Clinical Practice Guideline for the Evaluation of Fever and Infection in Older Adult Residents of Long-Term Care Facilities: 2008 Update by the Infectious Diseases Society of America

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Residents of long-term care facilities (LTCFs) are at great risk for infection. Most residents are older and have multiple comorbidities that complicate recognition of infection; for example, typically define fever is absent in more than one-half of LTCF residents with serious infection. Furthermore, LTCFs often do not have the on-site equipment or personnel to evaluate suspected infection in the fashion typically performed in acute care hospitals. In recognition of the differences between LTCFs and hospitals with regard to hosts and resources present, the Infectious Diseases Society of America firs provided guidelines for evaluation of fever and infection in LTCF residents in 2000. The guideline presented here represents the second edition, updated by data generated over the intervening 8 years. It focuses on the typical elderly person institutionalized with multiple chronic comorbidities and functional disabilities (e.g., a nursing home resident). Specifi topic reviews and recommendations are provided with regard to what resources are typically available to evaluate suspected infection, what symptoms and signs suggest infection in a resident of an LTCF, who should initially evaluate the resident with suspected infection, what clinical evaluation should be performed, how LTCF staff can effectively communicate about possible infection with clinicians, and what laboratory tests should be ordered. Finally, a general outline of how a suspected outbreak of a specifi infectious disease should be investigated in an LTCF is provided.

EXECUTIVE SUMMARY

By the year 2030, 20% of the United States population is estimated to be aged ⩾65 years, and almost 30 million of these persons are anticipated to have functional limitations that will increase the need for long-term care. Currently, there are >16,000 nursing homes/facilities for long-term care in the United States in which ~1.5 million older adults reside. Care providers in long-term care facilities (LTCFs) are primarily nursing staff, and

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It is important to realize that guidelines cannot always account for individual variation among patients. They are not intended to supplant physician judgment with respect to particular patients or special clinical situations. The Infectious Disease Society of America considers adherence to these guidelines to be voluntary, with the ultimate determination regarding their application to be made by the physician in the light of each patient's individual circumstances.

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most contract with group practices or use private physicians from the local community for clinical services. Select specialty services and diagnostic tests are most often provided through contracts with outside providers (e.g., dental care, podiatry, and imaging). Other more-complex or technical services require the resident be transferred to an acute care facility.

Urinary tract infection (UTI), pneumonia, soft-tissue infection, gastroenteritis, and prosthetic device–associated infections are well-recognized problems among elderly LTCF residents and are very common. For example, UTI occurs at an incidence of 0.1–2.4 cases per 1000 resident-days, and pneumonia develops among elderly nursing home residents at a rate of 1 episode per 1000 days of care, which is 10-fold greater than the rate of pneumonia among elderly persons who reside in the community. The common use of antibiotic therapy in LTCF residents for illness that is caused (or suspected to have been caused) by infection contributes to the high rates of antibiotic-resistant pathogens (e.g., methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus* species) and antibiotic-related complications, such as *Clostridium diff cile* colitis, in this setting.

The multifaceted nature of the evaluation of patients in LTCFs has led to participation, review, and support of these recommendations by the following organizations: Society for Healthcare Epidemiology of America and the American Geriatrics Society.

Additional and new information provided in this report since its firs publication in 2000 include the importance of functional assessment as part of the infectious disease evaluation in an older adult; proper method of collecting urine samples from individuals with a long-term indwelling bladder catheter for purposes of microbiological evaluation, as well as use of the dipstick method for diagnosis of a UTI; use of pulse oximetry for pneumonia diagnosis in nursing home residents; diagnostic aspects of legionellosis respiratory infection; diagnostic information on respiratory syncytial virus infection in this setting; diagnosis of conjunctivitis and fungal skin infections in LTCF residents; and expansion of the section on gastrointestinal (GI) infections, including those due to norovirus, protozoas, *C. difficile* and intraabdominal abscesses. These guidelines are specificall intended to apply to older adult residents of LTCFs. The potential heterogeneity of conditions present in LTCF residents (e.g., persons with spinal cord injuries or acute brain injury and young adults with rehabilitation needs) suggests that the recommendations described herein may not apply to all LTCF residents or to all such facilities, and thus, the recommendations are intended to assist with the management of the majority of LTCF residents (i.e., older adults with multiple comorbidities and functional disabilities).

Resources

Most LTCFs have limited diagnostic equipment on site and are staffed by nursing personnel (primarily certifie nurse assistants [CNAs]). Specifi data are available to make recommendations for personnel, but no data are available to guide minimal requirements for diagnostic equipment.

1. LTCFs should employ sufficien staff to adequately care for all residents (B-III).

Symptoms and Signs of Suspected Infection

Typical symptoms and signs of infection are frequently absent in LTCF residents, and as one ages and becomes more frail, basal body temperature decreases, making it less likely that one will achieve classic definition of fever. Infection should be suspected in residents with any of the following characteristics:

2. Infection should be suspected in LTCF residents with:

A. Decline in functional status, define as new or increasing confusion, incontinence, falling, deteriorating mobility, reduced food intake, or failure to cooperate with staff (B-II).

B. Fever, define as: (1) A single oral temperature >100°F (>37.8°C); or (2) repeated oral temperatures >99°F (>37.2°C) or rectal temperatures >99.5°F (>37.5°C); or (3) an increase in temperature of >2°F (>1.1°C) over the baseline temperature (B-III).

Evaluation of the Resident

CNAs are almost always the firs to recognize a symptom or sign of infection in LTCF residents, but data suggest that they frequently misinterpret these clinical clues.

3. The initial clinical evaluation of infection should be a 3-tiered approach involving a CNA, the on-site nurse, and an advanced-practice nurse, physician assistant, or physician (B-III).

4. CNAs should measure vital signs (temperature, heart rate, blood pressure, and respiratory rate). Residents who are suspected of having an infection or who have fever, as define previously, should be reported immediately to the on-site nurse (B-II).

Clinical Evaluation

Few data are available to suggest which of the most helpful clinical evaluations should be performed in LTCF residents with suspected infection. However, on the basis of the most common sites of infection and the tenuous physiologic reserve for most residents of LTCFs, the following recommendations can be made:

5. Initial clinical evaluation should involve assessment of

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respiratory rate, hydration status, mental status, oropharynx, conjunctiva, skin (including sacral, perineum, and perirectal areas), chest, heart, abdomen, and indwelling devices (if present) (B-III).

Communication

Effective communication of a resident's status is perhaps intuitive, but some guiding principles can be stated.

6. Information should be relayed to the responsible advance-practice nurse, physician assistant, or physician for decisions regarding further evaluation (B-III).
7. The full extent of the clinical evaluation should be documented as part of the medical record. If specif c diagnostic measures are consciously withheld, the reasons should be recorded (B-III).

Laboratory Tests

A full summary of the evaluations for laboratory tests in specifi situations is not possible, because they are too numerous to list. The reader is referred to the recommendations for specif c syndromes (i.e., UTI, pneumonia, GI infection, and skin and soft-tissue infection [SSTI]). However, several overall guiding principles can be highlighted.

Initial Diagnostic Testing

8. Advance directives for residents should be reviewed prior to any intervention; if not prohibited by such directives, initial diagnostic tests for suspected infection can be performed in the LTCF if resources are available and if studies can be done in a timely manner (B-III).

Blood Cell Count

9. A complete blood cell (CBC) count, including peripheral WBC and differential cell counts (preferably a manual differential to assess bands and other immature forms), should be performed for all LTCF residents who are suspected of having infection within 12–24 h of onset of symptoms (or sooner, if the resident is seriously ill), consistent with local standards of practice **(B-II)**.
10. The presence of an elevated WBC count (WBC count, $\geqslant$14,000 cells/mm^3) or a left shift (percentage of band neutrophils or metamyelocytes, >6%; or total band neutrophil count, $\geqslant$1500 cells/mm^3) warrants a careful assessment for bacterial infection in any LTCF resident with suspected infection, with or without fever (B-II).
11. In the absence of fever, leukocytosis and/or left shift, or specifi clinical manifestations of a focal infection, additional diagnostic tests may not be indicated, because of the low potential yield (C-III). Nonbacterial infections, however, cannot be excluded.

Urinalysis and Urine Culture

12. Urinalysis and urine cultures should not be performed for asymptomatic residents (A-I).
13. In noncatheterized residents, the diagnostic laboratory evaluation of suspected UTI should be reserved for those with acute onset of UTI-associated symptoms and signs (e.g., fever, dysuria, gross hematuria, new or worsening urinary incontinence, and/or suspected bacteremia) (A-II).
14. In residents with long-term indwelling urethral catheters, evaluation is indicated if there is suspected urosepsis (i.e., fever, shaking chills, hypotension, or delirium), especially in the context of recent catheter obstruction or change (A-II).
15. Appropriately collected urine specimens include a midstream or clean-catch specimen obtained from elderly men who are cooperative and functionally capable; however, it is often necessary to use a freshly applied, clean condom external collection system, with frequent monitoring of the urine bag (B-II). Specimen collection from women will often require an in-and-out catheterization (B-III).
16. Residents with long-term indwelling urethral catheters and suspected urosepsis should have catheters changed prior to specimen collection and institution of antibiotic therapy (A-II).
17. The minimum laboratory evaluation for suspected UTI should include urinalysis for determination of leukocyte esterase and nitrite level by use of a dipstick and a microscopic examination for WBCs (B-II). If pyuria (>10 WBCs/high-power field or a positive leukocyte esterase or nitrite test is present on dipstick, only then should a urine culture (with antimicrobial susceptibility testing) be ordered (B-III).
18. If urosepsis is suspected, urine and paired blood specimens should be obtained, if feasible, for culture and antimicrobial susceptibility testing, and a Gram stain of uncentrifuged urine should be requested (B-III).

Blood Culture

19. In a study of older adult nursing home residents, blood cultures were demonstrated to have a low yield and rarely to influenc therapy; thus, they are not recommended for most residents of LTCFs (B-II) (note: this may not apply to all types of residents or to all types of LTCFs). Blood cultures may be appropriate for residents in whom bacteremia is highly suspected and if the LTCF has quick access to laboratory facilities, adequate physician coverage to respond to positive culture results, and a capacity to administer parenteral antibiotics.

Pneumonia Evaluation

If pneumonia is clinically suspected and resources are available, the following diagnostic studies should be performed:

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20. Pulse oximetry should be performed for residents with respiratory rates of >25 breaths/min, to document hypoxemia (oxygen saturation, <90%) in residents with suspected pneumonia and to guide transfer to an acute care facility pending the resident's or family's wishes (B-II).

21. Chest radiography should be performed if hypoxemia is documented or suspected, to identify the presence of a new infiltrat compatible with acute pneumonia and to exclude other complicating conditions (e.g., multilobe infiltrates large pleural effusions, congestive heart failure, or mass lesions) (B-II).

