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What Is the Role of Nursing Homes in the Surviving Sepsis Campaign?

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A B S T R A C T

Recently, there have been several publications advocating for an expansive role for nursing homes (NHs) in the Surviving Sepsis Campaign (SSC). The rationale for this effort is the problem of high rates of 30-day readmissions from NHs and a disproportionate percentage of residents with a diagnosis of sepsis in emergency departments. This article provides a brief history of the SSC and the evolution of the definition of sepsis and of the timing of interventions that make up a "sepsis bundle." Screening tools for sepsis that may be used in the NH setting are discussed. It is emphasized that there is no gold standard for the diagnosis of sepsis, and this limits the ability to identify a screening tool with high sensitivity. Three recent publications that discuss the recognition and management of sepsis in the NH are reviewed, although there is very little published information about this problem. Despite the lack of information about sepsis in NHs, several states have developed protocols for identification and management of sepsis in NHs but there are no results of the impact of these efforts on hospitalization or readmission rates or resident outcome. Based on the review of this information, the ability of NH providers and staff to identify residents with possible sepsis is unclear given no effective screening tool and the recent change in the definition of sepsis that focuses on a point late in the continuum from infection to sepsis with organ dysfunction. Also, NH capability to perform, in a timely fashion, interventions recommended in a sepsis bundle such as insertion of an intravenous catheter, performing blood cultures, administering antibiotics, and fluid resuscitation will likely vary considerably. There is a need for more intensive study of sepsis in the NH setting to identify screening tools with better sensitivity and identification of interventions suitable for the NH setting and that have an impact on various outcomes.

Recently, there have been several publications in the *Journal of the American Medical Directors Association* (*JAMDA*) advocating for an expansive role for nursing homes (NHs) in the Surviving Sepsis Campaign (SSC).[1–3] Several factors underlie this focus including (1) high rates of readmissions for patients discharged to NHs,[4] many of them potentially preventable,[5] and (2) a seeming disproportionate percentage of NH residents diagnosed with sepsis. This latter fact was highlighted in a study of US emergency department visits from 2005 to 2009. During this time period, NH residents accounted for 25% of all visits with a diagnosis of severe sepsis and had a significantly higher intensive care unit (ICU) admission rate, hospital length of stay, and in-hospital mortality compared to non-NH residents after controlling for age.[6]

To give providers a better understanding of the SSC and its implication for the NH setting, the remainder of this article will review 4 areas: a brief history of the SSC, screening tools for sepsis, the recent publications in *JAMDA*[1–3] regarding the identification and management of sepsis in the NH setting, and ongoing efforts to promote NHs as first responders for sepsis identification and treatment.

SSC Guidelines, Sepsis Bundles, and Definitions of Sepsis

In the 1980s and 1990s, several approaches were developed to counteract what were thought to be important microbial and host mediators in the development of sepsis and septic shock with the goal of reducing mortality. However, all of these efforts were unsuccessful in reducing mortality related to sepsis and septic shock.[7–10] Because of these failures, the focus changed to identifying patients with infection who were trending toward sepsis and intervening before organ dysfunction occurs; this change in focus resulted in the SSC.[11] The SSC guidelines target care in the hospital setting and

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Table 1
Surviving Sepsis Campaign Hour-1 Bundle[18]

- Measure lactate level. Remeasure if initial lactate is >2 mmol/L.
- Obtain blood cultures prior to administration of antibiotics.
- Administer broad-spectrum antibiotics.
- Begin rapid administration of 30 mL/kg crystalloid for hypotension or lactate ≥4 mmol/L.
- Apply vasopressors if patient is hypotensive during or after fluid resuscitation to maintain mean arterial pressure >65 mm Hg

Hour-1 bundle is based on the concept that sepsis is an emergency and the more rapid the assessment and treatment, the better the outcome. Using the latest definition of sepsis[6] treatment should start immediately after a diagnosis is made. The components of the bundle describe the interventions that are recommended. The committee that developed this bundle is aware that it may take more than 1 hour to obtain the initial laboratory tests and resuscitation; the goal is not to delay initiation of management once a diagnosis of sepsis is made.

