Surveillance Definitions of Infections in Canadian Long Term Care Facilities

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BACKGROUND

The Canadian Patient Safety Institute (CPSI) and the Public Health Agency of Canada (PHAC) hosted a national infection prevention and control summit in November 2014. Participants came together with the goal of advancing infection prevention and control practices and reducing healthcare-associated infections (HAI) in Canada. During this meeting, measurement and surveillance, specifically improving consistency in surveillance practices across the country, surfaced as a key theme and an action plan was created. Under the leadership of Infection Prevention and Control Canada (IPAC Canada) and the Association of Medical Microbiology and Infectious Diseases Canada (AMMI Canada), a national committee was created to help establish and implement standard infection case surveillance definitions for HAI in acute care and long term care (LTC) facilities. Members of IPAC Canada's Surveillance and Applied Epidemiology, LTC, and Network of Networks Interest Groups and the L'Association des infirmières en prévention des infections formed a working group to revise the existing Society for Healthcare Epidemiology of America LTC facility infection surveillance definitions. Case definitions were updated based on the Canadian healthcare system and an increase in evidence-based literature about infections that occur in residents of LTC facilities.[1,2]

METHOD SUMMARY

The Centers for Disease Prevention and Control (CDC) Healthcare Infection Control Practices Advisory Committee (HICPAC) guideline development methodology was used to revise the definitions.[3] This included a structured review of evidence found in peer reviewed primary research reports and systematic and meta analyses. Changes to LTC infection case definitions were determined by consensus between working group members and reviewed by content experts including infectious disease physicians, epidemiologists, infection control professionals and public health officials. An annex describing the methodology used to produce these definitions, together with the literature search strategy, critical appraisal and stakeholder review and approval process, is available upon request.

GUIDING PRINCIPLES

Clinically relevant infections that occur in LTC facility residents are defined here for surveillance purposes. Infection presentation in the elderly may be atypical and failure to meet these surveillance definitions does not necessarily exclude the presence of infection. Further, as with the original definitions, key conditions must be met when applying the definitions: signs and symptoms must be new or acutely worse than the resident's baseline; non-infectious causes should be considered first; and identification of an infection should be based on both clinical presentation and diagnostic testing.[1,2]

Limited resources are available for infection prevention and control in many LTC facilities. As a result, it is recommended that surveillance focus on infections with the most potential for prevention, transmissibility, incidence, morbidity and/or mortality based on the local context. Attribution of an infection to a LTC facility for surveillance purposes should occur if there is no evidence the infection was incubating on admission to the facility and if infection onset occurs >2 calendar days after admission or >3 days after admission for *Clostridium difficile* infections (CDI).[1,4] This is in keeping with the Canadian Nosocomial Infection Surveillance Program (CNISP) case classification rules for CDI in acute care.[4] Finally, these definitions have not been tested in Canadian LTC facilities in advance of their publication.

DEFINITIONS

Constitutional Criteria for Infection

The constitutional criteria in Table 1 serves to establish parameters for common signs and symptoms of infection present in the clinical syndromes defined in this document. The only change to constitutional criteria from the original definitions is to leukocytosis. Normal levels of total leukocytes (including neutrophils, eosinophils, basophils, lymphocytes, and monocytes) in adults range between 4 to 10 x 10^9 cells/L.[5,6,7,8] Thus, a cell count above the normal range is considered leukocytosis. Further, the left

