SPECIAL COMMUNICATION

Infection prevention and control in the long-term–care facility

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More than 1.5 million residents reside in US nursing homes. In recent years, the acuity of illness of nursing home residents has increased. Long-term–care facility residents have a risk of developing nosocomial infection that is similar to acute-care hospital patients. A great deal of information has been published concerning infections in the long-term–care facility, and infection control programs are nearly universal.
This position paper reviews the literature on infections and infection control programs in the long-term–care facility, covering such topics as tuberculosis, bloodborne pathogens, epidemics, isolation systems, immunization, and antibiotic-resistant bacteria.
Recommendations are developed for long-term–care infection control programs based on interpretation of currently available evidence. The recommendations cover the structure and function of the infection control program, including surveillance, isolation, outbreak control, resident care, and employee health. Infection control resources also are presented.
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INTRODUCTION

Hospital infection control is well established in the United States. Infection control committees (ICCs) began to appear in the 1960s in response to recognized institutional outbreaks of infectious diseases and increased regulatory pressures. Infection control programs now are mandated in acute-care facilities; virtually every hospital has an infection control practitioner (ICP), and many larger hospitals have a consulting hospital epidemiologist. The Study on the Efficacy of Nosocomial Infection Control (SENIC) documented the effectiveness of an infection control program that applies standard surveillance and control measures.[1]

The term "nosocomial" often is applied to the long-term–care facility (LTCF), as well as to the acute-care hospital. The major elements leading to a nosocomial (institutionally associated) infection are the infectious agent, a susceptible host, and a means of transmission. These elements are present in LTCFs, as well as in hospitals. It is not surprising, therefore, that almost as many nosocomial infections occur annually in LTCFs as in hospitals in the United States.[2]

The 1980s saw recognition of the problem of infections in LTCFs, with subsequent widespread development of LTCF infection control programs, and definition of the role of the ICP in LTCFs. Research studies delineated the descriptive epidemiology of nosocomial infections and infectious disease outbreaks in LTCFs (see below), and regulatory requirements significantly increased.[3] Nevertheless, there is as yet no SENIC-equivalent study documenting the efficacy of infection control in LTCFs, and virtually no controlled studies have analyzed the effectiveness of specific control measures in that setting.

Application of currently available hospital infection control guidelines to the LTCF may be

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inappropriate and unrealistic in view of the different nature of infection control challenges that exist. Even so, regulators occasionally expect LTCFs to meet hospital standards. The problem is compounded by the varying levels of nursing intensity, as well as varying LTCF size and accessibility to physician input.

Although hospitals and LTCFs both have closed populations requiring nursing care, they are quite different. They differ with regard to payment systems, patient acuity, availability of laboratory and x-ray, and nurse-to-patient ratios. The LTCF must deal with a host whose resistance is declining, without the acute-care focus on recovery and high technology.[4]

This position paper provides basic infection control recommendations that could be widely applied to LTCFs with the expectation of minimizing nosocomial infections. The efficacy of these measures in the LTCF, in most cases, is not proved by prospective controlled studies, but is based on infection control logic, adaptation of hospital experience, LTCF studies, and field experience. Every effort will be made to address the unique concerns of LTCFs. Because facilities differ, the infection risk factors specific to the resident population, the nature of the facility, and the resources available should dictate the scope and focus of the infection control program.

In a number of instances, specific hospital-oriented guidelines have been published and are referenced (e.g. guidelines for prevention of intravascular-device–associated infections or vancomycin-resistant enterococci). These guidelines are relevant, at least in part, to the long-term–care setting, but must be adapted depending on facility size, resources, resident acuity, local regulations, local infection control issues, and so on. Reworking these guidelines to a form applicable to all LTCFs is not feasible.

Any discussion of these issues must be made in the context of the LTCF as a community. The LTCF is a home for residents, a home in which they usually reside for months or years; comfort and infection control principles both must be addressed.

BACKGROUND

Demography and definitions

The US population aged 65 to 85 years is increasing rapidly, and the population aged 85 years and older has doubled in the last 15 years. Currently, approximately 20% of the latter group reside in LTCFs.[5] One of every four persons who reach the age of 65 can be expected to spend part of his or her life in a nursing home; more people currently occupy nursing home beds than acute-care hospital beds in the United States.[6] More than 1.5 million persons in the United States reside in a nursing home; there are approximately 19,000 nursing homes in this country.[7] Ninety percent of nursing home residents are over 65 years of age, and the mean age of residents is over 80 years.

A long-term–care facility is a residential institution for providing nursing care and related services to residents. It may be attached to a hospital (swing-bed) or free standing; the latter is often called a nursing home. A resident is a person living in the LTCF and receiving care, analogous to the patient in a hospital.

Scope of position paper

This position paper addresses all levels of care in the LTCF. The focus is specifically the LTCF, also known as the nursing home, caring for elderly or chronically ill residents. These recommendations generally also should apply to special extended-care situations (such as institutions for the mentally retarded, psychiatric hospitals, and rehabilitation hospitals). However, other extended-care facilities may have different populations (e.g. the residents of institutions for the mentally retarded are much younger than nursing home residents) or different disease risks (e.g. hepatitis B in psychiatric hospitals). Thus, the recommendations may need to be adapted for these special extended-care situations.

Changes from prior Guideline

This position paper is similar to the 1991 APIC guideline,[8] although the present version reflects an updating of research and experience in the field. Several specific areas of discussion are new or changed, including the elimination of the regulatory requirement for an infection control committee, the discussion of vancomycin-resistant enterococci, a new Centers for Disease Control and Prevention (CDC) isolation system, more extensive tuberculosis control requirements, and several new published infection control guidelines (e.g. for pneumonia, medical waste).

INFECTIONS IN THE LONG-TERM–CARE FACILITY

Epidemiology

It is well known that the elderly population has a substantially increased incidence and

severity of many infectious diseases.[9-12] This vulnerability to infection is due partly to an age-related decline in immunologic function, specifically cell-mediated immunity and antibody response.[13,14] T-lymphocyte numbers and function decline with age, reflected in reactivation of latent infections in the elderly such as herpes zoster and tuberculosis. Antibody production declines with age as well.

The elderly have a variety of local host defense problems that predispose to infection. Examples are thinning of the skin (cellulitis), gastric achlorhydria (*Salmonella* gastroenteritis), urinary retention (urinary tract infection), and decreased mucociliary clearance of bacteria from the airways (pneumonia).[14]

Furthermore, a number of underlying diseases commonly seen in elderly persons (such as diabetes mellitus and malignancy) are known to increase the risk of infection. Depressed mental status from dementia may lead to either aspiration pneumonia or a pressure ulcer.

Elderly patients in the hospital and LTCF are particularly susceptible to infection.[15,16] In addition to the generic susceptibility to infection in the elderly population, the LTCF resident is a more susceptible host on the basis of severity of underlying diseases, medications that affect resistance to infection (such as steroids and antibiotics), impaired mental status (predisposing to pressure ulcers and aspiration pneumonia), incontinence, indwelling urinary catheters, and other factors. Garibaldi and coworkers[17] noted that LTCF residents had an average of 3.3 underlying conditions recorded in the medical record, and 12% had indwelling urinary catheters. Many residents are demented or incontinent of stool or urine. Jackson et al.[18] found a mean age of 82 years and a mean length of stay of 166 days.

An additional problem is the increasing severity of illness in LTCF residents. This is due in part to more rapid transfer of hospitalized patients following implementation of the diagnosis-related group-based hospital reimbursement system[19] and in part to the fact that LTCFs are sharing in the burden of caring for persons with acquired immunodeficiency syndrome (AIDS). LTCFs now occasionally have residents with tracheostomies, indwelling central venous lines, or ventilator dependence, once exclusively the province of hospitals.

There are many reservoirs for infectious agents in LTCFs. Most infections are thought to be endogenous, resulting from the resident's own flora of the perineum, skin, or nasopharynx. Infected or colonized residents may serve as reservoirs for certain infectious agents (such as methicillin-resistant *Staphylococcus aureus* [MRSA]); visitors and staff also are important reservoirs (e.g. for influenza).

Transmission is most frequently by direct contact (for example, by hands), but airborne, vehicle, and vectorborne spread may occur. As in the hospital, healthcare providers go from person to person, serving as important sources for transmission by the contact route. Vehicle transmission occurs through items such as food and water, whereas airborne spread occurs by dissemination of droplet nuclei or particles in the air. A unique problem facing LTCFs is that of an ambulatory resident who may be incontinent or coughing and serves as a potential means for spread of infectious agents. Transmission in the LTCF may be accentuated by lack of conveniently placed handwashing facilities, absence of private rooms, or deficiencies in ventilation systems.

Nosocomial infections—magnitude of the problem

Nosocomial infections are those that develop after admission to the LTCF. Infections that are incubating at the time of admission, or develop within 48 to 72 hours of admission, usually are community-acquired, or hospital-associated if the resident was transferred from an acute-care setting. Because of the long length of stay in the LTCF, the vast majority of infections will be nosocomial. Classification of an infection as nosocomial does not imply that the LTCF caused the infection, that the infecting organism was acquired in the LTCF, or that it was preventable, but simply that it occurred in the LTCF.

