JAMDA 19 (2018) 465–471

JAMDA

journal homepage: www.jamda.com

Editorial

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

Bernardo J. Reyes MD, Joseph Chang MD, Lena Vaynberg MD, Sanya Diaz NP, Joseph G. Ouslander MD *

Department of Integrated Medical Sciences, Charles E. Schmidt College of Medicine, Florida Atlantic University, Boca Raton, FL

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.[5,13] 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.[18–20] 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.[22] 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

Dr Ouslander is a full-time employee of Florida Atlantic University (FAU) and has received support through FAU for research on INTERACT from the National Institutes of Health, the Centers for Medicare & Medicaid Services, The Commonwealth Fund, the Retirement Research Foundation, the Florida Medical Malpractice Joint Underwriting Association, PointClickCare, Medline Industries, and Think Research. Dr Ouslander and his wife had ownership interest in INTERACT Training, Education, and Management ("I TEAM") Strategies, LLC, which had a license agreement with FAU for use of INTERACT materials and trademark for training during the time of the study, and now receive royalties from Pathway Health, which currently holds the license. Dr Ouslander serves as a paid advisor to Pathway Health, Think Research, and Curavi. Work on funded INTERACT research is subject to the terms of Conflict of Interest Management plans developed and approved by the FAU Financial Conflict of Interest Committee.

Drs Reyes and Diaz receive support from a research agreement with PointClickCare and the Florida Medical Malpractice Joint Underwriting Association.

* Address correspondence to Joseph G. Ouslander, MD, Department of Integrated Medical Sciences, Charles E. Schmidt College of Medicine, Florida Atlantic University, 777 Glades Rd, Boca Raton, FL 33431 6414.

E-mail address: jousland@fau.edu (J.G. Ouslander).

https://doi.org/10.1016/j.jamda.2018.04.004

Table 1
Examples of Criteria for Selected Infections in Skilled Nursing Facilities

Vital Sign Criteria For Infection

Vital Sign	McGeer Criteria 2012 for Surveillance[14]	AHRQ Minimum Criteria for Common Infections Toolkit[15]	INTERACT 4.0 Criteria for Clinician Notification[17]
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: ≥102°F (38.9°C) (need to check respiratory rate and O_2 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	Suspected lower respiratory infection: Pulse >100	>100 or <50
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 or tracheobronchitis) criteria: O_2 saturation <94% on room air or a reduction in O_2 saturation of >3% from baseline	Lower respiratory tract infection: O_2 saturation <94% on room air or a reduction in O_2 saturation of >3% from baseline	<90%

Lower Respiratory-Tract Infection

McGeer Criteria 2012 for Surveillance	AHRQ Minimum Criteria for Common Infections Toolkit	Loeb Criteria Minimum Criteria for Initiation of Antibiotics in Long-term Care Residents[16]	INTERACT 4.0 CARE PATH Symptoms of Lower Respiratory Tract Infection
Pneumonia (all 3 criteria must be present) 1. Interpretation of a chest radiograph as demonstrating pneumonia or the presence of a new infiltrate 2. At least 1 of the following: a. New or increased cough b. New or increased sputum production c. O_2 saturation <94% on room air or a reduction in O_2 saturation of >3% from baseline d. New or changed lung examination abnormalities e. Pleuritic chest pain f. Respiratory rate of ≥25 breaths/min. 3. At least 1 of the "constitutional" criteria: a. Fever b. Acute mental status change c. Acute functional decline d. Neutrophilia (>14,000 leukocytes/mm^3) or a left shift (>6% bands or ≥1500 bands/mm^3)	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: a. Respiratory rate of >25 breaths/min b. New or worsened cough c. New or increased sputum Production d. O_2 saturation <94% on room air or a reduction in O_2 saturation of >3% from baseline 2. Resident with a *fever* of 100°F (37.8°C) and less than 102°F (38.9°C); *cough* and at least 1 of the following: a. Pulse >100 b. Delirium c. Rigors (shaking chills) d. Respiratory rate >25 breaths/min	1. Fever >38.9°C (102°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)