Respiratory Viral Infection Evaluation

22. At the onset of a suspected respiratory viral infection outbreak, nasopharyngeal wash or swab samples obtained from the throat and nasopharynx (combined with refrigerated viral transport media in a single tube) should be obtained from several acutely ill residents for transportation to an experienced laboratory for virus isolation and rapid diagnostic testing for influ nza A virus and other common viruses (A-III).

Evaluation of SSTI

23. Bacterial cultures should be performed only under select conditions. Surface swab cultures are not indicated for the diagnosis of most bacterial SSTIs (A-II), with the exception of conjunctivitis (B-III). Needle aspiration (only skilled physicians should perform this procedure) or deep-tissue biopsy to obtain samples for Gram stain and culture may be appropriate in special circumstances in which unusual pathogens are suspected, fluctuan areas suggest an abscess is present, or initial antimicrobial treatment has been unsuccessful (C-III).

24. If a pressure ulcer demonstrates poor healing and/or persistent purulent drainage, obtain deep specimens for culture of tissue and bone specimens at the time of surgical debridement or biopsy (B-II). MRI is the most sensitive imaging modality to detect osteomyelitis, but bone biopsy for histopathologic examination definitivel confi ms the diagnosis and is most useful in guiding antimicrobial therapy (A-III).

25. For suspected mucocutaneous fungal infection, a scraping can be performed for potassium hydroxide 10% preparation to verify the presence of yeast or dermatophytes (B-III). If mucocutaneous candidiasis is refractory to empirical treatment, culture can be performed for the detection of drug-resistant species (B-III).

26. For suspected herpes simplex or herpes zoster, skin scrapings may be examined for the presence of giant cells (Tzanck preparation) and/or sent for culture, immunof uorescent viral antigen studies, or PCR (A-III).

27. Scabies should be considered in any nursing home resident with a generalized rash that is unexplained. Diagnosis should be attempted by light microscopy demonstration of mites, eggs, or mite feces on mineral oil preparations of several scrapings (B-III). If proper diagnostic equipment is not available and if clinical experience with scabies is limited, consider consultation with a dermatologist to inspect or obtain scrapings from suspected persons (C-III).

Evaluation of GI Infection

28. In the absence of an outbreak of GI illness, residents with symptoms of gastroenteritis consistent with small bowel infection and a stable clinical status should be evaluated before 7 days for volume assessment, but no laboratory evaluation is required unless the resident is severely ill or symptoms persist beyond 7 days. In such cases, presence of *Giardia* species and other protozoa should be examined in stool specimens (B-III).

29. If the resident exhibits symptoms of colitis (e.g., severe fever, abdominal cramps, and/or diarrhea, with or without blood and/or WBCs in the stool), initial evaluation for *C. diffici e* should be performed, especially if the patient has received antibiotics within the previous 30 days. Submit a single diarrheal stool specimen to the laboratory for a *C. difficil* toxin assay. If diarrhea persists and if the assay result is negative, submit 1 or 2 additional stool specimens for the toxin assay (A-II).

30. In a patient with symptoms of colitis but no history of antibiotic use within the previous 30 days and/or a negative *C. difficil* evaluation result, one should submit a stool sample for culture for isolation of the most frequent invasive enteropathogens (i.e., *Campylobacter jejuni, Salmonella* and *Shigella* species, and *Escherichia coli* O157:H7) (A-II).

31. Local public health authorities should be consulted if rates of gastroenteritis or colitis exceed baseline thresholds in the facility (if these thresholds are known), if ⩾2 cases occur at the same time in the same unit, or if a reportable pathogen is isolated (B-III).

32. Intra-abdominal infections and abscesses can occur in LTCF residents as a consequence of GI pathology. These complications are relatively uncommon but are associated with substantial morbidity and mortality; evaluation and treatment of possible abscesses should be performed in an acute care setting (B-III).

Suspected Outbreak

A broad description of an outbreak investigation is beyond the scope of these guidelines, but a general guide is provided, including circumstances in which appropriate authorities (e.g., the Centers for Disease Control and Prevention) should be notified An important aspect of the outbreak investigation is that residents with advanced directives that prohibit testing can and often should be tested if the goal is not for care of that specifi patient but reduction in the risk of illness in others.

33. During a possible outbreak of infection, testing of residents, regardless of advanced directive status, may be war-

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Table 1. Infectious Diseases Society of America–US Public Health Service Grading System for ranking recommendations in clinical guidelines.

Category, grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for use
B	Moderate evidence to support a recommendation for use
C	Poor evidence to support a recommendation
Quality of evidence	
I	Evidence from ⩾1 properly randomized, controlled trial
II	Evidence from ⩾1 well-designed clinical trial, without randomization; from cohort or case-controlled analytical studies (preferably from >1 center); from multiple time-series; or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

NOTE. Adapted from Canadian Task Force on the Periodic Health Examination [2].

ranted for diagnostic and infection-control purposes for the protection of other residents and staff (B-III).

PRACTICE GUIDELINES AND UPDATE METHODOLOGY

Practice guidelines. Practice guidelines are systematically developed statements to assist practitioners and patients in making decisions about appropriate health care for specifi clinical circumstances [1]. Attributes of good guidelines include validity, reliability, reproducibility, clinical applicability, clinical f exibility, clarity, multidisciplinary process, review of evidence, and documentation [1].

Panel composition. The Infectious Diseases Society of America (IDSA) Standards and Practice Guidelines Committee (SPGC) convened experts in the evaluation of residents with fever and infection in LTCFs. The Panel's expertise included infectious diseases, geriatrics, primary care, long-term care, and epidemiology/infection control.

Literature Review and Analysis

For the 2008 update, the Expert Panel completed the review and analysis of data published since 1999. Computerized literature searches (with the PubMed database) of the English-language literature published from 1999 through 2007 were performed. Search terms included "long-term care," "geriatrics," "infection," "communication," "testing," "outbreaks," "fever", "nursing home infections," "sepsis," "bacteremia," "pneumonia," "urinary tract infection," "pressure ulcers," "gastrointestinal infections," "scabies," "herpes zoster," "clostridium difficile, "candida," "bacterial diarrhea," "giardiasis," "influenza, "conjunctivitis," and "advanced directives."

Process Overview

In assessing the evidence regarding the evaluation of fever and infection in LTCF residents, the Expert Panel followed a process used in the development of other IDSA guidelines. The process included a systematic weighting of the quality of the evidence and the grade of recommendation (table 1) [2].

Consensus Development Based on Evidence

The Expert Panel met on 4 occasions via teleconference to complete the work of the guidelines. The purpose of the teleconferences was to discuss the questions to be addressed, to make writing assignments, and to discuss recommendations. All members of the Expert Panel participated in the preparation and review of the draft guidelines. Feedback from external peer reviews was obtained. The guidelines were reviewed and approved by the SPGC and the Board of Directors prior to dissemination.

Guidelines and Conflicts of Interest

All members of the Expert Panel complied with the IDSA policy on conflict of interest, which requires disclosure of any fi ancial or other interest that might be construed as constituting an actual, potential, or apparent conflict Members of the Expert Panel were provided the IDSA's conflic of interest disclosure statement and were asked to identify associations with companies developing products that may be affected by promulgation of the guidelines. Information was requested regarding employment, consultancies, stock ownership, honoraria, research funding, expert testimony, and membership on company advisory committees. The Expert Panel made decisions on a case-by-case basis as to whether an individual's role should be limited as a result of a conflict Potential conflict are listed in the Acknowledgements section.

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Revision Dates

At annual intervals, the Panel Chair, the SPGC liaison advisor, and the Chair of the SPGC will determine the need for revisions to the guideline on the basis of an examination of current literature. If necessary, the entire Expert Panel will be reconvened to discuss potential changes. If appropriate, the Expert Panel will recommend revision of the guidelines to the SPGC and the IDSA Board for review and approval.

INTRODUCTION

In 2000, the IDSA published clinical practice guidelines on the evaluation of fever and infection in LTCFs [3]. The IDSA updates its guidelines when new data or publications might change a prior recommendation or when the Expert Panel feels clarif cations or additional guidance is warranted.

The previous document is a source for a more detailed review of earlier studies [3], and the reader is referred to that document for additional information. The Expert Panel addressed the following questions in the 2008 Update.

1. What are the minimum resources required to evaluate suspected infection in LTCFs?
2. What are the criteria for fever and symptoms and signs that suggest infection in a resident of an LTCF?
3. Who should perform the initial evaluation of the resident with suspected infection?
4. What clinical evaluation should be performed for an LTCF resident with suspected infection?
5. How can LTCF staff effectively communicate concerns about possible infection with clinicians who will be making treatment decisions?
6. What laboratory tests should be ordered for the LTCF resident with suspected infection?
7. How should a suspected outbreak of a specif c infectious disease be investigated in LTCFs?

BACKGROUND

Public health importance: demographic characteristics of the aging population and long-term care. The aged human population is undergoing unprecedented growth in the United States and globally. Multiple nations have >2 million older citizens each, and the number is expected to grow within the next few decades, with the greatest burden in the developing world [4, 5]. By the year 2030, it is estimated that 20% of the US population will be aged ⩾65 years, among whom almost 30 million persons are anticipated to have functional limitations within the ensuing decade [6, 7]. These estimates are linked to the rising need for long-term care, particularly in nursing homes/facilities, in the United States.

Currently, in the United States, there are >16,000 nursing homes/facilities for long-term care in which ~1.5 million older adults reside. More than 90% of these facilities are either proprietary or voluntary nonprofit with the majority housing 50–200 residents each. Care providers within facilities are primarily nursing staff, with an average of 7 registered nurses (RNs), 13 licensed practical nurses (LPNs), and 35 CNAs per 100 resident beds [8]. The minority (19.6%) have physician providers on full-time staff. The majority have contracts with group practices or use private physicians from the local community. Select specialty services and diagnostic testing are most often provided through contracts with outside providers (e.g., dental care, podiatry, and imaging services) [8]. Other more complex or technical services require hospitalization of the resident. Overall, care needs are becoming increasingly complex for this population, which consists primarily of elderly women (median age, ~85 years) who are afflicte with a variety of comorbid conditions (e.g., dementia, stroke, or congestive heart failure) and who have functional limitations in mobility and dependence in activities of daily living (e.g., bathing, dressing, and toileting) [9].