The CDC estimates that 1.5 million nosocomial infections occur in LTCF residents per year; this translates to an average of one infection per resident per year.[2] Approximately 20 surveys (most of them prevalence studies) of LTCF nosocomial infections have been done, using a variety of surveillance techniques and infection definitions. The studies found nosocomial infection prevalence rates ranging from 2.7% to 32.7% and incidence rates ranging from 10.7% to 20.1%, or 2.6 to 7.1 infections per 1,000 resident days.[17,18, 20-37] The most common infections found in LTCF surveys are urinary tract infections (UTIs), respiratory infections (influenza, pneumonia), infected pressure ulcers, gastroenteritis, and conjunctivi-

tis. There is an association between pneumonia and increased mortality in the LTCF,[18,37] but the morbidity and mortality of infections in this setting have not been well defined.

SPECIFIC NOSOCOMIAL INFECTIONS IN THE LONG-TERM–CARE FACILITY

Urinary tract infections

In most surveys, the leading nosocomial infection in LTCFs is UTI, generally related to an indwelling urinary catheter.[38] External catheters also appear to be a risk factor for UTIs in male residents.[39] A high percentage of LTCF residents are incontinent of urine or feces, which contributes to the risk of UTI.[40] Bacteriuria is associated with incontinence and dementia, but may not by itself adversely affect survival.[41]

Several surveys reveal that the prevalence of urethral catheters in the LTCF is 7% to 10%.[42-44] Catheterization predisposes to clinical UTI, and the urinary tract is a frequent source of bacteremia in the LTCF.[45] Long-term catheterization may be associated with increased mortality.[43]

The symptoms of urinary tract infection are dysuria and frequency (cystitis) or fever and flank pain (pyelonephritis). The elderly often have atypical symptoms. The diagnosis of urinary tract infection requires demonstration of white blood cells in the urine (pyuria) or a positive quantitative urine culture. The latter is obtained by the clean-catch voided technique (often difficult in the LTCF setting) or by aspiration through a catheter system sampling port.

The vast majority of residents with indwelling urinary catheters in the LTCF are colonized with more than 50,000 colony-forming units of bacteria per mL of urine,[46] and the bacteria found generally are more resistant to oral antibiotics than the corresponding bacteria found in elderly persons in the community.[24,47] Although residents with newly placed catheters have quantitatively less bacteriuria, routine catheter changes may not alter the course of bacteriuria or culture results and are not advocated. Catheter-related bacteriuria is ever-changing and not amenable to prophylactic antibiotics.[48] These factors make it inappropriate to screen asymptomatic residents for bacteriuria or to treat asymptomatic bacteriuria.

Guidelines were published for prevention of catheter-associated UTIs in hospitalized patients,[49] and the recommendations generally are applicable to catheterized residents in LTCFs. Recommended measures include limiting use of catheters, insertion of catheters aseptically by trained personnel, use of as small a catheter as possible, handwashing before and after catheter manipulation, maintenance of a closed catheter system, avoiding irrigation unless the catheter is obstructed, keeping the collecting bag below the bladder, and maintaining good hydration in residents.

The CDC guideline[49] briefly discusses care of condom catheters and suprapubic catheters, but no guideline for leg bags is available. Leg bags allow for improved ambulation of residents, but probably increase the risk of UTI, because opening of the system and reflux of urine from the bag to the bladder occur more frequently than with a standard closed system. Suggestions for care of leg bags include using aseptic technique when disconnecting and reconnecting, disinfecting connections with alcohol, changing bags at regular intervals, rinsing with diluted vinegar, and drying between uses.[50] A 1:3 dilution of white vinegar has been recommended for leg bag disinfection.[51] The role of suprapubic catheters in prevention of urinary tract infections in long-term catheter situations has not been determined.

Respiratory tract infections

Because of the impaired immunity of elderly persons, viral upper respiratory infections that generally are mild in other populations may cause significant disease in the institutionalized elderly patient.[52] Examples include rhinoviruses, parainfluenza, respiratory syncytial virus, and adenoviruses.

Pneumonia

Pneumonia is a frequent infection in the LTCF. The elderly person is predisposed to pneumonia by virtue of decreased clearance of bacteria from the airways and altered throat flora.[53] Underlying diseases, such as chronic obstructive pulmonary disease and heart disease, further increase the risk of pneumonia in this population.[54] The clinical presentation of pneumonia in the elderly often is atypical. The diagnosis of pneumonia in the LTCF is hampered by lack of x-ray facilities and the difficulty of getting good sputum specimens from elderly residents. *Streptococcus pneumoniae* appears to be the most common etiologic agent.[55,56] However, the elderly LTCF resident, with frequent underlying medical diseases such as chronic obstructive pulmonary disease, is more likely than the community-dwelling elderly to develop pneumonia due to *Klebsiella pneumoniae* or *S. aureus,* pneumonias with higher mortality rates.[53] *Legionella* pneumonia also is a concern in the LTCF.

Aspiration pneumonia is important in this setting. Nursing home residents commonly have conditions that predispose to aspiration, including mental status abnormalities, swallowing disorders, and feeding tubes. The mortality rate for LTCF-acquired pneumonia is significantly higher than for community-acquired pneumonia in the elderly population.[57]

The CDC guideline for prevention of pneumonia[58] is oriented toward acute-care hospitals but covers a number of points relevant to the LTCF, including respiratory therapy equipment, suctioning techniques, tracheostomy care, prevention of aspiration with enteral feedings, and immunizations. Examples of relevant recommendations for the LTCF include handwashing after contact with respiratory secretions, wearing gloves for suctioning, elevating the head of the bed 30 to 45 degrees during tube feeding and for at least 1 hour after to decrease aspiration, and vaccination of high-risk residents with pneumococcal vaccine.[58] The evidence for the efficacy of pneumococcal vaccine in high-risk populations, including the elderly population, is debated.[59,60] However, the vaccine is safe, relatively inexpensive, and recommended for routine use in individuals over the age of 65 years.[61] It is an important vaccine in the LTCF setting.

Influenza

Influenza is an acute respiratory disease signaled by the acute onset of fever, cough, chills, and headache. It is a major threat to LTCF residents, who are among the high-risk groups deserving preventive measures.[62] Influenza is very contagious, and outbreaks in LTCFs are common and often severe. Clinical attack rates range from 25% to 70%, and case fatality rates average over 10%.[63-66]

A killed virus vaccine is available, but must be given annually. Influenza vaccine in the elderly is approximately 40% effective at preventing hospitalization for pneumonia and approximately 50% effective at preventing hospital deaths from pneumonia.[67] Although concern has been expressed regarding the efficacy of the influenza vaccine in institutionalized elderly patients, most authors feel that the influenza vaccine is effective and indicated for all residents and caregivers.[65-70] Amantadine or rimantadine prophylaxis may be an effective adjunctive measure for influenza A, especially during an outbreak in an institution with a high percentage of unvaccinated elderly persons.[69] It is given orally, usually for 2 weeks following influenza vaccine administration, when protective antibodies develop. Central nervous system side effects (such as insomnia, nervousness, and confusion), more common in the elderly population, require careful medical management and dosage adjustment of amantadine. Amantadine-resistant influenza has caused nursing home outbreaks.[71]

Other measures recommended during an outbreak of influenza include restricting admissions or visitors and cohorting of residents with influenza.[63,72,73] It may be advisable to confine residents to their rooms during an outbreak[73]; ill staff should not work.

Tuberculosis

Tuberculosis (TB) also has caused extensive outbreaks in LTCFs, generally traced to a single ambulatory resident. Large numbers of staff and residents may be involved.[74-76] Price and Rutala[77] found 8.1% of new employees and 6.4% of new residents to be positive by the purified protein derivative of tuberculin method in their North Carolina survey, with significant 5-year skin-test conversion rates in both groups.

The diagnosis of TB in the LTCF is problematic. Clinical signs (fever, cough, weight loss) are nonspecific. Chest radiographs, when obtained, often show characteristic pulmonary infiltrates (eg., cavities in the upper lung fields). Infection with TB usually causes a positive tuberculin skin test, although occasional false positives and false negatives are seen. The most specific diagnostic test is a sputum culture for TB, but a good specimen can be difficult to obtain.

Guidelines discussing standards for control of TB in institutions are available.[78-80] A CDC guideline discusses skin testing, isolation, preventive therapy, and contact investigation.[79] There appears to be a consensus that TB skin testing of residents and personnel in the LTCF should be undertaken on a regular basis,[81] although many LTCFs have inadequate TB screening programs.[82] The cost-effectiveness of using a two- step TB skin test to survey for the booster effect is not demonstrable for all populations,[83] but the two-step skin test is recommended by the CDC for initial screening of employees[80] and residents.[79]

Recent advances in microbiology have facilitated the diagnosis of TB greatly. The nucleic acid amplification technique has shortened the time for identification of *Mycobacterium tuberculosis* to several days on smear-positive cases, although susceptibility testing requires several weeks.

