

Controlling Infections: What You Need to Know

Kimberly A. Griffith, MSN, RN, ACNP A

and Andrea M. Erwin, MSN, RN

Multiple drug-resistant organisms (MDROs) have a potentially significant impact on hospital patients and the larger community. Antibiotics that were once effective are no longer adequate. While hospitals have been fighting antibiotic-resistant infections for years, a measurable increase in the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) and other infections has gained media attention. Health-care administrators and providers must be aware of the magnitude of the problem in order to develop and implement strategies to prevent the transmission of MDROs. Moreover, health-care personnel have a responsibility to establish a safe environment for their patients.

Definition

MDROs are broadly defined as “bacteria that are resistant to one or more classes of antimicrobial agents” (Centers for Disease Control and Prevention, 2006). These organisms are “usually resistant to all but one or two commercially available antimicrobial agents” (CDC, 2006). Examples include MRSA, vancomycin-resistant enterococci (VRE), extended spectrum beta lactamase (ESBL)-producing or intrinsically resistant gram-negative bacilli. Due to potentially life-threatening complications, these highly resistant organisms warrant special attention in healthcare settings.

Clinical Manifestations

In most cases, patients with MDRO infections exhibit clinical manifestations that are comparable to other infections. The problem

lies in viable options for treating patients with these multidrug-resistant infections. Alternative choices for treating these infections are often inadequate. Antibiotic usage patterns that eradicate normal flora and create a favorable environment for the colonization of multiple drug-resistant pathogens may have created resistance to currently available antimicrobials (CDC, 2006).

According to the CDC (2006), researchers have found that MDRO infections result in increased lengths of stay, increased costs, and higher mortality rates from multidrug-resistant gram-negative bacilli and VRE. For example, when comparing VRE patients with a matched hospital population, VRE infection resulted in increased mortality, length of hospital stay, admission to the intensive care unit, surgical procedures, and costs (CDC).

MRSA may differ clinically as compared to other MRDOs. MRSA-colonized patients more commonly develop symptomatic infections as compared to patients with methicillin-susceptible *Staphylococcus aureus* (CDC, 2006). Higher mortality rates have been detected for certain MRSA infections such as bacteremia and surgical site infections. *Staphylococcus aureus* with reduced vancomycin susceptibility may result in increased mortality risk. Conflicting information regarding MRSA infections and increased length of stay and health-care costs have been documented in the literature. Some authors have reported increased length of stay and increased healthcare costs, while

others have not. Lastly, following the introduction of MRSA into a health-care setting, some facilities have detected an increase in overall staphylococcal infections.

Epidemiology

Antimicrobial resistance rates and the prevalence of MDROs vary temporally, geographically, and by health-care setting (CDC, 2006). For example, ICUs have a higher prevalence of MDRO infections when compared to non-ICU settings. Although the frequency of clinical infection of MDROs is low in long-term care facilities (LTCF), colonized and infected LTCF residents may serve as hosts for transmission into acute care facilities resulting in serious disease and mortality. In addition, based on point prevalence surveys conducted in pediatric ICUs and neonatal ICUs throughout the U.S. comparable prevention and control efforts should be incorporated in both adult and pediatric settings.

The prevalence of MDROs has increased steadily over the last three decades. In 2003, the National Nosocomial Infection Surveillance (NNIS) found that 59.5% of *S. aureus* isolates in ICUs were MRSA. During this same year, VRE accounted for 28.5% of enterococcus isolates, and 20.6% of all *K. pneumoniae* isolates from ICUs were resistant to ceftazidime and other third-generation cephalosporins (CDC, 2006). These increases have been attributed to the presence of vulnerable patients, organism adaptation, increasing rates of community-associated colonization and infection, and/or inadequate adherence to infection-

control standards. In fact, the prevalence of MRSA colonization and infection in the community may influence prevention strategies in healthcare settings (CDC).