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TABLE 1: Definitions for Constitutional Criteria
A. Fever 1. Single oral temperature >37.8°C OR 2. Repeated oral temperatures >37.2°C or rectal temperatures >37.5°C OR 3. Single temperature >1.1°C increase over baseline from any site (oral, tympanic, auxiliary)
B. Leukocytosis > 10 x 10^9 leukocytes/L
C. Acute change in mental status from baseline (all criteria must be present; see Table 2) 1. Acute onset 2. Fluctuating course 3. Inattention 4. Either disorganized thinking or altered level of consciousness
D. Acute functional decline A new 3-point increase in total activities of daily living (ADL) score (range, 0–28) from baseline, based on the following 7 ADL items, each scored from 0 (independent) to 4 (total dependence) 1. Bed mobility 2. Transfer 3. Locomotion within LTC facility 4. Dressing 5. Toilet use 6. Personal hygiene 7. Eating

shift (bandemia) criterion was removed from the leukocytosis definition. Bandemia is a marker for a variety of inflammatory processes, tissue damage or necrosis, seizures, toxic ingestions, and metabolic abnormalities. It is not a specific marker for infection.[9,10,11,12] Measurement methods are also subject to inaccuracy due to sampling bias and variance in normal band reference ranges between laboratories.[13,14,15]

Confusion Assessment

Altered mental status can be a nonspecific sign of acute infection in LTC residents.[2,16,17] Table 2 outlines criteria from the Confusion Assessment Method (CAM) to detect delirium.[18,19] Meta analyses show this criteria has helped to improve identification of delirium in clinical and research settings.[20,21] CAM should be conducted during a formal interview with the resident and by trained personnel.[21] CAM has higher specificity than sensitivity and does not replace clinical judgment.

Respiratory Tract Infections (RTI)

Research shows that a resident can have a laboratory confirmed RTI (e.g. positive nasopharyngeal [N/P] swab) but few signs and symptoms of an infection due to the lack of immune response in the elderly.[22,23,24] Influenza like illness (ILI) clinical definitions, for instance, have performed poorly in studies for this reason.[25,26,27] Therefore, an N/P swab positive for a respiratory pathogen was added to the common cold syndrome and ILI definition sets in Table 3. ILI criteria were further updated to align with the PHAC case definition.[28,29]

In practice, laboratory specimens may not be collected during RTI outbreaks once a causative organism is identified. Residents experiencing symptoms in line with the identified disease agent and have an epidemiological link to a known positive case are considered clinically positive cases but do not technically qualify as surveillance cases. Consequently, it is recommended that inclusion of an epidemiological link in lieu of a laboratory confirmed positive specimen be used to meet case definition criteria during an outbreak. A case is considered epidemiologically linked by direct contact to a laboratory-confirmed case through person-to-person transmission (e.g., common caregiver), if there is geographic proximity in the facility or through a common exposure.

Urinary Tract Infection (UTI)

Minor changes were made to the UTI definitions. Acute dysuria can be a symptom of a UTI in the absence of an indwelling catheter. Recent literature shows acute dysuria alone is insufficient and at least one other sign or symptom must be present, in addition to microbiological confirmation, for a UTI to be classified as such.[30,31,32] Subsequently, acute dysuria was removed from criteria 1a in the original definition and included in criteria 1b and

TABLE 2. Confusion Assessment Method Criteria	
Criteria	**Comments**
Acute onset	Evidence of acute change in resident's mental status from baseline
Fluctuating	Behavior fluctuating (e.g., coming and going or changing in severity during the assessment)
Inattention	Resident has difficulty focusing attention (e.g., unable to keep track of discussion or easily distracted)
Disorganized thinking	Resident's thinking is incoherent (e.g., rambling conversation, unclear flow of ideas, unpredictable switches in subject)
Altered level of consciousness	Resident's level of consciousness is described as different from baseline (e.g., hyper alert, sleepy, drowsy, difficult to arouse, nonresponsive)

