Published in final edited form as:

Infect Dis Clin North Am. 2016 September ; 30(3): 785–804. doi:10.1016/j.idc.2016.05.001.

Infection Control in Alternative Health Care Settings: An Update

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Keywords

Infection control; Health care delivery; Nursing homes; Hand hygiene

BACKGROUND

Health care delivery in the United States has evolved significantly over the latter part of the twentieth century. Health care delivery has moved from acute care facilities to rehabilitation units, nursing homes (NHs), assisted living facilities, home, and outpatient settings. Measures to reduce health care costs have led to a reduced number of hospitalizations and shorter lengths of stay, along with increased outpatient, home care, and NH stays for older adults.^{1–3}

This article focuses on infection control issues in NHs and outpatient settings.

INFECTION PREVENTION PROGRAMS IN NURSING HOMES

NHs host approximately 1.5 million residents, which is more than in acute care hospitals and centers. About 3–15% of such residents acquire an infection in these facilities (1.8–13.5 infections per 1000 residents care days). Infections are among the top five causes of death^{4,5} and rank even higher among preventable causes. It is no surprise then that NH residents are more likely to be prescribed antimicrobial therapy than any other drug class. Antimicrobial therapy accounts for 20% or more of all recorded adverse drug reactions.^{6,7} Every year there are more than 2 million discharges, and these numbers will grow following shifts in the demographic curve.² The high volume of transfers from and to hospitals is a major determinant in shaping the epidemiology of infections in NHs.

Even with the evolution of health care delivery within the United States, NHs are institutions that provide health care to people who are unable to manage independently in the

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Portions of this article originally appeared in Volume 25, Issue 1 (March 2011) of *Infectious Disease Clinics of North America*.

community in two different circumstances: (1) for chronic care management, and (2) for short-term rehabilitative services following an acute care hospital stay, to complete their medical treatment plan before returning to independent living. As NHs accept increasingly medically complex patients from acute care, infection prevention becomes crucial. Infection prevention research in the NH setting has made enormous strides in the last 2 decades.

However, NHs have unique characteristics that create special challenges in implementing an infection prevention program. First, effective infection control programs require human and capital investment. Initial access to funds and to personnel experienced in infection prevention can be a challenge. Second, NH residents are particularly susceptible to infections because of comorbidities, greater severity of illness, functional and cognitive impairment, incontinence, and indwelling device use such as urinary catheters and feeding tubes. These factors also make the diagnostic process more challenging, especially when cognitive deficit is present or when fever response is inadequate. Third, NH residents may also serve as host reservoirs for antimicrobial-resistant pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE). Indeed, a previous stay in a NH is considered to be a risk factor for colonization with multidrug-resistant organisms (MDROs). With reduction in the hospital length of stay, the severity of illness among post-acute care residents has increased, with resultant inherent transfers back to the hospital. Thus, residents serve as vectors, transmitting pathogens from one setting to another. Fourth, the diagnostic yield of specimens is often subpar because of sampling difficulties (eg, obtaining a sputum sample or clean-catch urine sample). Delays in access to technology such as chest radiographs, blood, and microbiology tests may postpone diagnosis and affect clinical evaluation. Communication with off-site clinical providers is an additional challenge, since indirect assessment of residents encourages risk-aversion practices such as overuse of long-term empirical antibiotic therapy. This starts the vicious cycle of selection of MDROs, leading in time to further overuse of empiric wide-spectrum antibiotics.

To help navigate through those challenges, specific criteria for the diagnosis of infection were developed. These criteria have been recently modified incorporating the larger body of evidence and improvements in diagnostic tools now available.⁸ Loeb's minimum criteria should be used to help determine when it is appropriate to initiate antimicrobial therapy.⁹ Unfortunately, adherence to these criteria is still suboptimal.^{10,11}

INFECTION PREVENTION PROGRAMS IN NURSING HOMES: FUNCTIONS, COMPONENTS, AND OVERSIGHT

Main functions for an infection prevention program include

- Obtaining and managing critical data, including surveillance information for endemic infections and outbreaks
- Developing and updating policies and procedures
- Developing individualized interventions to prevent infections and antimicrobial resistance

- Educating and training health care workers (HCWs), residents, visitors, and nonmedical caregivers¹

An effective infection prevention program includes a method of surveillance for infections and antimicrobial-resistant pathogens, an outbreak control plan for epidemics, isolation and standard precautions, hand hygiene (HH), staff education, an employee health program, a resident health program, policy formation and periodic review with audits, and a policy to communicate reportable diseases to public health authorities.

An infection preventionist (IP) is the central figure among many indispensable individuals in developing and executing an infection prevention program. Due to the constant evolution and the adoption of best practices, the IP must be an engaged professional continually pursuing new knowledge and education.