specifically in the ICU. Research indicated that appropriate antibiotic therapy initiated early and aggressive fluid resuscitation reduced mortality related to sepsis in the ICU.[12,13] These findings resulted in a focus on timely administration of antibiotics and intravenous fluids and became an important component of the SSC guidelines along with other testing and interventions. The initial SSC guidelines were published in 2004, and there have been several revisions.[14–16] To assist clinicians in following the SSC guideline recommendations, a "sepsis bundle" was developed; the rationale for this approach was "to eliminate the piecemeal application of [SSC] guidelines" and "to make it easier for clinicians to bring the guidelines into practice."[17] The sepsis bundle recommendations have also been revised; these changes were primarily in the time to completion of a bundle. The initial bundle was divided into a 6-hour resuscitation bundle and a 24-hour management bundle. In 2012, the original 6-hour bundle was changed to a 3-hour bundle and a 6-hour bundle, and the 24-hour bundle was eliminated.[15] In 2018, the 3-hour and 6-hour bundles were combined into a 1-hour bundle (Table 1). The latest change was based on the concept that sepsis is a medical emergency and requires immediate attention.[18]

The most controversial change has been in the definition of sepsis (Table 2). The original sepsis definition was developed in 1992 and was based on the view at that time that sepsis was a result of the host's systemic inflammatory response syndrome (SIRS) to infection.[19] In 2001, the definitions were reviewed but there were no changes.[20] However, there was concern about the low specificity of the SIRS criteria because inflammation represents a nonspecific response to both infection and noninfection insults.[21] The definitions were reexamined, SIRS criteria and the severe sepsis category were eliminated, and sepsis was redefined as a life-threatening organ dysfunction caused by a dysregulated host response to infection (formerly severe sepsis).[22] Organ dysfunction was defined as an acute change in the Sequential Organ Failure Assessment (SOFA) score ≥2 and was predictive of a prolonged ICU stay and hospital mortality.[23] The new definition was developed to standardize the identification of sepsis for clinical use as well as for research purposes specifically for the ICU.

In a commentary on the new approach to defining sepsis, Vincent and colleagues state, "Changes in organ function can, of course, be caused by factors other than sepsis, but separation of what is due to sepsis itself and what is due to other elements is difficult."[24] They go on to state that in their opinion, "sepsis is more frequently identified by the presence of unexplained organ dysfunction [hypoxemia, oliguria, thrombocytopenia, hypotension, altered mental status] than by the presence of infection." The concept that a change in status of a patient should prompt an investigation for infection as well as other causes is relevant to the NH resident, as will be discussed in a later section.

Despite revisions of the SSC guidelines, bundles, and definitions, there has been considerable pushback from critical care, infectious diseases, and emergency medicine physicians.[25–30] A major concern is that the new sepsis definition defines a process that has been ongoing for some time. It is important to identify patients who have infection before they develop organ dysfunction but who are at risk for sepsis, which is not addressed by the latest guidelines or definitions.

Screening Tools for Sepsis

Two things need to be stressed regarding screening tools for sepsis. First, sepsis is not a disease like acute myocardial infarction or stroke that can be recognized clinically and by diagnostic testing; sepsis is a syndrome for which there is no gold standard for diagnosis.[28,31] Second, to be useful, a screening tool needs to be highly sensitive to minimize false negatives. This is especially true when one is dealing with a critical illness like sepsis and septic shock. However, the lack of a gold standard makes it difficult to develop highly sensitive screening tools for sepsis. This factor plus the new sepsis definition that does not deal with the process prior to development of organ dysfunction place a significant burden on clinicians to identify infection before sepsis (new definition) develops and intervene with antibiotics and fluid resuscitation as necessary.

Table 2
Sepsis Definitions, 1991-2016

Sepsis-1 Definitions, 1991[19]	Sepsis-2 Definitions, 2001[21]	Sepsis-3 Definitions, 2016[22]
Sepsis: Suspected or proven infection and 2 or more SIRS criteria: a. Respiratory rate >20/min b. Temperature >38° C or <36° C c. Heart rate > 90/min d. WBC >12,000 or <4000 or >10% bands Severe sepsis: Sepsis complicated by organ dysfunction Septic shock: Sepsis-induced hypotension persisting despite fluid resuscitation	Definitions unchanged	Sepsis: Life-threatening organ dysfunction* due to dysregulated host response to infection Septic shock: Subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality Clinically septic shock can be defined as sepsis with persistent hypotension requiring vasopressors to maintain a MAP ≥65 mmHg or with a serum lactate >2 mmol/L despite adequate fluid resuscitation Sepsis 3 definitions eliminate the SIRS criteria and the severe sepsis category

MAP, mean arterial pressure; WBC, white blood count.
*Organ dysfunction defined as SOFA ≥2 for patients in ICU; for patients in other settings, qSOFA ≥2 defines organ dysfunction (see Table 3).