Multifactorial risks of infection in older adults in LTCFs. The convergence of age-associated impairments in immunity, increasing prevalence of comorbid disease, functional limitations of extreme age, and residence in group quarters within a nursing home/facility increase the risk burden for infectious disease [5, 10, 11]. The specifi nature of senescence of the immune system with normal aging has been an area of increasing investigation, with evidence supporting impairments in adaptive (e.g., B and T cell function) and innate immunity (e.g., surface expression or function of Toll-like receptors) that may relate to the increased risk of disease due to specif c pathogens (e.g., *Listeria* species, *Mycobacterium tuberculosis,* and varicella-zoster virus) and an impaired response to vaccination (e.g., influenza pneumococcus, and zoster vaccines) [7, 12–15]. Concomitant comorbidities (e.g., diabetes, obstructive lung disease, urinary obstruction, impaired swallowing, poor dentition, and implanted prosthetic devices) further enhance the risk for common health care–associated infectious syndromes in the urinary tract, lung, and soft tissue. The common use of empirical antibiotic therapy for these conditions results in the additional complications of infections with antibiotic-resistant pathogens (e.g., methicillin-resistant *S. aureus,* vancomycin-resistant *Enterococcus* species, multidrug-resistant gram-negative bacilli) and *C. difficil* colitis [16]. As a result, the LTCF has become a reservoir for antibiotic-resistant pathogens in which elderly residents requiring periodic hospitalization may carry resistant organisms across sites of care.

Burden of infection. Although UTI, pneumonia, soft-tissue infection, gastroenteritis, and indwelling device–associated infections are well-recognized problems among elderly nursing home residents, UTI and pneumonia represent the greatest infectious disease burden. For example, UTI is the most commonly reported bacterial infection in nursing home residents, with an incidence of 0.1–2.4 cases per 1000 resident-days, and

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it is a leading source of sepsis and death [17]. Similarly, pneumonia develops among elderly nursing home residents at a rate of 1 episode per 1000 days of care, which is 10-fold greater than the rate of pneumonia among elderly community dwellers. At the current rate, by the year 2030, there will be almost 2 million episodes of nursing home–acquired pneumonia annually, with its inherent consequences of mortality, morbidity, functional decline, and health care expenditures [18–20].

RECOMMENDATIONS FOR THE EVALUATION OF FEVER AND INFECTION IN LTCFs

I. WHAT ARE THE MINIMUM RESOURCES REQUIRED TO EVALUATE SUSPECTED INFECTION IN LTCFs?

Recommendation

1. LTCFs should employ sufficien staff to adequately care for all residents (B-III).

Evidence Summary

When clinicians evaluate suspected infection in hospitalized patients, diagnostic technologies are usually readily available, and there are a variety of staff trained in acutely evaluating changes in health status. In contrast, the overarching goals of care for LTCF residents are patient comfort, maintenance or improvement of functional status, stabilization of chronic illnesses, and prevention of new health problems, and care is most often provided by the nursing staff (primarily CNAs) under the direction of a director of nursing. LTCF resident-to–health care staff ratios are considerably lower than patient-to-staff ratios at acute care hospitals. Although there is no federal standard for specifi levels of nurse staffin in a nursing home, the Centers for Medicare and Medicaid Services requires nursing homes to employ sufficien staff to adequately care for all residents [21]. Staffin guidelines should be adjusted according to case mix and acuity of the residents. A threshold for acceptable ratios of nursing staff to residents can be recommended on the basis of this study, as follows: ratio of CNAs to residents, ⩾1:12; ratio of RNs plus LPNs to residents, ⩾1:30; and ratio of RNs to residents, ⩾1:120 [21].

Relatively few physicians practice in an LTCF, and routine physician visits are infrequent—often monthly or even less frequent, depending on state or federal regulations. Some visits may be made by cross-covering physicians or physician extenders (i.e., physician assistants and advance-practice nurses). Between these visits, initiation of diagnostic testing and changes in medications and other treatments are usually accomplished by telephone communication [22–24].

Technologies available for the prompt diagnosis of infection in hospitals are often difficul to access in the LTCF. Vital signs generally are obtained on a weekly basis for stable residents who require long-term maintenance care; however, more-frequent measurements can be obtained on the basis of nursing judgment or physician order. Criteria for infections that rely less on diagnostic studies and more on patient symptoms and signs and on resources that are more readily available in LTCFs have been developed and widely used but not validated [25, 26].

There is no minimum requirement that diagnostic equipment be present on-site for evaluation of fever and suspected infection in LTCFs other than for equipment used for clinical assessment. Immediately available laboratory tests and radiography equipment are sometimes located on-site, but personnel to operate these devices are almost never available every day, 24 h per day. Contract organizations often provide services, and subspecialty or surgical consultation is very rarely available except for LTCFs attached to acute care hospitals. Cost and capitated care may influenc decisions to transport patients off site for diagnostic evaluation.

II. WHAT ARE THE CRITERIA FOR FEVER AND SYMPTOMS AND SIGNS THAT SUGGEST INFECTION IN A RESIDENT OF AN LTCF?

Recommendation

2. Infection should be suspected in LTCF residents with:

A. Decline in functional status, define as new or increasing confusion, incontinence, falling, deteriorating mobility, reduced food intake, or failure to cooperate with staff (B-II).

B. Fever, define as: (1) A single oral temperature >100°F (>37.8°C); or (2) repeated oral temperatures >99°F (>37.2°C) or rectal temperatures >99.5°F (>37.5°C); or (3) an increase in temperature of >2°F (>1.1°C) over the baseline temperature (B-III).

Evidence Summary

Clinical manifestations of infection. As in younger adults, the clinical clues that an infection might be present in an older person include fever and some obvious clinical signs (e.g., erythema and purulence of the eye [conjunctivitis]; heat, redness, purulence, and skin breakdown [infected pressure ulcer]; and cough and yellow sputum [respiratory infection]). However, clinical finding in infected elderly residents in LTCFs may also be absent or too subtle to be recognized by the staff, or infection may manifest atypically as a change in mental or cognitive function or a decline in physical functional status (e.g., the person is unable to perform the usual activities of daily living). Berman et al. [27] determined that infection is present in 77% of episodes of "decline in function," define as new or increasing confusion, incontinence, falling, deteriorating mobility, or failure to cooperate with rehabilitation. Ascertaining the functional status or functional capacity of older persons with infection before, during, and after resolution of infection is an

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essential aspect of managing the health care in the geriatric population [5].

Thus, LTCF residents may have typical or atypical presentations of infection [27–30]. For example, Brooks et al. [31] found "typical" symptoms and signs of UTI, such as fever (30%; absolute temperature criterion for fever was not defined) were not sensitive indicators of infection in LTCF residents. In contrast, persons with respiratory tract infection (RTI) more often presented with classic manifestations (cough, 75%; fever, 62%; and rales, 55%). In another large study, just 44% of nursing home residents with possible or probable pneumonia noted on a chest radiograph had a temperature of ⩾38°C, but only 7.5% had no respiratory symptoms [32].

Fever criteria in residents of LTCFs. There are several methods to determine whether fever is present in the LTCF resident. Basal body temperatures in frail, elderly persons may be lower than the well-established mean value of 37°C or 98.6°F [33]. In a study by Castle et al. [34] in which all temperatures were determined orally or rectally with use of an electronic thermistor probe and in which subjects were mostly male veteran nursing-facility residents, a single temperature reading of 101°F (38.3°C) had a sensitivity of only 40% for predicting infection. Lowering the criterion to 100°F (37.8°C) raised the sensitivity to 70% for predicting infection while maintaining excellent specificit at 90%. Thus, according to Castle et al. [34], a single temperature reading of ⩾100°F (37.8°C) is both a sensitive and specifi predictor of infection, with a positive predictive value of 55%, in LTCF residents. Other suggested temperature criteria indicative of possible infection in LTCF residents are an increase in temperature of at least 2°F (1.1°C) over baseline or an oral temperature of ⩾99°F (37.2°C) or a rectal temperature of ⩾99.5°F (37.5°C) on repeated measurements [34, 35].

Although temperatures in LTCF residents are most often measured in the mouth, there is some evidence that rectal measurements of temperatures may be more accurate than either the oral or axillary method and that electronic techniques are better than standard mercury thermometry [36, 37]. Another alternative method for measuring temperature is tympanic membrane thermometry. In one study of nursing home residents, the correlation of tympanic membrane thermometry versus rectal thermometry was somewhat better than oral versus rectal thermometry [38]. However, there are insuffi ient data to recommend the tympanic membrane method for measuring fever in older persons.

III. WHO SHOULD PERFORM THE INITIAL EVALUATION OF THE RESIDENT WITH SUSPECTED INFECTION?

Recommendations

3. The initial clinical evaluation of infection should be a 3-tiered approach involving a CNA, the on-site nurse, and an advanced-practice nurse, physician assistant, or physician (B-III).
4. CNAs should measure vital signs (temperature, heart rate, blood pressure, and respiratory rate). Residents who are suspected of having an infection or who have fever, as def ned previously, should be reported immediately to the on-site nurse (B-II).

Evidence Summary

Once infection is suspected or fever is established by the criteria outlined above, clinical evaluation of LTCF residents with suspected infection (i.e., clinical manifestations of infection or decline in functional status) should be a 3-tiered level of evaluation that includes CNAs, the on-site nurse (charge nurse), and the responsible physician or physician extender (i.e., advanced-practice nurses or physician assistant). A number of studies have reported use of advanced-practice nurses (e.g., nurse practitioners) to assess acute problems in residents of LTCFs as an approach to improve evaluation [23, 39–41]. Evidence suggests that geriatric nurse practitioners (GNPs) can enhance identificatio of acute medical problems (including fever) and improve activities of daily living, nursing therapies, and drug treatments, compared with the absence of GNPs [40]. However, GNPs do not alter overall outcomes, as measured by the resident's functional status, physical condition, and satisfaction [42]. Specifi outcome data do not exist for infection. It is unknown whether NPs without geriatric certificatio will perform equally well.

CNAs often have the firs opportunity to assess a resident in an LTCF. Jackson and Schafer [41] surveyed 50 CNAs and asked which symptoms or signs of pneumonia warranted notificatio of the charge nurse. For temperature elevation, cough, and shortness of breath, the response rates were 30%, 24%, and 12%, respectively. These investigators then determined the agreement/disagreement between GNPs (the number is not specifie in the paper) and CNAs regarding the presence of infection. There were 110 assessments made among 75 nursing facility residents. In 76 instances (69%), both groups agreed that there was no infection, and in 4% of assessments, both groups agreed that an infection was present. However, in the remaining 27% of assessments, there was disagreement between the GNPs and CNAs about whether infection was present or absent or about the type of infection; CNAs often attributed any symptoms and signs to "colds," even when the GNPs found UTIs, skin infections, and pneumonia. The fina diagnoses were not conf rmed by a physician.

To our knowledge, no studies have compared LPNs, RNs, advance-practice nurses, or physician assistants with physicians or have examined the impact of specifi training on the ability of CNAs to correctly identify infections. Several authors suggest the use of specifi protocols to assist nurses and GNPs with

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evaluation of fever [23, 43], but information on the utility of such protocols in LTCF residents has not been published. Thus, at present, the role of CNAs is to recognize and report significant changes in the clinical condition of LTCF residents or abnormalities in vital signs; the role of physician extenders and physicians is to initiate appropriate diagnostic and therapeutic interventions.