TABLE 3. Surveillance Definitions for Respiratory Tract Infections (RTI)	
NOTE. Epidemiological confirmation, instead of a laboratory confirmed positive specimen, can be used to meet case definition criteria during an outbreak.	
Criteria	**Comments**
A. Common cold syndrome or pharyngitis (at least 2 criteria must be present) 1. Runny nose or sneezing 2. Stuffy nose (i.e., congestion) 3. Sore throat or hoarseness or difficulty in swallowing 4. Dry cough 5. Swollen or tender glands in the neck (cervical lymphadenopathy) 6. N/P swab positive for a respiratory pathogen	Fever may or may not be present. Symptoms must be new and not attributable to allergies.
B. Influenza-like illness (criteria 1 and/or 2 must be present, AND 3 or 4) 1. Fever 2. New and or increased cough 3. At least 2 of the following influenza-like illness subcriteria a.. Chills b. New headache or eye pain c. Myalgias or body aches d. Malaise or loss of appetite e. Sore throat f. Arthralgia (joint pain) 4. N/P swab positive for Influenza virus	Fever may not be present in the elderly. If criteria for influenza-like illness and another upper or lower RTI are met at the same time, only the diagnosis of influenza-like illness should be recorded. Because of increasing uncertainty surrounding the timing of the start of influenza season, the peak of influenza activity, and the length of the season, "seasonality" is no longer a criterion to define influenza-like illness.
C. Pneumonia (criteria 1 and 2 must be present, OR criteria 1 and 3) 1. Interpretation of a chest radiograph as demonstrating pneumonia or the presence of a new infiltrate 2. At least 1 of the following respiratory subcriteria a. New or increased cough b. New or increased sputum production c. O_2 saturation <94% on room air or a reduction in O2 saturation of >3% from baseline d. New or changed lung examination abnormalities e. Pleuritic chest pain f. Respiratory rate of ≥25 breaths/min 3. At least 1 constitutional criteria (see Table 1)	For both pneumonia and lower RTI, the presence of underlying conditions that could mimic the presentation of a RTI (e.g., congestive heart failure or interstitial lung diseases) should be excluded by a review of clinical records and an assessment of presenting symptoms and signs.
D. Lower respiratory tract infection (bronchitis or tracheobronchitis; all 3 criteria must be present) 1. Chest radiograph not performed or negative results for pneumonia or new infiltrate 2. At least 2 of the respiratory subcriteria (a–f) listed in section C above 3. At least 1 of the constitutional criteria (see Table 1)	(See comment for section C above.)

1c of Table 4 for residents without an indwelling catheter. In catheterized residents, purulent discharge from around the catheter insertion site can be a symptom of a UTI in males and females. This criterion was grouped with acute pain, swelling, or tenderness of the testes, epididymis, or prostate criteria in males in the original definitions but is separated here for clarity. Finally, the original definitions allow for a UTI in the absence of localizing symptoms if a blood culture isolate is the same as the organism isolated from the urine and there is no alternate site of infection but this information was not included in the tabular definitions. This was added to Table 4.

Surveillance definitions of UTI in older adults are highly specific and rely on localized genitourinary symptoms. Infections in the elderly often have atypical clinical presentation and residents of LTC can also be cognitively impaired or have comorbidities like dementia and stroke that impede communication of symptoms.[17,33,34] Studies show that there is a gap between qualifying surveillance cases and the number of clinically diagnosed and treated cases for residents without an indwelling catheter. A change in mental status is often one of the reasons a UTI is suspected and treated in LTC settings.[35,36,37,38] Some researchers have called for the inclusion of altered mental status to the definition set to close the gap between surveillance and clinical cases for residents without an indwelling catheter.[35,39] A change in mental status has been statistically associated