Table 3
Potential Screening Tools for Sepsis in Suspected/Proven Infection

SIRS[19]	qSOFA[32]	3-100s[33]
2 or more of the following: a. Respiratory rate >20/min b. Temperature >38° C or <36° C c. Heart rate >90/min d. WBC >12,000 or <4000 or >10% bands	2 or more of the following: a. Respiratory rate ≥22/min b. Altered mentation (Glasgow Coma Scale score ≤13) c. Systolic blood pressure ≤100 mmHg	2 of more of the following: a. Temperature >100° F b. Pulse >100/min c. Systolic blood pressure <100 mmHg

WBC, white blood count.

The first screening tool for sepsis was the SIRS criteria (Table 3),[19] which has been used extensively in studies of sepsis in the last 3 decades and has been part of the SSC guidelines until the latest revision in 2016. Despite extensive use of the SIRS criteria, the SCC consensus committee eliminated it when the definition of sepsis was changed.[16] Because many patients with possible sepsis are not in an ICU setting, a simplified version of SOFA was developed, Quick SOFA (qSOFA; Table 3), for use outside of the ICU.[32] However, qSOFA, like SOFA, is not a screening tool for sepsis but a risk stratification tool predictive of the need for ICU care, prolonged ICU care, and mortality.[28,31]

The Minnesota Hospital Association developed the Seeing Sepsis program to reduce mortality related to sepsis, and targeted hospitals and NHs.[33] A screening tool called the 3-100s or 100-100-100 criteria (Table 3) was developed for use in NHs. Other than the recent study by Sloane and colleagues[1] (discussed below), there are no published studies utilizing the 3-100s criteria in the NH setting.

The Modified Early Warning System (or MEWS) is a tool that was developed for use in the hospital setting to identify critical illness, the need for rapid intervention, and predict mortality (Table 4).[34] MEWS contains all of the SIRS, 3-100s, and qSOFA criteria, including a simplified approach for assessing mental status. Whereas the SIRS, 3-100s, and qSOFA criteria all have equal weight, MEWS is an ordinal scale that assigns weights based on the degree of difference (high or low) from a normal level, which is assigned a score of 0. In the original study describing MEWS, a score of ≥5 was associated with ICU admission and increased mortality.[34]

In summary, the lack of a gold standard for sepsis precludes identifying the optimal screening tool, that is, one that has high sensitivity for identifying a person with suspected or proven infection who is either at risk for sepsis or is septic. MEWS should be studied in the NH setting because it incorporates all the elements of the 3 other tools discussed above, provides a measure of the level of change of a component from normal rather than assigning an equal weight to all components, and all the MEWS parameters are readily available to NH staff. The MEWS may allow for a more refined assessment of the severity of the changes and may improve sensitivity compared to the other screening tools.

Table 4
Modified Early Warning System (MEWS)[34]

Parameter	3	2	1	0	1	2	3
SBP, mm Hg	<70	71-80	81-100	101-199		>200	
Pulse, beats/min		<40	41-50	51-100	101-110	111-129	>130
Respiratory rate, breaths/min		<9		9-14	15-20	21-29	>30
Temperature, °C		<35		35-38.4		>38.5	
AVPU score*				A	V	P	U

SBP, systolic blood pressure.
*A: alert, V: responding to voice, P: responding to pain, U: unresponsive.

Sepsis in the NH Setting

As previously noted, there has been a recent emphasis on the NH setting for identification of sepsis at an early stage and to initiate treatment, based on the hour-1 sepsis bundle components (Table 1), with the goal of reducing hospitalizations as well as mortality.[1–3] However, there is little information about sepsis in the NH setting, how to identify residents with infection who may develop sepsis, or the feasibility of NHs to evaluate residents in a timely fashion and initiate management as suggested in the SCC guidelines.

A recent study retrospectively evaluated the sensitivity and specificity of the SIRS criteria, qSOFA, and the 3-100s criteria to identify residents transferred to the hospital with an eventual diagnosis of sepsis from those with nonsepsis conditions.[1] Within 12 hours of hospitalization, the most sensitive tool for identifying residents with a hospital discharge diagnosis of sepsis was the 3-100s criteria (79%); SIRS criteria had a specificity of 86%. The authors suggested that the 3-100s criteria may be a useful screening tool for sepsis risk in the NH population.

