the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) 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) does not require laboratory data and it appears to identify high-risk patients with suspected sepsis, thus necessitating a thorough assessment for organ dysfunction. 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 NF 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

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<thead>
<tr>
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<tr>
<td><strong>Temperature/Fever</strong></td>
<td>• Single oral temperature &gt;37.8°C (100°F) &lt;br&gt; • Repeated oral temperatures &gt;37.2°C (99°F) or rectal temperatures &gt;37.5°C (99.5°F) &lt;br&gt; • Single temperature &gt;1.1°C (2°F) over baseline from any site (oral, tympanic, axillary)</td>
<td>Suspected lower respiratory tract infection: ≥102°F (38.9°C) and ≤101°F (38.3°C) (need to check respiratory rate and pulse) &lt;br&gt; Suspected urinary tract infection: With indwelling catheter: see McGeer criteria. Without indwelling catheter: single temperature of 100°F (37.8°C)</td>
<td>&gt;100°F &lt;br&gt; INTERACT Fever Care Path uses McGeer definition</td>
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<tr>
<td><strong>Apical heart rate or pulse</strong></td>
<td>N/A</td>
<td>Suspected lower respiratory infection: Pulse &gt;100</td>
<td>&gt;100 or &lt;50</td>
</tr>
<tr>
<td><strong>Respiratory rate</strong></td>
<td>Pneumonia and lower respiratory tract (bronchitis/tracheobronchitis) criteria: ≥25 breaths/min</td>
<td>Lower respiratory tract infection: ≥25 breaths/min</td>
<td>&gt;28/min or &lt;10/min</td>
</tr>
<tr>
<td><strong>Blood pressure</strong></td>
<td>N/A</td>
<td>Urinary tract infection: With indwelling catheter. Hypotension (significant change from baseline BP or a systolic BP &lt;90)</td>
<td>&lt;90 or &gt;200 systolic</td>
</tr>
<tr>
<td><strong>Oxygen saturation</strong></td>
<td>Pneumonia and lower respiratory tract (bronchitis/tracheobronchitis) criteria: O2 saturation &lt;94% on room air or a reduction in O2 saturation of &gt;3% from baseline</td>
<td>Lower respiratory tract infection: O2 saturation &lt;94% on room air or a reduction in O2 saturation of &gt;3% from baseline</td>
<td>&lt;90%</td>
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### Lower Respiratory-TRACT Infection

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<tr>
<td>Pneumonia (all 3 criteria must be present)</td>
<td>Criteria are met if 1 of the 4 situations are met: 1. Resident with a fever of 102°F (38.9°C) or higher and 1 of the following: &lt;br&gt; a. Respiratory rate of ≥25 breaths/min &lt;br&gt; b. New or worsened cough &lt;br&gt; c. Neutrophilia (&gt;14,000 leukocytes/mm³) or a left shift (&gt;6% bands or ≥1500 bands/mm³) &lt;br&gt; 2. At least 1 of the following: &lt;br&gt; a. New or increased sputum production &lt;br&gt; b. New or worsened cough &lt;br&gt; c. Neutrophilia (&gt;14,000 leukocytes/mm³) or a left shift (&gt;6% bands or ≥1500 bands/mm³) &lt;br&gt; d. New or changed lung examination abnormalities &lt;br&gt; e. Pleuritic chest pain &lt;br&gt; f. Respiratory rate of ≥25 breaths/min. &lt;br&gt; 3. At least 1 of the “constitutional” criteria: &lt;br&gt; a. Fever &lt;br&gt; b. Acute mental status change &lt;br&gt; c. Acute functional decline &lt;br&gt; d. Neutrophilia (&gt;14,000 leukocytes/mm³) or a left shift (&gt;6% bands or ≥1500 bands/mm³)</td>
<td>1. Fever &gt;38.9°C (102°F) and at least 1 of the following: &lt;br&gt; a. Respiratory rate &gt;25 &lt;br&gt; b. Productive cough &lt;br&gt; 2. Fever &gt;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: &lt;br&gt; a. Pulse &gt;100 &lt;br&gt; b. Rigors &lt;br&gt; c. Delirium &lt;br&gt; d. Respiratory rate &gt;25 &lt;br&gt; 3. Afebrile resident with COPD and age &gt;65 y and new or increased cough with purulent sputum production</td>
<td>Symptoms of lower respiratory tract infection &lt;br&gt; • New or worsened cough &lt;br&gt; • New or increased sputum production &lt;br&gt; • New or worsening shortness of breath &lt;br&gt; • Chest pain with inspiration or coughing &lt;br&gt; New or increased findings on lung examination (rales, wheezes)</td>
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</table>
6. Afebrile resident without COPD and new cough with purulent sputum production and at least 1 of the following:
   a. Respiratory rate >25 breaths/min
   b. Delirium