There was a resurgence of TB in the United States in the mid-1980s; multidrug-resistant cases of TB have been seen, and nosocomial spread is a concern.[84] In response to this, guidelines have

been promulgated by the CDC and the Occupational Safety and Health Administration (OSHA) that address a hierarchy of TB controls in the hospital: administrative control measures (eg, education of personnel), ventilation (e.g. negative air pressure with at least six air exchanges per hour), and personal protective respirators.[80] The necessity and cost-effectiveness of these measures are the object of debate even in hospitals,[85] and the applicability to LTCFs remains to be determined. The CDC guideline states that LTCFs should follow the hospital recommendations.[80] In an LTCF that does not have a negative-pressure room, residents with suspected active TB should be transferred to an appropriate acute-care facility for evaluation. There should be a referral agreement with that facility.

Skin and soft-tissue infections, infestations

Pressure ulcers (also termed decubitus ulcers) occur in up to 20% of residents in LTCFs and are associated with increased mortality.[86,87] Infected pressure ulcers often are deep soft-tissue infections and may have underlying osteomyelitis; secondary bacteremic infections have a 50% mortality rate.[88] They require aggressive medical and surgical therapy.

Medical factors predisposing to pressure ulcers have been delineated[86] and include immobility, pressure, friction, shear, moisture, incontinence, steroids, malnutrition, and infection. Several of these factors may be partially preventable (such as malnutrition and fecal incontinence). Prevention of pressure ulcers involves developing a plan for turning, positioning, eliminating focal pressure, reducing shearing forces, and keeping skin dry.

Many physical and chemical products are available for the purpose of skin protection, debridement, and packing, although controlled studies are lacking in the area of pressure ulcer prevention and healing.[89] A variety of products may be used to relieve or distribute pressure (such as special mattresses, kinetic beds, or foam protectors) or to protect the skin (such as transparent dressings or hydrogels). Nursing measures such as regular turning are essential as well. A pressure-ulcer flow sheet is a useful tool in detecting and monitoring pressure ulcers: recording information such as ulcer location, depth, size, stage, and signs of inflammation, as well as the timing of care measures.

Because all pressure ulcers, like the skin, are colonized with bacteria, antibiotic therapy is not appropriate for a positive surface-swab culture without signs and symptoms of infection. True infection of a pressure ulcer (cellulitis, osteomyelitis, sepsis) is a serious condition, generally requiring broad-spectrum parenteral antibiotics and surgical debridement in an acute-care facility.

Cellulitis (infection of the skin and soft tissues) can occur either at the site of a previous skin break (pressure ulcer) or spontaneously. Skin infections generally are caused by Group A streptococci or *S. aureus*. Outbreaks of Group A streptococcal infections have been described, presenting as cellulitis, pharyngitis, pneumonia, or septicemia.[90,91]

Scabies is a contagious skin infection caused by a mite. Lesions usually are very pruritic. Scabies causes large outbreaks in long-term–care institutions.[92] Diagnosis in an individual with a rash requires a high index of suspicion, in order to recognize the need for diagnostic skin scrapings. The presence of a proven case should prompt a thorough search for secondary cases. A single treatment with permethrin or lindane usually is effective, but repeated treatment or treatment of all LTCF residents, personnel, and families occasionally is necessary.[93] Therapy of rashes without confirming the diagnosis of scabies unnecessarily exposes residents to the toxic effects of the topical agents. Because scabies can be transmitted by linen and clothing, the environment should be cleaned thoroughly. This includes cleaning inanimate surfaces, hot-cycle washing of washable items (clothing, sheets, towels, etc), and vacuuming the carpet.

Other infections

Viral gastroenteritis,[94] salmonellosis, and *Clostridium perfringens* food poisoning are well-known causes of diarrhea outbreaks in LTCFs. *Escherichia coli* O157:H7, *Clostridium difficile,* and *Giardia lamblia* have been added to the long list of enteric pathogens in the LTCF.[95-99]

The elderly are at increased risk of infectious gastroenteritis due to age-related decrease in gastric acid. In a population with a high prevalence of incontinence, the risk of cross-infection is substantial. Person-to-person spread plays a role in viral gastroenteritis and in *Shigella* and *C. difficile* diarrhea.[100] Foodborne disease outbreaks also are very common in this setting,[101] most often caused by *Salmonella* or *S. aureus*. *E. coli* O157:H7 and *Giardia* also may cause foodborne outbreaks, underscoring the importance of proper food preparation and storage.

Bacteremia[102] in the LTCF, although rarely documented, may be primary or secondary to an

TABLE 1

Common Long-Term–Care Facility Epidemics

Respiratory
Influenza
Other respiratory viruses
Tuberculosis
Gastrointestinal
Salmonellosis
Viral gastroenteritis
Escherichia coli O157:H7 colitis
Other infections
Scabies
Conjunctivitis
Group A streptococcal infections
Methicillin-resistant *Staphylococcus aureus* infections

infection at another site (pneumonia, UTI). The most common source of secondary bacteremia is the urinary tract.[103] As the acuity of illness in LTCF residents has risen, the prevalence of IV devices and related bacteremic complications appear to have increased. The CDC guideline for prevention of IV infections is a useful resource and generally applicable to the LTCF.[104] Relevant points include aseptic insertion of the IV cannula, daily inspection of the IV for complications such as phlebitis, and quality control of IV fluids and administration sets.

Conjunctivitis in the adult presents as ocular pain, redness, and discharge. In the LTCF, cases may be sporadic or outbreak-associated.[17] Many cases are nonspecific or of viral origin; *S. aureus* appears to be the most frequent bacterial isolate.[105] Epidemic conjunctivitis may spread rapidly through the LTCF. Transmission may occur by contaminated eye drops or hand cross-contamination. Gloves should be worn for contact with eyes or ocular secretions, with handwashing performed immediately after removing gloves.

Many additional infections have been encountered in the LTCF, including herpes zoster, herpes simplex, endocarditis, viral hepatitis, septic arthritis, and abdominal infections. There has been a resurgence of "pediatric" infections in the LTCF (e.g. pertussis, respiratory syncytial virus, and *Haemophilus influenzae* respiratory tract infections), reflecting the decline of the host's immunologic memory with aging.

The elderly nursing home resident is known to have a blunted febrile response to infections.[11] This parallels other age-related immunologic abnormalities. A notable fever in this population often signals a treatable infection, such as urinary tract infection or aspiration pneumonia.

Epidemic nosocomial infections in the long-term–care facility

Most LTCF nosocomial infections are sporadic, but epidemic clustering of infectious diseases can occur. An epidemic, or outbreak, implies the occurrence of cases in excess of the expected number. For TB, this may be a single case. Outbreaks in LTCFs account for a substantial proportion of reported epidemics[106] (Table 1). Garibaldi and coworkers[17] noted clustering of upper respiratory tract infections, diarrhea, conjunctivitis, and multiply antibiotic-resistant bacteriuria. Major outbreaks of infection also have been ascribed to *E. coli,*[95,96] *Streptococcus pyogenes,*[90,91] *C. difficile,*[97,98] respiratory viruses,[52] gastrointestinal viruses,[94] and many other infectious agents. These outbreaks underscore the vulnerability of the elderly to infection, as well as the role of cross-infection in epidemics.[107]

As discussed above, large outbreaks of influenza and TB are well documented. Influenza outbreaks can spread rapidly through the LTCF and result in significant mortality.[62] TB outbreaks are caused by single cases of infected residents and may infect large numbers of residents and staff by the airborne route before detection.[74,81]

During a 12-year period, nursing homes accounted for 2% of all foodborne disease outbreaks reported to the CDC and 19% of outbreak-associated deaths. Salmonellosis was the most frequently reported cause, accounting for 52% of the LTCF outbreaks and 81% of the deaths. The most commonly implicated food vehicles were eggs or egg products. The next most commonly identified cause was *S. aureus.*[101]

Other epidemics are frequent, including scabies and conjunctivitis. Group A streptococcal infections[91] are spread by cross-infection and can cause significant morbidity in residents.

Antibiotic-resistant bacteria

Finally, antibiotic-resistant bacteria, such as MRSA and multiply resistant gram-negative bacteria, are not simply a problem confined to hospitals but cause colonization and infection in LTCFs.[108-113] Both infected and colonized residents may serve as sources for the spread of MRSA in the LTCF.[114] Vancomycin-resistant enterococci (VRE) is a major problem in hospitals and already has spilled over into LTCFs.[115] MRSA in the LTCF poses a particular problem for several reasons. Elderly and disabled residents are at increased risk for colonization with MRSA, and colonized

residents tend to carry MRSA for long periods of time.[113] When MRSA becomes endemic within a facility, elimination is unlikely. Spread usually is by the hands of personnel.[114]

The treatment of MRSA infections is limited to vancomycin, a parenteral drug that is more toxic and expensive than beta-lactam antibiotics. Eradication of the MRSA carrier state by oral or topical medications often is impossible. Multidrug-resistant TB has been seen in hospitals and may spread to nursing homes as well. Long-term–care facilities can expect outbreaks of highly resistant organisms to be a continuing problem. The isolation of residents colonized or infected by resistant organisms is discussed under "Antibiotic Use and Resistance" (below).

