
Definitions of Infection for Surveillance in Long-term Care Facilities

Allison McGeer, Beverly Campbell, T. Grace Emori, Walter J. Hierholzer, Marguerite M. Jackson, Lindsay E. Nicolle, Carla Pepler, Amersolo Rivera, Debra G. Schollenberger, Andrew E. Simor, Philip W. Smith, and Elaine E-L. Wang

In the last decade, increasing attention has focused on the practice of infection control in long-term care facilities. It has become clear that much more data on rates, risk factors, and management of infections in residents of such facilities are needed if the quality of resident care and the cost-effectiveness of infection control programs are to be optimized. It is also clear that the standard definitions of nosocomial infections developed for use in acute care hospitals are not applicable in most long-term care facilities. Standard definitions of infections for use in long-term care facilities would be helpful, both as guidelines for surveillance and as outcome measures for studies of infections and infection control in these facilities.

This set of definitions was developed at a consensus conference held in January 1989 and subsequently revised by a modified Delphi technique involving consensus conference participants. Discussion at the conference was based on definitions developed at Yale University (Checko P, et al., unpublished manuscript) and revised by the

Co-operative Infection Control Committee¹ and on detailed reviews of these definitions written by a sample of 62 infectious disease physicians, geriatricians, infection control practitioners from long-term care facilities, and authors of published research in the field. They are intended specifically for use in facilities that provide homes for elderly residents who require 24-hour personal care under professional nursing supervision. The majority of these residents will have some degree of cognitive impairment. All will require some assistance with activities of daily living, and some may require urinary catheters, sterile dressings, and/or tube feedings. However, neither intravenous therapy nor laboratory/radiology facilities will usually be available on the premises.

We have no data as yet on the reliability or validity of these definitions, although they are the subject of an ongoing study. We hope, however, that they will stimulate thought and research, and we look forward to the development of uniform definitions and of infection surveillance and control programs in long-term care facilities.

From the Departments of Microbiology and Infectious Disease, Mount Sinai Hospital, Toronto; Laboratory Centre for Disease Control, Health Protection Branch, Department of Health and Welfare, Canada; Association for Practitioners in Infection Control; Hospital Infections Program, Centers for Disease Control; Yale-New Haven Hospital; University of California San Diego Medical Center; University of Manitoba Health Sciences Center; Ontario Nursing Home Association; Disease Control and Epidemiology Service, Ontario Ministry of Health; Epidemiology Department, Clarkson Hospital, Omaha; and Hospital for Sick Children, Toronto. This conference was funded under contract to the Laboratory Centre for Disease Control, Health Protection Branch, Department of Health and Welfare, Canada. Reprinted with permission. From McGeer A et al: *Definitions of Infection for Surveillance in long-term care facilities*, *Am J Infect Control* 19(1):1-7, 1991.

DEFINITIONS

Principles

The definitions presented here are not all-inclusive. They focus on infections for which surveillance is expected to be useful (i.e., infections that are common and can be acquired and detected in the facility). Three important conditions apply to all of the definitions:

1. All symptoms must be new or acutely worse. Many residents have chronic symptoms, such as cough or urinary urgency, that are not associated with infection. However, a change in the resident's status

is an important indication that an infection may be developing.

2. Noninfectious causes of signs and symptoms should always be considered before a diagnosis of infection is made.
3. Identification of infection should not be based on a single piece of evidence. Microbiologic and radiologic findings should be used only to confirm clinical evidence of infection. Similarly, physician diagnosis should be accompanied by compatible signs and symptoms of infection.

Respiratory tract infection

Common cold syndromes/pharyngitis The resident must have at least two of the following signs or symptoms: (a) runny nose or sneezing, (b) stuffy nose (i.e., congestion), (c) sore throat or hoarseness or difficulty in swallowing, (d) dry cough, (e) swollen or tender glands in the neck (cervical lymphadenopathy).

Comment. Fever may or may not be present.

Symptoms must be new, and care must be taken to ensure that they are not caused by allergies.

Influenza-like illness Both of the following criteria must be met:

1. Fever ($\geq 38^{\circ}\text{C}$)*
2. The resident must have at least three of the following signs or symptoms: (a) chills, (b) new headache or eye pain, (c) myalgias, (d) malaise or loss of appetite, (e) sore throat, (f) new or increased dry cough.

Comment. This diagnosis can be made only during influenza season (November to April in Canada). If criteria for influenza-like illness and another upper or lower respiratory tract infection are met at the same time, only the diagnosis of influenza-like illness should be recorded.