7. New infiltrate on chest radiograph thought to represent pneumonia and at least 1 of the following:
   a. Fever >37.8°C (100°F) or a 1.5°C (2.4°F) increase above baseline temperature
   b. Respiratory rate >25 breaths/min
   c. Productive cough

Symptoms and signs for immediate notification:
- Cough with or without sputum production
- Abnormal lung sounds
- Edema
- Change in mental status

Laboratory results for notification:
- Critical values in blood count or metabolic panel
- WBC >14,000 or neutrophils >90%

Infiltrate or pneumonia on chest radiograph

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**Urinary Tract Infection**

<table>
<thead>
<tr>
<th>Residents without an indwelling catheter:</th>
<th>Resident without an indwelling catheter</th>
<th>Resident with an indwelling catheter</th>
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</thead>
<tbody>
<tr>
<td>One of the signs or symptom subcriteria and 1 of the microbiologic subcriteria must be present:</td>
<td>Criteria are met if 1 of these are present:</td>
<td>The criteria are met to initiate antibiotics if 1 of the below is met:</td>
</tr>
<tr>
<td>Signs or symptoms subcriteria include:</td>
<td>1. Acute dysuria alone</td>
<td>1. Fever of 100°F (37.8°C) or repeated temperatures of 99°F (37°C)</td>
</tr>
<tr>
<td>1. Acute dysuria or acute pain, swelling or tenderness of the testes, epididymis, or prostate</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>
<td>2. New back or flank pain</td>
</tr>
<tr>
<td>2. If fever or leukocytosis are present, 1 of the signs or symptoms localizing subcriteria must be present: Acute costovertebral angle pain or tenderness, suprapubic pain gross hematuria, new or marked increase in incontinence, new or marked increase in urgency, or new or marked increase in frequency</td>
<td>3. No fever, but 2 or more of the signs above</td>
<td>4. New dramatic change in mental status</td>
</tr>
<tr>
<td>Microbiologic subcriteria include:</td>
<td>1. At least 10⁵ CFU/mL of no more than 2 species of microorganisms in a voided urine sample</td>
<td>5. Hypotension (significant change from baseline BP or a systolic BP &lt;90)</td>
</tr>
</tbody>
</table>
| 1. At least 10⁵ CFU/mL of no more than 2 species of microorganisms in a voided urine sample | 2. At least 10⁵ CFU/mL of any number of organisms in a specimen collected by in-and-out catheter | Note: Foul-smelling or cloudy urine is not a valid indication for initiating antibiotics

Asymptomatic bacteriuria should not be treated with antibiotics

In residents without an indwelling catheter:
- Symptoms or signs of UTI
- Painful urination (dysuria)
- Lower abdominal (suprapubic) pain or tenderness
- Blood in urine
- New or worsening urinary urgency, frequency, incontinence

Symptoms and signs for immediate notification:
- Abdominal distension
- New or worsened incontinence
- Suprapubic tenderness
- Pain/tenderness in testes suggesting epididymitis
- Gross blood in urine
- Not eating or drinking

Laboratory results for notification:
- Critical values in blood count or metabolic panel
- WBCs >14,000 or neutrophils >90%
- PVR >350 mL
- Urine results suggest infection and symptoms or signs present

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(continued on next page)
**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.**

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

1. **Diarrhea**
2. **Vomiting**
3. Both of the following signs or symptoms subcriteria:
   a. A stool specimen testing positive for a pathogen (e.g., *Salmonella* spp, *Shigella* spp, *Escherichia coli* O157:H7, *Campylobacter* species, rotavirus)
   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.
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.

**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.

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. 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.

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 3). 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. 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.

Effective implementation of INTERACT has been associated with substantial reductions in all-cause and potentially avoidable hospitalizations. 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), 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;

   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
Electronic Health Records (EHRs) 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


### Table 3

**Recommendations for Management of Sepsis**

1. At least 30 mL/kg of IV crystalloid fluid should be given within the first 3 h.
2. Additional fluid administration should be guided by frequent reassessment of hemodynamic status.
3. Mean arterial pressure (MAP) and serum lactate are considered adequate indicators of tissue perfusion. These values should be maintained at MAP >65 mmHg and lactate <2 mmol/L (<18 mg/dL).
4. To estimate MAP, double the diastolic blood pressure and add the sum to the systolic blood pressure. Then divide by 3.
5. Appropriate routine microbiologic cultures (including blood) should be obtained before starting antimicrobial therapy in patients with suspected sepsis.
6. Administration of IV antimicrobials should be initiated as soon as possible, within 1 h after recognition of sepsis.
7. Goals of care and prognosis should be discussed with patients and families.
8. Goals of care should be incorporated into treatment and end-of-life care planning, using palliative care principles where appropriate.