IV. WHAT CLINICAL EVALUATION SHOULD BE PERFORMED FOR AN LTCF RESIDENT WITH SUSPECTED INFECTION?

Recommendation

5. Initial clinical evaluation should involve assessment of respiratory rate, hydration status, mental status, oropharynx, conjunctiva, skin (including sacral, perineum, and perirectal areas), chest, heart, abdomen, and indwelling devices (if present) (B-III).

Evidence Summary

No specifi studies have addressed the utility of a focused history and physical examination, but a general approach to the clinical evaluation of fever in residents of LTCFs can be suggested on the basis of the most likely sources of infection [44, 45]. Attention should be directed toward the following: mental status, oropharynx, conjunctiva, skin (including turning the patient to look for pressure ulcers), chest, heart, abdomen, perineum and perirectal area, and CNS [44]. Several groups have outlined general guidelines for evaluation of suspected infection, including clinical recommendations [25, 26, 45]. Although these guidelines have not been validated, they represent a consensus of representatives from various organizations interested in or involved with care of LTCF residents with infection.

An English study from the 1980s suggested that a respiratory rate of >25 breaths/min was both sensitive and specif c for diagnosis of pneumonia [46]. In an observational study of 87 English LTCF residents, the normal respiratory rate was 16–25 breaths/min. In a follow-up prospective study of 60 consecutive residents acutely admitted to a geriatric unit, pneumonia was diagnosed in 21 (35%), 19 (90%) of whom had respiratory rates of >25 breaths/min. The respiratory rate of 12 residents with UTIs were not elevated, and of those residents without infection, only 1 of 27 had a respiratory rate of >25 breaths/min. However, in a study of 2334 residents of 36 Missouri nursing homes who were evaluated for a possible lower RTI, 19% of those with no radiographic evidence of pneumonia had a respiratory rate of ⩾30 breaths/min [32].

Dehydration commonly accompanies fever in elderly residents of LTCFs; this is perhaps a result of impaired vasopressin responses in elderly subjects [47, 48]. In a study of 40 febrile residents in a hospital-based LTCF [49], 24 (60%) had evidence of hypernatremia and/or an elevated ratio of blood urea nitrogen level to serum creatinine level. Most of the 40 residents had UTI, urosepsis, or pneumonia, but a signif cant proportion (25%) had an upper respiratory viral syndrome. No single physical findin is of particular value in assessing dehydration [49, 50], although tongue dryness, tongue furrows, and dry mucous membranes provide the best correlation. In one study [49], a reference in the chart by staff regarding poor oral intake was observed in 11 residents, and 9 (82%) were found to be dehydrated according to the laboratory criteria noted above. Thus, LTCF residents with poor oral intake are likely to be at enhanced risk for dehydration in the setting of fever, and this historic clue may indicate a population in whom baseline electrolyte, blood urea nitrogen, and serum creatinine determinations are of particular importance. In addition, medications such as diuretics may lead to dehydration and hence, drug evaluation is important.

In LTCF residents, special attention should be noted for specifi underlying disorders or conditions that predispose them to select infections, such as diabetes mellitus (a predisposition for skin infection and UTI), chronic obstructive pulmonary disease (for pneumonia), poor swallowing or gag ref ex (for aspiration pneumonia), long-term indwelling urinary catheters (for UTI), prosthetic devices (e.g., artificia joints leading to septic arthritis), altered mental status (for aspiration pneumonia), or chronic immobility (for pressure ulcers). For example, the presence of an indwelling bladder catheter is associated with a 39-fold increase in the risk of bacteremia over a 1-year period in residents of LTCFs [43].

Adequacy of the clinical evaluation of fever in LTCFs. Several studies suggest that fever is inadequately evaluated or, at the very least, inadequately documented in residents of LTCFs. In one study, 241 infections were identifie among 227 residents in LTCFs in Maryland [51]. The criteria for all infections included measurement of temperature, examination by a physician, and microbiologic culture of specimens from the suspected sites; a chest radiograph was considered to be appropriate for all those who had pneumonia or were suspected of having pneumonia or for those who had fever without a clear source. On the basis of these criteria, only 21% of residents with infection were "appropriately" evaluated. Pneumonia was the most likely infection to be adequately evaluated (53%). When the same records [51] were reviewed regarding antibiotic use, it was found that RNs and LPNs examined 36% of residents for whom antibiotics were prescribed, that 47% of residents were assessed by physicians, and that the remaining 17% were not examined before the prescription of antibiotics [52]. Some of the lack of evaluation and intervention may reflec conscious decisions of the health providers neither to assess nor to treat the more debilitated residents [53]; it is also possible that the standards of evaluation of acute care facilities may influenc

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the criteria and decisions on appropriateness of care of residents in LTCFs.

Advance directives may greatly impact the initiation or extent of evaluation in febrile episodes in LTCF residents. It has been reported that evaluation and antibiotic treatment were provided far less often to "comfort care only" residents with UTI, RTI, or skin infections [54]. However, some data suggest that there are distinct differences of evaluation based not just on advance directives but also on the type of care facility. None of the procedures (including a physical examination) outlined as "appropriate" were performed for 71 (31%) of the 227 patients noted above [51]; however, the definitio of "appropriate" was based on the opinion of practitioners who more often practice in a hospital setting, and this definitio may not be accurate for evaluation of fever in persons in LTCFs. A multivariate analysis of factors contributing to "no evaluation" in that study showed that dementia, residing in a larger facility (>150 beds), and residing in an urban facility were signif cantly associated with an absence of a medical evaluation.

It has also been suggested that the type of facility inf uenced fever evaluation: a quicker response to persons with fever and more thorough assessment and treatment were found in hospital-based nursing homes (where there was more physician involvement) than in community-based nursing homes [55]. However, no difference was noted with regard to outcome in hospital-based versus community-based homes (survival rates were 87% and 88%, respectively; early mortality rates were 3% and 4%, respectively; and the percentages of patients who were transferred to a hospital were 11% and 8%, respectively). Thus, it is not clear whether evaluation of fever in residents of LTCFs by a physician alters outcome.

V. HOW CAN LTCF STAFF EFFECTIVELY COMMUNICATE ABOUT POSSIBLE INFECTION WITH CLINICIANS WHO WILL BE MAKING TREATMENT DECISIONS?

Recommendations

6. Information should be relayed to the responsible advance-practice nurse, physician assistant, or physician for decisions regarding further evaluation (B-III).
7. The full extent of the clinical evaluation should be documented as part of the medical record. If specif c diagnostic measures are consciously withheld, the reasons should be recorded (B-III).

Evidence Summary

Long-term care staff often need to communicate among themselves and, subsequently, with a clinician (physician, nurse practitioner, or physician assistant) to initiate patient evaluation and management. Clinician access for timely direct patient assessment of fever or other symptoms remains a vexing problem for many LTCFs. Consequently, fever is a common antecedent to the decision to transfer patients to a higher level of care. Although direct care staff often make the initial clinical observations, calls to clinicians are typically made by supervising staff (an LPN or RN), because they are the ones licensed to take physician orders over the telephone. Multiple issues can impede effective communication about a possible infection in a facility or with a clinician, such as failure to communicate a change in condition at a shift change, difficult contacting an on-call physician after hours, or a difficul relationship between a nurse and a physician [56]. Skills of direct care staff in recognizing symptoms of infection and communicating them to a supervisor may be influence by experience, education, and language skills (for nonnative speakers). The LPN or RN should independently assess the resident to be certain that key information on the resident's condition is available when the nurse calls the clinician. Clinicians practicing in the LTCF need to participate in setting and reinforcing standards for consistent collection and reporting of clinical information, so that adequate detail is communicated when there are overt or subtle signs suggesting an infection or other acute change in condition. Acute or subacute changes in functional status, such as new urinary incontinence, falls, decreased oral intake, or delirium, may be the initial and/or only clinical manifestation of infection in elderly persons [5].

When calling the clinician, certain minimum information should be available to report at the time of the call. In addition to vital signs and acute or subacute changes in functional status, depending on the presenting symptom, a directed review of systems will help with an over-the-phone determination of what needs to be done next. Presence of a urinary catheter or any other indwelling device (e.g., vascular devices) should always be reported, along with whether entry sites are erythematous or tender. Similarly, staff should report breathlessness and cough (or a change in these if chronically present), most recent bowel movement and its character, and any urinary symptoms. Assessment should also include the following: an assessment of respiratory status, including use of accessory muscles, retractions, and quality of breath sounds; presence of bowel sounds; and any wounds or areas of tenderness or redness. Any abnormal vital signs should be repeated. An example of what should be reported for a variety of conditions can be found in the American Medical Directors Association patient evaluation guideline [57]. An independent consensus panel has suggested that pneumonia be considered a possible diagnosis if $\geqslant 2$ of several respiratory and general illness signs are present and that their presence should trigger immediate nursing home communication with a clinician and a prompt response [58].

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VI. WHAT LABORATORY TESTS SHOULD BE ORDERED FOR THE LTCF RESIDENT WITH SUSPECTED INFECTION?

Initial Diagnostic Testing

Recommendations

8. Advance directives for residents should be reviewed prior to any intervention; if not prohibited by such directives, initial diagnostic tests for suspected infection can be performed in the LTCF if resources are available and if studies can be done in a timely manner (B-III).

Evidence Summary

There are several site-specifi considerations that must be addressed in making recommendations for diagnostic laboratory and radiologic tests for suspected infections in LTCF residents.

Appropriate diagnostic tests for evaluation of fever and infection in LTCF residents have not been established and, when recommended, have not been systematically studied [25, 45]. Furthermore, the guidelines from "expert panels," including physicians with experience in LTCFs, are often influence by diagnostic standards used routinely in acute care settings (e.g., site-specifi bacterial cultures for suspected skin infection, UTI, and lower RTIs and urine and blood cultures for fever of unknown source) [51, 59]. However, obtaining specimens adequate for microbiologic studies in LTCFs can be problematic. Residents suspected of having an RTI may not be able to produce expectorated sputum. When respiratory secretions are available, they may be misleading, because sputum samples or nasopharyngeal aspirate specimens are often contaminated with respiratory pathogens that colonize the oropharynx [60]. Although urine specimens are more frequently obtained, the prevalence of asymptomatic bacteriuria is 15%–50% in noncatheterized LTCF residents and is essentially 100% in residents with long-term urinary catheters [61–63]. Thus, some diagnostic tests with poor positive and negative predictive values must be accepted in the evaluation of LTCF residents suspected of having infection.