TABLE 4. Surveillance Definitions for Urinary Tract Infections (UTI)	
NOTE. A urinalysis negative for leukocytes effectively rules out a UTI while a urinalysis positive for leukocytes does not differentiate symptomatic UTI from asymptomatic bacteriuria.	
Criteria	**Comments**
A. For residents without an indwelling catheter (criteria 1 and 2 must be present with no other identified source of infection, OR criteria 2 and 3) 1. At least 1 of the following sign or symptom subcriteria a. Acute pain, swelling, or tenderness of the testes, epididymis, or prostate in males b. Fever or leukocytosis (see Table 1) and at least 1 of the following localizing urinary tract subcriteria i. Acute dysuria ii. Acute costovertebral angle pain or tenderness III. Suprapubic pain iv. Gross hematuria v. New or marked increase in incontinence vi. New or marked increase in urgency vii. New or marked increase in frequency c. In the absence of fever or leukocytosis, then 2 or more of the following localizing urinary tract subcriteria i. Acute dysuria ii. Suprapubic pain iii. Gross hematuria iv. New or marked increase in incontinence v. New or marked increase in urgency vi. New or marked increase in frequency	UTI should be diagnosed when there are localizing genitourinary signs and symptoms and a positive urine culture result. A diagnosis of UTI can be made without localizing symptoms if a blood culture isolate is the same as the organism isolated from the urine and there is no alternate site of infection. In the absence of a clear alternate source of infection, fever or rigors with a positive urine culture result in the noncatheterized resident or acute confusion in the catheterized resident will often be treated as UTI. However, evidence suggests that most of these episodes are likely not due to infection of a urinary source.
2. ≥ 10^8cfu/L of no more than 2 species of microorganisms from a midstream urine OR ≥ 10^5 cfu/L of any number of organisms in a specimen collected by in-and-out catheter	Urine specimens for culture should be processed as soon as possible, preferably within 2 hours. If urine specimens cannot be processed within 30 minutes of collection, they should be refrigerated. Refrigerated specimens should be cultured within 24 hours. In and out catheter collection is the gold standard for urine collection in residents without an indwelling catheter.
3. A blood culture isolate is the same as the organism isolated from the urine and there is no alternate site of infection	
B. For residents with an indwelling in a single catheter urine specimen or in a midstream voided urine specimen from a resident whose catheter has been removed within the previous 48 hours (criteria 1 and 2 must be present with no other identified source of infection, OR criteria 2 and 3) 1. At least 1 of the following sign or symptom subcriteria a. Fever, rigors, or new-onset hypotension, with no alternate site of infection b. Either acute change in mental status (see Table 2) or acute functional decline (see Table 1), with no alternate diagnosis and leukocytosis c. New-onset suprapubic pain or costovertebral angle pain or tenderness d. Purulent discharge from around the catheter e. Acute pain, swelling, or tenderness of the testes, epididymis, or prostate in males	Recent catheter trauma, catheter obstruction, or new onset hematuria are useful localizing signs that are consistent with UTI but are not necessary for diagnosis.
2. Urinary catheter specimen culture with ≥ 10^8cfu/L of any organism(s)	Urinary catheter specimens for culture should be collected following replacement of the catheter if the current catheter has been in place for >14 days.
3. A blood culture isolate is the same species as the organism isolated from the urine, with the same resistance pattern, and there is no alternate site of infection	