In the last 10 years, successful infection prevention programs have increasingly utilized bundles, usually 3 to 5 interventions each with demonstrated efficacy, which are deployed together to greatly increase the power of the program and at the same time maximize effort and resources (Box 1). The advantages of intervention bundles are many and often reach beyond the stated goal of the specific program itself: Promoting cost-effective measures, engaging personnel at all levels, creation of a culture of safety and quality, promoting a chain of accountability, facilitating learning rather than blaming, and helping to establish ripe translational frameworks for further interventions, which is key in such an evolving and resource intensive setting. Bundles may also have disadvantages in certain cases (eg, the specific impact of each individual component of the intervention cannot be quantified). Also, in populations with unique characteristics, there may not be multiple proven interventions available for inclusion in the bundle.

Box 1

Resources for infection preventionists

1. SHEA and APIC both have long-term care committees that publish and approve NH infection guidelines and publish periodic position papers related to pertinent infection control issues. Their websites have several educational resources for staff education and in-services. In addition, APIC also publishes a quarterly long-term care newsletter.
2. Local professional infection prevention society chapters provide a network to socialize, discuss infection control challenges and practical solutions to overcome them, and provide access to educational resources and services. ICPs should become members of these professional societies at both the local and national level to remain up-to-date with practice guidelines, position statements, information technology resources, and changes in policies and regulations.
3. Hospital epidemiology and infection control, 3rd edition; C. Glen Mayhall Ed.: Lippincott Williams & Wilkins: Philadelphia, PA.
4. Selected internet websites:

- a. CDC: <http://www.cdc.gov>
- b. SHEA: <http://www.shea-online.org/>
- c. APIC: <http://www.apic.org>
- d. OSHA: <http://www.osha.gov>
- e. Joint Commission on Accreditation of Healthcare Organizations—Infection Control Initiatives: <http://www.jcaho.org/accredited+organizations/patient+safety/infection+control/ic+index.htm>
- f. AAMI Standards and Recommended Practices Sterilization in Health Care Facilities 2015 Edition: www.aami.org
- g. Guidelines for Perioperative Practice 2015 Edition: www.aorn.org
- h. CDC Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care Web site 2011: <http://www.cdc.gov/hai/pdfs/guidelines/ambulatory-care-04-2011.pdf>

Recent examples of successful protocols using bundles include

- A multimodal intervention including preemptive barrier precautions, active surveillance for MDROs and infections, and NH staff education, leading to a decrease in overall MDRO prevalence density, new MRSA acquisition, and catheter associated urinary tract infection (CAUTI)¹²
- A nationwide initiative in 133 Veterans Administration (VA) NHs, consisting of universal nasal surveillance for MRSA, contact precautions for patients colonized or infected with MRSA, HH, and direct accountability of everyone who had contact with patients, leading to a 36% decrease in MRSA health care-associated infections¹³
- An active protocol of decolonization with nasal mupirocin and chlorhexidine bathing, coupled with enhanced environmental cleaning, which reduced MRSA colonization from 16% to 10% in a high-risk population¹⁴
- A comprehensive protocol based on the World Health Organization (WHO) multimodal HH improvements strategy, including the use of alcohol-based handrub placed at point of care on dedicated racks; the use of pull reels; HH posters and reminders; an educational program; and performance feedback, which resulted in both compliance improvement and reduction in respiratory outbreaks and MRSA infection requiring hospital admission¹⁵
- A multimodal protocol targeted at HCWs that reduced hand colonization and resolved longstanding issues of enteral feed contamination¹⁶

Information Transfer During Care Transitions

Transitional care is defined as “a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations or different levels of

care in the same location”.¹⁷ For older adults, these locations can include acute care hospitals, NHs, skilled nursing facilities, rehabilitation units, assisted living facilities, inpatient hospice care, home care, and outpatient primary and specialty clinics. During these care transitions, older adults are particularly prone to fragmented care, which can lead to errors and omissions in health care delivery. These transitions also provide an opportunity for pathogens to be transferred from one setting to another. Risk factors at discharge, such as presence of central venous catheters or other invasive devices, and presence of chronic wounds, for example, are predictors of subsequent colonization with MRSA in transitioning residents.¹⁸ It then becomes important for the NHs to request clinical information from the transferring facility regarding current culture reports of the resident’s body sites that may be infected or colonized with pathogenic organisms, especially MDROs. This action will enable the physician providers and HCWs to determine the nursing care interventions necessary to meet the resident’s needs and to prevent spread of pathogens in the facility. An important step would be to provide every transitioning resident a standardized form with key information about their specific risk factors for infections, history of MDRO colonization or infection, and antibiotic therapy, including specific agents and duration. This information should be readily accessible in a common and recognizable format. In a not so distant future, nationwide compatibility and communication in electronic records should make it possible to mandate effortless, automatic creation and update of such standardized forms.

Hand Hygiene

HH remains the most effective and least expensive measure to prevent transmission of pathogenic organisms in health care settings. Despite calls from numerous local, national, and international organizations and infection prevention societies, compliance with HH remains dismal, averaging only 30% to 50%.^{19–26} Reasons frequently reported for poor compliance with HH measures by HCWs include skin irritation from frequent washing, too little time due to a high workload, and simply forgetting.