Infectious diseases physicians with considerable experience in LTCFs have noted that clinicians must weigh the benefit of diagnostic tests versus their direct costs. This is especially relevant for LTCFs operating under the current Prospective Payment System. These physicians recommend that tests only be performed if they have a reasonable diagnostic yield, are of low risk, are reasonable in cost, and improve patient management. If a test will not cause the clinician to reassess his or her treatment strategy, then there is little justificatio for ordering the laboratory examination [64]. Others with similar expertise and experience have noted that additional diagnostic tests should be performed only for clinical presentations or manifestations that are unusual or that fail to respond to initial therapy or in circumstances in which prolonged antimicrobial therapy is considered [65]. Moreover, explicit plans (or as implied by directives to limit interventions) to not perform or to limit diagnostic studies in severely debilitated or ill residents with poor survival prognosis shall always be considered to be appropriate, unless a risk is posed to other residents and staff [54].

Blood Cell Count

Recommendations

9. A CBC count, including peripheral WBC and differential cell counts (preferably a manual differential to assess bands and other immature forms), should be performed for all LTCF residents who are suspected of having infection within 12–24 h of onset of symptoms (or sooner, if the resident is seriously ill), consistent with local standards of practice (B-II).

10. The presence of an elevated WBC count (WBC count, $\geqslant$14,000 cells/mm^3) or a left shift (percentage of band neutrophils or metamyelocytes, >6%; or total band neutrophil count, $\geqslant$1500 cells/mm^3) warrants a careful assessment for bacterial infection in any LTCF resident with suspected infection, with or without fever (B-II).

11. In the absence of fever, leukocytosis and/or left shift, or specifi clinical manifestations of a focal infection, additional diagnostic tests may not be indicated, because of the low potential yield (C-III). Nonbacterial infections, however, cannot be excluded.

Evidence Summary

Suspected symptomatic infection in LTCF residents. Provided that there are no prior directives (in advance or currently expressed by the resident or caregiver) limiting diagnostic or therapeutic medical interventions, all residents in LTCFs with suspected symptomatic infection should have appropriate diagnostic laboratory studies performed promptly, provided that the tests have reasonable yield, are of low cost and risk, and may improve the resident/patient management. Findings should be discussed with the primary care clinician as soon as results are available.

CBC count with differential. In a prospective cohort analytic study of >200 older persons who presented to a community-based hospital emergency department, 33 persons had documented bacterial infection, including ~50% of persons with no fever [66].

Evaluation of the total WBC count (with leukocytosis define as a leukocyte count $\geqslant$14,000 cells/mm^3), number of band forms, and the percentage of neutrophils and band forms revealed that an elevated total band count ($\geqslant$1500 cells/mm^3) had the highest likelihood ratio (14.5) for detecting documented bacterial infection; an increase in the percentage of neutrophils ($\geqslant$90%) and band neutrophils (>6%; i.e., left shift) had likelihood ratios of

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7.5 and 4.7, respectively. Leukocytosis with a leukocyte count ⩾14,000 cells/mm^3 had a likelihood ratio of 3.7. Thus, this study and others [67, 68] demonstrate that there is a high probability of an underlying bacterial infection in an older person if the WBC count is elevated, with or without fever; has a high percentage of neutrophils or left shift (even in the presence of a normal total leukocyte count—i.e., <10,000 cells/mm^3); or shows an elevated total band count. In observational studies, leukocytosis has been associated with increased mortality among LTCF residents with nursing home–acquired pneumonia (WBC count, >15,000 cells/mm^3) and bloodstream infection (WBC count, >20,000 cells/mm^3) [69, 70].

Urinalysis and Urine Culture

Recommendations

12. Urinalysis and urine cultures should not be performed for asymptomatic residents (A-I).
13. In noncatheterized residents, the diagnostic laboratory evaluation of suspected UTI should be reserved for those with acute onset of UTI-associated symptoms and signs (e.g., fever, dysuria, gross hematuria, new or worsening urinary incontinence, and/or suspected bacteremia) (A-II).
14. In residents with long-term indwelling urethral catheters, evaluation is indicated if there is suspected urosepsis (i.e., fever, shaking chills, hypotension, or delirium), especially in the context of recent catheter obstruction or change (A-II).
15. Appropriately collected urine specimens include a midstream or clean-catch specimen obtained from elderly men who are cooperative and functionally capable; however, it is often necessary to use a freshly applied, clean condom external collection system, with frequent monitoring of the urine bag (B-II). Specimen collection from women will often require an in-and-out catheterization (B-III).
16. Residents with long-term indwelling urethral catheters and suspected urosepsis should have catheters changed prior to specimen collection and institution of antibiotic therapy (A-II).
17. The minimum laboratory evaluation for suspected UTI should include urinalysis for determination of leukocyte esterase and nitrite level by use of a dipstick and a microscopic examination for WBCs (B-II). If pyuria (>10 WBCs/high-power field or a positive leukocyte esterase or nitrite test is present on dipstick, only then should a urine culture (with antimicrobial susceptibility testing) be ordered (B-III).
18. If urosepsis is suspected, urine and paired blood specimens should be obtained, if feasible, for culture and antimicrobial susceptibility testing, and a Gram stain of uncentrifuged urine should be requested (B-III).

Evidence Summary

Symptomatic UTI in LTCF residents may present as fever and clinical pyelonephritis or as irritative symptoms (e.g., dysuria, frequency, urgency, nocturia, and increased incontinence) [17, 62]. The evaluation of these symptoms and signs is diffi ult, because they are frequently observed in residents and are not necessarily associated with bacteriuria (>10^5 cfu/mL) or altered with antimicrobial therapy [71]. The majority of elderly persons with bacteriuria are asymptomatic [17, 62, 72]. Moreover, residents are often treated for UTIs when nonspecif c symptoms, including low-grade fever, increased confusion, incontinence, anorexia, or functional decline, are noted, but limited studies suggest that these symptoms may not be associated with UTIs [27].

Residents who are suspected of harboring an infection will often undergo urinalysis and urine culture as part of the evaluation to determine the cause of infection. These tests, however, frequently demonstrate bacteria because of the noted high prevalence (10%–50%) of asymptomatic bacteriuria [61, 62]. Prospective studies have shown that untreated asymptomatic bacteriuria in LTCF residents without long-term indwelling urinary catheters persist for as long as 1–2 years without evidence of increased morbidity or mortality [73, 74]. Microscopic pyuria (⩾10 WBCs/high-power fiel of spun urine) or a dipstick test positive for leukocyte esterase are not highly predictive of bacteriuria, but the absence of pyuria or even a dipstick test negative for leukocyte esterase and nitrite can exclude bacteriuria (i.e., the negative predictive value approaches 100%) [75–78]. In persons with neutropenia or, on rare occasions, with a normal peripheral WBC count, significan bacteriuria may occur without pyuria. Thus, although the presence of pyuria has a relatively low predictive value for UTI, both a negative urinalysis for WBCs and dipstick tests for leukocyte esterase and nitrite are useful to exclude a urinary source for a suspected infection. However, in residents suspected of having urosepsis because of, for example, high fever, shaking chills, and hypotension, urine culture is recommended along with blood culture. For residents with new indwelling urinary catheters, catheter-associated UTI, define as new pyuria and bacteriuria, develops on average within 4 days and are rarely symptomatic [79]. In residents with chronic indwelling urinary catheters, the presence of bacteriuria and pyuria is virtually universal. For residents with long-term indwelling urethral catheters, fever, and symptomatic UTI, a prospective randomized trial of 54 nursing home residents demonstrated that replacement of the catheter prior to the institution of antimicrobial therapy was associated with improved clinical outcomes [80].

Frail elderly LTCF residents are often unable to provide a midstream voided urine specimen for diagnostic testing. For men, it is frequently necessary to apply a clean condom external collection device. However, this validated method for urine collection requires carefully trained personnel and frequent monitoring of the urine bag [81]. If appropriately collected voided urine cannot be obtained from women, in-and-out catheterization should be used to obtain urine specimens for culture

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[62]. The benefi of antimicrobial or antiseptic coated catheters in LTCF residents has not been directly assessed.

Blood Culture

Recommendation

19. In a study of older adult nursing home residents, blood cultures were demonstrated to have a low yield and rarely to influenc therapy; thus, they are not recommended for most residents of LTCFs (B-II) (note: this may not apply to all types of residents or all types of LTCFs). Blood cultures may be appropriate for residents in whom bacteremia is highly suspected and if the LTCF has quick access to laboratory facilities, adequate physician coverage to respond to positive culture results, and a capacity to administer parenteral antibiotics.

Evidence Summary

Bacteremia is documented infrequently in LTCFs, with an incidence of 5–40 episodes per 100,000 resident-days [82]; the proportion of infections complicated by secondary bacteremia in this setting is ~6% [83]. These rates were documented primarily in large LTCFs (often associated with Veterans Affairs medical centers) with full-time medical staff and 24-h on-site physician coverage; there are no comparable studies reported from the more representative smaller proprietary or the not-for-profi community-based LTCFs.

As expected, the most frequent sites of infection with LTCF-acquired bacteremias are as follows: the urinary tract (50%–55%), the respiratory tract (10%–11%), skin or soft tissue (~10%), intra-abdominal foci (~5%), infected intravenous catheters (~3%), and unknown site (15%–22%) [83]. The overall mortality rates associated with bacteremia in LTCF residents range from 18% to 50%; the highest rates are for patients with bacteremic pneumonia [70, 83, 84]. Despite appropriate therapy, ~50% of deaths occur within 24 h after the diagnosis of bacteremia [83].

In retrospective studies, nonspecifi symptoms, such as lethargy, confusion, falls, abdominal pain, nausea, vomiting, and incontinence, are frequently noted in older persons at the onset of documented bacteremia [85]. Fever (⩾100°F [⩾37.8°C]) is usually present in bacteremic older persons; in 1 series, however, ~15% of older persons had "afebrile" bacteremia, including many of the nosocomial bacteremias for which they were already receiving antimicrobial therapy [68]. In a prospective study, older patients in a geriatric hospital had predictors of bacteremia, with higher relative risks (3.4–15.7) than was noted for nonbacteremic older patients. These predictors were: fever (temperature, >101.3°F [>38°C]), in community-acquired cases only; bladder catheter removal, in hospital-acquired cases only; and shaking chills, shock, total band neutrophil count ⩾1500 cells/mm^3, and lymphocyte count <1000 cells/mm^3 in both groups [86]. A prospective observational study of elderly adults (3% of whom were from LTCFs; C. L. Chen, personal communication) with bloodstream infection found that, although the elderly persons were less likely to present with fever or tachycardia, they were more likely to have acute renal failure or respiratory failure, compared with younger adults (age, <65 years) [87]. Other studies, using case-control methods in hospital and emergency department settings, however, have also noted that older bacteremic patients have fewer symptoms or signs than do younger bacteremic patients and that clinical indicators alone are unreliable predictors of bacteremia in older patients [88, 89]. In a retrospective study of 166 cases of nursing home–acquired bloodstream infection among patients who were subsequently hospitalized, predictors of mortality were pulmonary source of infection, hypotension, and leukocytosis (leukocyte count, >20,000 cells/mm^3) [90].

