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SHEA/CDC POSITION PAPER

Surveillance Definitions of Infections in Long-Term Care Facilities: Revisiting the McGeer Criteria

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(See the commentary by Moro, on pages 978–980.)

Infection surveillance definitions for long-term care facilities (ie, the McGeer Criteria) have not been updated since 1991. An expert consensus panel modified these definitions on the basis of a structured review of the literature. Significant changes were made to the criteria defining urinary tract and respiratory tract infections. New definitions were added for norovirus gastroenteritis and *Clostridum difficile* infections.

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When McGeer and colleagues proposed the first set of infection surveillance definitions specifically for use by long-term care facilities (LTCFs), their intent was to provide standardized guidance for infection surveillance activities and research studies in nursing homes and similar institutions.[1] These definitions were adapted from existing surveillance definitions (such as those of the Centers for Disease Control and Prevention [CDC] National Nosocomial Infection Surveillance) that are used in acute care hospitals and with modifications determined by consensus discussions among infectious diseases physicians, geriatricians, and infection control nurses with experience in LTCFs,[1,2] using an unstructured review of the limited literature available at the time. These consensus definitions, also known as the McGeer Criteria, have not been validated or updated despite their ongoing use by infection prevention and control programs and in research studies of nursing homes.

The original surveillance definitions[1] were specifically developed for use in LTCFs with older adults who required (1) supervision and care for impaired cognition, (2) assistance with activities of daily living (ADLs), or (3) skilled nursing care, such as the use of indwelling devices (eg, urinary catheters or enteral feeding tubes). At the time the McGeer Criteria were developed, these facilities rarely provided intravenous therapy or had on-site laboratory or radiology services for the diagnosis of new clinical problems. Now, 20 years later, these definitions should still be applied in skilled nursing facilities and nursing homes that care for the postacute and frail elder populations, as well as in other long-term residential care environments that deliver medical and skilled nursing services if appropriate clinical and diagnostic evaluations can be provided. However, the McGeer Criteria were not designed for use in long-term acute care hospitals, acute inpatient rehabilitation facilities, or pediatric LTCFs.

In March 2009, members of the Society for Healthcare Epidemiology of America (SHEA) Long-Term Care Special Interest Group (LTCSIG) agreed that the surveillance definitions of infections in LTCFs should be updated in light of

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(1) a substantial increase in the body of evidence-based literature about infections in the elderly in LTCF settings, (2) the availability of improved diagnostics for infection surveillance, (3) the changing populations of patients who are cared for in nonhospital settings, and (4) the updated acute care hospital surveillance definitions of the CDC's National Healthcare Safety Network (NHSN). The process of updating the McGeer Criteria included an evidence-based structured review of the literature in addition to consensus opinions from industry leaders including infectious diseases physicians and epidemiologists, infection preventionists, geriatricians, and public health officials.

METHODS

Review of Clinical Syndromes

We systematically reviewed the definitions of clinical syndromes that commonly occur in LTCF residents, including respiratory tract infections (RTIs), urinary tract infections (UTIs), skin and soft tissue infections (SSTIs), and gastrointestinal (GI) tract infections. Because of a lack of recent, relevant research pertaining to systemic infections (bloodstream infections [BSIs] and unexplained febrile episodes), revisions to the definitions in these categories were not pursued. Specific criteria for defining nasal and otic infections have been removed; categorizing these events should be based on evaluation by a clinical provider. Oropharyngeal and conjunctival infections were included with SSTIs as mucosal infections. For the infection surveillance definitions of each clinical syndrome undergoing revision, a team of SHEA LTCSIG members was assigned to review the literature and provide updated surveillance criteria. The definitions were reviewed, modified where appropriate on the basis of the review, and approved by the LTCSIG and a panel of outside reviewers selected by the SHEA Board of Directors.

Search Procedure

First we searched for relevant guidelines, using Medline, National Guideline Clearinghouse, Cochrane Health Technology Assessment, National Institutes of Health Consensus Development, and the US Preventative Services Task Force. On the basis of a review of those guidelines, each team developed a series of key questions. Examples of these key questions are "What is the utility of examination of urine for pyuria for the diagnosis of symptomatic urinary tract infection?" and "What is the diagnostic accuracy of pulse oximetry for nursing home pneumonia?" These key questions further guided the evidence review used to revise the existing surveillance criteria. Next, a search of the primary literature was performed, using Medline, CINAHL, Embase, Cochrane Systematic Reviews, and the Cochrane Controlled Clinical Trials Registry. Examples of key search terms include the following: nursing home, long-term care, aged, skilled nursing facility, older adults, elderly, fever, healthcare-associated infection, pneumonia, influenza, respiratory tract infection, functional impairment, confusion, leukocyte count, pulse oximetry, urinary tract infection, bacteriuria, urine culture, gastroenteritis, diarrhea, *Clostridium difficile*, norovirus, cellulitis, soft tissue infection, pressure ulcer, scabies. A line listing of articles that met the search criteria and were included in the final analyses is available upon request from the authors.