THE INFECTION CONTROL PROGRAM

Evolution of programs

The 1980s saw a dramatic increase in LTCF infection control activities, stimulated by federal and state regulations. Several studies provide insight into the extent of program development. A 1981 survey of Utah LTCFs[17] noted that all facilities had regular infection control meetings, but none performed systematic surveillance for infections or conducted regular infection control training. All LTCFs had policies regarding the maintenance and care of urinary catheters, although the policies were not uniform. Price and associates[21] surveyed 12 North Carolina LTCFs in 1985 and found that, although all 12 had a designated ICP, none of the ICPs had received special training in this area. Also noted were deficiencies in isolation facilities, particularly an insufficient number of sinks and recirculated, inadequately filtered air.

In a 1985 survey of Minnesota LTCFs, Crossley and colleagues[116] found that the majority had an ICC and a designated ICP, although substantial deficiencies in resident and employee health programs occurred. For instance, only 61% offered the influenza vaccine to residents, and one third did not screen new employees for a history of infectious disease problems. A 1988 Maryland survey[117] found that one third of nursing homes still performed routine environmental cultures, and many lacked proper isolation policies. In 1990, a survey of Connecticut LTCFs found that most ICPs had received some training in infection control.[118,119] Most LTCFs performed surveillance at least weekly, and most used written criteria to determine nosocomial infections.

A more recent survey[120] noted increasing infection control activity in Maryland nursing homes in 1994. The mean time spent on infection control activities by the infection control staff was 9 hours per week, of which approximately half was spent on surveillance. Seventy-eight percent of the LTCFs reported a systematic surveillance system, and 59% calculated infection rates. All facilities reportedly used Universal Precautions in caring for their residents.

From these surveys, one can develop a composite picture of the LTCF ICP as an individual who spends 8 to 57 hours per month on infection control activities, depending on facility size, resident acuity, and facility commitment to infection control. The ICP frequently has other duties such as general duty nursing, nursing supervision, in-service education, employee health, and quality assurance.[3]

Regulatory aspects

Long-term–care facilities are covered by federal, state, and voluntary-agency guidelines.[121,122] Skilled nursing facilities are required by the Omnibus Budget Reconciliation Act of 1987 (OBRA) to have an infection control program.[123] The Health Care Financing Administration (HCFA) has published requirements for LTCFs[124] that apply to LTCFs accepting Medicare or Medicaid residents. HCFA regulations address the need for an infection control program, surveillance of infections, isolation, employee health, and handwashing.[124,125] For example, the LTCF is required to have an infection control program to investigate, control, and prevent infections in the facility. An infection control committee per se no longer is required. Interpretive guidelines for surveyors further discuss definitions of infection, risk assessment, outbreak control, antibiotic monitoring, and assessment of compliance with infection control policies.[126]

Because the LTCF is an employer of healthcare workers, it must comply with federal and state OSHA guidelines. Standards[127,128] deal primarily with protection of workers from exposure to bloodborne pathogens such as human immunodeficiency virus (HIV) and hepatitis B virus (HBV) and from TB exposure.[80] Adherence of LTCFs to infection control standards is an OSHA priority.

Other standards that apply to LTCFs include the federal minimum requirements for construction and equipment[129] and the Joint Commission on Accreditation of Healthcare Organizations' (JCAHO) Long-Term Care Standards.[130] The 1996 JCAHO standards for long-term care require a coordinated infection control process with clinical, nursing, and administrative oversight; it deals

TABLE 2

Long-Term–Care Facility Infection Control Elements

Oversight Committee, which directs the
Infection Control Practitioner, who directs the
Infection Control Functions
Surveillance
Outbreak control
Isolation and precautions
Policies and procedures
Education
Resident health program
Employee health program
Antibiotic review
Disease reporting
Other functions

with sick employees, handwashing, surveillance, and control issues.[130] In addition, many states have statutory requirements for LTCFs that vary widely.[131]

The LTCF administrative staff should be knowledgeable about the federal, state, and local regulations dealing with infection control in order to conduct a program in compliance with these regulations. The LTCF ICP ideally should be involved in the formation and revision of regulations, through local and national infection control and long-term–care organizations, to help assure the scientific validity of the regulations.

Components of an Infection Prevention and Control Program

Overview

Several authors have discussed the components of an infection control program in the LTCF.[3,16,50,122,132,133] These components generally are drawn from regulatory requirements, current nursing home practices, and extrapolations from hospital programs. The limited resources of most LTCFs affect the type and extent of programs developed.[16] Most authors feel that an infection control program should include some form of surveillance for infections, an epidemic control program, education of employees in infection control methods, policy and procedure formation and review, an employee health program, a resident health program, and monitoring of resident-care practices. The program also may be involved in quality management (QM), environmental review, antibiotic monitoring, product review and evaluation, and reporting of diseases to public health authorities. The elements of an infection control program are shown in Table 2.

An ICP is an essential component of an effective infection control program and is the person designated by the facility to be responsible for infection control. The regulatory requirement for a nursing home ICC was dropped by OBRA at the federal level, but some states still require them.[124] The ICP should be familiar with state regulations. This committee frequently has been less active than the corresponding ICC in the hospital setting, in part because of decreased physician availability. A small working group consisting of the ICP, the administrator, and the medical director may efficiently make most of the infection control decisions. The ICC functions may be merged with the quality management committee, but infection control must remain identifiable as a distinct program. Whatever group is selected to oversee the infection control program, it should meet regularly to review infection control data, review policies, and monitor program goals and activities. Records of meetings should be kept.

The ICP usually is a staff nurse, a background that is helpful for resident assessment and chart review. The ICP most commonly is a registered nurse. Because of size and staffing limitations, the vast majority of LTCF ICPs have other duties, such as assistant director of nursing, charge nurse, in-service coordinator, employee health, or quality management. The number of LTCF beds justifying a full-time ICP is unknown and usually depends on the acuity level of residents and the level of care provided. A LTCF with more than 250 to 300 beds may need a full-time ICP. The LTCF ICP, like the hospital ICP, requires specific training in infection control, well-defined support from administration, and the ability to interact tactfully with personnel, physicians, and residents.

The LTCF administrative staff should support the ICP with appropriate educational opportunities and resources, including expert consultation in infectious diseases and infection control as needed. Participation of a physician with training or experience in infectious diseases and infection control should be considered on at least a consultative basis. Information may be obtained from the Society for Healthcare Epidemiology of America (SHEA; 609-845-1636). The local health department may have useful information, and local ICPs are another valuable source of information.[134]

A few courses are available. The Association for Professionals in Infection Control and Epidemiology offers a training course for hospital and LTCF infection control professionals (202-

296-2742). The Nebraska Infection Control Network offers regular 2-day basic training courses specifically for LTCF infection control ICPs (402-552-2360), and other local courses are available. SHEA offers courses in hospital infection control for physicians (609-845-1636).

Surveillance. Infection surveillance in the LTCF involves the collection of data on nosocomial infections. Traditionally, outcome measures (such as "number of UTIs") are used, rather than process measures (such as "Was correct catheter-care procedure followed?"). Quality improvement methods focusing on process (such as antibiotic appropriateness studies) often are quite useful and may measure process variation. Surveillance data are used primarily to plan control activities and educational programs and to prevent epidemics, but surveillance also may detect infections that require therapeutic action.

The feasibility of routine surveillance in LTCFs has been demonstrated, and data have been used to provide a basis for continuing education.[30] Surveillance needs to be simple and pragmatic, particularly because the ICP may be able to spend only a few hours per week on infection control activities.

Surveillance requires objective, valid definitions of infections. Most hospital surveillance definitions are based on the National Nosocomial Infections Surveillance (NNIS) System criteria,[135] but no such standard exists for long-term care. NNIS definitions depend heavily on laboratory data and recorded clinical observations. In the LTCF, radiology and microbiology data are less available, and written physician notes and nursing assessments in the medical record usually are brief. Timely detection of nosocomial infections in the LTCF often depends on recognition of clues to infection by nurses' aides and reporting of these findings to the licensed nursing staff.[136] Positive cultures do not necessarily signify infection.

Modified LTCF-specific surveillance criteria were developed by a Canadian consensus conference.[137] These definitions were designed in light of some of the unique limitations of nursing home surveillance mentioned previously. They are used widely, although they have not yet been validated in the field.[138]

The surveillance process consists of collecting data on individual cases and determining whether or not a nosocomial infection is present by comparing collected data to standard written definitions (criteria) of infections. One recommended data-collection method in the LTCF is "walking rounds."[134] This is a means of collecting concurrent and prospective infection data that are necessary to make infection control decisions. Surveillance should be done on a timely basis, probably at least weekly.[137] During rounds, the ICP may use house reports from nursing staff, chart review, laboratory or radiology reports, treatment review, and clinical observations as sources of information. Monthly computer printouts of antibiotic use may be available from pharmacies, and monthly computer printouts of cultures and susceptibilities may be available from medical laboratories.

Published LTCF surveys have been either incidence or prevalence studies. Prevalence studies detect the number of existing (old and new) cases in a population at a given time, whereas incidence studies find new cases during a defined time period. The latter is preferred, because more current information can be collected by an incidence study if data are collected with regularity.