Because MDROs are so prevalent, public and health-care provider education is essential. Evidence-based infection prevention and control practices should be a priority. Identifying and understanding the risk for MDRO infections in any given setting is essential. Understanding an organization's risk for MDRO infections is key to developing a MDRO prevention program. As noted by the CDC, "nearly all studies reporting successful MDRO control employed a median of seven to eight different interventions concurrently or sequentially" (CDC, 2006). The type and significance of the problem MDROs play within the institution, the population, and health-care setting, as well as differences in opinion about optimal control strategies, contribute to the fact that no single approach is appropriate for all health-care facilities. As noted by the CDC (2006), a universal set of evidence-based control measures that can be used in all health-care settings has not been established. Therefore, a comprehensive approach is needed. MDRO prevention strategies include hand hygiene, Standard and Contact precautions, easy access to personal protective equipment (PPE), active surveillance cultures (ASCs), education, effective environmental and equipment cleaning, dedicated equipment, improved communication between facilities about patients with MDROs, bundle care measures and respiratory hygiene/cough etiquette.

Hand Hygiene

One of the most important aspects

of an infection prevention program is hand hygiene, established as a patient safety standard by the Joint Commission. The Commission recommends that facilities provide evidence of an effective hand-hygiene program (Grota, 2007). One component of this patient safety standard is monitoring hand hygiene compliance and providing compliance rates to the health-care workers. Grota (2007) presented two suggestions for measuring improvements in hand-hygiene adherence: 1) monitoring and recording adherence, which is reported as the number of hand-hygiene episodes performed by personnel divided by the number of hand-hygiene opportunities; and 2) monitoring the volume of alcohol-based product used per 1,000 patient days. In health-care settings, the CDC recommends using alcohol-based hand rubs in addition to traditional handwashing. In other settings, hand washing with soap and water remains the recommendation.

Standard Precautions & Contact Precautions

Also essential to infection prevention Standard Precautions and Contact Precautions, applied to all patients in any health-care setting, are based on the principle that body fluids, blood, secretions, excretions (except sweat), nonintact skin, and mucous membranes may contain transmissible infectious agents. Contact Precautions help prevent direct and indirect cross contamination. Contact Precautions are instituted to prevent the transmission of infectious agents and should remain in effect until the patient is culture-negative for a target MDRO. Transmission-based precautions are used in addition to

standard precautions for patients with documented or suspected infection or colonization.

Access to and Availability of PPE

Another important component in MDRO prevention and control is making PPE - specialized clothing or equipment worn by health-care workers for protection against infectious materials – both easily accessible and constantly available. Appropriate PPE in health-care settings commonly include gloves, gowns, barrier mask (with and without face shields), aprons, and goggles.

At the very least, gloves and gowns should be immediately available as they help protect health-care workers and reduce cross contamination. Many health-care settings have installed PPE cabinets adjacent to patient rooms or have added over-the-door devices so that health-care workers can have immediate access to appropriate equipment and clothing for protecting themselves and their patients from infection (Grota, 2007).

Active Surveillance Cultures

A vital part of preventing MDROs is obtaining ASCs, which are generally obtained upon admission and at specified intervals to identify colonized, asymptomatic patients and to evaluate whether interventions have decreased transmission. The use of ASCs, in addition to Contact Precautions in colonized patients, "contributed directly to the decline or eradication of the target MDRO" (CDC, 2006). The CDC notes that "populations targeted for ASC are not well defined and vary among published reports" (CDC, 2006).

Education

Health-care workers should be

taught to identify the risk factors and how to prevent transmission of MDROs. An effective infection control education program begins with basic infection control principles including hand hygiene and isolation precautions. Facility or setting specific epidemiology of MDROs with specific interventions should be emphasized. For example, interventions for MRSA may differ slightly from interventions for VRE.