Pneumonia Both of the following criteria must be met:

1. Interpretation of a chest radiograph as demonstrating pneumonia, probable pneumonia, or the presence of an infiltrate. If a previous radiograph exists for comparison, the infiltrate should be new.
2. The resident must have at least two of the signs and symptoms described under "other lower respiratory tract infections."

Comment. Noninfectious causes of symptoms must be ruled out. In particular, congestive heart failure may produce symptoms and signs similar to those of respiratory infections.

Other lower respiratory tract infection (bronchitis, tracheobronchitis) The resident must have at least three of the following signs or symptoms: (a) new or

increased cough, (b) new or increased sputum production, (c) fever ($\geq 38^{\circ}\text{C}$), (d) pleuritic chest pain, (e) new or increased physical findings on chest examination (rales, rhonchi, wheezes, bronchial breathing), (f) one of the following indications of change in status or breathing difficulty: new/increased shortness of breath *or* respiratory rate >25 per minute *or* worsening mental or functional status.*

Comment. This diagnosis can be made only if no chest film was obtained or if a radiograph failed to confirm the presence of pneumonia.

Urinary tract infection Urinary tract infection includes only symptomatic urinary tract infections. Surveillance for asymptomatic bacteriuria (defined as the presence of a positive urine culture in the absence of new signs and symptoms of urinary tract infection) is not recommended, as this represents baseline status for many residents.

Symptomatic urinary tract infection One of the following criteria must be met:

1. The resident does not have an indwelling urinary catheter and has at least three of the following signs and symptoms: (a) fever ($\geq 38^{\circ}\text{C}$) or chills, (b) new or increased burning pain on urination, frequency or urgency, (c) new flank or suprapubic pain or tenderness, (d) change in character of urine,[†] (e) worsening of mental or functional status (may be new or increased incontinence).
2. The resident has an indwelling catheter and has at least two of the following signs or symptoms: (a) fever ($\geq 38^{\circ}\text{C}$) or chills, (b) new flank or suprapubic pain or tenderness, (c) change in character of urine,[†] (d) worsening of mental or functional status.

Comment. It should be noted that urine culture results are not included in the criteria. However, if an appropriately collected and processed urine specimen was sent *and* if the resident was not taking antibiotics at the time, then the culture must be reported as either positive or contaminated.

Because the most common occult infectious source of fever in catheterized residents is the urinary tract, the combination of fever and worsening mental or functional status in such residents meets the criteria for a urinary tract infection. However, particular care should be taken to rule out other causes of these symptoms. If a catheterized resident with only fever and worsening mental or functional

*Significant deterioration in the resident's ability to carry out the activities of daily living or in the resident's cognitive status, respectively.

[†]Change in character may be clinical (e.g., new bloody urine, foul smell, or amount of sediment) or as reported by the laboratory (new pyuria or microscopic hematuria). For laboratory changes, this means that a previous urinalysis must have been negative.

*A single temperature of $\geq 38^{\circ}\text{C}$, taken at any site.

status meets the criteria for infection at a site other than the urinary tract, only the diagnosis of infection at this other site should be made.

Eye, ear, nose, and mouth infection

Conjunctivitis *One* of the following criteria must be met:

1. Pus appearing from one or both eyes, present for at least 24 hours.
2. New or increased conjunctival redness, with or without itching or pain, present for at least 24 hours (also known as "pink eye").

Comment. Symptoms must not be due to allergy or trauma to the conjunctiva.

Ear infection *One* of the following criteria must be met:

1. Diagnosis by a physician* of any ear infection.
2. New drainage from one or both ears. (Non-purulent drainage must be accompanied by additional symptoms, such as ear pain or redness.)

Mouth and perioral infection Oral and perioral infections, including oral candidiasis, must be diagnosed by a physician or a dentist.

Sinusitis The diagnosis of sinusitis must be made by a physician.

Skin infection

Cellulitis/soft tissue/wound infection *One* of the following criteria must be met:

1. Pus present at a wound, skin, or soft tissue site.
2. The resident must have four or more of the following signs or symptoms: (a) fever ($>38^{\circ}\text{C}$) or worsening mental/functional status; *and/or*, at the affected site, the presence of new or increasing (b) heat, (c) redness, (d) swelling, (e) tenderness or pain, (f) serous drainage.

Fungal skin infection The resident must have both (a) a maculopapular rash and (b) either physician diagnosis or laboratory confirmation.[†]

Herpes simplex and herpes zoster infection. For a diagnosis of cold sores or shingles, the resident must have both (a) a vesicular rash and (b) either physician diagnosis or laboratory confirmation.