Evidence Review

A reference was included if it was (1) relevant to key questions; (2) a systematic review, meta-analysis, or primary research report; and (3) written in English. For each clinical syndrome, a standardized evidence table was prepared that summarized the data from each relevant article. Information on the type(s) of LTCF and the specific resident population(s) was included in the evidence tables. The strategy for review of the literature by asking key questions and summarizing the evidence was based on a standard methodology developed by the CDC's Healthcare Infection Control Practices Advisory Committee and the University of Pennsylvania Center for Evidence-Based Practice.[3] When evidence was limited or unavailable to inform changes to the definitions, expert consensus guided any modifications.

Most of the studies we evaluated were small observational or uncontrolled case series that primarily addressed questions related to the utility of signs and symptoms for the purpose of diagnosing infection in older people. The majority of these studies did not clearly address questions about the utility of 1 or more clinical findings in the context of infection detection and surveillance in LTCFs or other healthcare facilities. Because the evidence was generally indirect and judged to be of low quality, a decision was made to not grade proposed additions or changes in clinical parameters according to standardized methods that are typically applied to recommendations and guidelines.

GUIDING PRINCIPLES

The criteria that define infections for surveillance purposes were selected to increase the likelihood that the events captured by application of the definitions are true infections. Presentations of infection in older residents of LTCFs may be atypical, so failure to meet surveillance definitions may not fully exclude the presence of infection. For this reason, the surveillance definitions presented here may not be adequate for real-time case finding, diagnosis, or clinical decision making (eg, antibiotic initiation). Separate clinical guidelines address early identification of infections and appropriate initiation of antibiotic therapy in LTCF residents,[4,5] which are both important for impacting resident outcomes.

The syndromes included here represent a variety of clinically relevant infections that can occur in the LTCF population. Surveillance should be performed for infections for which there are clear strategies that can be implemented for prevention and control of transmission (Table 1). However, for completeness and consistency with the original surveil-

TABLE 1. Considerations for Inclusion of Infections in Long-Term Care Facilities (LTCFs) into Facility Infection Surveillance Programs

Points to consider	Infections	Comments
A. Infections that should be included in routine surveillance		
1. Evidence of transmissibility in a healthcare setting	Viral respiratory tract infections, viral gastroenteritis, and viral conjunctivitis	Associated with outbreaks among residents and healthcare personnel in LTCFs.
2. Processes available to prevent acquisition of infection		
3. Clinically significant cause of morbidity or mortality	Pneumonia, urinary tract infection, gastrointestinal tract infections including *Clostridium difficile*, and skin and soft tissue infections	Associated with hospitalization and functional decline in LTCF residents.
4. Specific pathogens causing serious outbreaks	Any invasive group A *Streptococcus* infection, acute viral hepatitis, norovirus, scabies, influenza	A single laboratory-confirmed case should prompt further investigation.
B. Infections that could be considered in surveillance		
1. Infections with limited transmissibility in a healthcare setting	Ear and sinus infections, fungal oral and skin infections, and herpetic skin infections	Associated with underlying comorbid conditions and reactivation of endogenous infection.
2. Infections with limited preventability		
C. Infections for which other accepted definitions should be applied in LTCF surveillance (may apply to only specific at-risk residents)	Surgical site infections, central-line-associated bloodstream infections, and ventilator-associated pneumonia	LTCF-specific definitions were not developed. Refer to the National Healthcare Safety Network's criteria (http://www.cdc.gov/nhsn/TOC_PSCManual.html).

lance definitions,[1] several infections that may occur because of underlying host factors rather than transmission within the facility have also been included in this document, so that both infection prevention programs and research studies have a standard set of criteria. Given the limited infection prevention and control resources that are currently available in most LTCFs, surveillance activities may need to target those infections in a facility that have the most potential for prevention. In addition, some infections are associated with a high likelihood of transmission and development of outbreaks (eg, norovirus, influenza, group A *Streptococcus*, acute viral hepatitis). For these infections, identification of even a single case in a LTCF should trigger a more intensive investigation.[6,7]

For infection surveillance purposes, infections should be attributed to a LTCF onset if (a) there is no evidence of an incubating infection at the time of admission to the facility (on the basis of clinical documentation of appropriate signs and symptoms and not solely on screening microbiologic data) and (b) onset of clinical manifestation occurs >2 calendar days after admission. Although debate exists about the use of this time frame to determine a LTCF onset for *C. difficile* infections,[8] it is consistent with acute care infection surveillance reporting and surveillance methodology, and there is currently no evidence to support changing this standard for LTCFs.

As outlined in the original McGeer Criteria, 3 important conditions should be met when applying these surveillance definitions:

1. All symptoms must be new or acutely worse. Many residents have chronic symptoms, such as cough or urinary urgency, that are not associated with infection; however, a new symptom or a change from baseline may be an indication that an infection is developing.