The WHO launched its first Global Patient Safety Challenge, “Clean Care is Safer Care,” in October 2005.²¹ The objective of this initiative was to reduce health care-associated infections around the globe. The program’s initial focus was the promotion of HH practices in diverse health care systems. WHO has also developed an innovative core theme, “My Five Moments of Hand Hygiene,” which details appropriate situations for compliance with HH measures during health care delivery. This approach provides guidelines and specific recommendations to enhance HH compliance and is targeted at a broad audience of HCWs, hospital administrators, and health authorities. A systematic review of 56 studies suggested that HH helped decrease the infection risk in NHs, with major impacts on respiratory infections and influenza (80%) and gram-positive bacterial infections (76%), and a lower impact on gram-negative bacterial infections (44%).² In a recent survey, it was noted that although HH was an important focus of infection control programs, formal policies regarding monitoring of staff compliance were lacking.²³

To improve HH bundles of simple and effective measures should be used. In a recent meta-analysis,²⁴ several strategies proved useful towards improving overall HH compliance:

- Ensure HH resources are accessible facility wide and at the point of care.

- Reinforce HH behavior and accountability.
- Provide regular reminders.
- Establish ongoing monitoring and feedback of HH compliance.
- Establish ongoing monitoring and feedback on infection rates.
- Establish administrative leadership and support.
- Establish a multidisciplinary design and response team.
- Provide ongoing education and training for staff, patients, families, and visitors.

The use of waterless, alcohol-based handrubs as an adjunct to resident washing hands with soap and water has become a routine practice by HCWs in acute care facilities.²⁵

Introduction of alcohol-based handrubs has been shown to significantly improve HH compliance among HCWs in acute care hospitals and to decrease overall nosocomial infection rates and transmission of MRSA infections. Alcohol-based handrubs have also been shown to enhance compliance with HH in NHs and should be used to complement educational initiatives.²⁷ Although the cost of introducing alcohol-based handrubs could be a concern for NHs, a study in acute care has shown that the total costs of a HH promotion campaign including alcohol-based handrub corresponded to less than 1% of costs that could be attributed to nosocomial infections.²⁸

While introducing alcohol-based handrub in health care settings is a prudent, cost-effective measure, several issues need to be considered. Alcohol-based handrubs should not be used if hands are visibly soiled, in which case HH with antimicrobial soap and water is recommended. Alcohol-based handrubs can cause dry skin; however, recent data on rubs containing emollients have shown that handrubs cause significantly less skin irritation and dryness than soap and water.²⁶ NH staff should be aware that alcohols are flammable. NH staff should work with their local fire marshals to ensure that installation of alcohol-based handrub containers is consistent with local fire codes. More information on HH is available elsewhere in this issue (See Bolon MK: Hand Hygiene, in this issue).

Compliance in the use of gown and gloves still needs improvement and must be enforced. In addition, it is important to stress the importance of gown and glove changes when appropriate, to prevent contamination. In a recent study, dressing, transferring, providing hygiene, changing linens and toileting a resident were found to be high-risk care activities for the transmission of MRSA from colonized resident to HCW gown and gloves.²⁹

Multidrug-Resistant Organisms

Infection and colonization with antimicrobial-resistant pathogens are important concerns in NHs and develop primarily due to widespread use of empiric antibiotics, functional impairment, use of indwelling devices, limited adherence to HH programs among HCWs, and cross-transmission during group activities. In 2013, the US Centers for Disease Control and Prevention (CDC) identified 18 most important antibiotic resistant threats.³⁰ Of those 18, at least 11 are common in NH residents. The most important are MRSA, which in the United States accounts for more than half of all *S aureus* isolates, VRE, and multi-drug

resistant gram-negative bacilli (MDR-GNB), defined as resistant to 3 or more antibiotic classes. Among MDR-GNB, the most common species are *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus spp*, *Acinetobacter baumannii*, and *Pseudomonas aeruginosa*.³¹ *Burkholderia cepacia* and *Stenotrophomonas maltophilia*, although isolated less often, are important, because they are commonly resistant to most broad-spectrum antibiotics.³²

The most important risk factors for MDRO infection in NHs are use of indwelling devices, functional disability, presence of wounds,³³ prior antimicrobial use,³⁴ and prior hospitalization. Interestingly, some functional disability and comorbidity scoring systems, such as the Physical Self Maintenance Score (PSMS) and Charlson's Comorbidity Score, which have been established to aid in prognostic and effort/cost evaluations, might also prove useful in quantifying infection risk.³⁵ NHs can reduce infections and colonization with resistant pathogens by emphasizing HH, developing an antimicrobial utilization program, encouraging evidence-based clinical evaluation and management of infections, and ensuring that the facility has a well-established individualized infection prevention program. Guidelines and expert reviews to control MRSA and VRE provide a good base for developing facility-specific policies.^{1,36–38}