Scabies The resident must have both (a) a maculopapular and/or itching rash and (b) either physician diagnosis or laboratory confirmation.

Comment. Care must be taken to ensure that a rash is not allergic or secondary to skin irritation.

Gastrointestinal tract infection

Gastroenteritis *One* of the following criteria must be met:

1. Two or more loose or watery stools *above what is normal* for the resident within a 24-hour period.
2. Two or more episodes of vomiting in a 24-hour period.
3. Both of the following: (a) a stool culture positive for a pathogen (*Salmonella*, *Shigella*, *E. coli* O157:H7, *Campylobacter*) or a toxin assay positive for *C. difficile* toxin and (b) at least one symptom or sign compatible with gastrointestinal tract infection (nausea, vomiting, abdominal pain or tenderness, diarrhea).

Comment. Care must be taken to rule out noninfectious causes of symptoms. For instance, new medications may cause both diarrhea and vomiting; vomiting may be associated with gallbladder disease.

Systemic infection

Primary bloodstream infection *One* of the following criteria must be met:

1. Two or more blood cultures positive for the same organism.
2. A single blood culture documented with an organism thought not to be a contaminant *and* at least one of the following: (a) fever ($\geq 38^{\circ}\text{C}$), (b) new hypothermia ($<34.5^{\circ}\text{C}$, or does not register on the thermometer being used), (c) a drop in systolic blood pressure of > 30 mm Hg from baseline, or (d) worsening mental or functional status.

Comment. Bloodstream infections related to infection at another site are reported as secondary bloodstream infections and are not included as separate infections.

Unexplained febrile episode The resident must have documentation in the medical record of fever ($\geq 38^{\circ}\text{C}$) on two or more occasions at least 12 hours apart in any 3-day period, with no known infectious or noninfectious cause.

COMMENTARY

The identification of infections in residents of long-term care facilities is often difficult, and several of these definitions may be found to lack sufficient validity and/or reliability for use in many surveillance programs. Because there is a general consensus of both conference participants and written reviewers as to those definitions and criteria that are likely to cause the most difficulty, the conference discussion surrounding these areas is summarized here.

*Requires a written note or a verbal report from a physician specifying the diagnosis. usually implies direct assessment of the resident by a physician. An antibiotic order alone does *not* fulfill this criterion. In some homes, it may be appropriate also to accept a diagnosis made by other qualified clinicians (e.g., nurse practitioner, physician associate).

[†]For *Candida* or other yeast, laboratory confirmation includes positive smear for yeast or culture for *Candida* spp.; for herpetic infections, positive electron microscopy or culture of scraping or swab; for scabies, positive microscopic examination of scrapings.

General

These definitions do not specify the location of the resident (community, facility, acute care hospital) at the time the infection was acquired. A definition of "facility-associated" analogous to the CDC's definition for *nosocomial*² would be that, for an infection to be facility-associated, there must be no evidence that the infection was present or incubating on admission or readmission (after hospitalization or community visit) and no evidence that the infection began as the result of a procedure carried out in an acute care hospital or a physician's office. The utility of classifying infections on the basis of this definition remains to be tested.

Fever has been defined as at least one temperature, taken at any site, of 38° C or more. Prospective studies disagree on the proportion of elderly persons with significant systemic infections who mount a fever of this magnitude.³⁻⁵ Other studies have suggested that the range of normal temperature is wider for the elderly than for younger adults and that, for some residents, temperatures of less than 38° C may be abnormally high.^{6,7} Most conference participants would have preferred a definition based on a temperature increase of 1° or 1.5° C above baseline for the resident, and some believed that differentiation between axillary, oral, and rectal temperatures would be desirable. However, there was no consensus as to what would constitute an adequate baseline (for instance, what the number or timing of baseline measurements should be). In addition, participants were not confident that such temperatures would be recorded consistently and were concerned that if oral or axillary temperatures were taken with mercury thermometers they might be unreliable.⁸ These considerations led to a decision to use the simplest definition, recognizing that the consequences of that decision must be evaluated.

For those infections that occur most often as outbreaks (e.g., gastroenteritis, influenza), consideration was given to a criterion requiring similar illness in a specified number of other residents or staff. This was advanced because of concerns that the definitions as written are not sensitive enough to detect mild cases of viral gastroenteritis or influenza but that the result of relaxing the criteria would be definitions that were not specific enough to avoid mislabeling of noninfectious symptoms as infections. However, a requirement that a certain number of infections be present for any one to be reported would make surveillance more complicated. Further, most participants thought that consideration of clustering was more appropriately incorporated into the analysis of the collected data. This criterion was thus not included.