2. Alternative noninfectious causes of signs and symptoms (eg, dehydration, medications) should generally be considered and evaluated before an event is deemed an infection.

3. Identification of infection should not be based on a single piece of evidence but should always consider the clinical presentation and any microbiologic or radiologic information that is available. Microbiologic and radiologic findings should not be the sole criteria for defining an event as an infection. Similarly, diagnosis by a physician alone is not sufficient for a surveillance definition of infection and must be accompanied by documentation of compatible signs and symptoms.

The feasibility of implementation and the validity of these surveillance definitions would benefit from further assessment in different types of LTCFs. As with the original article by McGeer and colleagues,[1] these definitions have not been tested in advance of their publication. Data from a French study demonstrated that application of the original surveillance definitions underestimated the number of nursing home–associated infections when compared with provider diagnoses of infection.[9] This finding highlights the need for future studies to determine the sensitivity and specificity of criteria used within the surveillance definitions and to validate their application in this setting.

DEFINITIONS

Constitutional Criteria for Infection

In an effort to standardize terminology across the clinical syndromes defined in this article, we agreed on common definitions for fever, acute change in mental status, and acute functional decline (Table 2). The definition of fever was changed from a temperature of greater than 38°C (100.4°F), as in the original McGeer Criteria, to a definition consistent with the 2008 Infectious Diseases Society of America (IDSA) guideline for evaluating fever and infection in older adults residing in LTCFs: either (1) a single oral temperature greater than 37.8°C (100°F) or (2) repeated oral temperatures greater than 37.2°C (99°F) or rectal temperatures greater than 37.5°C (99.5°F) or (3) a single temperature greater than 1.1°C (2°F) over baseline from any site.[4] The rationale for this recommendation includes:

1. A desire to maintain consistency across different guidelines.

2. Recognition that although the IDSA guideline is based on data from small numbers of participants in studies performed nearly 2 decades ago, no recent evidence has provided any rationale to modify them.

3. The lower threshold will increase sensitivity for detecting infection given the greater likelihood of a lower febrile response in the elderly.[10,11]

Although both the IDSA guideline and the original McGeer Criteria note that "worsening mental or functional status" can be a nonspecific manifestation of acute infection in an elderly resident of a LTCF,[1,4] there are relatively few studies that have defined a standard assessment of mental status or functional change in the context of acute infection. Mehr et al, in their prospective study involving 36 nursing homes and 2,334 episodes of pneumonia in 1,474 residents, showed that residents with either probable or possible pneumonia were more likely to be somnolent and confused when compared with those with no pneumonia.[12] Lim and MacFarlane[13] compared 397 patients with community-acquired pneumonia (CAP) with 40 patients who had nursing home–acquired pneumonia and found that the patients with nursing home–acquired pneumonia were more likely to be confused when compared with patients who had CAP. Integrated into the recently released Minimum Data Set (MDS), version 3.0, is an assessment of delirium that is based on the confusion assessment method (CAM) criteria.[14,15] In order to standardize an assessment of acute mental status across LTCFs, the CAM criteria are adopted here for the definition of acute confusion or altered mental status (Table 3). For similar reasons, the definition of acute functional decline is also based on changes in ADLs according to the scoring system in MDS 3.0.[16]

Respiratory Tract Infections

Relative to the original surveillance definitions,[1] few changes were made to the definitions of RTIs, which include 4 subcategories: (1) common cold syndromes or pharyngitis, (2)

TABLE 2. Definitions for Constitutional Criteria in Residents of Long-Term Care Facilities (LTCFs)

A. Fever
1. Single oral temperature >37.8°C (>100°F)
OR
2. Repeated oral temperatures >37.2°C (99°F) or rectal temperatures >37.5°C (99.5°F)
OR
3. Single temperature >1.1°C (2°F) over baseline from any site (oral, tympanic, axillary)
B. Leukocytosis
1. Neutrophilia (>14,000 leukocytes/mm^3)
OR
2. Left shift (>6% bands or ≥1,500 bands/mm^3)
C. Acute change in mental status from baseline (all criteria must be present; see Table 3)
1. Acute onset
2. Fluctuating course
3. Inattention
AND
4. Either disorganized thinking or altered level of consciousness
D. Acute functional decline
1. A new 3-point increase in total activities of daily living (ADL) score (range, 0–28) from baseline, based on the following 7 ADL items, each scored from 0 (independent) to 4 (total dependence)[14]
a. Bed mobility
b. Transfer
c. Locomotion within LTCF
d. Dressing
e. Toilet use
f. Personal hygiene
g. Eating

influenza-like illness, (3) pneumonia, and (4) lower RTI (Table 4). No changes were made to the definitions of cold syndromes or pharyngitis.

