

Editorial

Double, Double, Toil and Trouble: Infections Still Spreading in Long-Term-Care Facilities

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The rapid shift in the delivery of healthcare from acute care settings to chronic care settings has continued unabated.¹ Provision of care to an increasingly frail and elderly population in long-term-care facilities (LTCFs) is, not unexpectedly, associated with infection. In hospitals, guidelines and processes for detection, diagnosis, treatment, and control of infections have evolved during approximately the past 40 years. In contrast, infection control research in LTCFs began in the 1980s, conducted by investigators from a few institutions based primarily in North America.² In 2005, basic questions remain regarding the prevalence of infection and the most effective means of diagnosis and treatment. In addition, it is difficult to judge the efficacy, or lack thereof, of infection control measures used in LTCFs.

The Society for Healthcare Epidemiology of America (SHEA) and the Association for Professionals in Infection Control and Epidemiology (APIC) have called for active surveillance for collection and review of infection control data in LTCFs analogous to that done in hospitals.^{3,4} Unfortunately, no specific processes have been defined and widely varying infection rates generated by different methods in individual LTCFs have made interfacility comparisons difficult.

In this issue of *Infection Control and Hospital Epidemiology*, Stevenson et al. propose a standardized surveillance program that was prospectively validated in 17 regional skilled nursing facilities.⁵ Infection control professionals experienced in infection surveillance were trained to use uniform infection definitions, based on the McGeer criteria, data collection, and reporting methods.⁶ Surveillance data were compiled from ward rounds and review of records, temperature charts, antibiotic orders, laboratory

data, culture data, and radiographic studies. Residents' functional status, diagnoses, and treatments were obtained from the Minimum Data Set.⁷ Data were adjusted for acuity using resource utilization groups, version III (RUG-III), case-mix indices.⁸

Of submitted reports, 93.9% were correctly identified as infection, and the authors found less variability in infection rates between facilities with this process. Infection rates and threshold data for each month could be generated for each facility to account for the seasonal variability of some infections. In addition, individual facility data could be compared against aggregate data for all facilities per month or by percentiles in a manner used by the National Nosocomial Infections Surveillance (NNIS) System.⁹

Using these data as a benchmark, the authors propose that LTCFs would be able to compare their infection rates with those in other facilities. Such data would assist in determining whether infection control strategies require re-evaluation or greater resource allocation. Ultimately, the authors hope that a network of LTCFs could enter their own data into a central repository similar to the NNIS System. The Centers for Medicare & Medicaid Services has been considered using such data for public performance reporting, and the Department of Veterans Affairs is considering using its nationwide computerized patient database to begin to address the prevalence of infection and antibiotic resistance in its LTCFs.

This is an important study in that the clinically based McGeer criteria are validated as effective and accurate in the detection of infection when used by facilities with personnel experienced in infection detection. However, even with highly trained infection control personnel, more than

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one-fifth of infections were missed by active surveillance in this study. There are several challenges unique to infection detection and surveillance in LTCFs that should be considered further before applying this process to all LTCFs or using the data in public reporting.

In most LTCFs, the infection control professional commonly is a nurse assigned to that duty part-time in addition to other clinical duties.⁴ It is hoped that associating outcomes with reimbursement will spur LTCFs to increase their interest and budgets for infection surveillance, control, and prevention. The presence of a full-time, well-trained infection control professional alone will not necessarily ensure success.

In LTCFs, the first line of infection detection more often than not is a nurses' aide, who must determine that there is a problem with the resident and then promptly report it to the charge nurse.¹⁰ These healthcare workers have weeks of education rather than years and experience is limited by frequent job turnover. Nurses' aides recognize abnormal vital signs and symptoms of an infection much less often than do nurse practitioners.¹⁰ As in hospitals, LTCFs with more highly trained nursing staff have lower antibiotic resistance rates and fewer infections than do facilities with fewer skilled personnel.^{11,12} For optimum infection surveillance and prevention, hiring, paying, and maintaining an educated and highly skilled work force in LTCFs will be a significant challenge.

Second, diagnosis of infection in the LTCF is not a clear-cut matter. It is well recognized that the optimum temperature to use for fever detection in LTCFs has not been standardized.^{6,10} The McGeer criteria use a higher temperature threshold of 38°C.⁶ Lowering the temperature threshold from 101°F (38.3°C) to more than 100°F (37.8°C) or 2.4°F (1.5°C) from baseline might increase the sensitivity to detect infection from 40% to 70% with no change in specificity of 90%.¹⁰ Vital signs are typically taken weekly and what constitutes an adequate baseline has not been established.