Blood cultures could potentially be helpful in establishing a definitiv microbiologic diagnosis in LTCF residents with selected conditions, such as (1) suspected polymicrobial bacteremia in older residents with probable urosepsis and long-term indwelling urethral catheters or in those with infected pressure ulcers [59], (2) suspected urosepsis when polymicrobial bacteriuria is present [59], or (3) suspected pneumonia (or other suspected bacterial infections) when the resident appears ill enough to warrant hospitalization but will be cared for in the LTCF [37]. Blood samples should be obtained for cultures prior to transfer to an acute care facility, if feasible. Although obtaining blood samples for culture within 24 h after presentation has been associated with improved 30-day survival in community-acquired pneumonia [90], there are no comparable studies in LTCFs. However, because of the high mortality rates within 24 h after onset and because 50% of deaths among nursing home residents with positive blood culture results occur within the firs 3 days after onset, it is doubtful that blood cultures would significantl impact mortality risk for most nursing home residents, and they would provide little opportunity for starting or adjusting effective antimicrobial therapy [70, 91]. Blood cultures may be appropriate if the LTCF has quick access to laboratory facilities, adequate physician coverage to respond to positive culture results, and capacity to administer parenteral antibiotics.

Pneumonia Evaluation

If pneumonia is clinically suspected and resources are available, the following diagnostic studies should be performed.

Recommendations

20. Pulse oximetry should be performed for residents with respiratory rates of >25 breaths/min, to document hypoxemia (oxygen saturation, <90%) in residents with suspected pneumonia and to guide transfer to an acute care facility pending the resident's or family's wishes (B-II).

21. Chest radiography should be performed if hypoxemia is

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documented or suspected, to identify the presence of a new infiltrat compatible with acute pneumonia and to exclude other complicating conditions (e.g., multilobe infiltrates large pleural effusions, congestive heart failure, or mass lesions) (B-II).

Evidence Summary

Pulse oximetry. Hypoxemia (arterial oxygen partial pressure, <60 mm Hg) is one of the important indicators in the Pneumonia Prognosis Index of acute severity and short-term mortality for patients with community-acquired pneumonia, which included residents with LTCF-acquired pneumonia [92]. This index has been further validated in nursing home populations [93]. In a prospective cohort study of risk factors for 30-day mortality in nursing home residents with lower RTI, oxygen saturation of <90% was associated with higher mortality rate in bivariable analysis but was not part of a multivariate prediction model. However, the oxygen saturation value was missing in the majority of cases evaluated; this may have affected its significanc in a multivariate model [32]. More recently, oxygen saturation of <90% was a strong predictor of hospitalization but was not significantl associated with mortality in a nested cohort study of nursing home pneumonia in residents of 9 Ontario, Canada, nursing homes [94]. Hypoxemia is a predictor of impending respiratory failure requiring intensive care unit admission [95]. Impending respiratory failure can be suspected at the bedside if the patient has a respiratory rate of >25 breaths/min, and it can be confi med by an oxygen saturation of <90% on pulse oximetry, as advised in the recent modificatio and validation study of the Pneumonia Prognosis Index in nursing home residents [93]. Finally, in febrile nursing home residents, pulse oximetry may also assist in differentiating pneumonia from other infectious processes. A case-control study comparing nursing home residents with pneumonia versus residents with other infections found that an oxygen saturation of <94% had a sensitivity of 80%, specificit of 91%, and positive predictive value of 95% for diagnosis of pneumonia [96].

Chest radiographs. An abnormal chest radiograph demonstrating a new infiltrat compatible with pneumonia is often considered to be the most reliable method of diagnosing suspected LTCF-acquired pneumonia [18, 25, 28, 45, 51]. More recently, radiographic diagnosis of pneumonia in nursing homes was associated with both death and hospitalization [94]. However, practice patterns in LTCFs show considerable variability with respect to performing chest radiographs, ranging from 20% to 35% in community-based nursing facilities [45, 51, 64] to as high as 85% in university medical center–affiliate nursing facilities [97].

Although most LTCFs have contract services to provide chest radiography, several problems remain, including (1) the inability of frail older persons to maintain a stationary, upright sitting position; (2) the relatively poor quality of portable radiography techniques (compared with standard techniques using the posterior-to-anterior projection); and (3) a lack of availability of previous film for comparison. Despite these concerns, evidence of acute pneumonia is present on 75%–90% of chest radiographs obtained for residents with suspected LTCF-acquired pneumonia [45, 97]. However, there are no prospective trials evaluating the impact of chest radiography on outcomes of LTCF-acquired pneumonia.

The clinical diagnosis of pneumonia can be exceedingly difficul [98]. Excluding bacteremia from all sources, pneumonia is the only infection that is an important contributor to mortality for residents in LTCFs [82]; thus, it is important to document this serious condition by chest radiography whenever possible. Moreover, the chest radiograph may demonstrate other high-risk conditions (e.g., multilobe infiltrate congestive heart failure, large pleural effusions, and mass lesions) that should warrant considering for transfer to an acute care facility, depending on the wishes of the resident or their family or caregiver.

Respiratory secretions. The diagnosis of suspected pneumonia in LTCF residents is usually based on clinical criteria alone (e.g., fever, tachypnea [>25 breaths/min], and new or increased cough with purulent respiratory secretions) [44]. Retrospective studies of nursing-facility practices indicate that sputum examinations are ordered for only 5%–10% of residents with the diagnosis of pneumonia [51, 97]. Even in carefully performed prospective studies of radiographically conf rmed LTCF-acquired pneumonias, using recommended methods for screening prior to culture of expectorated sputum, sputum samples are obtained from <30% of residents [28]; when sputum is obtained, <50% of specimens demonstrate <25 squamous epithelial cells/low-power fiel on microscopic examination of Gram-stained specimens [99]. In addition, the single-most frequent causative agent (~35%) is "mixed flora (i.e., ⩾2 respiratory pathogens or normal throat flor only) [100]. No prospective studies have been done to determine whether a more rigorous microbiologic study of respiratory secretions will lead to improved outcomes (i.e., cure, a reduced number hospital transfers, or a patient still alive 30 days after diagnosis of pneumonia). In a retrospective study of 99 nursing home–acquired pneumonias in a single large nursing home with on-site bacteriology testing facilities, only 14 adequate sputum samples were obtained. Although the overall 30-day mortality rate for the cohort was 10%, none of the residents from whom a sputum sample was obtained died within 30 days, suggesting that the ability to obtain sputum may actually be a marker for better outcomes or higher functional status [101].

Urinary antigen testing. There are few specifi data on LTCF residents regarding the performance characteristics of urinary antigen testing to detect *Streptococcus pneumoniae* or *Legionella pneumophila* (serogroup I), the 2 pathogens for

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which US Food and Drug Administration–approved test kits are available. Thus, specifi recommendations cannot be provided. However, the tests may be useful in LTCF residents in selected circumstances, particularly if sputum specimens cannot be obtained. Older adults have been included in studies of hospitalized patients with pneumonia. The sensitivity of urinary antigen testing for *S. pneumoniae* in those studies was ~75%, whereas the specificit approached 90%. Performance characteristics are similar for *L. pneumophila,* but it is important to recognize that only serogroup I is detected by this test, and the sensitivity may be lower for nosocomial legionellosis (and, by implication, perhaps also in LTCF residents), even when illness is caused by serogroup I [102]. Several studies have examined the utility of *Legionella* urinary antigen tests in outbreak settings and for diagnosis of legionellosis in regions where it is highly endemic (e.g., western Pennsylvania). The proportion of LTCF-associated cases of pneumonia caused by *L. pneumophila* ranged from 0% to 6.5%; thus, the organism is relatively rare even in areas in which community-acquired legionellosis is common. It is likely that *Legionella* urinary antigen testing would prove to be most useful in LTCF outbreaks of pneumonia due to unclear etiology [103].

Respiratory Viral Infection Evaluation

Recommendation

22. At the onset of a suspected respiratory viral infection outbreak, nasopharyngeal wash or swab samples obtained from the throat and nasopharynx (combined with refrigerated viral transport media in a single tube) should be obtained from several acutely ill residents for transport to an experienced laboratory for virus isolation and rapid diagnostic testing for influenz A virus and other common viruses (A-III).

Evidence Summary

Influenz is the most serious viral respiratory infection for older persons; clusters or outbreaks of influenz occur frequently in LTCFs, with attack rates ranging from 20% to 70%. During outbreaks, complication rates among unvaccinated residents of LTCFs are substantial, approaching 32% (range, 5–84%); 7% (range, 5%–42%) pneumonia, including pneumonia due to methicillin-resistant *S. aureus;* 4% (range, 3%–26%) hospitalization; and 4% (range, 0%–73%) death [104]. Recent studies suggest that the consequences of respiratory syncytial virus infection are just as severe in older populations [105–107].

The diagnosis of influenz and respiratory syncytial virus infection is frequently made on the basis of clinical and epidemiologic finding during a community outbreak. However, additional diagnostic efforts are warranted in LTCF outbreaks, because of the increased frequency of other respiratory viruses that can cause severe illness in this setting (e.g., parainfluenz virus, metapneumovirus, coronaviruses, and rhinoviruses) [107, 108].

Of all the respiratory viruses mentioned, influenz virus is the most easily detected. In frail elderly patients, specimens for viral isolation by culture are best obtained by nasopharyngeal swab, because it is simpler to perform, with acceptable sensitivity, compared with nasopharyngeal wash [108, 109]. The swabs are combined in a single refrigerated tube containing viral transport media and are transported (preferably on ice and within 1–2 h after collection) to an experienced laboratory for viral culture and rapid diagnostic testing [108, 110]. However, not all LTCFs will fin it feasible to obtain and transfer the specimens. Of all the respiratory viruses mentioned, inf uenza is the most readily isolated by culture technique, particularly if the specimen is obtained within 24–48 h after onset of clinical illness [108]. In general, rapid antigen testing for respiratory viruses in adults has been insensitive. For influenza the sensitivity of rapid antigen tests has ranged from 40% to 80%, with specificit of ⩾85% [108, 109]. However, confi mation of influenz in LTCFs by rapid testing assisted with decisions about isolation and initiation of antiviral prophylaxis, with significan reductions in duration of the outbreak and hospitalization costs [111]. Very sensitive and specif c RT-PCR tests for multiple respiratory viruses are available but expensive [108, 109].