Environmental and Patient-Care Equipment Cleaning

An important part of an effective environmental program is how to effectively clean environmental and patient-care equipment. Hospital disinfectants that are approved by the Environmental Protection Agency should be chosen by infection-control personnel based on the facility's identified need. In addition to daily thorough cleaning of the patient-care environment, all health-care workers should have access to liquid disinfectants and to disposable forms of disinfectants to use in the reduction and prevention of contamination and transmission of organisms. It is important to follow manufacturer guidelines when using the disinfectants. Most of the disinfectant agents are not bacteriocidal until they air dry, which is an important concept to understand and to practice. All patient care equipment and furniture must be disinfected between patient uses. When MDRO outbreaks occur, increased frequency of disinfecting may be necessary.

Dedicated Patient-Care Equipment

Whenever possible, dedicated patient-care equipment should be utilized, especially for patients who

are in isolation. By using disposable items such as stethoscopes, blood- pressure cuffs and personal thermometers for isolation patients, health-care workers can decrease patient-to-patient transmission of organisms.

Improvements in Communication

Greater communication about patients with MDROs within and between health-care facilities can prevent outbreaks of MDROs. Many health-care settings use signs to identify the type of isolation required for a patient. The health-care team should work together to institute the required measures and to educate the patient and visitors on how they can prevent cross-contamination and transmission of the MDRO. Health-care professionals need to be held accountable for following proper isolation procedures and techniques. When patients are transferred from one unit or area of a facility to another or from one facility to another, it is imperative to communicate the MDRO identified, the source, and type of isolation measures needed.

Bundle- Care Measures

To prevent infections and improve patient outcomes, many health-care facilities are instituting bundle-care measures or "bundles". The Institute for Health-care Improvement (www.ihc.org) developed the concept of bundles as "a structured way of improving the processes of care and patient outcomes: a small, straightforward set of practices – generally three to five – that, when performed collectively and reliably, have been demonstrated to improve patient outcomes"

The two most common bundles seen in practice currently are the ventilator-associated pneumonia

(VAP) and the central-venous-line associated bloodstream infections (CVL-BCIs).

Respiratory Hygiene / Cough Etiquette

Simple interventions that confine infectious material at its source, such as respiratory hygiene/cough/etiquette, should be incorporated into infection control practices as one component of standard precautions. The CDC recommends that these guidelines apply to all patients with signs and symptoms of a respiratory infection, with or without a fever. The following measures to contain respiratory secretions are recommended: cover the nose/mouth when coughing or sneezing; use tissue to contain respiratory secretions and dispose of them in the nearest waste receptacle after use; perform hand hygiene (e.g., hand washing with non-antimicrobial soap and water, alcohol based hand rub, or antiseptic hand wash) after having contact with respiratory secretions and contaminated objects/materials. As a prevention measure, health-care facilities should ensure the availability of materials for adhering to the above interventions in all patient and visitor areas.

MDRO Control Interventions

Control interventions are often enhanced or intensified prevention measures instituted once a MDRO has been identified. The type and significance of the problem MDROs play within the health-care setting will influence which interventions are appropriate. Also, the population and the type of health-care setting will impact decision-making. Various combinations and degrees of intensity specific to the MDRO setting are needed to identify specific control interventions. Table

3 identifies commonly used control measures.

Administrative Support

Institutional administrative support for MDRO control interventions may be necessary. The interventions may require administrative commitment of increased fiscal and human resource needs. Examples impacting fiscal resources might include placing additional sinks for hand washing and adding alcohol-based hand rub dispensers. Increasing the number of microbiology staff for ASC is an example of increased human resources that might be needed. Staffing levels with increased interventions could impact both fiscal and human resource needs.