Some infections, such as herpes zoster and oral candidiasis, can be reliably diagnosed on clinical

grounds by an experienced observer. Because staff members in some long-term care institutions may not have sufficient training to be able to make these diagnoses, and because there is no simple measure of the experience required, "diagnosis by a physician" became the relevant criterion for these infections. However, the experience of the observer is recognized as more important than the particular qualification.

The conference participants had some difficulty in agreeing on a precise requirement for "diagnosis by a physician," although the consensus was that it should usually imply direct physical assessment of the resident. Most participants thought that acceptance of a diagnosis based on a telephone conversation or an order for antibiotics would result in overdiagnosis of infections but that requiring chart documentation would result in substantial underdiagnosis. The current definition is a compromise and must be validated. Similarly, in facilities in some geographic areas, clinicians other than physicians (e.g., nurse practitioners, physician associates) may be equally able to diagnose infections. However, because their availability and training is geographically variable, "physician" has been retained in the definitions, with the comment that individual infection control committees may wish to define diagnosis by other clinicians as acceptable for their institutions.

Specific

There was considerable disagreement as to the value of including a definition that attempted to capture influenza. Influenza is a significant cause of morbidity and mortality and intervention early in an outbreak may prevent new cases. However, influenza cannot be diagnosed reliably on clinical grounds, and, because of the explosive nature of many outbreaks, the effectiveness of surveillance is not clear. Participants debated two strategies for recognition of influenza: (a) a statement that, during influenza season, any cluster of febrile respiratory illness should be suspected of being influenza and (b) a case definition. Although there was no consensus as to the preferable strategy, a definition of "influenza-like illness" was developed, with the intention of providing a case definition whose utility could be tested.

There was a consensus that pneumonia could not be differentiated from other lower respiratory tract infections without radiographs of the chest. Thus the definition of pneumonia requires radiologic examination. Participants agreed that misclassification of some cases of pneumonia as "other lower respiratory" infections will result, but they did not believe that such errors were a serious concern for infection control purposes. Results of blood tests, such as the white blood cell count, were considered as criteria, but there was a general consensus that these

would be available too rarely to justify inclusion. Isolation of a pathogen from sputum was also considered as a criterion but was rejected. In general, although culture of a pathogen may help to identify the etiologic agent of a pneumonia and guide antimicrobial therapy, culture results are not helpful in determining the presence or absence of infection.^{9,10} In addition, the frequency with which adequate specimens can be obtained in this population is low.^{11,12}

Asymptomatic bacteriuria has not been included in the definitions. The prevalence of asymptomatic bacteriuria in institutionalized elderly persons is high.¹³ Available evidence suggests that it is not an independent predictor of mortality,^{14,15} that treatment does not eradicate it in the majority of patients,¹⁶ and that treatment to prevent infection is not completely effective and is associated with significant side effects.¹⁷ Participants thought that surveillance for asymptomatic bacteriuria would not be useful. The known high prevalence of bacteriuria in this population also led to the decision to use urine culture results as a condition rather than as a criterion. Tests for pyuria were considered as criteria but were rejected as being reliably predictive of neither bacteriuria nor symptomatic infection in this population.^{18,19}

Because laboratory confirmation of fungal infections and scabies is often unavailable, consideration was given to a criterion involving response to specific therapy. This was rejected because the appearance of rashes caused by these infections may be non-specific and because spontaneous resolution of noninfectious rashes may occur in the length of time that would be considered "response to therapy."

Although surgical wound infections may be included in the category of cellulitis/soft tissue/wound infections, it will usually be possible to use current CDC definitions² (see also Appendix A) for their diagnosis. The CDC definitions should take precedence, and the infections should be attributed to the acute care facility in which they were acquired.

Most participants had significant reservations about the definition of gastroenteritis. Participants generally thought that because gastrointestinal symptoms are common, and viral gastroenteritis is often a mild disease, any definition that captured most viral gastroenteritis would also label many noninfectious episodes as infections. There was concern that such a definition would also label as infected residents who were carriers of *Salmonella* spp. or *Clostridium difficile* and who had mild, noninfectious gastrointestinal symptoms. It is hoped that the results of studies currently under way will be of help in improving the surveillance definition.