Bronchitis or tracheobronchitis (all 3 criteria must be present): 1. Chest radiograph not performed or negative results for pneumonia or new infiltrate 2. At least 2 of the respiratory subcriteria (a–f) listed above 3. At least 1 of the "constitutional" criteria above	3. Afebrile resident with COPD and age >65 y and new or increased cough with purulent sputum production 4. Afebrile resident without COPD and age >65 y and new or increased cough with purulent sputum production and at least 1 of the following: a. Respiratory rate >25 breaths/min b. Delirium (sudden onset of confusion, disorientation, dramatic change in mental status)	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
Urinary Tract Infection			
Residents *without* an indwelling catheter: One of the signs or symptom subcriteria and 1 of the microbiologic subcriteria must be present: Signs or symptoms subcriteria include: 1. Acute dysuria or acute pain, swelling or tenderness of the testes, epididymis, or prostate 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	Resident *without* an indwelling catheter Criteria are met if 1 of these are present: 1. Acute dysuria alone 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 3. No fever, but 2 or more of the signs above	Resident *without* an indwelling catheter • Acute dysuria or • Fever [>37.8°C (100°F) or a 1.5°C (2.4°F) increase above baseline temperature] *and* at least 1 of the following: New or worsening: Urgency Frequency Suprapubic pain Gross hematuria Costovertebral angle tenderness Urinary incontinence	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
3. In the absence of fever or leukocytosis, 2 or more of the signs or symptoms localizing subcriteria in item 2 must be present Microbiologic subcriteria include: 1. At least 10^5 CFU/mL of no more than 2 species of microorganisms in a voided urine sample 2. At least 10^2 CFU/mL of any number of organisms in a specimen collected by in-and-out catheter Residents *with* an indwelling catheter: At least 1 of the following sign or symptoms and urinary catheter specimen culture with at least 10^5 cfu/mL of any organism(s) • Fever, rigors, or new-onset hypotension, with no alternate site of infection • Either acute change in mental status or acute functional decline, with no alternate diagnosis and leukocytosis • New-onset suprapubic pain or costovertebral angle pain or tenderness • Purulent discharge from around the catheter or acute pain, swelling, or tenderness	Resident *with* an indwelling catheter The criteria are met to initiate antibiotics if 1 of the below is met: 1. Fever of 100°F (37.8°C) or repeated temperatures of 99°F (37°C) 2. New back or flank pain 3. Rigors/shaking chills 4. New dramatic change in mental status 5. Hypotension (significant change from baseline BP or a systolic BP <90)	Resident *with* an indwelling catheter At least 1 of the following: • Fever [>37.8°C (100°F) or a 1.5°C (2.4°F) increase above baseline temperature] • New costovertebral tenderness • Rigors • New onset of delirium Note: Foul-smelling or cloudy urine is not a valid indication for initiating antibiotics Asymptomatic bacteriuria should not be treated with antibiotics	

(*continued on next page*)

Gastrointestinal Tract Infection	
McGeer Criteria 2012 for Surveillance	INTERACT 4.0 CARE PATH Gastrointestinal Symptoms
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. 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: a. A stool specimen testing positive for a pathogen (eg, *Salmonella* sp, *Shigella* sp, *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.]	New or worsening GI symptoms or signs • Nausea and/or vomiting • Diarrhea (3 or more loose or liquid bowel movements per day) • Constipation (no bowel movement in 3 d) • Abdominal pain • Distended abdomen Symptoms and signs for immediate notification • Abdominal tenderness or distention • Absent or hyperactive bowel sounds • Jaundice • Blood in stool or vomitus • Recurrent diarrhea after treatment for *Clostridium difficile* • Other residents with similar symptoms suggesting outbreak of a GI virus • Recent initiation or adjustment of enteral tube feeding (diarrhea) • Recent initiation or adjustment of narcotic medication (constipation) Laboratory results for notification • Results of abdominal radiograph/ultrasound suggests ileus, obstruction, mass, or perforation • Critical values in blood work • Stool analysis suggests infection
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

qSOFA Criteria[23]
• Respiratory rate ≥22 breaths/min = 1 point
• Altered mentation = 1 point
• Systolic blood pressure ≤100 mmHg = 1 point
"100/100/100" Criteria[24]
• Temperature *above* 100
• Heart rate *above* 100
• Blood pressure *below* 100