The McGeer criteria recognize that few LTCFs have ready access to laboratory or diagnostic facilities and that diagnosis of infection should rely primarily on new or acutely worse signs and symptoms. In addition, these criteria recognize the importance of acute change in functional status as a symptom of infection; 77% of such episodes are due to infection.^{6,10} However, many LTCF residents cannot accurately report or perceive specific symptoms so critical to meet criteria for infection. In addition, concurrent non-infectious comorbid conditions may confound interpretation of the physical examination. Reliance on the presence of typical symptoms and signs alone could lead to underdiagnosis of infection.

Detection of infection is further confounded by a lack of ready access to laboratory and diagnostic testing. Even if readily available, many of the diagnostic strategies used in hospitals may not be helpful in improving diagnosis or altering treatment or outcomes in LTCFs. A recent Infectious Diseases Society of America guideline began to develop a minimum evaluation for fever and infection in LTCFs based on the evidence available.¹⁰ Interpretation of culture data

from LTCF residents is problematic; differentiation of colonization from true infection can be difficult. In contrast, adequate expectorated sputum specimens are difficult to obtain from frail elderly LTCF residents. Thus, based on culture, wound infection and urinary tract infection may be overdiagnosed and specific respiratory pathogens underdiagnosed.

Furthermore, the mission of LTCFs may not be about diagnosis. Diagnostic evaluations may not be pursued and infections may not be detected if resident advanced directives preclude this. The diagnostic evaluation also may be pursued in a hospital if it is determined that the patient is too unstable and that monitoring, diagnosis, and treatment cannot be accomplished safely within the LTCF. Infection control professionals may miss an infection if the diagnosis is not suspected before transfer and the patient is never admitted back to the LTCF.

Antimicrobial use has been used as a surrogate marker for infection. However, a significant proportion of antimicrobial use is not explained by infection rates in some studies.^{8,13} Many prescriptions for antimicrobials are empiric or are ordered over the phone and documentation of the rationale for their use in the medical record can be scant. As a result, reliance on records of antimicrobial use may overdiagnose infection. Physician education via recent SHEA guidelines for the appropriate initiation of antimicrobials in LTCFs will, hopefully, begin to address this important issue.¹⁴

RUG-II and -III have been used as a way to assess the effect of case mix on rates of infection and antimicrobial use.^{5,8,12} The current study and others have not found that case-mix indices as measured by RUG correlate well with infection rates.^{5,8,12} This finding is not surprising as RUG was designed as an instrument for reimbursement, not as a means to assess risk of infection. The term LTCF encompasses many heterogeneous institutions including chronic acute care hospitals and units devoted to subacute care, rehabilitation, chronic ventilator care, long-term custodial care, chronic neuropsychiatric care, or care devoted primarily to patients with human immunodeficiency virus (HIV), pediatric patients, and others. It is inconceivable that patients with different needs for skilled care will not influence infection rates, control procedures, and the need for resources. Appropriate adjustments for case mix will be critical to compare infection rates in different types of facilities, nationally and perhaps worldwide.¹⁵

Active infection surveillance based on the McGeer criteria is not perfect. However, there clearly is a need and a demand for a reliable and reproducible infection surveillance instrument. Some LTCF personnel have begun to collect information from existing performance improvement instruments. One such instrument, the Minimum Data Set, was not designed or validated for detection of infection. Prospective studies have determined that the ability of the Minimum Data Set to discriminate between asymptomatic bacteriuria and true urinary tract infection is only 10%.¹⁶

Although a national chronic care equivalent of the NNIS System may not be ready for prime time, valid infec-

tion rates and benchmark data are essential for individual facilities to improve their surveillance and adjust their resources as needed. These data are also important to convince nursing home administrators and regulatory agencies that infection control in LTCFs is important and worthy of support and the resources necessary to improve quality of care and resident safety.

The potential impact of case mix in LTCFs on infection control outcomes is demonstrated in the next two articles in this issue of *Infection Control and Hospital Epidemiology*. In two separate reports from Fry et al. and Carter et al., an outbreak followed by persistence of multidrug-resistant *Streptococcus pneumoniae* is described in an LTCF ward for patients with HIV in 1995–1996 that subsequently spreads to separate wards for patients receiving chronic ventilation and geriatric residents by 1999–2001.^{17,18} As seen in other outbreaks, serotype 23F was the predominant clone. No healthcare workers were colonized or developed invasive infection.

Strategies that were effective in controlling other invasive pneumococcal and multidrug-resistant *Streptococcus pneumoniae* outbreaks such as screening, cohorting, and isolating residents and new admissions in conjunction with an aggressive vaccination campaign failed to control the outbreak.¹⁹ Treatment of carriers with ofloxacin and rifampin was not useful in eliminating colonization or stopping the outbreak. In addition, emergence of resistance to rifampin and ofloxacin occurred. These resistant clones persisted during 3 years, despite high vaccination rates. Colonization was particularly persistent in patients with tracheostomies. Healthcare workers, patients, and visitors received intensive education and were instructed in mask use whenever colonized patients were visited. In addition, patients were asked to wear masks outside of their rooms. In contrast to most LTCFs, most of these colonized residents were young and ambulatory and some refused to comply with isolation procedures. Socialization between residents in smoking areas was common.