There has been some debate on the role of active surveillance cultures and their impact on isolation policies in acute care hospitals. The Society for Healthcare Epidemiology of America (SHEA) guideline for preventing nosocomial transmission of MDROs advocates for use of active surveillance cultures,³⁹ whereas the recent draft of the CDC's Healthcare Infection Control and Prevention Advisory Committee (HIC-PAC) guidelines call for individual facilities to assess their own needs and conduct surveillance cultures as they deem necessary.⁴⁰ These guidelines refer to studies from acute care hospitals serving a sicker, shorter-stay population than those served by NHs. The role of active surveillance cultures in NHs has not been clearly defined. In a rural setting comprised of 1 hospital, 5 affiliated NHs, and 1 ambulatory center, active surveillance resulted in a dramatic decrease in MRSA colonization in NH residents and MRSA infections in hospital patients.⁴¹ Although these results may not translate as well to highly populated areas with complex health care networks, they serve as proof that facilities should be familiar with guidelines and evidence, and monitor rates of MRSA and VRE, and any recent outbreaks.

Isolation Precautions

HICPAC has proposed a 2-tiered structure for isolation precautions. The first tier is standard precautions, which apply to the care of all patients in health care settings regardless of their infectious status. Standard precautions constitute the primary strategy for preventing transmission of organisms between patients and health care workers. In the second tier are transmission-based precautions, which are used for the care of patients suspected of or known to be infected with epidemiologically important pathogens when the route of transmission (eg, physical contact, or airborne or droplet transmission) is not completely interrupted by standardized precautions.⁴²

Standard precautions apply to blood, all body fluids, secretions and excretions regardless of whether they contain visible blood, nonintact skin, and/or mucous membrane material. Designed to reduce the risk of transmission of pathogens, both from apparent and

ambiguous sources of infection, standard precautions include HH compliance, gowns, glove use, masks, eye protection or face shield, as well as avoiding injuries from sharps. Two new elements of standard precautions added in the HICPAC isolation precautions guidelines respiratory hygiene/cough etiquette and safe injection practices, also apply to NHs. The elements of respiratory hygiene/cough etiquette include

- Education of health care facility staff, residents, and visitors
- Use of language and education appropriate posters and signs
- Source control measures such as covering the mouth/nose with a tissue and prompt disposal of used tissues or sneezing into the elbow area rather than the hand if tissues are not available
- HH after contact with respiratory secretions and spatial separation of greater than 3 feet in common areas if possible

Safe injection practices include the use of single-use, sterile, disposable needle and syringe for each injection and prevention of contamination of any injection equipment and medication.⁴² Injuries caused by needles and other sharps have been associated with the transmission of hepatitis B virus, hepatitis C virus, and human immune deficiency virus (HIV).

Transmission-based precautions are intended for use with patients who may be infected with highly transmissible or epidemiologically significant pathogens. There are three main types of transmission-based precautions: airborne precautions (eg, for tuberculosis), droplet precautions (eg, for influenza), and contact precautions (eg, for *Clostridium difficile*). Contact precautions are recommended for residents with MDROs who are ill, or whose secretions or drainage cannot be contained. Single rooms are preferred for these residents if available, as well as for residents with excessive coughing or widespread skin disease. Often NHs have high occupancy rates and a paucity of single-resident rooms. In such situations, residents should be cohorted or kept in a semiprivate room, preferably with a resident who is at low risk of developing an infection (such as one who is well nourished, ambulatory, can perform daily activities independently, and has no indwelling catheters/lines or open wounds). Spatial separation of at least 3 feet between beds is advised to reduce the opportunities for inadvertent sharing of items between the infected/colonized residents.⁴² Although these guidelines were designed for acute care settings, several of them, especially standard precautions, apply to NHs also. These recommendations have to be adapted to the needs of the individual facility.

Residents colonized with a specific pathogen should participate in facility activities and be able to dine in the dining hall. Because there are both recognized and unrecognized pathogen carriers participating in these group activities, all residents should have wounds or invasive device sites cleansed and covered, and have hands washed before leaving their rooms.

Surveillance for Infections and Antimicrobial Usage

Overuse of antibiotics or use of inappropriate regimens such as wide-spectrum antibiotics, is of concern in NHs and often leads to infections with antimicrobial-resistant organisms in

residents who receive antibiotics as well as those in NHs who do not receive antibiotics.^{34,43} NHs are often major reservoirs of MDROs.^{44–46} Furthermore, there are immense geographic variations, demanding locally relevant policies and practices. For example, in European NHs, empirical and prophylactic antibiotics account for 80% of all treatments. Specific regimens and indications vary greatly across countries, with conditions such as antibiotic overuse in residents with bacteriuria standing out as one area needing much improvement in every single region and making a case for structured, sustained surveillance practices.⁴⁷

Infection surveillance in NHs involves collection of data on facility-acquired infections. Surveillance is defined as “ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with timely dissemination of these data to those who need to know.”⁴⁸ Surveillance can be limited based on a particular objective, a particular ward, or an unusual organism or may be facility-wide.