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;

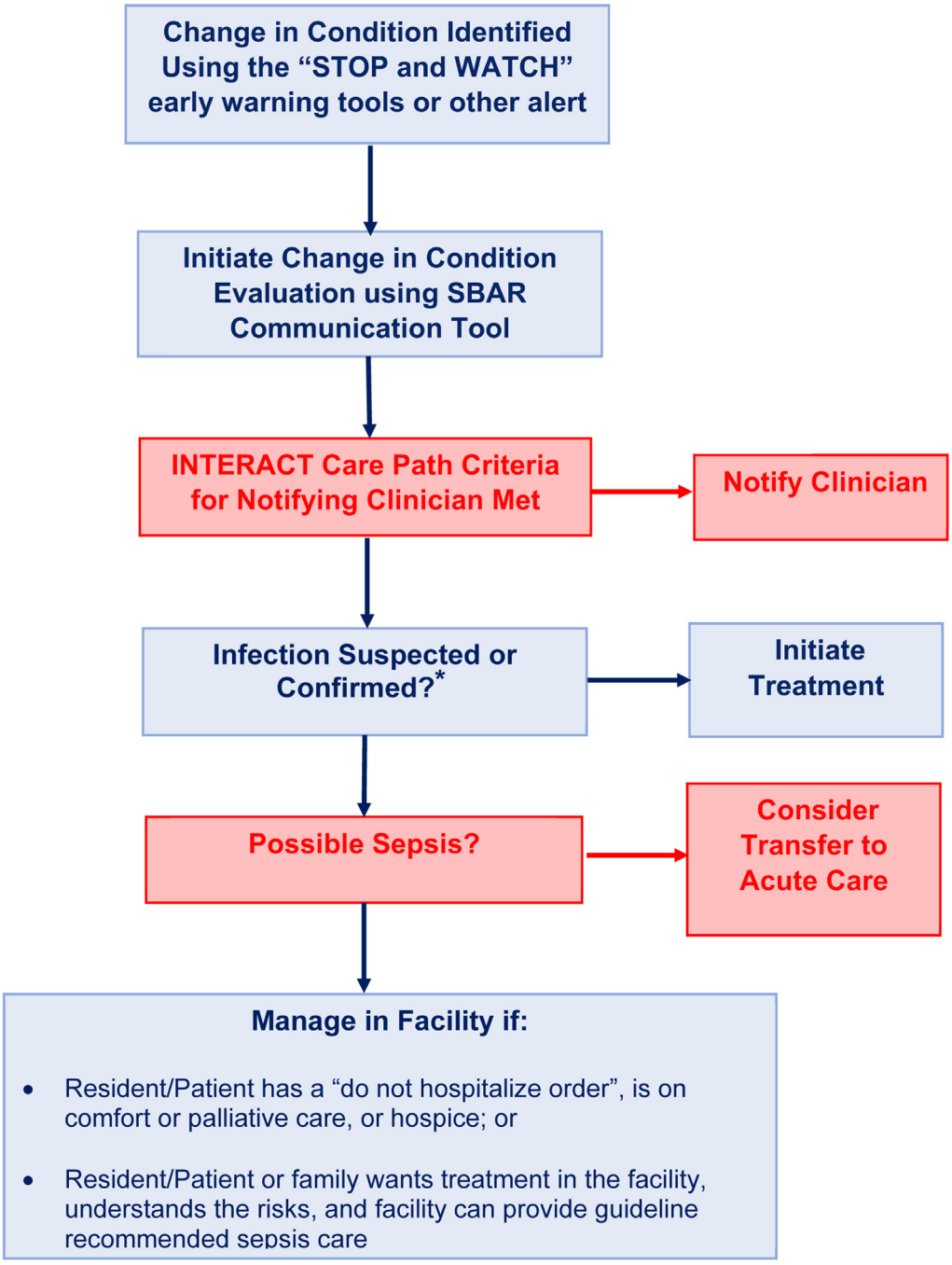

Fig. 1. Management of possible sepsis using INTERACT tools. *Refer to INTERACT Guidance on Infections (Table 1).