TABLE 5. Surveillance Definitions for Skin, Soft Tissue, and Mucosal Infections	
NOTE: For wound infections related to surgical procedures, LTC facilities should use the CDC's National Healthcare Safety Network Surgical Site Infection criteria and report these infections back to the institution where the original surgery was performed.	
Criteria	**Comments**
A. Cellulitis, soft tissue, or wound infection (at least 1 of the following criteria must be present) 1. Pus present at a wound, skin, or soft tissue site 2. New or increasing presence of at least 4 of the following sign or symptom subcriteria a. Heat at the affected site b. Redness at the affected site c. Swelling at the affected site d. Tenderness or pain at the affected site e. Serous drainage at the affected site f. One constitutional criterion (see Table 1) 3. Non-commensal organism isolated with 1 or more signs or symptoms from criterion 2	Presence of organisms cultured from the surface (e.g., superficial swab sample) of a wound is not sufficient evidence that the wound is infected. More than 1 resident with streptococcal skin infection from the same serogroup (e.g., A, B, C, G) in a LTC facility may indicate an outbreak. Common commensal organisms include diphtheroids (*Corynebacterium spp.* not *C. diphtheria*), *Bacillus spp.* [not *B. anthracis*], *Propionibacterium spp.*, coagulase-negative staphylococci (including *S. epidermidis*), viridans group treptococci, *Aerococcus spp.*, and *Micrococcus spp.*
B. Scabies (both criteria 1 and 2 must be present) 1. A maculopapular and/or itching rash characteristic of scabies 2. At least 1 of the following scabies subcriteria a. Physician diagnosis b. Laboratory confirmation (scraping or biopsy) c. Epidemiologic linkage to a case of scabies with laboratory confirmation	Consider the appearance and distribution of the rash. The most common symptom of scabies is itching (pruritus) especially at night and pimple (papular) like rash. The itching and rash may affect much of the body or be limited to common sites such as wrists, elbow, armpit, webbing between the fingers, nipple, penis, waist, beltline and buttocks. Tiny burrows that are raised and crooked, grayish white or skin coloured lines on the skin surface. They are found most often in the webbing between the fingers, in the skin folds of the wrist, elbow or knee and on the penis, breast or shoulder blades. If rash presentation is atypical, lab confirmation is recommended. A case is considered epidemiologically linked by direct contact to a laboratory-confirmed case through person-to-person transmission (e.g., common caregiver), if there is geographic proximity in the facility or through a common exposure. Care must be taken to rule out rashes due to skin irritation, allergic reactions, eczema, and other noninfectious skin conditions.
C. Fungal oral or perioral and skin infections 1. Oral candidiasis (criteria a and b must be present) a. Presence of raised white patches on inflamed mucosa or plaques on oral mucosa b. Diagnosis by a medical or dental provider 2. Fungal skin infection (criteria a and b must be present) a. Characteristic rash or lesions b. Either a diagnosis by a medical provider or a laboratory confirmed fungal pathogen from a scraping or a medical biopsy.	Mucocutaneous *Candida* infections are usually due to underlying clinical conditions such as poorly controlled diabetes or severe immunosuppression. Although they are not transmissible infections in the healthcare setting, they can be a marker for increased antibiotic exposure. Dermatophytes have been known to cause occasional infections and rare outbreaks in the LTC setting.
D. Herpesvirus skin infections 1. Herpes simplex infection (criteria a and b must be present) a. A vesicular rash b. Either physician diagnosis or laboratory confirmation 2. Herpes zoster infection (criteria a and b must be present) a. A vesicular rash b. Either physician diagnosis or laboratory confirmation	Reactivation of herpes simplex ("cold sores") or herpes zoster ("shingles") is not considered a healthcare-associated infection. Primary herpesvirus skin infections are very uncommon in a LTC facility except in pediatric populations, where it should be considered healthcare associated.
E. Conjunctivitis (at least 1 of the following criteria must be present) 1. Pus appearing from 1 or both eyes, present for at least 24 hours 2. New or increased conjunctival erythema, with or without itching 3. New or increased conjunctival pain, present for at least 24 hours	Conjunctivitis symptoms ("pink eye") should not be due to allergic reaction or trauma.