The study by Sloane and colleagues[1] has several limitations that impact the usefulness of the findings. The diagnosis of sepsis was based on discharge records from the hospital and was not verified by a review of hospital records. Twenty percent of the 236 study residents transferred to the hospital were lost to follow-up in terms of final diagnosis. The number of residents with sepsis was small (N = 47), limiting the assessment of the sensitivity and specificity of the 3 screening tools. One of the qSOFA criteria is the Glasgow Coma Score, which could not be calculated from information available, and the authors needed to use a surrogate for this variable. The most important finding of this study is that documentation of vital signs and other parameters required for screening were absent in one-third with a sepsis diagnosis and in 26% with nonseptic diagnoses. This latter finding points out the importance of educating staff and providers about the importance of collecting appropriate data to identify infection and possible sepsis.

In conjunction with the publication by Sloane and colleagues,[1] there was an editorial commentary.[2] This commentary focused on several issues of importance related to identifying sepsis in an NH population. First, it was noted that the clinical presentation of infection tends, at times, to be atypical in residents making it more difficult to identify sepsis. Second, nursing staff are critical to making both a diagnosis of infection and management of sepsis; therefore, education of staff regarding infection presentation and sepsis is key to early recognition and management. Third, multiple care pathways or algorithms have been created to identify and manage sepsis in the NH (discussed below), but none have been validated and there has yet to be an effort to standardize the protocol. Fourth, a screening tool for sepsis should be highly sensitive to minimize false negatives, which tend to result in low specificity. The authors raise a concern about the low specificity of existing screening tools that may result in unnecessary hospitalizations. However, one can argue that it is more important to not miss a case of sepsis than to be concerned about false positive screens. Lastly, the authors state that if infection is suspected

and there is possible sepsis, the resident should be transferred to the hospital unless there are advance directives stating no hospitalization or family does not want a transfer.

Jump and colleagues[3] published an editorial building on the findings of Sloane et al[1] and comments by Reyes et al[2] and suggested that NHs function as "first responders" in recognizing sepsis in residents. The basis for this statement is evidence that early intervention with antibiotic therapy and fluid resuscitation appears to reduce mortality related to sepsis in the ICU setting.[13] Jump et al[3] note, "Nursing facilities that recognize and initiate early management of sepsis can improve outcomes through a swift response that begins before the resident arrives in the emergency room." Although this is a reasonable goal, there is no evidence that this is true at the present time. The authors subsequently temper their comments by noting that NHs vary in their capabilities to complete a sepsis bundle (Table 1). However, they go on to state (based on the Hour-1 bundle; Table 1), "although few nursing facilities can measure a serum lactate level, most should be able to obtain blood samples to send for microbiological culture, initiate resuscitation with crystalloid fluids in residents who are hypotensive, and, when indicated, administer broad-spectrum antibiotics." One can certainly question if "most" NHs can perform these interventions in a timely fashion 24 hours a day and 7 days a week. The "first responder" designation sets the bar very high for NHs in terms of recognizing possible sepsis without availability of an effective screening tool, and starting management without evidence that these interventions can be done effectively and impact outcome.

These 3 articles represent well-intentioned efforts to deal with the identification and management of sepsis in the NH.[1–3] However, before one can place NHs in the "first responder" role, there needs to be validation and standardization of screening methods for sepsis in the NH setting, education of NH providers and staff about sepsis and its management, and establishing feasible intervention standards that most NHs can comply with. In addition, consideration needs to be given to the cost of establishing a sepsis protocol that can function around the clock 7 days a week with staff who are available and capable to carry out identification and management protocols.

Existing Efforts to Incorporate the SSC Into the NH Setting

Notwithstanding the lack of studies of sepsis in the NH setting regarding diagnosis and management, there have been efforts in several states to integrate the SSC into NHs.[33,35–37] The format of these pathways is generally similar. A screening tool is recommended (SIRS or 3-100s) followed by an assessment for infection and determination of vital signs, signs and symptoms, evaluation of advance directives, contacting family, contacting a provider with data collected and family response, and decision on hospitalization or treating in the NH. Also, there is a section on interventions that are based on the Hour-1 sepsis bundle (Table 1). However, there are no published studies regarding results of these efforts. Individual states may have information on results but none could be found in a form that addresses the questions of capabilities, cost for having continuous capability, impact on hospital admissions and readmissions, and resident outcome.