For surveillance to be conducted correctly, utilization of standardized NH-appropriate definitions of infections is crucial.^{49,50} Besides using valid surveillance definitions, a facility must have clear goals and aims for setting up a surveillance program. These goals, as with other elements of an infection control program, have to be reviewed periodically to reflect changes in the facility’s population, pathogens of interest, and changing antimicrobial resistance patterns. Plans to analyze the data and use of these data to design and implement proven preventive measures must also be clearly delineated in advance. The analysis and reporting of infection rates in NHs are typically conducted monthly, quarterly, and annually to detect trends. Infection rates (preferably reported as infections per 1000 resident days) can be calculated by using as the denominator resident days or average resident census for the surveillance period.

These data can then be used to establish endemic baseline infection rates, and to recognize variations from the baseline that could represent an outbreak. This information should eventually lead to specific, targeted infection control initiatives and to evaluate the success of the changes. Additionally, a facility’s surveillance system should include monitoring for appropriate antibiotic use. For example a positive culture in a person without clinical symptoms rarely requires treatment with antibiotics. Surveillance strategies may alternatively focus the effort on screening for MDROs in high-risk residents such as those with indwelling devices or functional disability.^{51,52} Evidence on the optimal strategy to screen for MDROs is not yet clear. Screening in research settings has included screening for multiple anatomic sites, which greatly improves not just sensitivity, but also the quality of screening data and allows for the uncovering of important specific strain epidemiology.^{53–55}

For high-risk groups, surveillance could be conducted using the PRECEDE (Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation) model, which follows 4 stages:

- The starting stage is defining predisposing factors, by assessing the local, current epidemiology of infection and colonization with MDROs, and the relevant attitude, practices, and knowledge in HCWs.

- The second stage focuses on enabling HCWs using education, involvement in leadership and promotion of prevention practices, HH campaigns, and by making related products and infrastructure available.
- Reinforcement is then provided to NH staff using simple, regular feedback on infection and colonization rate.
- The fourth stage, which is intended to feed back into the first, consists of outcome evaluation by knowledge and adherence reassessment and by determining how rates of infection and colonization have been impacted.⁵¹

Outbreak Management

An illness in a community or region is considered an outbreak when the frequency of this illness clearly exceeds the normal rate of expectancy. The existence of an outbreak is thus always defined relative to the number of cases that are expected to occur in a specific population in a specific time period.

The main objectives of an outbreak investigation are discovery and elimination of the source and prevention of new cases. To prevent future outbreaks, research is carried out to gain additional knowledge about the infectious agent, its mode of transmission, and conditions that facilitate it. This new knowledge leads to re-evaluation of infection control programs and strategies for improvement are devised.

It is vital that the IP, in conjunction with physician support, has the skills to recognize an outbreak, conduct appropriate data collection methods, analyze and interpret the data using simple epidemiologic measures, conduct an initial outbreak investigation efficiently, and institute emergent, effective and appropriate outbreak control measures. Although local health departments are available for counseling, it may also be beneficial for the IP to have access to a hospital epidemiologist for consultation. More information about outbreak investigations is available elsewhere in this issue (See Sood G, Perl TM: Outbreaks in Healthcare Settings, in this issue).

Rehabilitation Services

NHs also provide post-acute care rehabilitation, including physical therapy (PT), occupational therapy (OT), and wound care with or without hydrotherapy. These therapists, like other clinical staff such as nurses and nurses' aides, frequently come into contact with residents and thus have many opportunities to transmit pathogens. In a NH, PT and OT services can be provided either at the bedside or in a central therapy unit. For bedside therapy, therapists may move between rooms and units and do not routinely wear gloves and gowns. For care at a central therapy unit, residents are transported to an open unit, where handwashing sinks may not be readily available. Although therapists are seldom directly linked to hospital outbreaks,⁵⁶ hydrotherapy for wounds has been shown to facilitate outbreaks with resistant pathogens.⁵⁷

A detailed infection control program for rehabilitation services should be prepared and focus on facility design to promote HH compliance including convenient and easy access to sinks and the use of alcohol-based handrubs. Patients who are infectious should not be treated at

the central therapy unit. Facilities providing hydrotherapy should consider providing the service in a dedicated room with a separate resident entrance.

Environmental Hygiene

Cleaning and disinfection of frequently touched surfaces reduce the risk of transmission of MDROs and *C difficile*. NH residents share common areas such as rehabilitation rooms, dining areas, common halls, and activity rooms, offering opportunities for pathogen exchange. Staff should be educated on the use of the chemicals, and annual competencies are recommended to be required for specific disinfection procedures in compliance with CDC guidelines.⁵⁸

Resident and Employee Health Program

The resident health program should focus on immunizations, tuberculin testing, and infection control policies to prevent specific infections. The program should include areas such as skin care, oral hygiene, prevention of aspiration, and catheter care to prevent urinary tract infections. Adults over the age of 65 should receive pneumococcal vaccination at least once and influenza vaccination every year. New pneumococcal vaccinations covering additional serotypes should be also considered in residents who received previous formulations. Standing orders for pneumococcal vaccination have improved vaccination rates in NHs.⁵⁹ Tetanus, diphtheria and pertussis (Tdap) vaccination is also recommended among older adults in NHs.