Analysis and reporting of infection case data usually are done monthly, quarterly, and annually to detect trends. This process is facilitated by an individual infection report form, samples of which have been published.[50,122,132]

Analysis of absolute numbers of infections is misleading; calculation of rates provides the most accurate information. Rates may be calculated by using resident days or average resident census for the surveillance period (such as month, quarter, or year) as the denominator. The average daily census is not an accurate denominator for hospitals; however, it can be used by LTCFs, because the facility usually is full, and resident turnover is less than in acute-care facilities.

For example, if in a 30-day month an LTCF with an average census of 200 has 15 new nosocomial infections:

$$\text{Infection (incidence) rate} = \frac{\text{Number of new nosocomial infections}}{\text{Number of resident days in the month}} \times 1{,}000 =$$

$$\frac{15}{(30)\,(200)} \times 1{,}000 =$$

2.5 infections per 1,000 resident days

The preferred rate is infections per 1,000 resident days. Infection control data, including rates, then need to be displayed and distributed to appropriate committees and personnel (including administration) and used in planning infection control efforts. The data should lead to specific educational and control programs. To compare rates within a facility or to other facilities, the method of calculation must be identical (including the denominator). Even when calculation

methods are consistent, infection rates may vary between facilities because of differences in resident risk factors and disease severity, and comparisons may not be valid.

Although facility-wide surveillance is useful for calculating baseline rates and detecting outbreaks, a more detailed analysis could include examination of infection rates in residents who are at risk for certain kinds of infection (such as aspiration pneumonia in residents receiving tube feedings or UTI in nonambulatory residents). Facility-wide surveillance is useful for establishing an infection control "presence" in the LTCF and may be required as a part of local or state regulatory programs. To establish baseline infection rates, track progress, determine trends, and detect outbreaks, site-specific rates should be calculated. Routine analysis should try to explain the variation in site-specific rates. For example, a change in the rate might be related to a change in the resident population. Focused or high-risk resident surveillance may permit conservation of resources.

Published studies of LTCF infections have yet to describe adequately the specific risk factors (eg, device use) for site-specific infections. When such data become available, appropriate risk stratification of infection rates might be a worthwhile objective for this field of practice. This also could lead to focusing resources on those residents at highest risk for developing infections. Also needed are methods that are simple and appropriate for the comparison of site-specific data within an LTCF over time, to establish endemic levels of infection and to recognize potential outbreaks.

The statistics used in analysis of data need not be complex. Computerization for sorting and analysis of data may be time-saving for larger programs, and software for use on a personal computer is available. Graphs and charts facilitate presentation and understanding of infection control data and also may be facilitated by computer programs. The commercially available programs may help with analysis of surveillance data, but manual data collection is still necessary.

Outbreak control. An important reason to collect and analyze surveillance data is for the early detection and prevention of infectious disease outbreaks. The leading causes of LTCF outbreaks are discussed above and listed in Table 1. When the number of cases exceeds the normal baseline, an outbreak should be considered. Even a single new case of an infection such as TB or MRSA should trigger an evaluation.

The approach to investigation of an outbreak involves a number of steps, including (1) determining if an outbreak has occurred, (2) developing a case definition, (3) analyzing the outbreak, (4) formulating a hypothesis, (5) designating control measures, (6) evaluating control measures, and (7) making a report. Concurrently, the potential for spread of disease is evaluated and addressed.[139]

The LTCF may have difficulty responding to an epidemic with appropriate therapeutic measures (such as mass vaccination or administration of amantadine in an influenza outbreak) if consent needs to be obtained on short notice from a resident's relatives or the primary physician. One way to circumvent this problem is to develop a policy for obtaining prospective consent that gives the medical director or administrator the power to act in an infectious disease emergency. Ultimately, outbreak prevention depends on key prevention strategies (such as influenza and pneumococcal vaccination), and the LTCF can obtain consent for pneumococcal vaccine and yearly influenza vaccine on admission.

Isolation and precautions. An isolation and precautions system is an important means of preventing cross-infection. The use of barrier precautions in LTCFs has been handicapped by lack of adequate handwashing facilities, private rooms, and appropriate ventilation systems.[21]

Two traditional systems for implementing barrier precautions in the hospital were developed by the CDC.[140] The Category-Specific System listed seven categories of isolation or precautions based on means of disease transmission: strict isolation, contact isolation, respiratory isolation, TB isolation, enteric precautions, drainage and secretion precautions, and blood and body fluid precautions. The Disease-Specific System listed all relevant contagious diseases and the recommended barrier method. In general, the Category-Specific System was simpler to use, but the Disease-Specific System consumed fewer resources, because precautions were tailored to the specific disease. A third isolation system, Body Substance Isolation, was a generic precautions system that emphasized isolation of all moist and potentially infectious body substances from all residents, primarily through glove use.[141]

The human immunodeficiency virus profoundly affected institutional isolation issues. Subsequent CDC guidelines and OSHA regulations mandate the concept of Universal Precautions (UP) designed to protect the healthcare worker from bloodborne pathogens, including HIV and

HBV.[127,128,142,143] In this system, all blood and certain body fluids are potentially infectious. Education, provision of needle-disposal units, provision of protective equipment (such as gloves, gowns, and protective eye wear), and monitoring compliance are part of UP. UP by itself is not a complete isolation system.

The newest CDC isolation guideline is an attempt to integrate and update the four systems above.[144] This two-tiered system consists of basic Standard Precautions, to be applied to all patients, which are designed to reduce the risk of transmission of infectious agents in moist body secretions. Standard Precautions emphasize handwashing, gloves (when touching body fluids), masks, eye protection, and gowns (when splashing of body fluids is likely), as well as avoidance of needlestick and other sharps injuries. There are additional Transmission-Based Precautions for patients with documented or suspected contagious pathogens. These include Airborne Precautions (eg, for varicella and TB), Droplet Precautions (eg, for influenza and streptococcal pneumonia), and Contact Precautions (eg, for MRSA infection and Salmonella diarrhea). The guideline lists specific symptoms that are highly suspicious for infection and suggests using Transmission-Based Precautions temporarily until a diagnosis is made.

The CDC guideline was developed for hospitals but states that some of the recommendations are applicable to LTCFs.[144] This two-tiered system is a reasonable basis on which to build an LTCF isolation system; each LTCF needs to adapt the aspects of the CDC isolation system that apply to its needs. Isolation and precautions policies need to define authority. The nurse should have the authority to initiate precautions without a physician's order in an emergency, and a policy for this should be developed.

Handwashing appears to be the most important infection control measure in the LTCF, as well as in the hospital. Unfortunately, inadequate handwashing has been noted in LTCFs, as in other settings.[145,146] Several published guidelines for handwashing and choice of antiseptic agents are applicable.[147,148] In general, handwashing with bar or liquid soap is adequate in the LTCF. Handwashing with an antiseptic agent is recommended before invasive procedures such as placement of an intravenous or urinary catheter. Alcohol-based handrubs are recommended only when handwashing facilities are not accessible.

Several conditions, such as TB and major wound infections caused by *S aureus,* require use of a private room, if the LTCF has adequate isolation facilities. For certain infections that have significant implications for the LTCF (such as TB, MRSA, and VRE), the facility should assess its isolation needs and capabilities before facing admission of a case. Tuberculosis cases, for example, require a negative–air-pressure room with at least six air exchanges per hour and special masks.[80] The air should not be recirculated unless it passes through a high-efficiency filter.

Infections are an important reason for transfer of LTCF residents to acute-care hospitals.[149] LTCF-hospital transfers result in a dynamic microbiological equilibrium, making interinstitutional epidemics a concern. Minimizing spread of hazardous organisms requires open and honest communication between hospital and LTCF ICPs.

Resident health. Resident health programs are believed to be important in prevention of nosocomial infections,[138] but comprehensive programs often are lacking in LTCFs.[21] One of the major functions of a resident health program is the immunization of the elderly resident.[61,62,150] In addition to the basic childhood vaccines, residents benefit from tetanus, diphtheria, pneumococcal, and influenza immunizations. The elderly are underserved in terms of immunization to tetanus,[151] as well as pneumococcal and influenza vaccines.[152] The elderly should receive pneumococcal vaccine at age 65, when they are relatively immunologically responsive, rather than at age 80 to 85 when entering the LTCF. The influenza vaccine should be given annually in the fall.

It is required that residents receive a TB skin test on admission[79] and undergo chest radiograph if skin-test positive or symptomatic. Other resident-care practices that should be addressed include prevention of aspiration, skin care, prevention of UTIs, and oral hygiene.