Evaluation of SSTI

Recommendations

23. Bacterial cultures should be performed only under select conditions. Surface swab cultures are not indicated for the diagnosis of most bacterial SSTIs (A-II), with the exception of conjunctivitis (B-III). Needle aspiration (only skilled physicians should perform this procedure) or deep-tissue biopsy to obtain samples for Gram stain and culture may be appropriate in special circumstances in which unusual pathogens are suspected, fluctuan areas suggest an abscess is present, or initial antimicrobial treatment has been unsuccessful (C-III).

24. If a pressure ulcer demonstrates poor healing and/or persistent purulent drainage, obtain deep specimens for culture of tissue and bone specimens at the time of surgical debridement or biopsy (B-II). MRI is the most sensitive imaging modality to detect osteomyelitis, but bone biopsy for histopathologic examination definitivel confi ms the diagnosis and is most useful in guiding antimicrobial therapy (A-III).

25. For suspected mucocutaneous fungal infection, a scraping can be performed for potassium hydroxide 10% preparation to verify the presence of yeast or dermatophytes (B-III). If mucocutaneous candidiasis is refractory to empirical treatment, culture can be performed for the detection of drug-resistant species (B-III).

26. For suspected herpes simplex or herpes zoster, skin

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scrapings may be examined for the presence of giant cells (Tzanck preparation) and/or sent for culture, immunof uorescent viral antigen studies, or PCR (A-III).

27. Scabies should be considered in any nursing home resident with a generalized rash that is unexplained. Diagnosis should be attempted by light microscopy demonstration of mites, eggs, or mite feces on mineral oil preparations of several scrapings (B-III). If proper diagnostic equipment is not available and if clinical experience with scabies is limited, consider consultation with a dermatologist to inspect or obtain scrapings from suspected persons (C-III).

Evidence Summary

SSTI is the third most common infection seen in LTCFs; rates of 1%–9% and a prevalence of 0.9–2.1 cases per 1000 patient-days have been reported [112]. SSTI typically results when breaks in skin or mucosa occur as a consequence of physical trauma, maceration, pressure, or use of devices. Wounds may become secondarily infected with pathogens found among the resident's own endogenous flor or exogenously via the hands of personnel, from other residents, or by contact with contaminated environment or fomites.

Although bacteria are the most common causes of SSTI in LTCF residents, viruses, fungi, and parasites must also be considered. The 3 most common types of SSTI in LTCF residents include cellulitis, infected pressure ulcer, and scabies. Primary infections of skin and mucosa, reactivation of latent herpetic infection, ectoparasitic infection, and secondary infection of pressure ulcers also occur.

Primary SSTI. The primary SSTIs seen in LTCF residents include erysipelas, cellulitis, folliculitis, and impetigo. Primary infections of deep soft tissue involving fascia and muscle rarely occur and typically do so as part of an outbreak. Common bacterial etiologies of primary SSTI include *S. aureus* and β-hemolytic streptococci, especially *Streptococcus pyogenes.* Diagnosis and treatment decisions are made primarily on the basis of clinical characteristics. When the presentation is atypical or the patient is not responding to empirical therapy, Gram stain and culture of pus, blister fluid or deep-tissue specimens can be useful to confi m a bacterial cause and antimicrobial susceptibilities [113, 114].

Secondary SSTI. Twenty percent of nursing home residents will develop secondary infection of a pressure ulcer within 2 years after admission; 6% of those ulcers will become infected, at a rate of 1.4 infections per 1000 resident-days [115]. Infection of pressure ulcers is diagnosed primarily by clinical symptoms and signs. These local finding may range from nonhealing to overt presence of surrounding erythema, warmth, tenderness, and purulent discharge to presence of necrotic tissue and even crepitus [115–117]. Signs of systemic inflammation such as fever and leukocytosis, may be absent. Suggested—although unvalidated—criteria for diagnosis of infected pressure ulcer include presence of purulent discharge plus ⩾4 of the following characteristics: fever (temperature, ⩾38°C), worsening mental or functional status, warmth, redness, swelling, localized tenderness/pain, or serous drainage.

The surfaces of pressure ulcers are always colonized with bacteria; thus, cultures of specimens obtained from superficia swabs cannot differentiate between colonization and infection. The utility of fine-needl aspiration and deep-tissue biopsy has been debated. Irrigation with saline and massage of the area followed by needle aspiration have been found to be very sensitive and specifi in some studies; however, aspirates of clinically uninfected ulcers yield bacteria in 30% of instances. Correlations between swabs, aspiration, and deep-tissue biopsy specimen culture results have been poor. In general, deeper specimens are preferred for culture; however, positive culture results must be interpreted in conjunction with clinical and laboratory evidence that infection is present. Although a positive probe-to-bone test result has been shown to be predictive of osteomyelitis in patients with diabetes and lower-extremity ulcers, in pressure ulcers, the presence of exposed bone and of positive swab culture results is not diagnostic of osteomyelitis. Unfortunately, confi mation of osteomyelitis in pressure ulcers with exposed bone using histopathology, the gold standard for the diagnosis, yields positive results in only <20% of cases, perhaps because of sampling error. Imaging may also provide supporting evidence that osteomyelitis is present; MRI is the most sensitive (98%) and specifi (89%) diagnostic method [115–117].

Most pressure ulcer infections are polymicrobial; aerobic gram-negative bacilli (e.g., *E. coli, Proteus* species, and *Pseudomonas* species), gram-positive cocci (e.g., streptococci and staphylococci), and anaerobic flor (e.g., bacteroides, peptostreptococci, and *Clostridium perfringens*) are found most commonly. Although blood cultures are not generally recommended for evaluation in nursing home–acquired infection, the presence of polymicrobial infection may provide supporting evidence that an infected pressure ulcer is the source [115–117]. Most evaluations for acute osteomyelitis should be done in the acute care setting.

Conjunctivitis. Conjunctivitis is another common SSTI that occurs in 0.3%–3.4% of LTCF residents or at a rate of 0.1–1.0 cases per 1000 resident-days [118]. Conjunctivitis is primarily define as the presence of purulent exudate or new or worsening redness in 1 or both eyes for at least 24 h; allergy and trauma should be excluded. Ideally, treatment should be based on Gram stain results, culture results, and antibiotic susceptibilities of purulent discharge specimens obtained from the conjunctival sac. A cause may be established in <40% of cases; most are due to *S. aureus, Moraxella catarrhalis, Haemophilus* species, epidemic strains of *S. pyogenes,* and, during outbreaks,

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adenovirus infection. Thus, therapy is often empirical, and close follow-up should be conducted for treatment failure.

Mucocutaneous fungal infection. SSTI may also result from the overgrowth of endogenous resident fungi in moist macerated skin and in association with use of antimicrobials and corticosteroids; infection with *Candida* species—typically *Candida albicans*—and dermatophytes may result. In one study, 84% of LTCF residents were colonized with yeast [119]. Mucocutaneuous candidiasis may present as thrush, denture stomatitis, chelitis, paronychia, and intertrigo. Dermatophyte infection may manifest as tinea corporis, tinea pedis, tinea cruris, and tinea ungium (onychomycosis). Microscopic examination of scrapings following digestion with 10% potassium hydroxide can confi m the presence of *Candida* species or dermatophytes [120]. If candidal infection fails to respond to empirical treatment, cultures and speciation of yeast should be performed. Azole-resistant *Candida glabrata* has been isolated with greater frequency from older adults with systemic fungal infection than from young adults [121], but there are no data for cutaneous disease.

Mucocutaneous viral infection. Reactivation of latent viral infection occurs with increasing age and waning immunity; 10,500–16,500 cases of herpes zoster occur in LTCF residents each year [114]. Herpes simplex virus infections typically present as vesicles or ulcerations involving nasolabial, genital, or rectal skin or mucosa. Reactivation of zoster presents as a painful vesicular rash typically in a dermatomal distribution. Presence of giant cells on Tzanck smear is diagnostic for herpes virus infection, and speciation between simplex and zoster can be confi med by obtaining vesicle flui specimens for immunofluo escence antigen testing, culture, or PCR. Differentiation between the 2 viral infections is important because of infection control issues and because of the increased doses of antivirals required for treatment of herpes zoster [114, 122]. The role of zoster vaccine in LTCF residents is undefine [123].

Ectoparasitic infection. Scabies *(Sarcoptes scabiei)* and lice *(Pediculus humanus capitus, P. humanus corporis,* and *Phthirus pubis)* are acquired by LTCF residents from other infected persons or contaminated fomites [124, 125]. The clinical presentation of scabies infection in nursing home patients can be atypical. Burrows, inflammato y changes in intertrigenous areas, and pruritis may be absent. Debilitated patients may present only with hyperkeratosis, papules, or vesicles [126]. Diagnosis of scabies is often made when the typical rash occurs in health care workers or visitors [114, 127]. Debilitated older adults are often heavily infested with scabies mites. Scabies outbreaks are usually suspected by the occurrence of ⩾1 unexplained rash in residents [127]. Although it may be necessary to make the diagnosis on the basis of clinical fi dings alone, an incorrect diagnosis can often lead to pseudo-outbreaks, with widespread "psychogenic" scabies (itching but no skin lesions), especially among staff or family members. Therefore, once scabies is suspected, an etiologic diagnosis should be attempted in several residents or staff. Skin should be scraped 6 or 7 times with a scalpel, and examination of the scrapings under immersion oil by low-power microscopy readily detects mites, ova, and feces [125, 126]. Lice are typically found at the base of hair follicles (nits), in the scalp (head lice), or in the seams of clothing (body lice).

Evaluation of GI Infection

Recommendations

28. In the absence of an outbreak of GI illness, residents with symptoms of gastroenteritis consistent with small bowel infection and a stable clinical status should be evaluated before 7 days for volume assessment, but no laboratory evaluation is required unless the resident is severely ill or symptoms persist beyond 7 days. In such cases, presence of *Giardia* species and other protozoa should be examined in stool specimens (B-III).

29. If the resident exhibits symptoms of colitis (e.g., severe fever, abdominal cramps, and/or diarrhea, with or without blood and/or WBCs in the stool), initial evaluation for *C. difficil* should be performed, especially if the patient has received antibiotics within the previous 30 days. Submit a single diarrheal stool specimen to the laboratory for a *C. diff cile* toxin assay. If diarrhea persists and if the assay result is negative, submit 1 or 2 additional stool specimens for the toxin assay (A-II).

30. In a patient with symptoms of colitis but no history of antibiotic use within the previous 30 days and/or a negative *C. difficil* evaluation result, one should submit a stool sample for culture for isolation of the most frequent invasive enteropathogens (i.e., *C. jejuni, Salmonella* and *Shigella* species, and *E. coli* O157:H7) (A-II).

31. Local public health authorities should be consulted if rates of gastroenteritis or colitis exceed baseline thresholds in the facility (if these thresholds are known), if ⩾2 cases occur at the same time in the same unit, or if a reportable pathogen is isolated (B-III).