The employee health program mainly concerns employees with potentially communicable diseases, policies for sick leave, immunizations, and Occupational Safety and Health Administration (OSHA) regulations to protect them from blood-borne pathogens. It is a requirement that NHs bar employees with known communicable diseases or infected skin lesions from providing direct contact with the residents, and that employees with infected skin lesions or infectious diarrhea be prevented from having direct contact with residents' food. Moreover, when hiring new employees, an initial medical history must be obtained along with a physical examination and screening for tuberculosis. Immunization status should also be assessed.

Infection control policies and measures in NHs must be in place to address post-exposure prophylaxis for infections such as HIV and hepatitis B. Varicella vaccine should be given to employees not immune to the virus. Employees are expected to be up-to-date with their tetanus boosters and to receive influenza vaccinations every year. Influenza vaccine has been associated with decreased absenteeism among HCWs and decreased influenza mortality in NH residents.⁶⁰ Annual influenza vaccination campaigns play a central role in deterring and preventing nosocomial transmission of the influenza virus and should be promoted by the IP and NH leadership. Employee immunization records should reflect immunity status for indicated vaccinations and those administered during employment, and should be accessible in the event of an outbreak situation.⁶¹

Role of Infection Preventionist

An IP, usually a staff nurse, is assigned the responsibility of directing infection control activities in an NH. The IP is responsible for implementing, monitoring, and evaluating the infection control program. To maintain compliance with regulations, NHs have increased the rate of NH IP employment from 8.1% in 2003 to 44% in 2008.⁶² However, often an IP has additional responsibilities such as employee health or staff education.⁶³ For an infection control program to succeed, the IP should be empowered with sufficient time and resources to carry out infection control activities. The IP should also be familiar with the federal, state, and local regulations regarding infection control. Collaborating with an infectious diseases epidemiologist should be encouraged. Such collaborations could also provide assistance with outbreak investigations, emergency preparedness in the event of bioterrorism and vaccine shortages, and the use of microbiologic and molecular methods for infection prevention.

Environmental Rounds

The IP should conduct walking rounds on a regular basis to make observations regarding equipment decontamination and cleaning procedures, and adherence to infection control guidelines. Observations should be made regarding availability of soap and paper towels, handling of sharps and infectious waste, and storage of health care supplies, medications and food.

Staff Education

The IP plays a vital role in meeting infection control requirements and in educating NH personnel on various infection control measures, particularly in view of rapid staff turnover common in NHs. A lack of understanding of key infection prevention concepts among NH staff has been reported.⁶⁴ A recent study on nursing assistants reported language, knowledge, part-time status, workload demands, and accountability as barriers to using infection control practices, and proposed translating in-services, hands-on training, on-spot training for part time staff, and increased staffing ratios and inclusion and empowerment as strategies to overcome those barriers.⁶⁵ Informal education during infection control and quality improvement meetings as well as during infection control walking rounds should be complemented with in-service education on HH, appropriate and early diagnosis of infections, indications for antibiotic usage and antimicrobial resistance, and isolation precautions and policies.

Ongoing staff education is important due to the new research and guidelines published every year, advancements in technology, and regulatory demands. The Joint Commission (TJC) expects new employee orientation to include the facility's infection prevention program, and the employee's individual responsibility is to prevent infections. In addition, OSHA requires training for blood-borne pathogens and tuberculosis on any employee expected to potentially come into contact with infectious agents.

Oversight Committee

The Federal Nursing Home Reform Act from the Omnibus Budget Reconciliation Act of 1987 mandated the formation of a formal infection control committee to evaluate infection

rates, implement infection control programs, and review policies and procedures. This mandate has been dropped by OBRA at the federal level. However, some states may still require them. A small subcommittee or a working group comprised of the medical director, administrator or nursing supervisor, and IP should evaluate the NH infection rates on a regular basis and present the data at quality control meetings, review policies and any relevant research, and make decisions regarding infection control changes. This subcommittee can review and analyze the surveillance data, assure that these data are presented to the nursing and physician staff, and approve targeted recommendations to reduce the incidence of infections. Records pertaining to these activities and infection data should be kept and filed for future reference. Given that infection control involves multiple disciplines, the participation of representatives from food services, maintenance, housekeeping, laundry services, clinical services, resident activities, and employee health should be considered. It is recommended that the infection control committee meet at least quarterly throughout the year and on an emergent basis as needed.

AMBULATORY CARE CENTERS

Ambulatory care settings have the same infection prevention and control requirements as inpatient hospital settings, but the method of application to comply with the standards will vary depending on the type of care provided by that clinic to their population. The settings range from clinics that provide medical specialty expertise to clinics that provide invasive procedures such as hemodialysis, endoscopy, and surgical centers. There are many challenges in ambulatory care to reduce infection risk and improve patient safety. Infection control oversight and accountability are often lacking, especially if the clinics are not part of a hospital or system.