Employee health. Published information on infection control in hospital personnel is available.[153,154] Employee infection control considerations in the LTCF are somewhat different than in the hospital (eg, hepatitis B and measles are lesser concerns), but these articles generally apply to the LTCF. LTCFs are required to prohibit employees with communicable diseases or infected skin lesions from direct contact with residents and to prohibit employees with potentially infectious skin lesions from contact with residents' food.[124] Also, OSHA regulations concerning protection of employees from bloodborne pathogens apply to

the LTCF.[127,143] The LTCF should be able to provide chemoprophylaxis to employees exposed to HIV in the workplace.[155]

Initial assessment of employees and education in infection control also are important, as is a reasonable sick-leave policy.[116] Ill employees may cause significant outbreaks in the LTCF.[94] Tuberculosis is a primary concern in initial employee screening.[79,80] Employee health policies and procedures also should address postexposure follow-up or prophylaxis for certain infections, such as HIV, HBV, TB, and scabies. Employee vaccinations include tetanus, diphtheria, influenza, and HBV (if exposure to blood or body fluids occurs). Varicella vaccine is indicated if an employee is not immune, and hepatitis A vaccine may be appropriate in certain circumstances (especially psychiatric facilities and facilities for the mentally impaired).

Education. The value of education of the LTCF ICP has long been recognized, and surveys of personnel confirm this need.[156] The importance of ICP education is accentuated by the great turnover in LTCF personnel. While the benefits of ICP training are widely assumed, one study analyzed the effects of a 2-day, intensive basic training program on 266 ICPs.[157,158] Trainees not only demonstrated an increase in postcourse knowledge but, at 3- and 12-month follow-up, had a significant increase in implementation of key infection control practices. Practices included performance of surveillance, using infection definitions, calculating infection rates, and giving employees and residents TB skin tests and influenza vaccine.

One of the most important roles of the ICP is education of LTCF personnel in basic infection control principles. Education should focus on new personnel and nursing aides.[122] Surveillance data are an excellent starting point for infection control training, and walking rounds provides an opportunity for the ICP to provide timely, informal education to personnel. Infection control content should include information on disease transmission, handwashing, barrier precautions, and basic hygiene.[157] In addition, all individuals with direct resident-care responsibility need education in early problem or symptom recognition. The teaching methods used need to be sensitive to language, cultural background, and educational level. A coordinated, effective educational program will result in improved infection control activities.[158]

Antibiotic use and resistance. Antibiotic-resistant bacteria pose a significant hazard in the LTCF, and this resistance develops largely as a consequence of antibiotic use. Antibiotics are given to approximately 7% to 10% of residents in LTCFs, frequently for lengthy periods of time.[159-161] Several studies have questioned the appropriateness of this practice.[159-161] A common problem is the confusion of infection with colonization (such as a positive swab culture of a pressure ulcer or a urine culture showing bacteriuria without signs or symptoms of infection) and the treatment of the colonization with antibiotics. In addition, antibiotics often are prescribed over the telephone in this setting.[162] A recent position paper published by SHEA encourages inclusion of antimicrobial review in the LTCF infection control program and discusses appropriate choices for various clinical situations.[163]

Approaches to isolation of MRSA in the LTCF vary. Transfer of MRSA patients between hospitals and nursing homes often is problematic, which led a number of states to develop MRSA guidelines. Barrier precautions are necessary to prevent cross-infection with known resistant microorganisms (such as MRSA and VRE). General guidelines for control of MRSA[114] and VRE[164] are published, but emphasize hospital settings. These guidelines serve as an appropriate starting point for adapting an LTCF approach. A SHEA position paper on antimicrobial resistance, focused on the LTCF,[165] discusses prescreening admissions for resistant bacteria, surveillance for resistant bacteria, and endemic resistance. It is not recommended that the LTCF refuse MRSA or VRE cases, but rather develop an institutional strategy for control of the resistant organisms based on local considerations.[113,114,165]

HIV-related issues. The increasing burden of care for persons with AIDS is being shared by the LTCF, especially for individuals who are too ill to reside at home but do not require acute-hospital care.

Guidelines for dealing with HIV infection in the healthcare setting are incorporated widely in hospitals but also apply in the LTCF.[142,143,166] Information is available that discusses HIV infection and AIDS in the LTCF.[167] Issues to be considered include development of policies for acceptance of residents with HIV infection, protection of employees (such as needle-disposal units), education of employees, HIV-positive employees, confidentiality issues, cost of care, and social concerns. For example, needlestick injuries do occur in the LTCF and usually are related to needle recapping.[168]

Residents infected with HIV do not require any isolation or precautions beyond those previously discussed unless they have certain contagious secondary infections, such as pulmonary TB (see

TABLE 3

Classification of the Strength and Quality of Evidence of Each Recommendation

Category	Definition
Categories reflecting the strength of the recommendation	
A	Good evidence to support the recommendation
B	Moderate evidence to support the recommendation
C	Poor evidence to support the recommendation
Categories reflecting the quality of evidence for the recommendation	
I	Evidence from at least one properly randomized, controlled trial.
II	Evidence from at least one well-designed clinical trial without randomization, from cohort or case-controlled analytic studies (preferably from more than one center), from multiple time-series studies, or from dramatic results in uncontrolled experiments.
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

"Isolation and Precautions"). The institution should develop plans for HIV-related issues. At least one survey has suggested the need for education in the LTCF regarding AIDS-related attitudes,[169] and such education is required by OSHA regulations.[127]

Other aspects of the program. An important aspect of infection control programs is the development and updating of infection control policies and procedures. Resources are available on the writing of policies and procedures in general,[125,170] dietetic service policies,[125] laundry policies,[171] physical therapy policies,[125,172,173] and handwashing.[147,148] Respiratory therapy issues may be relevant to the LTCF, including cleaning of humidifiers, respiratory therapy equipment, suctioning technique, and tracheotomy care.[50] Pharmacy and medication issues include use of multidose medication vials.

No policy or procedure is more important than that of addressing handwashing. The policy details specific indications for handwashing (including when coming on duty; whenever hands are soiled; after personal use of toilet; after blowing or wiping nose; after contact with resident blood or body secretions; before performing any invasive procedures on a resident; after leaving an isolation room; after handling items such as dressings, bedpans, catheters, or urinals; after removing gloves; before eating; and on completion of duty), and the procedure lists explicit steps in the handwashing process. A 10-second handwash usually is recommended.[50,148] When handwashing facilities are inadequate or inaccessible, alcohol-based handrubs should be made available. Handwashing compliance should be monitored.

The ICP is concerned with the environment in the facility. While routine environmental cultures are not cost-effective, periodic environmental rounds are recommended.[122] Sources are available suggesting specific environmental measures such as dishwasher and laundry cleaning temperatures,[122,174] although limited data exist.

Selection of proper disinfectants and antiseptics is difficult and requires the input of the ICP. The participation of the ICP also is essential in evaluating sterilization and disinfection methods, such as monitoring reuse of disposable equipment. Resources are available.[175]

The ICP should be asked to give advice on additional and new products that affect infection prevention, such as urinary catheter systems, gloves, and disposable diapers. Quality, efficacy, and cost issues need to be weighed in product selection.[176]

Medical waste issues are controversial, and there is a disparity between Environmental Protection Agency regulations and CDC recommendations.[177] The ICP may be involved in medical waste issues relevant to the LTCF, and several resources are available.[125,174,177,178]

Another important function of the infection control program is *disease reporting* to public health authorities. State health departments provide a list of reportable diseases.

Finally, the increased emphasis on *QM* in health care is becoming evident in long-term care. A quality assessment and assurance committee is required.[124] Infection control is an important form of QM, and the ICP's skills are well suited to addressing QM measurement issues.[179] The QM process focuses on adverse events and assesses functions of the system.[180,181] In the course of performing control activities such as surveillance, the ICP is able to monitor compliance with policies and procedures and to provide informal infection control education to correct observed problems. Examples of appropriate quality indicators for longitudinal study include percentage of employees vaccinated for influenza, number of employee TB skin-test conversions, and employee handwashing compliance.

RESOURCES

A few resources for the ICP are listed below:

1. Smith PW, ed. Infection Control in Long-Term Care Facilities. 2nd ed. Albany, NY: Delmar Publishers, Inc (800-347-7707); 1994. Cost, $38.95.
2. APIC Infection Control in Long-Term Care Facilities Newsletter. Available from the Association for Professionals in Infection Control and Epidemiology (202-296-2742). Cost for nonmembers, $15.
3. Strausbaugh, LJ, Joseph C. Epidemiology and prevention of infections in residents of long-term care facilities. In: Mayhall CG, ed. Hospital Epidemiology and Infection Control. Baltimore, MD: Williams & Wilkins (800-638-0672); 1996. Cost, $160.
4. Duma RJ, ed. Recognition and Management of Nursing Home Infections. Bethesda, MD: National Foundation for Infectious Diseases (301-656- 0003); 1992. Cost, $6.
5. Benenson AS, ed. Control of Communicable Diseases in Man.16th ed. Washington, DC: American Public Health Association. Cost, $22.

RECOMMENDATIONS (See Table 3 for scoring scheme)

A. Infection Control Program

1. An active, effective, facility-wide infection control program should be established in the LTCF to help prevent the development and spread of infectious diseases (Category BIII).
Comment: LTCF infection control programs developed in response to studies of LTCF infections and regulations. The elements of a program generally include the following:
   a. Surveillance based on systematic data collection to identify infections in residents
   b. A system for detection, investigation, and control of institutional outbreaks of infectious diseases
   c. An isolation and precautions system to reduce the risk of transmission of infectious agents
   d. Infection control policies and procedures
   e. Continuing education in infection prevention and control
   f. A resident health program
   g. An employee health program
   h. A system for antibiotic review and control
   i. Disease reporting to public health authorities
2. The infection control program must be in compliance with federal, state, and local regulations.