32. Intra-abdominal infections and abscesses can occur in LTCF residents as a consequence of GI pathology. These complications are relatively uncommon but are associated with substantial morbidity and mortality; evaluation and treatment of possible abscesses should be performed in an acute care setting (B-III).

Evidence Summary

Gastroenteritis and diarrhea. Gastroenteritis and diarrhea are the most commonly encountered GI infections in LTCF residents. Diarrhea may be attributable to increased susceptibility or exposure to pathogens. Increased achlorhydria and reduced intestinal motility with age may allow the organism to

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survive in the stomach with slowed egress from the GI tract. Many medications and underlying diseases affect gastric acidity and slow gut motility in aged persons. Enteric pathogens may be acquired from environmental sources, direct contact with infected residents and hands of personnel, and ingestion of contaminated food and water. Visits by children and animals have also been associated with outbreaks. Devices such as feeding tubes or thermometers may provide an efficien means to introduce pathogens directly into the GI tract [128, 129].

Although the exact incidence of infectious diarrhea in LTCF is not known, numerous outbreaks reported from individual facilities suggest that the problem is common. It has been estimated that one-third of nursing home residents will have an episode of diarrhea annually. More than one-half of all diarrheal deaths involve adults aged ⩾74 years; one-third of these deaths occur in LTCF residents [128, 129].

Gastroenteritis and diarrhea can be caused by the organism itself or by the elaboration of toxins. Causes of diarrhea in the LTCF may be bacterial, viral, or, less commonly, parasitic. A commonly used case definitio of diarrhea includes the presence of ⩾3 watery, loose, or unformed stools per day for >48 h. In general, GI infection can be classifie by the organ involved. Infection of the small bowel or gastroenteritis is most commonly associated with mid abdominal pain and large-volume watery stools; blood and pus in stool are rare. Typical small bowel pathogens include viruses and the protozoa *Giardia lamblia* and *Cryptosporidium* and *Cyclospora* species [130, 131].

In contrast to upper GI tract disease, infection of the large bowel is associated with lower abdominal or rectal pain; mucosal ulcers, blood, and fecal leukocytes or stool lactoferrin may be present. Causes of large-bowel infections described in LTCFs include *C. difficile* toxigenic enterohemorrhagic *E. coli, Shigella* species, *Salmonella* species, *Campylobacter* species, *Yersinia* species, and *Entamoeba histolytica*. *Campylobacter, Yersinia,* and *Salmonella* species also cause disease in the terminal ileum [130, 131].

Infections of the small intestine/gastroenteritis. Viruses account for the majority of outbreaks of gastroenteritis that typically occur in the winter time in association with vomiting, respiratory symptoms, and headaches [129]. Viral causes, such as norovirus, calciviruses, adenoviruses, enteroviruses, and rotavirus infections, are common. Viral diarrheas resolve with supportive treatment. Diagnosis is generally not required unless there is a prolonged outbreak that does not resolve with appropriate isolation techniques. Most new laboratory methods rely on the detection of viral antigens in stool by RT-PCR or enzyme immunoassay [131].

Norovirus, a particularly prevalent and highly contagious agent, deserves specifi comment for several reasons. First, fatal cases of norovirus infection occur the majority of the time among LTCF residents [130]. Second, very small numbers of virus particles are infectious and can be transmitted by direct contact, by fomites, or by aerosolization during vomiting. This mandates stringent infection control procedures [132]. Third, as with *C. difficil* (see below), alcohol hand preparations may not completely inactivate the organism, and vigorous handwashing with soap, friction, and running water is still preferred [133].

Enterotoxin-producing foodborne strains of *Bacillus cereus, C. perfringens,* and *S. aureus* have caused epidemics of nausea and vomiting in nursing homes. The diagnosis of infection is made solely on the basis of the abrupt onset of nausea, vomiting, abdominal cramps, and diarrhea within 1–72 h after ingestion of suspect foods in multiple patients. Fever and inflam matory signs are lacking, and the episodes resolve in 24–48 h with supportive care [129, 134].

The parasites *G. lamblia* and *Cryptosporidium parvum* have been identifie less often in association with contaminated food and water and with child-care programs [129, 135]. Diagnosis of infection with these organisms by antigen detection is more sensitive than examination of stool specimens for trophozoites and for cysts [136, 137]. Standard examinations of stool specimens for ova and parasites do not include the acid-fast staining required to detect *Cryptosporidium, Cyclospora,* or *Isospora* species [138].

C. difficil *infection.* *C. difficil* is the most common readily identifiabl cause of infectious diarrhea in LTCF residents [129, 139, 140]. Most other diarrheal pathogens are identif ed only after an outbreak is suspected. Rates of asymptomatic *C. difficil* colonization in LTCFs approach 10%–30% [140], in part because of decreases in protective antibody to toxin A with increasing age [139]. Rates of symptomatic infection appear to be highest in subacute and rehabilitative units, especially after recent admission from a hospital [140]. Under the selective pressure of antibiotics, growth of toxin-producing *C. diff cile* occurs, with resulting diarrhea. One-third of nursing home residents already colonized with *C. difficil* will acquire symptomatic *C. difficil* –associated diarrhea within 2 weeks after receiving antibiotic therapy [139], highlighting the need to avoid unnecessary antibiotic use in this cohort. Alcohol preparations used for hand sanitizing in hospitals and LTCFs do *not* inactivate the spores of *C. difficile* thus, strict handwashing (which mechanically removes the spores) is recommended after caring for patients with *C. difficil* illness. Nosocomial transmission of *C. difficil* by person-to-person contact is now well recognized in institutional settings such as LTCFs. Therefore, outbreaks of diarrhea in LTCFs should prompt consideration of *C. diffici e*–associated diarrhea as the diagnosis [140, 141].

Clinical manifestations of *C. difficil* infection range from mild diarrhea to pseudomembranous colitis to toxic megacolon. Recent *C. difficil* –associated diarrhea strains are clearly associated with increased incidence and severity of disease in

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the older adult, leading to increased rates of hospitalization, intensive care, surgical intervention, and death [141].

The diagnosis of *C. difficil* should be strongly considered if the patient has received antibiotics or chemotherapy in the previous 4–6 weeks and for any older patient with severe leukocytosis (>30,000 cells/mm^3), even in the absence of abdominal pain, diarrhea, or recent antibiotic use. An EIA positive for toxins A or B in diarrheal stool specimens is diagnostic. Toxin assays are 60%–90% sensitive and 75%–100% specif c for detection of the organism, particularly if multiple specimens are tested. Stool cultures are not performed for patients without diarrhea, because *C. difficil* is part of normal GI fl ra. Sigmoidoscopy is less useful than assays for detection of toxin in stool specimens, because not all cases of *C. diff cile* infection have pseudomembranes, and isolated right-side disease can be missed [139]. Patients with signs of ileus or peritonitis should be transferred to a hospital for urgent imaging by CT and monitoring, if appropriate.

E. coli 0157:H7 and other Shiga toxin–producing enterohemorrhagic strains have been associated with foodborne outbreaks of bloody diarrhea without fever and hemolytic uremic syndrome [142]. Diarrhea due to toxigenic strains of *E. coli* is diagnosed primarily with an assay of Shiga toxin or the presence of colorless colonies on Sorbitol-MacConkey agar cultures of stool specimens [128].

Diarrhea due to invasive pathogens, such as *Salmonella, Shigella,* and *Campylobacter* species, have been associated with fever and prominent inflammato y signs, in addition to bloody stool, and are readily diagnosed by stool culture [129]. Rarely, parasites such as *Entamoeba histolytica* have been identif ed as a cause of bloody diarrhea in this setting [129].

Intra-abdominal infection and abscesses. Complications of biliary tract and GI disease, such as appendiceal, hepatic, and diverticular abscesses, are uncommon but should be considered in febrile, older LTCF residents. The manifestations of these infections in this population are atypical, with a resulting delay in treatment and increased morbidity and mortality. Fever and focal finding on physical examination may be lacking, leading to perforation, abscess formation, and death [143].

Compared with young adults, rates of diverticulitis and cholecystitis increase several-fold among older persons [143, 144]. Leading causes of intra-abdominal infections in older adults include appendicitis (28%), diverticulitis (28%), cholecystitis (12%), cholangitis (12%), and intraabdominal abscess (9%) [143]. Appendicitis is less common with aging but accounts for 15% of surgical emergencies among persons in this age group [144]. Intra-abdominal abscess is also a leading diagnosis in older adults with fever of unknown origin. Evaluation for these infections should be considered to be a medical emergency that requires admission to an acute care facility.

VII. HOW SHOULD A SUSPECTED OUTBREAK OF A SPECIFIC INFECTIOUS DISEASE BE INVESTIGATED IN LTCFs?

Recommendation

33. During a possible outbreak of infection, testing of residents, regardless of advanced directive status, may be warranted for diagnostic and infection-control purposes for the protection of other residents and staff (B-III).

Evidence Summary

Although a broad description of outbreak investigation is beyond the scope of these guidelines, LTCFs commonly experience outbreaks of disease above endemic levels (i.e., epidemics). The role of the LTCF physician is to recognize an outbreak; to take immediate action regarding isolation, if required; and to notify the medical director and infection-control practitioner or appropriate authorities (e.g., local public health department or the Centers for Disease Control and Prevention) for further assistance, if needed [145, 146]. Importantly, testing of LTCF residents, even those with advanced directives prohibiting such measures in their own care, may be done when the goal is to benefi the community of the LTCF [54]. To facilitate early recognition of an outbreak, facilities should monitor their baseline infection rates using standard defin tions.

The following initial steps should be initiated in recognizing an outbreak:

- Conf rm the diagnosis of disease in the index patient.
- Decide and defin key variables to study (before chart review) and involve a multidisciplinary team in planning the study.
- Derive a uniform case definitio to be used in chart review and patient evaluation.
- With use of the case definition perform a chart review and prospectively observe newly suspected cases.
- Plot an epidemic curve (number of cases over time) that includes a sufficien pre-epidemic period to establish that an outbreak truly exists.
- Determine whether the outbreak is a "pseudo-outbreak" (presence of positive laboratory results in the absence of clinical disease) that is now recognized because of a change in surveillance, laboratory and/or specimen collection methods, or altered procedures rather than a true increase in the number of cases.
- Review the relevant literature.
- Inform appropriate administrative personnel (director of nursing or department heads) of isolation procedures, if required.
- Seek assistance from local epidemiology personnel in the health department, the Centers for Disease Control and Prevention, or a hospital.

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PERFORMANCE MEASURES

1. In LTCF residents suspected of having an infection, the temperature, pulse, blood pressure, and respiratory rate should be obtained by nursing home/facility personnel within 30 min.
2. In LTCF residents suspected of having an infection and in whom no prior advance directive prohibits further evaluation, a CBC count, including peripheral WBC count and differential cell counts, should be performed within 12–24 h (or sooner if the patient is seriously ill), consistent with local standards of practice.

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