Because most residents who have bloodstream infections will be ill enough to require transfer to an

acute care hospital before the diagnosis of bloodstream infection is made, bloodstream infections will be diagnosed infrequently in most long-term care facilities. In general, when an infection related to the facility is diagnosed in the hospital, the facility should include the infection in its surveillance data, but the CDC's definition of nosocomial infection should be used.² However, since blood cultures might be obtained in some institutions, a definition was included. The definition is somewhat more stringent than the CDC definition of nosocomial infection in that laboratory confirmation is required (i.e., two positive blood cultures or one positive blood culture and a relevant symptom).²

The clinical criteria accompanying the single positive blood culture are not intended to be all-inclusive symptoms of sepsis. Rather, it was thought that any resident who had true sepsis would meet at least one of the criteria. Note that "hypothermia" is defined arbitrarily and that it must be "new" because some elderly residents who are well may have low baseline temperatures.

Several participants thought that adequate evaluation of residents should yield a site of infection in all episodes that are truly infectious and that noninfectious febrile episodes would most often be of trivial significance. The category of "unexplained febrile episode" has been retained to allow testing of these hypotheses. If they are correct, the definition may be useful for the detection of lack of adequate assessment of febrile residents.

In summary, these definitions are consensus definitions from conference participants. Some of them will likely need to be improved when more data on their performance become available. Individual institutions may also wish to modify them to suit their particular resident populations and physician and laboratory availability. These definitions will also be of limited use in outbreak investigation, since a case definition specific to each outbreak must be developed. We hope, however, that they will provide a basis for the development of standardized definitions and stimulate further research into infection control in long-term care facilities.

REFERENCES

1. Co-operative Infection Control Committee (Pepler C, Campbell B, Prince K, Rivera A, Scully D): A surveillance protocol for long term care facilities, Markham, Ontario, Canada, 1988, Ontario Nursing Home Association, pp 8-14.
2. Garner JS, Jarvis WR, Emori TG et al: CDC definitions for nosocomial infections, 1988, *Am J Infect Control* 16:128-140, 1988.
3. McAlpine CH, Martin BJ, Lennox IM, et al: Pyrexia in infections in the elderly, *Age Ageing* 15:230-234, 1986.
4. Berman P, Hogan DB, Fox RA: The atypical presentation of infection in old age, *Age Ageing* 16:201-207, 1987.

5. Castle S, Yeh M, Miller D, et al: Fever response in elderly nursing home residents, *Clin Res* 30:80A, 1990.
6. Howell TH. Oral temperature range in old age, *Gerontol Clin (Basel)* 1975, 17:133-136.
7. Williams BT. Oral temperatures of elderly applicants for welfare services, *Gerontol Clin (Basel)* 10:281-287, 1968.
8. Downton JH, Andrews K, Puxty JAH. "Silent" pyrexia in the elderly. *Age Ageing* 16:41-44, 1987.
9. Lentino JR, Lucks DA. Nonvalue of sputum culture in the management of lower respiratory tract infections, *J Clin Microbiol* 25:756-762, 1987.
10. Gleckman R, Devita J, Hibert D, Pelletier C, Martin R. Sputum gram stain assessment in community-acquired bacteremic pneumonia, *J Clin Microbiol* 26:846-849, 1988.
11. Marrie TJ, Durant H, Kwan C: Nursing home acquired pneumonia, *J Am Geriatr Soc* 34:697-702, 1986.
12. Peterson PK, Stein D, Guay DRP et al: Prospective study of lower respiratory tract infections in an extended-care nursing home program, *Am J Med* 85:165-171, 1988.
13. Kaye D: Urinary tract infections in the elderly, *Bull NY Acad Med* 56:209-20, 1980.
14. Nicolle LE, Henderson E, Bjornson J et al: The association of bacteriuria with resident characteristics and survival in elderly institutionalized males, *Ann Intern Med* 106:682-686, 1987.
15. Kunin CM, Chin QF, Chambers S: Morbidity and mortality associated with indwelling catheters in elderly patients in a nursing home—confounding due to the presence of associated diseases, *J Am Geriatr Soc* 35:1001-1006, 1987.
16. Nicolle LE, Mayhew JW, Bryan L: Outcome following antimicrobial therapy for asymptomatic bacteriuria in elderly women resident in an institution, *Age Ageing* 17:187-192, 1987.
17. Nicolle LE, Mayhew WJ, Bryan L: Prospective randomized comparison of therapy and no therapy for asymptomatic bacteriuria in institutionalized elderly women, *Am J. Med* 83:27-33, 1987.
18. Flanagan PG, Davies EA, Rooney PG et al: Evaluation of four screening tests for bacteriuria in elderly people, *Lancet* 1:1117-1119, 1989.
19. Boscia JA, Abrutyn E, Levison ME et al: Pyuria and asymptomatic bacteriuria in elderly ambulatory women, *Ann Intern Med* 110:404-5, 1989.