The only change to the definition of influenza-like illness was the removal of seasonal restrictions for the identification of this infection. In the past, seasonal influenza activity in the United States typically peaked in January or February. However, on occasion, seasonal influenza activity has extended into May. In 2009, the H1N1 influenza A virus strain caused increased hospitalization, morbidity, and mortality from influenza-related illnesses during the summer months.[17] Because of increasing uncertainty surrounding the timing of the start of influenza season, the peak of influenza activity, and the length of the season, "seasonality" is no longer a criterion to define influenza-like illness.

Changes to the surveillance definitions of pneumonia and lower RTI were made to increase the specificity of the criteria. Several recent studies have used at least 1 respiratory and 1 constitutional sign or symptom, along with radiographic findings, to define pneumonia.[13] The definition of lower RTI requires the presence of 2 respiratory criteria and 1 constitutional sign or symptom without radiographic findings that is suggestive of pneumonia. The respiratory signs and symptoms are unchanged in this article from the original criteria except for the addition of oxygen saturation in the lower RTI and pneumonia definitions, because of increased access to pulse oximeters in most facilities.

Given that the initial respiratory examination of a LTCF resident who has suspected pneumonia is rarely performed by a physician, the literature was reviewed to determine the role of a physical examination by a nurse or paramedic in predicting pneumonia. Mehr et al[12] demonstrated that a nurse's assessment for the presence of crackles and the absence of wheezing was highly predictive of identifying radiographic evidence of pneumonia. Ackerman and Waldron[18] retrospectively reviewed 244 ambulance reports of breathing difficulty to determine whether paramedic physical examinations, patient history, and clinical judgment correlated with emergency room physician diagnoses. In that study, the classification of respiratory disease included aspiration, asthma, chronic obstructive pulmonary disease, dyspnea, pleurisy, pneumonia, and upper respiratory tract infection (URI). The paramedic respiratory diagnoses had a sensitivity of 71% (range, 58%–82%) and a specificity of 94% (range, 89%–96%). These 2 studies suggest that nonphysician assessments can assist with the determination of pneumonia, and therefore we retained in our definitions the criterion of abnormal findings on lung examination.

The structure of the new pneumonia and lower RTI definitions should facilitate surveillance by segregating criteria into 3 categories (radiography results, respiratory signs or symptoms, and constitutional criteria) and explicitly requiring the exclusion of alternative explanations for respiratory signs or symptoms such as congestive heart failure, atelectasis, and other noninfectious respiratory conditions.

Urinary Tract Infections

The definitions for UTI presented here differ substantially from the original surveillance definitions[1] for both (A) residents without an indwelling catheter and (B) residents with an indwelling catheter (Table 5). The revised definitions take into account the low probability of UTI in residents without indwelling catheters if localizing symptoms are not present, as well as the need for microbiologic confirmation for diagnosis.[19]

For residents without an indwelling catheter, the clinical criterion "acute dysuria" and the urinary tract subcriteria are derived from Loeb et al's[5,20] consensus criteria, which require localizing genitourinary findings and have been validated in a prospective randomized trial showing efficacy and safety. The criterion "acute pain, swelling, or tenderness of the testes, epididymis, or prostate" was added by expert consensus during the review. Fever or leukocytosis plus 1 localizing urinary tract subcriterion or the presence of 2 or more new or increased localizing urinary tract subcriteria could be used to meet the definition for symptomatic UTI. Acute change in mental status and change in the character of the urine (eg, change in color or odor) were each independently associated with bacteriuria ($\geq 10^5$ colony-forming units [cfu]/mL) plus pyuria ($\geq$10 white blood cells per high-power field) in a prospective study of LTCF residents with clinically suspected UTI;[21] however, these 2 symptoms are frequently demonstrated in the presence of asymptomatic bacteriuria[22] due to other confounding clinical

TABLE 3. Confusion Assessment Method Criteria

Acute onset	Evidence of acute change in resident's mental status from baseline
Fluctuating	Behavior fluctuating (eg, coming and going or changing in severity during the assessment)
Inattention	Resident has difficulty focusing attention (eg, unable to keep track of discussion or easily distracted)
Disorganized thinking	Resident's thinking is incoherent (eg, rambling conversation, unclear flow of ideas, unpredictable switches in subject)
Altered level of consciousness	Resident's level of consciousness is described as different from baseline (eg, hyperalert, sleepy, drowsy, difficult to arouse, nonresponsive)

NOTE. Criteria are adapted from a study by Lim and MacFarlane.[13]

TABLE 4. Surveillance Definitions for Respiratory Tract Infections (RTIs)