TABLE 6. Surveillance Definitions for Gastrointestinal (GI) Tract Infections	
NOTE. Epidemiological confirmation, instead of a laboratory confirmed positive specimen, can be used to meet case definition criteria during an outbreak.	
Criteria	**Comments**
A. Gastroenteritis (at least 1 of the following criteria must be present) 1. Diarrhea: 3 or more loose or watery stools above what is normal for the resident within a 24 hour period 2. Vomiting: 2 or more episodes in a 24 hour period 3. Both of the following sign or symptom subcriteria a. A stool specimen testing positive for a pathogen (e.g. *Salmonella, Shigella, Escherichia* coli O157:H7, *Campylobacter* species, rotavirus) b. At least 1 of the following GI subcriteria i. Nausea ii. Vomiting iii. Abdominal pain or tenderness iv. Diarrhea v. Mucous in stool	Care must be taken to exclude noninfectious causes of symptoms. For instance, new medications may cause diarrhea, nausea, or vomiting; initiation of new enteral feeding may be associated with diarrhea; and nausea or vomiting may be associated with gallbladder disease. Presence of new GI symptoms in a single resident may prompt enhanced surveillance for additional cases. In the presence of an outbreak, stool specimens should be sent to confirm the presence of norovirus or other pathogens (e.g. rotavirus or *E. coli* O157:H7).
B. Norovirus gastroenteritis (both criteria 1 and 2 must be present) 1. At least 1 of the following GI subcriteria a. Diarrhea: 3 or more loose or watery stools (i.e. Conforming to the shape of the specimen collection container) above what is normal for the resident within a 24 hour period b. Vomiting: 2 or more episodes in a 24 hour period 2. A stool specimen for which norovirus is positively detected by electron microscopy, enzyme immunoassay, or molecular diagnostic testing such as polymerase chain reaction (PCR)	
C. *Clostridium difficile* infection (both criteria 1 and 2 must be present) 1. One of the following GI subcriteria a. Diarrhea: 3 or more loose or watery stools (i.e., conforming to the shape of the specimen collection container) above what is normal for the resident within a 24 hour period b. Presence of toxic megacolon (abnormal dilatation of the large bowel, documented radiologically) 2. One of the following diagnostic subcriteria a. A stool sample yields a positive laboratory test result for *C. difficile* toxin A or B, or a toxin-producing *C. difficile* organism is identified from a stool sample culture or by a molecular diagnostic test such as PCR b. Pseudomembranous colitis identified during endoscopic examination or surgery or in histopathologic examination of a biopsy specimen	A "primary episode" of *C. difficile* infection is defined as one that has occurred without any previous history of *C. difficile* infection or that has occurred 8 weeks after the onset of a previous episode of *C. difficile* infection. A "recurrent episode" of *C. difficile* infection is defined as an episode of *C. difficile* infection that occurs 8 weeks or sooner after the onset of a previous episode, provided that the symptoms from the previous episode resolved. Individuals previously infected with *C. difficile* may remain colonized even after symptoms resolve. During a GI infection outbreak, individuals could have positive test results for the presence of *C. difficile* toxin because of ongoing colonization and also be co-infected with another pathogen. It is important that other surveillance criteria be used to differentiate infections in this situation.

with bacteriuria plus pyuria without distinguishing between true UTI and asymptomatic bacteriuria.[40,41] These symptoms may manifest in asymptomatic bacteriuria cases because of confounding factors like dehydration.[1,40,42] This suggests altered mental status is not specific for UTI and is excluded from this definition set to ensure reported UTI surveillance cases are accurate.

Skin, Soft Tissue, and Mucosal Infections

A single addition was made to the cellulitis, soft tissue or wound infection definition based on expert opinion. Specifically, a cellulitis, soft tissue or wound infection can be identified by isolating a non-commensal organism with the presence of one or more signs or symptoms of infection. No data were found to support revisions in the remainder of the skin, soft tissue and mucosal infection definitions.

Gastrointestinal (GI) Tract Infections

The definitions for GI tract infections are generally unchanged from those proposed in the original surveillance definitions. The current gastroenteritis definition includes mucous in stool in the signs and symptoms subcriteria. Both viral and bacterial enteric pathogens can trigger excess mucous production including norovirus, rotavirus,

Helicobacter pylori, *Escherichia coli* and *Salmonella*.[43,44,45,46,47] The definition of diarrhea now states loose stools instead of liquid stools to align diarrhea criteria with the Bristol Stool Chart.[48] Finally, as with RTI, laboratory specimens may not be collected during GI outbreaks once a causative organism is identified. Residents experiencing symptoms in line with the identified disease agent are considered clinically positive cases but do not technically qualify as surveillance cases. Consequently, it is recommended that inclusion of an epidemiological link in lieu of a laboratory confirmed positive specimen be used to meet case definition criteria during an outbreak.

Blood Stream Infections (BSI)

Special criteria to define BSI and unexplained febrile episode criteria in the elderly continues to be scarce, despite exhaustive review of the literature. BSI criteria by the CDC's National Healthcare Safety Network were reviewed and consensus is to use these definitions for LTC facility surveillance.

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