Communicable Disease and Isolation Management

Patients may be exposed to infectious diseases in the ambulatory waiting rooms. HCWs need to use standard precautions in the care of all patients, but patients exhibiting communicable disease symptoms should be managed per CDC isolation precautions.⁴² Because most ambulatory centers do not have adequate private rooms, a triage policy should be followed. The goal is to promptly identify and process patients with symptoms compatible with communicable disease in order to protect other patients and ambulatory care staff from exposure or infection. Symptoms of a communicable disease may include tuberculosis symptoms such as cough, bloody sputum production, night sweats, weight loss, anorexia, and fever. Symptoms of other communicable diseases might include rash of unknown origin or persistent cough. Patients with respiratory symptoms should wear a mask and should be promptly processed to a waiting area or examination room apart from other patients. If the ambulatory site has a negative pressure room for acid fast bacillus (AFB) and airborne isolation, patients with suspected tuberculosis and other communicable diseases transmitted by the airborne route should be triaged to these rooms as soon as possible.⁶⁶ When entering the room of a patient with suspected or confirmed tuberculosis, all ambulatory staff should wear a fit-tested particulate respirator. Cough-inducing procedures such as aerosol administration of medication, bronchoscopy, and sputum inductions on patients with a respiratory illness pose a high risk of aerosolization of organisms and

infection of staff and other patients. Rooms in which these aerosol-producing procedures are performed must be modified to meet airborne isolation standards to protect ambulatory care staff and other patients. Ambulatory surgery centers must provide particulate respirators to staff caring for patients maintained in AFB and airborne isolation. Dental clinics should defer treatment on a patient with known or suspected active *Mycobacterium tuberculosis* or other potentially communicable airborne disease unless it is determined that the procedure is an emergency.

Respiratory hygiene/cough etiquette is an infection control component of standard precautions. The protocol is optimized by giving patients tissues and instructions to cover their mouth and nose when coughing or sneezing and disposing of tissues in the trash. Handwashing must be reinforced with accessible handwashing facilities or waterless alcohol-based handrub. Patients with a persistent cough are to be given a surgical mask while in a waiting room or other common areas and instructed to ask for a new mask if their old mask becomes soiled or moistened. Respiratory etiquette signage is a Joint Commission requirement for ambulatory centers within hospital institutions, but is encouraged to be used in all ambulatory centers, especially during the influenza season.

Environmental Hygiene—Cleaning Disinfection and Sterilization

Cleaning and disinfection of frequently touched surfaces reduce the risk of transmission of MDROs and *C difficile*. Ambulatory settings need to standardize cleaning procedures, types of chemicals used, and establish a monitoring system to assure that the patient care equipment and environment are cleaned, disinfected and stored appropriately so that patient safety is optimized.^{67–70} Staff should be educated on the use of the chemicals, and annual competencies are recommended for specific disinfection and sterilization procedures. All cleaning, disinfection, and sterilization processes should comply with CDC guidelines.⁶⁷

High-level disinfection and sterilization of patient care equipment are important for infection control in many ambulatory settings and are discussed in the next section and in more detail elsewhere in this issue (See Rutala WA, Weber DJ: Disinfection and Sterilization in Health-Care Facilities: An Overview and Current Issues, in this issue).

Ambulatory Surgical Centers

The same aseptic technique and environmental standards apply to all surgical settings. The National Patient Safety Goals (NPSG) for ambulatory and office-based surgery provide the elements of performance to achieve safe patient care.⁷¹ One of the NPSG elements requires improvement in HH compliance. Another element requires evidence-based practices for preventing surgical site infections. The IP can provide guidance to implement the practices. Major components include: hair removal only with clippers and not shaving the surgical site, administration of antimicrobial agents for prophylaxis for a particular procedure or disease according to guidelines, and education regarding surgical site infection prevention provided to patients and families as well as staff and licensed independent practitioners involved in surgical procedures. Process and outcome measures need to be documented and reviewed as determined by the ambulatory site's risk assessment. These measures might include incidence of surgical site infection, compliance with antibiotic prophylaxis, time out

practices by the operating team, preoperative chlorhexidine bath, surgical skin prep, use of wound protectors, supplemental oxygen, or compliance with hair removal methods. The IP can collaborate with the surgery team in identifying the high risk or most frequent surgical procedures performed, so that the surveillance program can be targeted to address key components of operative care. Currently there are no external benchmarks available for surgical site infection (SSI) or other process measures for surgery performed in ambulatory centers. It is recommended that internal benchmarks be used (ie, ambulatory centers track SSI and compliance rates at their institution over time and look for changes over time). Overall surgical infection rates and procedure-specific rates (for procedures primarily performed in hospitals), as published by the CDC, may be used.⁷²