B. Infection Control Administrative Structure

1. Oversight of the infection control program should include participation of the ICP, administration, nursing staff, and physician staff (Category BIII).
Comment: A committee, traditionally the ICC, may oversee the infection control program for the facility. ICC members often include the ICP, the medical director, and representatives from nursing, administration, and pharmacy. Participation of other departments, such as dietary, housekeeping, and physical therapy, should be considered on an ad hoc basis. Administrative structures other than an ICC may provide oversight to the infection control program. One example of an infection control oversight committee is a small group consist-

ing of the LTCF administrator, the ICP, and the medical director. Alternatively, the quality management committee and the ICC may be combined, but it is important to maintain the identity of the infection control program. The duties of the ICC should be delegated appropriately if no formal ICC exists. Consultation may be obtained from an infectious disease physician with expertise in infection control.

2. Management of the infection control program involves establishing policies and procedures for investigating, controlling, and preventing infection transmission in the facility. Other functions include review of infection control data, approval of policies and procedures, monitoring program activities, and recommending policy to the facility administration (Category BIII).

Comment: Those responsible for infection control program oversight should meet on a regular basis and as needed for emergent situations and should keep written minutes of all meetings. The minutes should reflect problem identification and follow-up action.

C. Infection Control Practitioner

1. One person, the ICP, should be assigned the responsibility of directing infection control activities in the LTCF. The ICP should be someone familiar with LTCF resident-care problems (Category BIII).

2. The ICP should have a written job description of infection control duties (Category BIII).

3. The ICP is responsible for implementing, monitoring, and evaluating the infection control program for the LTCF (Category BIII).

4. The ICP requires the support of administration in order to function effectively (Category BIII).

5. The ICP should be guaranteed sufficient time to direct the infection control program (Category BIII).

6. The ICP (or another appropriate individual, such as the medical director) should have written authority to institute infection control measures (such as isolation or visitor restrictions) in emergency situations (Category BIII).

Comment: The ICP should have a sufficient infection control knowledge base to carry out responsibilities appropriately. A background in infectious diseases, microbiology, geriatrics, and educational methods is advisable. Management and teaching skills also are helpful. Continuing education is essential for the ICP (eg, meetings, courses, journals). The ICP should know the federal, state, and local regulations dealing with infection control in the LTCF.

Communication is an important part of infection control. The ICP should communicate with relevant facility committees and personnel. The ICP should communicate openly with hospital ICPs about residents transferred into or out of the LTCF, to ensure appropriate isolation and collection of surveillance information.

D. Surveillance

1. The LTCF should have a system for ongoing collection of data on infections in the institution (Category BIII).

2. A documented surveillance procedure should be used, including written definitions of infections (Category BIII).

Comment: Concurrent surveillance is preferable to retrospective surveillance. The frequency of surveillance for nosocomial infections should be based on factors such as acuity level of the resident population. Surveillance at least once a week generally is needed to collect timely data.

Surveillance data should be collected primarily from communication with staff; this may be during walking rounds in the LTCF. Medical progress notes in the chart, laboratory or radiology reports, nursing notes, treatment records, medication records, physical assessment, environmental observations, and follow-up information from transfers to acute-care hospitals provide clues to the presence of infections.

3. The ICP should review surveillance data frequently and recommend infection control measures, as appropriate, in response to identified problems (Category BIII).

Comment: Analysis of surveillance data should include at least the following elements on each infection to detect clusters and trends: type of infection, date of onset, location in the facility, and appropriate culture information. An infection surveillance report form facilitates recording of data on residents with nosocomial infections.

4. Infection rates should be calculated periodically, recorded, analyzed, and reported to the administration and the ICC (Category BIII).

Comment: Infection rates usually are calculated monthly, quarterly, and annually. Nosocomial infection rates are calculated preferably as nosocomial infections per 1,000

resident days. A standard infection report form facilitates reporting of surveillance information. Tables, graphs, and charts may be used, and facilitate education of personnel.

5. Surveillance data should be used for planning infection control efforts, detecting epidemics, directing continuing education, and identifying individual resident problems for intervention (Category BIII).

Comment: In addition to collection of baseline infection rates, the ICP should perform problem-focused studies. Examples of special studies are evaluation of UTIs in catheterized residents, a study of the occurrence of influenza in vaccinated versus unvaccinated residents, or the prevalence of pressure ulcers in bedbound residents.

E. Outbreak Control

1. Surveillance data should be used to detect and prevent outbreaks in the LTCF (Category BIII).

Comment: The occurrence of even a single verified case of a disease of epidemiological significance (such as nosocomial TB, influenza, or VRE infection) in the LTCF should prompt consideration of an outbreak, notification of appropriate individuals (such as the administrator or medical director), and a search for additional cases. A nosocomial case of TB in the facility should lead to TB skin testing and evaluation of residents and employees.

After the institution of isolation or precautions, assessment of exposed residents and personnel should be made in a timely fashion to detect other cases. Obtaining cultures of the environment or personnel is not recommended except as targeted by an epidemic investigation.

2. The facility should define authority for intervention during an outbreak (Category BIII).

Comment: The LTCF should have an administrative protocol for dealing with infectious disease epidemics, including the authority to relocate residents, confine residents to their rooms, restrict visitors, obtain cultures, isolate, and administer relevant prophylaxis or treatment (such as amantadine during an influenza outbreak).

In order to facilitate response to an outbreak, consent for appropriate diagnostic or therapeutic measures should be obtained from the resident, the resident's family, or the resident's primary physician on admission to the facility.

3. A TB control program should focus on detection of cases in residents, periodic screening of employees, and isolation or transfer of residents with known or suspected TB disease (Category BIII).

Comment: TB control programs are mandated by OSHA.

F. The Facility

1. Handwashing facilities that are conveniently located with adequate supplies should be available for residents and staff (Category BIII).

2. Clean and dirty utility areas should be functionally separate and designated (Category BIII).

3. Appropriate ventilation and air filtration should be addressed by the LTCF (Category BIII).

Comment: Each LTCF should be able to provide a room with negative air pressure and direct exhaust of air to the outside if TB cases are handled in the LTCF. If TB cases cannot be handled, a system for transfer of suspected TB cases to an appropriate institution should be developed.

4. Housekeeping in the facility should be performed on a routine and consistent basis to provide for a safe and sanitary environment (Category BIII).

Comment: Cleaning schedules should be kept for all areas in the LTCF. Cleaning products should be approved by the ICP or the ICC and labeled appropriately; manufacturers' (or other authoritative) recommendations for use and dilution should be followed.

5. Measures should be instituted to correct unsafe and unsanitary practices (Category BIII).

Comment: Environmental cleanliness may be monitored by walking rounds with a checklist for each area of the LTCF. Nursing interventions may be monitored by direct observation during such rounds.

6. Areas in the LTCF with unique infection control concerns (eg, laundry, kitchen, physical therapy) should have appropriate policies and procedures developed (Category BIII).

Comment: Laundry policies and procedures should address the following: proper bagging of linen at the site of use, transporting linen in appropriate carts, cleaning of the carts on a regular basis, separation of clean and dirty linen, washing temperatures, covering of clean linen, protection of personnel handling dirty laundry, and handwashing after contact with dirty linen. Adequate supplies of clean linen should be available. Laundry regulations should be addressed if the facility does its own laundry. Dietetic-service–area policies and procedures

should address the following: handling of uncooked foods, cooking of food, cleaning of food preparation areas, food storage, cooking and refrigeration temperatures, hygienic practices, dishwashing temperatures, cleaning of ice machines, handwashing indications, and employee health. Food and drink should be limited to specific areas.

Policies and procedures covering infection control aspects of physical therapy (including cleaning of hydrotherapy tanks) should be developed. It should include cleaning and disinfection of hydrotherapy equipment, handwashing indications, and cleaning of exercise equipment.

If pets are allowed, the LTCF should have a policy defining access, containment, cleanliness, and vaccination of pets.

7. Policies and procedures for disposal of infectious medical waste (including waste categorization, packaging, collection, transport, and disposal) should be developed in accordance with federal, state, and local regulations (Category BIII).

Comment: Examples of specific issues include types of waste disposal bags, cleaning of waste transportation carts, and types of waste storage containers. Policies for sharps disposal should be developed.

G. Isolation and Precautions

1. Isolation and precautions policies and procedures should be developed, evaluated, and updated. Compliance (eg, with handwashing) should be monitored (Category BIII).

2. Any isolation and precautions system used should include wearing of masks, eye protection, and gowns when contamination or splashing with blood or body fluids is likely (Category BIII).

3. Used needles and syringes should not be manually recapped, broken, or bent. They should be disposed of, with all sharps, in a puncture-resistant, leak-proof container (Category BIII).

4. Gloves are indicated for contact with blood or body fluids, contaminated items, mucous membranes, or nonintact skin (Category BIII).

5. Policies should be developed to deal with spills and personnel exposure to blood or body fluids. Employees should know how to respond to an exposure (eg, washing the skin in the event of a blood exposure) (Category BIII).