Criteria	Comments
A. Common cold syndrome or pharyngitis (at least 2 criteria must be present) 1. Runny nose or sneezing 2. Stuffy nose (ie, congestion) 3. Sore throat or hoarseness or difficulty in swallowing 4. Dry cough 5. Swollen or tender glands in the neck (cervical lymphadenopathy)	Fever may or may not be present. Symptoms must be new and not attributable to allergies.
B. Influenza-like illness (both criteria 1 and 2 must be present) 1. Fever 2. At least 3 of the following influenza-like illness subcriteria a. Chills b. New headache or eye pain c. Myalgias or body aches d. Malaise or loss of appetite e. Sore throat f. New or increased dry cough	If criteria for influenza-like illness and another upper or lower RTI are met at the same time, only the diagnosis of influenza-like illness should be recorded. Because of increasing uncertainty surrounding the timing of the start of influenza season, the peak of influenza activity, and the length of the season, "seasonality" is no longer a criterion to define influenza-like illness.
C. 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 respiratory subcriteria 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 (see Table 2)	For both pneumonia and lower RTI, the presence of underlying conditions that could mimic the presentation of a RTI (eg, congestive heart failure or interstitial lung diseases) should be excluded by a review of clinical records and an assessment of presenting symptoms and signs.
D. Lower respiratory tract (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 in section C above 3. At least 1 of the constitutional criteria (see Table 2)	(See comment for section C above.)

conditions, such as dehydration. Other nonspecific signs and symptoms (eg, falls) without localizing lower urinary tract findings were not associated with bacteriuria plus pyuria.

For residents with an indwelling catheter, the first clinical criterion, "fever, rigors, or new-onset hypotension with no alternate site of infection" is consistent with the criteria of Loeb et al.[5] Localizing urinary tract symptoms for residents with an indwelling catheter include "new-onset suprapubic pain," "costovertebral angle tenderness," and "purulent discharge from around the catheter." "Acute pain, swelling, or tenderness of the testes, epididymis, or prostate" is included for both catheterized and noncatheterized men as recognized complications of UTI in males, particularly when an indwelling urinary catheter is present.[23] The additional criterion "acute change in mental status or acute functional decline with no alternate diagnosis and leukocytosis" has been included. Acute mental status change and functional decline are nonspecific manifestations of many conditions including hypoxia, dehydration, and adverse effects of medication. The additional requirement of concomitant leukocytosis, a marker of a systemic inflammatory reaction, provides support that the clinical deterioration has an infectious etiology. However, symptomatic UTI in the catheterized resident should always be a diagnosis of exclusion in the absence of localizing urinary tract findings.

A positive urine culture is necessary for diagnosis of UTI[4] and is applied in the revised surveillance definitions for both subcategories (residents without and with an indwelling catheter). For individuals without an indwelling catheter, at least 10^5 cfu/mL of no more than 2 species of microorganisms is the recommended quantitative count from a voided specimen, and for a specimen collected by in-and-out catheteri-

TABLE 5. Surveillance Definitions for Urinary Tract Infections (UTIs)

Criteria	Comments
A. For residents without an indwelling catheter (both criteria 1 and 2 must be present)	UTI should be diagnosed when there are localizing genitourinary signs and symptoms and a positive urine culture result. A diagnosis of UTI can be made without localizing symptoms if a blood culture isolate is the same as the organism isolated from the urine and there is no alternate site of infection. In the absence of a clear alternate source of infection, fever or rigors with a positive urine culture result in the noncatheterized resident or acute confusion in the catheterized resident will often be treated as UTI. However, evidence suggests that most of these episodes are likely not due to infection of a urinary source.
1. At least 1 of the following sign or symptom subcriteria	
a. Acute dysuria or acute pain, swelling, or tenderness of the testes, epididymis, or prostate	
b. Fever or leukocytosis (see Table 2) and at least 1 of the following localizing urinary tract subcriteria	
i. Acute costovertebral angle pain or tenderness	
ii. Suprapubic pain	
iii. Gross hematuria	
iv. New or marked increase in incontinence	
v. New or marked increase in urgency	
vi. New or marked increase in frequency	
c. In the absence of fever or leukocytosis, then 2 or more of the following localizing urinary tract subcriteria	
i. Suprapubic pain	
ii. Gross hematuria	
iii. New or marked increase in incontinence	
iv. New or marked increase in urgency	
v. New or marked increase in frequency	
2. One of the following microbiologic subcriteria	Urine specimens for culture should be processed as soon as possible, preferably within 1–2 h. If urine specimens cannot be processed within 30 min of collection, they should be refrigerated. Refrigerated specimens should be cultured within 24 h.
a. At least 10^5 cfu/mL of no more than 2 species of microorganisms in a voided urine sample	
b. At least 10^2 cfu/mL of any number of organisms in a specimen collected by in-and-out catheter	
B. For residents with an indwelling catheter (both criteria 1 and 2 must be present)	Recent catheter trauma, catheter obstruction, or new-onset hematuria are useful localizing signs that are consistent with UTI but are not necessary for diagnosis.
1. At least 1 of the following sign or symptom subcriteria	
a. Fever, rigors, or new-onset hypotension, with no alternate site of infection	
b. Either acute change in mental status or acute functional decline, with no alternate diagnosis and leukocytosis	
c. New-onset suprapubic pain or costovertebral angle pain or tenderness	
d. Purulent discharge from around the catheter or acute pain, swelling, or tenderness of the testes, epididymis, or prostate	
2. Urinary catheter specimen culture with at least 10^5 cfu/mL of any organism(s)	Urinary catheter specimens for culture should be collected following replacement of the catheter (if current catheter has been in place for >14 d).