IPs and other HCWs who clean and process patient care equipment should be familiar with the basic principles for sterilization and disinfection outlined by Earle H. Spaulding, which classify patient care items and equipment into three categories based on the degree of risk of infection involved in the use of the items: critical, semi-critical, and noncritical.⁷⁰ This classification provides guidance for determining the level of disinfection required and items requiring sterilization. Immediate use steam sterilization (IUSS) must be kept to a minimum and should not be used as a reason for shortage of instruments or back-to-back cases per Association for the Advancement of Medical Instrumentation (AAMI) guidelines.⁶⁸ Efforts should be made to purchase equipment and minimize the number of back-to-back cases to reduce the use of IUSS. Implants are not to be sterilized by IUSS, and biological monitoring is required before use. The Joint Commission Infection Control Standards have now placed a focus on immediate-use steam sterilization procedures in the operating room to assure optimal procedural compliance.⁶⁹ A major challenge to ambulatory surgical centers and the IP is to remain current with changes in sterilization technology and disinfectant products. New surgical equipment is becoming available, and manufacturer processing guidelines need to be followed to prevent damage to the instruments as well as adequate disinfection or sterilization. The Joint Commission and Centers for Medicare/Medicaid require documentation of staff competencies and knowledge of the manufacturer guidelines for management of surgical equipment in their surveys. Endoscopy centers must comply with AAMI standards for flexible and semirigid endoscope cleaning and disinfection processing to prevent cross-contamination between patients.⁶⁹

Safe Injection Practices

The CDC has implemented recommendations relating to safe injection practices as part of their standard precautions to provide safety to both the HCW and patient. Injuries due to needles and other sharps have been associated with the transmission of hepatitis B virus, hepatitis C virus, and HIV. The federal Needlestick Safety and Prevention Act signed into law in November 2000 authorized OSHA's revision of its Bloodborne Pathogens Standard to require the use of safety-engineered sharp devices.⁷³ Ambulatory services need to provide policies and infection control in-services to staff regarding aseptic technique and correct management of sharps during patient care.

Syringes, needles, insulin pens, and all sharps must be single use. Changing a needle or cannula and using the same syringe may support transmission of pathogens or viruses. Fluid

infusion and administration should be single use.⁷⁴ Single-dose vials should be used whenever possible and clearly dedicated to a single patient. If multiple-dose vials are used, they must be stored appropriately according to manufacturer recommendations and kept in immediate patient treatment areas. Bags or bottles of intravenous solution used as a common source for multiple patients is an unsafe practice and has been associated with outbreaks.⁷⁵

Inappropriate use of one product among multiple patients has resulted in many large and harmful outbreaks. Examples include a hepatitis B outbreak in New York City in 2001 that correlated with the use of multiple-dose vials for injections and contaminated syringes left on the table where medications were prepared; a hepatitis C outbreak in a Nevada endoscopy clinic in 2007 due to reuse of the same syringe for propofol administration; and reuse of glucometers and insulin pens resulting in hepatitis B and C transmission.^{75–78}

Bioterrorism and Disaster Planning

A risk assessment of the clinic location and the community it services provides guidance for emergency preparedness plans. Factors to consider in planning are the socioeconomic level and vaccine status of the population, natural disasters the area may be prone to, and access routes to the clinic. Clinics associated with health systems should be included in the emergency plans of the health system. Independent clinics need to collaborate with a local hospital, public health department, and government agencies and have a generic screening form for infectious disease disasters. The plans should provide a process by which the facility can use mitigation strategies to become prepared to respond to and recover from all types of disasters. IPs should actively participate in the planning process.⁷⁹

SUMMARY

Outpatient services are continually increasing and changing with expansion of new technologies. Increased use of invasive devices and procedures provides new and challenging risks for infection. Risks associated with contaminated equipment can be decreased by knowledge and maintenance of aseptic technique and disinfection practices. The challenge to IPs and ambulatory staff is to remain updated and familiar with emerging technologies to increase the likelihood of preventing health care-associated infection and providing safe patient care. More patients with a high acuity of illness are now being seen in ambulatory instead of inpatient settings, and these patients often spend prolonged periods in waiting rooms, in close proximity to others. The risk of communicable disease transmission and the relatively high prevalence of some MDROs in health care and community settings necessitate standard and transmission-based precautions for all patient care settings, including ambulatory settings. The health care worker, patient, and family members of patients need to be provided education to support patient safety and minimize infection risk. The IP has unique challenges in providing the ambulatory clinic both infection prevention and regulatory strategies.

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KEY POINTS

- With changing health care delivery, patients receive care at various settings, including acute care hospitals, nursing homes, outpatient primary care and specialty clinics, as well as at home. Each of these settings exposes patients to pathogens.
- Each health care setting faces unique challenges, requiring individualized infection control programs.
- Infection control programs in nursing homes should address: surveillance for infections and antimicrobial resistance, outbreak investigation and control plan for epidemics, isolation precautions, hand hygiene, staff education, and employee and resident health programs.