Discussion

Given the lack of studies regarding recognition and initial management of sepsis in the NH setting, it appears premature to consider NHs as "first responders" in the SSC. Although the revised definition of sepsis is more concise, it has been argued that it "de-emphasizes intervention at earlier stages of sepsis when the syndrome is actually at its most treatable."[25,38] The revised sepsis definition does not concur with the notion of the NH functioning as a "first responder" in the SSC, which has the goal of early identification of residents with risk for developing sepsis [as originally defined]. Therefore, utilization of the revised definition of sepsis in a diagnosis and treatment pathway for NHs cannot be recommended.

There is a need for an organized national effort to study sepsis in the NH setting with the goal of defining the most accurate sepsis screening tool for residents and verifying which intervention measures are feasible and beneficial in terms of outcomes and cost effectiveness. However, it will take considerable time and cost to do studies of sepsis in NHs, if they are done at all. The recent *JAMDA* articles[1–3] emphasize that sepsis is a life-threatening complication of infection, and recognition in the NH may impact outcome. The seriousness of sepsis has also resulted in advocacy by nonprofit organizations to make the general public aware of this problem and empowering them to be proactive in their care and in their family's care.[39,40]

Given this background of urgency, how should NHs deal with the problem of sepsis when there is no accurate method for identifying those at risk for sepsis and management may be limited by NH capability? Although there are no answers to these questions presently, an approach utilized by the INTERACT program could be useful as a starting point.[41] INTERACT focuses on reducing hospitalization of residents, and it begins with recognition of a change in status of a resident and provides a method to evaluate this change, for which there are many causes including infection. When infection is suspected, a pathway developed by various states[33,35–37] or the INTERACT Care Path for management of possible sepsis[42] could be used.

After evaluation, if it is decided to transfer the resident to the hospital, a NH may be able to initiate some interventions. It has been stated that the interventions most nursing homes should be able to do prior to hospital transfer if sepsis is suspected include blood cultures, laboratory tests, insertion of a peripheral intravenous catheter, and administration of intravenous (IV) fluids and broad-spectrum antibiotics.[3] However, it is unrealistic to promote this level of capability for most NHs. The only intervention listed above that can be done consistently by the majority of nursing homes is probably obtaining blood samples for electrolytes, blood urea nitrogen, creatinine, and complete blood count that can be sent to the hospital with the resident. Some facilities may be able to do blood cultures any day or time, but most nursing homes do not have that capability. Insertion of a peripheral IV catheter would seem to be a reasonable capability for a nursing home; the question to ask is, "Can a peripheral IV be inserted successfully at 2 AM?" The most important intervention is administering broad-spectrum antibiotic therapy that is dependent on IV access. In the absence of IV access, administration of antibiotics intramuscularly or orally is a reasonable alternative. Concern has been raised that administration of antibiotic therapy in the absence of cultures makes subsequent management difficult in terms of identifying the etiology of infection as well as lack of information about organism antibiotic susceptibility.[16] However, because early, empiric antibiotic treatment is critical in terms of outcome in someone with sepsis,[43,44] it takes precedence over obtaining cultures.

The resident, family, and provider should be made aware of what the NH capabilities are when it comes to identification and management of sepsis. Physician and nursing competency, as well as medical provider availability, will likely be strong predictors of timely diagnosis and treatment of sepsis. In the study by Sloane et al,[1] a low rate of on-site evaluation by a provider prior to hospital transfer was identified. These authors suggested that there may be a role for telemedicine in dealing with the absence of on-site evaluation. It has been proposed that facilities develop a sepsis policy or protocol describing capabilities and management plans.[3] Along with careful written documentation of the clinical findings, diagnosis, and management prior to transfer, a specific sepsis policy provides transparency for the care provided in an individual NH when sepsis is suspected. This does not eliminate the possibility of liability but it does provide

documentation of how possible sepsis is identified and managed and that residents, families, and providers have been informed. In the words of John Wooden, legendary UCLA basketball coach, "Don't let what you can't do, prevent you from doing what you can do." NHs cannot perform all the interventions available in the hospital when it comes to identifying and managing sepsis; however, they can perform some interventions that need to be clearly defined but will not be the same for all facilities.

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