NOTE. Pyuria does not differentiate symptomatic UTI from asymptomatic bacteriuria. Absence of pyuria in diagnostic tests excludes symptomatic UTI in residents of long-term care facilities. cfu, colony-forming units.

zation it is at least 10^2 cfu/mL of any number of organisms. Although a small proportion of female residents in LTCFs who have UTI have voided specimens with quantitative counts of less than 10^5 cfu/mL, these specimens were usually evidence of contamination.[24] Before urine samples for culture are obtained from individuals with a chronic indwelling catheter (in place for more than 14 days), the original urinary catheter should be replaced and the specimen should be obtained from the new catheter.[25] Again, a small number of individuals with symptomatic UTI may have lower counts, but a value of at least 10^5 cfu/mL is recommended for increased specificity for surveillance criteria,[26] and it is also consistent with current NHSN acute care definitions for symptomatic UTI.[27] Repeat urine cultures following treatment as a "test of cure" are not recommended because of the high prevalence of asymptomatic bacteriuria in the LTCF population.

A diagnosis of UTI can be made without localizing urinary tract symptoms if a blood culture isolate is the same as the organism isolated from the urine and there is no alternate site of infection. This secondary BSI provides definitive evidence of the existence of systemic infection; in the absence

of an alternate source, a UTI becomes the presumptive diagnosis.

Skin, Soft Tissue, and Mucosal Infections

Consistent with the original surveillance definitions,[1] this section includes definitions for (A) skin (cellulitis/soft tissue/wound) infections, (B) scabies, (C) fungal oral/perioral and skin infections (fungal mucocutaneous infections), (D) herpesvirus skin infections, and (E) conjunctivitis (Table 6). The review of the literature revealed that because diagnoses of infections of the skin, soft tissue, and mucous membranes are heavily dependent on clinical criteria, developing definitions with specificity is challenging. Additionally, there was no original research literature that described the validation of a surveillance definition for soft tissue infections.

The original definitions for SSTIs include clinical but not microbiological criteria, whereas the definitions used by NHSN for infection surveillance include a laboratory component.[27] At this time, there is insufficient evidence to support changing the criteria. However, for LTCF residents who have undergone recent surgical procedures, it would be appropriate to utilize the NHSN criteria for defining surgical site infections.

The review of the literature did not identify studies describing the validation of a surveillance definition for scabies. A criterion for identification of an epidemiological linkage to a known case has been added to the definition because (a) residents with scabies, particularly heavily infested residents, are highly infectious and (b) skin scraping, which remains the dominant diagnostic test, has low sensitivity.[28]

The original surveillance definitions of fungal mucocutaneous infections, including those caused by *Candida* species, require diagnosis by a physician or dentist.[1] Definitions of mucocutaneous candidiasis are based on vague clinical descriptions, and there is insufficient basis for changing the criteria; however, a description of typical lesions has been added to increase the specificity of the definition. Although fungal skin infections other than mucocutaneous candidiasis are rare, the original definition for these required both a maculopapular rash and either physician diagnosis or laboratory confirmation. The minor change in the definition substitutes "characteristic rash or lesions" for "maculopapular rash," since dermatophyte lesions may be macular.[29] No data were found to support revisions in the definitions of herpesvirus skin infections (herpes simplex and herpes zoster) or conjunctivitis.

Gastrointestinal Tract Infections

This section includes infection definitions for (A) gastroenteritis, (B) norovirus gastroenteritis, and (C) *C. difficile* infection (Table 7). The general surveillance definition for gastroenteritis was unchanged from that proposed in the original surveillance definitions.[1] Two new surveillance definitions have been added: (a) criteria for determining the presence of norovirus gastroenteritis and (b) criteria for *C. difficile* infection. These new GI infection definitions were developed because it is now recognized that norovirus is highly transmissible, causing frequent and often large outbreaks in healthcare institutions including LTCFs,[30] and *C. difficile* is the major infectious cause of healthcare-associated and antibiotic-associated diarrhea, contributing to significant morbidity and mortality among elderly institutionalized individuals.[31,32]

The gastroenteritis criteria were deemed appropriate and adequate for identifying sporadic or outbreak-associated cases of GI infection caused by common bacterial enteric pathogens. A minor change in the definition of diarrhea substitutes "liquid or watery stools" for "loose or watery stools," since the concept of liquid stools (ie, conforming to the shape of the specimen collection container) is consistent with other surveillance definitions for diarrheal illness.[27,33] 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.