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

Table 3
Recommendations for Management of Sepsis[20]

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

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

1. Sloane PD, Ward K, Weber DJ, et al. Can sepsis be detected in the nursing home prior to the need for hospital transfer? J Am Med Dir Assoc 2018;19:492–496.
2. Ouslander JG, Berenson RA. Reducing unnecessary hospitalizations of nursing home residents. N Engl J Med 2011;365:1165–1167.
3. Saliba D, Kington R, Buchanan J, et al. Appropriateness of the decision to transfer nursing facility residents to hospital. J Am Geriatr Soc 2000;48:154–163.
4. Mor V, Intrator O, Feng Z, Grabowski DC. The revolving door of rehospitalization from skilled nursing facilities. Health Aff 2010;29:57–64.
5. Ouslander JG, Lamb G, Perloe M, et al. Potentially avoidable hospitalizations of nursing home residents: Frequency, causes, and costs: [see editorial comments by Drs. Jean F. Wyman and William R. Hazzard, pp 760–761]. J Am Geriatr Soc 2010;58:627–635.
6. Grabowski DC, O'Malley AJ, Barhydt NR. The costs and potential savings associated with nursing home hospitalizations. Health Aff 2007;26:1753–1761.
7. Walsh EG, Wiener JM, Haber S, et al. Potentially avoidable hospitalizations of dually eligible Medicare/Medicaid beneficiaries from nursing facility and home and community-based services waiver programs. J Am Geriatr Soc 2012;60:821–829.
8. Spector WD, Limcangco R, Williams C, et al. Potentially avoidable hospitalizations for elderly long-stay residents of nursing homes. Med Care 2013;51:673–681.
9. Ouslander J, Maslow K. Geriatrics and the triple aim: Defining preventable hospitalizations in the long term care population. J Am Geriatr Soc 2012;60:2313–2318.
10. Burke R, Rooks S, Levy C, et al. Identifying potentially preventable emergency department visits by nursing home residents in the United States. J Am Med Dir Assoc 2015;16:395–399.
11. Vasilevskis EE, Ouslander JG, Mixon AS, et al. Potentially avoidable readmissions of patients discharged to post-acute care: Perspectives of hospital and skilled nursing facility staff. J Am Geriatr Soc 2017;65:269–276.
12. McWilliams JM, Gilstrap LG, Stevenson DG, et al. Changes in postacute care in the Medicare Shared Savings Program. JAMA Intern Med 2017;177:518–526.
13. Carnahan JL, Unroe KT, Torke AM. Hospital readmission penalties: Coming soon to a nursing home near you! J Am Geriatr Soc 2016;64:614–618.
14. Stone ND, Ashraf MS, Calder J, et al. Surveillance definitions of infections in long-term care facilities: Revisiting the McGeer criteria. Infect Control Hosp Epidemiol 2012;33:965–977.
15. Toolkit 3. Minimum Criteria for Common Infections Toolkit. Rockville, MD: Agency for Healthcare Research and Quality. Available at: http://www.ahrq.gov/nhguide/toolkits/determine-whether-to-treat/toolkit3-minimum-criteria.html. Accessed December 24, 2017.
16. Loeb M, Bentley DW, Bradley S, et al. Development of minimum criteria for the initiation of antibiotics in residents of long-term–care facilities: Results of a consensus conference. Infect Control Hosp Epidemiol 2001;22:120–124.
17. Ouslander JG, Lamb G, Tappen R, et al. Interventions to reduce hospitalizations from nursing homes: Evaluation of the INTERACT II Collaborative Quality Improvement Project. J Am Geriatr Soc 2011;59:745–753.
18. Seymour CW, Liu VX, Iwashyna TJ, et al. Assessment of clinical criteria for sepsis for the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016;315:762–774.
19. Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016;315:801–810.
20. Rhodes A, Evans LE, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock: 2016. Intensive Care Med 2017;43:304–377.
21. Le Gall JR, Klar J, Lemeshow S, et al. The logistic organ dysfunction system. A new way to assess organ dysfunction in the intensive care unit. ICU scoring group. JAMA 1996;276:802–810.