Multidrug-resistant *Streptococcus pneumoniae* has continued to increase among community-dwelling and hospitalized elderly and it is not surprising that outbreaks of invasive disease are beginning to be seen in LTCFs.¹⁹ Few LTCFs are screening for multidrug-resistant *Streptococcus pneumoniae* and detection of the organism in clinical specimens will be unlikely given the difficulties in obtaining sputum in this population.^{10,20} Reliance on empiric treatment is the norm and fluoroquinolones are the predominant antimicrobial class currently prescribed.^{8,13} Most LTCFs focus on detection and contact isolation of residents colonized with other multidrug-resistant organisms such as methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococci, or *Clostridium difficile*. Only if there is widespread invasive disease or unanticipated failure of quinolone therapy will drug-resistant *Streptococcus pneumoniae* be detected in many LTCFs.

The inability to control the outbreak could relate to failure of the vaccine or antimicrobial prophylaxis or lack of adherence to infection control procedures. Prior outbreaks

of invasive pneumococcal disease and drug-resistant *Streptococcus pneumoniae* occurred in LTCFs where residents were unvaccinated and elderly.¹⁹ In contrast to those studies in which vaccination seemed to control an outbreak, 95% of residents were vaccinated and protective antibody levels were demonstrated in residents from the current studies.

In these studies, oropharyngeal decolonization procedures were associated with microbial failure and emergence of antibiotic resistance. Decolonization of pneumococci has been attempted with varying success and in different populations. Nuorti et al. gave chemoprophylaxis to LTCF residents and staff while awaiting development of protective immunity following vaccination. At 5 weeks, 4% of residents and no staff carried drug-resistant *Streptococcus pneumoniae*.¹⁹ Decolonization efficacy may relate to the colonizing strain and host characteristics. Long-term eradication of methicillin-susceptible *Staphylococcus aureus* carriage in healthcare workers by chemoprophylaxis has been fairly successful without emergence of resistance. In contrast, in LTCF residents, single attempts at methicillin-resistant *Staphylococcus aureus* eradication with rifampin in combination with trimethoprim-sulfamethoxazole or clindamycin rapidly lead to resistance with little effect on carriage.²

Enforcing adherence to infection control procedures is difficult even in the cognitively impaired, physically frail, immobile resident. The presence of this relatively nonadherent, young, and highly functional HIV population likely contributed to the persistence of the outbreak.

Rapid diagnostic tests may facilitate infection detection, limit broad-spectrum antimicrobial use, and help target infection control resources to prevent transmission of specific organisms in LTCFs.²¹ Increasing use of more sensitive methods of detection for norovirus may increase our understanding of its epidemiology and, possibly, better methods for its control.²² Studies by Cooper et al. and Navarro et al. in this issue of *Infection Control and Hospital Epidemiology* demonstrate how the use of reverse transcriptase-polymerase chain reaction allowed rapid identification of a specific cause of diarrhea and targeted allocation of resources to disrupt multiple modes of transmission.^{23,24}

Potential mechanisms of norovirus spread are many and may involve person-to-person transmission and contamination of the environment, food, and water.^{22,25} Isolated symptoms of nausea, vomiting, and diarrhea are common among nursing home residents and the non-infectious causes are many. Suspicion for norovirus occurs primarily in winter months when episodes of nausea and vomiting rapidly occur among residents, staff, and visitors. Short incubation periods of 24 to 48 hours are typical and symptoms are brief, lasting 48 to 72 hours in most patients.²² The illness may persist for up to 60 hours in older frail adults.²⁵ Isolation is typically discontinued with resolution of symptoms, but viral shedding is known to occur for up to 21 days. This “mild” self-limited illness can lead to significant morbidity and mortality in residents of LTCFs.

In these studies, identification of norovirus led to ini-

tiation of multiple procedures to reduce transmission. Units were closed to new admissions and visitors, symptomatic patients were cohorted, and symptomatic healthcare workers were excluded from work.^{23,24} The environment was disinfected with bleach, and intensive hand hygiene measures were initiated with relatively rapid resolution of the outbreak within 21 to 32 days.^{23,24}

Newer diagnostic tests could potentially have a great impact on infection control in LTCFs, if they focus on testing specimens that are easily obtainable from LTCF residents. Specimens should be stable for shipping to off-site laboratories. In addition, the ideal tests should have not only high sensitivity and specificity, but also the ability to discriminate among true infection, colonization, and contamination.

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