The definition for norovirus gastroenteritis requires the presence of both a compatible clinical presentation and a laboratory confirmation with detection of the infectious agent by one of several accepted laboratory methods. This definition is based on numerous descriptions of norovirus outbreaks and studies of the clinical manifestations of norovirus gastroenteritis in healthcare settings.[34] The norovirus definition can be used to identify either sporadic or outbreak-associated cases. However, sporadic cases would require laboratory confirmation, whereas outbreak cases may not if either a subset of cases involved in the outbreak have laboratory-confirmed diagnosis or the "Kaplan Criteria" are met.[35] The Kaplan Criteria, which have been useful in identifying outbreaks of acute gastroenteritis due to norovirus,[36] provide a surveillance definition to detect a presumed norovirus-like outbreak in a LTCF even in the absence of laboratory confirmation.

C. difficile has been associated with severe, life-threatening disease, especially in the elderly, and infection with this organism can be acquired or transmitted in LTCFs.[32] *C. difficile* infection may be endemic in some healthcare facilities, as well as a cause of outbreaks. Consequently, it is recommended that surveillance for *C. difficile* infection should be done in LTC settings.[31] Surveillance should include prompt clinical and appropriate laboratory evaluation of LTCF residents who have antibiotic-associated diarrhea or an acute diarrheal illness that is not otherwise explained. A surveillance definition for *C. difficile* infection is proposed that includes clinical and microbiology laboratory test criteria. Importantly, because LTCF residents may be colonized with this organism, tests for *C. difficile* or its toxins should be performed only on diarrheal (liquid) stool specimens, unless ileus is suspected. Laboratory surveillance of asymptomatically colonized residents or repeat testing for the presence of *C. difficile* toxins following treatment is not recommended.[31,32] The proposed definition includes criteria for determining whether the *C. difficile* infection is a primary episode or whether it represents

TABLE 6. Surveillance Definitions for Skin, Soft Tissue, and Mucosal Infections

Criteria	Comments
A. Cellulitis, soft tissue, or wound infection (at least 1 of the following criteria must be present)	
1. Pus present at a wound, skin, or soft tissue site	Presence of organisms cultured from the surface (eg, superficial swab sample) of a wound is not sufficient evidence that the wound is infected. More than 1 resident with streptococcal skin infection from the same serogroup (eg, A, B, C, G) in a long-term care facility (LTCF) may indicate an outbreak.
2. New or increasing presence of at least 4 of the following sign or symptom subcriteria	
a. Heat at the affected site	
b. Redness at the affected site	
c. Swelling at the affected site	
d. Tenderness or pain at the affected site	
e. Serous drainage at the affected site	
f. One constitutional criterion (see Table 2)	
B. Scabies (both criteria 1 and 2 must be present)	An epidemiologic linkage to a case can be considered if there is evidence of geographic proximity in the facility, temporal relationship to the onset of symptoms, or evidence of common source of exposure (ie, shared caregiver). Care must be taken to rule out rashes due to skin irritation, allergic reactions, eczema, and other noninfectious skin conditions
1. A maculopapular and/or itching rash	
2. At least 1 of the following scabies subcriteria	
a. Physician diagnosis	
b. Laboratory confirmation (scraping or biopsy)	
c. Epidemiologic linkage to a case of scabies with laboratory confirmation	
C. Fungal oral or perioral and skin infections	
1. Oral candidiasis (both criteria a and b must be present)	Mucocutaneous *Candida* infections are usually due to underlying clinical conditions such as poorly controlled diabetes or severe immunosuppression. Although they are not transmissible infections in the healthcare setting, they can be a marker for increased antibiotic exposure.
a. Presence of raised white patches on inflamed mucosa or plaques on oral mucosa	
b. Diagnosis by a medical or dental provider	
2. Fungal skin infection (both criteria a and b must be present)	Dermatophytes have been known to cause occasional infections and rare outbreaks in the LTCF setting.
a. Characteristic rash or lesions	
b. Either a diagnosis by a medical provider or a laboratory-confirmed fungal pathogen from a scraping or a medical biopsy	
D. Herpesvirus skin infections	Reactivation of herpes simplex ("cold sores") or herpes zoster ("shingles") is not considered a healthcare-associated infection. Primary herpesvirus skin infections are very uncommon in a LTCF except in pediatric populations, where it should be considered healthcare associated.
1. Herpes simplex infection (both criteria a and b must be present)	
a. A vesicular rash	
b. Either physician diagnosis or laboratory confirmation	
2. Herpes zoster infection (both criteria a and b must be present)	
a. A vesicular rash	
b. Either physician diagnosis or laboratory confirmation	
E. Conjunctivitis (at least 1 of the following criteria must be present)	Conjunctivitis symptoms ("pink eye") should not be due to allergic reaction or trauma.
1. Pus appearing from 1 or both eyes, present for at least 24 h	
2. New or increased conjunctival erythema, with or without itching	
3. New or increased conjunctival pain, present for at least 24 h	

NOTE. For wound infections related to surgical procedures, LTCFs should use the Centers for Disease Control and Prevention's National Healthcare Safety Network Surgical Site Infection criteria and report these infections back to the institution where the original surgery was performed.