6. The facility should have infection control policies dealing with acceptance and transfer of residents with infectious diseases (Category BIII).

Comment: A variety of isolation systems may be appropriate to the LTCF. All should include the concept of UP for prevention of exposure to bloodborne pathogens. Masks, gowns, and gloves should be provided as appropriate. Private rooms used for isolation or precautions should have readily accessible toilet and handwashing facilities and should be identified by precautionary signs. A new CDC guideline[145] simplifies isolation by proposing a two-tiered system, Standard Precautions (similar to UP) and Transmission-Based Precautions.

H. Asepsis and Handwashing

1. Handwashing must be encouraged. Hands should be washed after contact with body fluids, after removing gloves, when soiled, and when otherwise indicated (Category AII).

Comment: Handwashing with plain soap is adequate for most situations in the LTCF.

2. A handwashing policy and procedure should be developed by the LTCF (Category BIII).

Comment: Issues such as indications for handwashing, selection of handwashing agent, cleaning of soap containers, hand lotion use, and use of alcohol-based antiseptic handrubs should be addressed. The institution should monitor handwashing compliance.

3. Policies and procedures for disinfection and sterilization should be developed (Category BIII).

Comment: These policies and procedures should address issues such as sterile supplies, reuse of disposable items, disinfection of equipment (such as thermometers), and cleaning of non-critical items. All items, other than disposables, should be cleaned, disinfected, or sterilized, following published guidelines and manufacturers' recommendations. The ICP should identify those resident-care procedures that require aseptic technique.

I. Resident Care

1. Resident rooms should have an accessible sink, with soap, water, towels, and toilet facilities (Category BIII).

Comment: Provision should be made for maintaining adequate resident personal hygiene and for instructing residents in hygiene and handwashing as appropriate to their functional status.

2. A resident skin-care program should be developed to maintain the skin as a barrier to infection (Category BIII).

Comment: Resident skin care should include

the following: routine frequent turning for those unable to do so themselves, keeping the residents clean and dry, inspecting all residents' skin on a routine basis, ensuring appropriate nutrition, and treating pressure ulcers. Turning schedules and pressure ulcer assessment forms may be useful.

3. A program to prevent UTIs should address catheter use, catheter insertion, closed drainage systems, irrigation of catheters, maintenance of urinary flow, and indications for changing the catheter (Category BIII).
Comment: Adequate hydration should be maintained. If leg bags are used, the LTCF should develop policies and procedures for aseptic connection, cleaning, and storage of leg bags. Intermittent catheterization is an alternative to an indwelling urinary catheter.

4. A program to minimize the risk of pneumonia in the LTCF should address immunizations, reducing the potential for aspiration following feeding, minimizing atelectasis, and caring for respiratory therapy equipment (Category BIII).

5. Policies and procedures should be developed for prevention of infections associated with nasogastric and gastrostomy feeding tubes, including preparation, storage, refrigeration, and administration of feeding solutions (Category BIII).

6. Policies and procedures should be developed for prevention of IV infections, if IV devices are used (Category BIII).
Comment: Policies should address indications for IV therapy, the type of dressing used to cover the IV exit site, cannula insertion, site maintenance, and changing fluids or tubing.

7. The LTCF should develop policies for dealing with HIV-infected residents (Category BIII).

J. Resident Health Program

1. Each resident should have an initial history (including important past and present infectious diseases), immunization status evaluation, recent physical examination, and intradermal (Mantoux) skin test (Category BIII).
Comment: A recent chest radiograph is advisable if the skin test is positive.

2. All newly admitted residents should receive TB screening by the intradermal (Mantoux) tuberculin method unless a physician's statement is obtained that the resident had a past positive reaction to tuberculin. When new or active TB is suggested by a positive skin-test result or by symptoms, a chest radiograph and medical evaluation should be obtained (Category BIII).
Comment: A two-step booster technique may be used.

3. Follow-up skin testing for TB should be performed periodically or after discovery of a new case of TB in a resident or staff member. The intradermal Mantoux method should be used (Category BIII).
Comment: The frequency of skin testing depends on the regional prevalence of TB, and federal, state, or local regulations.

4. Each resident should receive tetanus and diphtheria vaccine every 10 years. This should be recorded in the resident's chart (Category AII).

5. Each resident should receive the pneumococcal vaccine if indicated. This should be recorded in the resident's chart (Category BIII).

6. Each resident should receive the influenza vaccine annually in the fall, unless medically contraindicated. This should be recorded in the resident's chart (Category AII).

7. Policies and procedures addressing visitors should be developed to deal with introduction of community infections (such as influenza) into the LTCF (Category BIII).

K. Employee Health Program

1. All new employees should have a baseline health assessment, including immunization status and history of relevant past or present infectious diseases (Category BIII).
Comment: The past history of infectious diseases should address diseases such as chickenpox, measles, hepatitis, skin boils, and bacterial diarrhea. Screening cultures of new employees rarely are indicated.

2. All new employees should receive TB screening by the intradermal (Mantoux) method unless a physician's statement is obtained that the employee had a positive reaction to tuberculin. When new or active TB is suggested by a positive skin-test result or by symptoms, a chest radiograph and medical evaluation should be obtained (Category BIII).
Comment: A two-step booster technique may be used.

3. Follow-up skin testing for TB should be performed periodically or after discovery of a new case of TB in a resident or staff member. Skin-test–negative personnel should undergo repeat skin testing at regular intervals as determined by a risk assessment. The intradermal Mantoux method should be used (Category BIII).

Comment: The frequency of skin testing depends on the regional prevalence of TB and on federal, state, or local regulations.

4. All employees should have current immunizations, with documentation in the employee record, including tetanus and diphtheria vaccination every 10 years (Category BIII).

5. Employees with blood or body fluid contact should be offered HBV immunization (Category AII).
Comment: Refusal of this vaccine should be documented.

6. Employees should be offered the influenza vaccine annually in the fall (Category AII).

7. Each employee should be taught basic hygiene and handwashing and to consider blood and all body fluids as potentially infectious (Category BIII).

8. Employees with signs or symptoms of communicable diseases (eg, cough, rash, diarrhea) should not have contact with the residents or their food (Category BIII).

9. All employees should be educated to report any significant infectious illnesses to the staff member responsible for employee health (Category BIII).
Comment: Each employee record should include factors affecting immune status (such as steroid therapy, diabetes, HIV infection), illnesses, and incidents such as exposures to contagious diseases, needlesticks, injuries, and accidents.

10. The LTCF should develop protocols for managing employee illnesses and exposures (such as HBV, HIV, TB, scabies) (Category BIII).
Comment: An employee absentee policy that discourages the employee from working while ill should be developed. The LTCF should develop policies for dealing with the HIV-infected employee.

L. Education

1. Infection control education should be provided at the initiation of employment and regularly thereafter. Training should include all staff, especially those providing direct resident care (Category BIII).

2. All programs should be documented with the date, topic, names of attendees, and evaluations (Category C).
Comment: Program topics should be timely and relevant to infection prevention. Basic hygiene, handwashing, transmission of infectious diseases, employee health, prevention of TB, UP, and the susceptibility of residents to infectious diseases are topics that should be included. The ICP may recommend topics. Surveillance data are of interest to staff and may be included as appropriate.

M. Policies and Procedures

1. Infection control policies and procedures should be approved, reviewed, and revised on a regular basis (Category BIII).
Comment: The ICP should assist in the development and updating of infection-related policies and procedures.

2. Employees should be made aware of infection control policies and procedures (Category BIII).
Comment: The ICP should develop a system for monitoring staff compliance with infection control policies and procedures.

N. Antibiotic Resistance and Monitoring[163,165]

1. The ICP should monitor antibiotic susceptibility results from cultures to detect clinically significant antibiotic-resistant bacteria (such as MRSA or VRE) in the institution. Changes in antibiotic-susceptibility trends should be communicated to appropriate individuals and committees (Category BIII).

2. The LTCF should have a policy dealing with resistant bacteria (such as MRSA or VRE) (Category BIII).
Comment: This policy deals with acceptance of colonized or infected patients into the facility, inquiring about colonization of admissions with resistant bacteria, isolation of residents with resistant bacteria, and surveillance for residents of the facility who are colonized or infected with resistant bacteria. Denial of admission to the LTCF solely on the basis of colonization or infection with a resistant organism is not appropriate.

3. Infection control programs in LTCFs should be encouraged to include a component of antimicrobial utilization review (Category BIII).
Comment: The LTCF should encourage prudent antimicrobial prescribing. In selected LTCFs, a more intensive antimicrobial utilization program may be developed, including review of antibiotic appropriateness.

O. Miscellaneous Aspects

1. There should be a system for reporting notifiable diseases to proper public health officials.

2. The ICP should communicate with the director of the QM program, if a formal program exists (Category BIII).
Comment: Infection control is an important component of QM, and the epidemiological techniques used in infection control will assist the QM program.

3. The ICP may be involved with the infection control implications of new products and the safety program as needed (Category C).
4. The ICP may be involved with other activities relevant to infection control, as compatible with program goals and time constraints (Category C).

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