22. Freund Y, Lemachatti N, Krastinova E, et al. Prognostic accuracy of sepsis-3 criteria for in-hospital mortality among patients with suspected infection presenting to the emergency department. JAMA 2017;317:301–308.
23. Quick Sepsis Related Organ Failure Assessment. Available at: http://www.qsofa.org/index.php. Accessed March 24, 2018.
24. Skilled Nursing Facility Care Pathway symptoms of sepsis and septic shock. Available at: http://atlanticquality.org/download/AQIN_Nursing_Facility_Sepsis_Care_Pathway.pdf. Accessed March 24, 2018.
25. Chest JG, Rudolph JL. Vital signs in older patients: age-related changes. J Am Med Dir Assoc 2011;12:337–343.
26. Peter DD, Pack AI, Silage DA, et al. Effects of ageing on ventilatory and occlusion pressure responses to hypoxia and hypercapnia. Am Rev Respir Dis 1981;124:387–391.
27. Zuskin E, Mustajbegovic J, Schachter EN. Respiratory findings in a nursing home population. Arch Gerontol Geriatr 2007;44:153–161.
28. Sloane PD, Kistler C, Mitchel CM, et al. Role of body temperature in diagnosing bacterial infection in nursing home residents. J Am Geriatr Soc 2014;62:135–140.
29. Jones SL, Ashton CM, Kiehne L, et al. The Sepsis Early Recognition and Response Initiative (SERRI). Joint Commission J Qual Patient Saf 2016;42:122–138.
30. Seeing sepsis: Early detection saves lives. Available at: https://www.mnhospitals.org/Portals/0/Documents/ptsafety/SeeingSepsisLTC/1.%20Seeing%20Sepsis%20-%20LTC%20Poster.pdf. Accessed March 24, 2018.
31. Ouslander JG, Bonner A, Herndon L, et al. The Interventions to Reduce Acute Care Transfers (INTERACT) quality improvement program: an overview for medical directors and primary care clinicians in long term care. J Am Med Dir Assoc 2014;15:162–170.
32. Kane RL, Huckfeldt P, Tappen R, et al. Effects of an intervention to reduce hospitalizations from nursing homes: A randomized implementation trial of the INTERACT Program. JAMA Intern Med 2017;177:1257–1264.
33. Rantz MJ, Popejoy L, Vogelsmeier A, et al. Successfully reducing hospitalizations of nursing home residents: Results of the Missouri Quality Initiative. J Am Med Dir Assoc 2017;18:960–966.
34. Ouslander JG, Diaz S, Hain D, et al. Frequency and diagnoses associated with 7- and 30-day readmission of skilled nursing facility patients to a nonteaching community hospital. J Am Med Dir Assoc 2011;12:195–203.
35. Schuetz P, Wirz Y, Mueller B. Procalcitonin testing to guide antibiotic therapy in acute upper and lower respiratory tract infections. JAMA 2018;319:925–926.
36. Crnich CJ, Jump R, Trautner B, et al. Optimizing antibiotic stewardship in nursing homes: A narrative review and recommendations for improvement. Drugs Aging 2015;32:699–716.
37. Agency for Healthcare Research and Quality. Advancing Excellence in Health Care. Available at: https://www.ahrq.gov/nhguide/index.html. Accessed December 24, 2017.
38. Centers for Disease Control and Prevention. The core elements of antibiotic stewardship of nursing homes. Nursing Homes and Assisted living (Long-Term Care Facilities [LTCFs]). Available at: https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html. Accessed December 24, 2017.
39. The Cecil G. Sheps Center for Health Services Research, University of North Carolina. Promoting wise antibiotic use in nursing homes. Infection Management and Antibiotics Stewardship. Available at: https://nursinghomeinfections.unc.edu/. Accessed December 24, 2017.
40. Zarowitz FJ, Allen C, Tangalos E, Ouslander JG. Algorithms promoting antimicrobial stewardship in long-term care. J Am Med Dir Assoc 2016;17:173–178.
41. Jump RLP, Gaur S, Katz MJ, et al. Template for an antibiotic stewardship policy for post-acute and long-term care settings. J Am Med Dir Assoc 2017;18:913–920.