TABLE 7. Surveillance Definitions for Gastrointestinal (GI) Tract Infections

Criteria	Comments
A. Gastroenteritis (at least 1 of the following criteria must be present) 1. Diarrhea: 3 or more liquid or watery stools above what is normal for the resident within a 24-h period 2. Vomiting: 2 or more episodes in a 24-h period 3. Both of the following sign or symptom subcriteria a. A stool specimen testing positive for a pathogen (eg, *Salmonella*, *Shigella*, *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	Care must be taken to exclude noninfectious causes of symptoms. For instance, new medications may cause diarrhea, nausea, or vomiting; initiation of new enteral feeding may be associated with diarrhea; and nausea or vomiting may be associated with gallbladder disease. Presence of new GI symptoms in a single resident may prompt enhanced surveillance for additional cases. In the presence of an outbreak, stool specimens should be sent to confirm the presence of norovirus or other pathogens (eg, rotavirus or *E. coli* O157 : H7).
B. Norovirus gastroenteritis (both criteria 1 and 2 must be present) 1. At least 1 of the following GI subcriteria a. Diarrhea: 3 or more liquid or watery stools above what is normal for the resident within a 24-h period b. Vomiting: 2 or more episodes of in a 24-h period 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)	In the absence of laboratory confirmation, an outbreak (2 or more cases occurring in a long-term care facility [LTCF]) of acute gastroenteritis due to norovirus infection may be assumed to be present if all of the following criteria are present ("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.
C. *Clostridium difficile* infection (both criteria 1 and 2 must be present) 1. One of the following GI subcriteria a. Diarrhea: 3 or more liquid or watery stools above what is normal for the resident within a 24-h period 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	A "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. A "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. In the setting of an outbreak of GI infection, individuals could have positive test results for presence of *C. difficile* toxin because of ongoing colonization and also be coinfected with another pathogen. It is important that other surveillance criteria be used to differentiate infections in this situation.

a recurrence (relapse or reinfection). Published recommendations for surveillance for *C. difficile* infection have also attempted to determine the setting in which the infection was likely to have been acquired;[33] however, there is controversy about how to apply these attribution criteria in LTCFs.[8]

Systemic Infections

The original surveillance definitions included BSI and unexplained febrile episodes in this section.[1] However, there has been scant literature to better define approaches to the diagnosis or routine surveillance of these clinical entities in LTCFs. In 2008, the IDSA guideline did not recommend performing blood cultures as part of the evaluation for infection in "most" residents in LTCFs, but they qualified this by saying that in facilities with quick access to laboratory facilities, physicians available to respond to results, and capacity to administer parenteral antibiotics, diagnostic blood cultures would be appropriate.[4]

There have been limited studies assessing the utility and reliability of blood cultures in LTCFs. In 2005, Mylotte[37] reviewed several studies evaluating nursing home–associated BSI. Only 1 reported on the total numbers of blood cultures obtained during the study period,[38] and 1 reported the proportion of contaminated blood cultures ("false positives").[39] None of the studies in the review had data more recent than from 2000. Since the Mylotte review, a single study from Israel

has reported on results from blood cultures performed on samples from a multilevel geriatric facility over a 2-year period from 2002 to 2004.[40] In this study, 252 (15.8%) of 1,588 cultures had positive results, which indicates an incidence of BSI of 0.46 per 1,000 resident-days. The study did not provide data on episodes of suspected contaminated cultures. However, in a cohort of 100 bacteremic residents, only 58% had received adequate empiric antibiotic therapy and the mortality rate was 34%, compared with 13% in nonbacteremic matched controls. The incidence of BSI and the prevalence of positive cultures were much higher in this study compared with earlier studies, suggesting that those LTCFs with the capacity to perform blood cultures and respond to results should include blood cultures in the diagnostic evaluation of infection.

Given the limited evidence addressing the effectiveness of blood cultures in LTCFs, we did not attempt to propose a revised surveillance definition for BSI. Instead, consideration should be given to an application of the NHSN criteria for central line–associated BSI in those LTCFs who care for residents with indwelling vascular catheters including peripherally inserted central catheters (PICCs) and hemodialysis catheters.[27]

CONCLUSIONS

These infection surveillance definitions for LTCFs update the consensus definitions proposed by McGeer et al, incorporating evidence published over the interim 20 years. The majority of definitions and criteria were retained with only minor revisions except for those for UTI, where the criteria were made more specific, and GI infection, where 2 new infections were added to the surveillance definitions (norovirus and *C. difficile*).

These updated definitions are intended to serve as a national standard for infection surveillance in LTCFs. Because they are implemented in this setting, feedback from providers and efforts to validate the definitions will guide subsequent modifications as appropriate.

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ENDORSEMENTS

These definitions have been endorsed by the American Medical Directors Association, the Association of Medical Microbiology and Infectious Disease–Canada, the Association for Professionals in Infection Control and Epidemiology, the Community and Hospital Infection Control Association–Canada, and the National Association of Directors of Nursing Administration in Long Term Care.

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