Judicious Use of Antimicrobials

In an attempt to prevent antimicrobial resistance and to decrease the number of new MDROs, antimicrobials will need to be used judiciously. The CDC's "Campaign to Prevent Antimicrobial Resistance," launched in 2002, provides evidence-based principles for the judicious use of antimicrobials and tools for implementation. (CDC, 2006). Key components of this effort include effective antimicrobial treatment of infections, use of narrow-spectrum agents, treatment of infections and not contaminants, avoidance of excessive duration of therapy and restriction of the use of broad-spectrum and more potent antimicrobials for the treatment of serious infections when the pathogen is unknown or when other effective agents are unavailable.

Surveillance

Implementing protocols to obtain Active Surveillance Cultures (ASC) from patients at risk

and to isolate colonized as well as infected patients will allow detection of newly emerging pathogens, facilitate monitoring epidemiologic trends, and measure the effectiveness of interventions. Patients at risk include those with compromised host defenses related to severe disease or an underlying medical condition, those who have undergone recent surgery, or those with indwelling medical devices like a urinary catheter or an endotracheal tube. Individual healthcare settings must determine their own guidelines to follow based primarily on their MDROs of interest or concern. One area hospital uses the following inclusion criteria to initiate admission surveillance cultures: 1) hospitalization for two consecutive days or more in the preceding 90 days; 2) residence in a nursing home or extended/long term care facility; 3) presence of a decubitus ulcer or a draining wound. If the patient is admitted to the hospital and has one of the three listed criteria, then surveillance cultures are obtained and the patient is placed on contact precautions. An institution or facility should base their criteria on the patient population they encounter and on the prevalence of MDROs. The methods for obtaining the ASC may vary depending on the MDRO of interest. For example, for MRSA, studies suggest that cultures of the nares can identify most patients, but additional carriers can be identified with perirectal and wound cultures (CDC, 2006).

Standard and Contact Precautions

Essential in controlling the transmission of MDROs are Standard and Contact Precautions. The CDC has recommended the use of them for MDROs since 1996.

Two important components to note are the recommendation for a single, private room for patients on contact precautions and strategies of cohorting (a systematic grouping of patients, staff, units, and/or equipment based on exposure to a designated organism). In several reports of outbreaks, cohorting was utilized in varying degrees. Some facilities cohorted only patients and staff while others included the use of designated beds and units or even unit closure during severe MDRO outbreaks. The exact duration necessary for the contact precautions is unclear. Contact precautions are generally discontinued when three or more surveillance cultures for the target MDRO are negative.

Environmental Measures

Environmental measures to enhance the education of housekeeping/environmental staff members and to intensify cleaning and disinfecting protocols should be implemented specific to the MDRO (Grota, 2007). There should be increased cleaning and disinfecting of frequently touched surfaces such as bedrails, charts, and doorknobs. Lack of adherence to facility procedures for cleaning and for disinfecting has been cited as a common reason for MDRO transmission. Monitoring adherence to recommended environmental cleaning practices of housekeeping personnel has been shown to facilitate control of transmission of MDROs (CDC, 2006).

Education

Increased frequency of health-care worker education should be adapted specifically to the prevalence of the targeted MDRO unique to that unit and type of infection (Grota, 2007). This includes educating all

employees in the facility who may come in contact with the patients (nurses, technicians, respiratory therapists, dietary workers, chaplains, physicians, social workers, housekeeping staff, etc.) family members or visitors.

Decolonization

Decolonization involves specific treatment to eradicate carriage of the organism in persons colonized with a MDRO, usually MRSA. There has been little success in attempting to decolonize VRE, but positive results for patients harboring MRSA in their nares have been reported. As noted by the CDC (2006), one successful regimen for eradicating nasal MRSA consisted of a three-day regimen of baths with providine-iodine and nasal therapy with mupirocin. Another method reviewed for MRSA decolonization included topical mupirocin in combination with oral antibiotics. Most health-care facilities limit the use of decolonization regimens to outbreaks and in high prevalence situations in special-care areas for several reasons. First, surveillance cultures are needed to identify colonized individuals. Then, follow-up cultures and monitoring are required to ensure eradication. And finally, recolonization and drug-resistance issues must be addressed. If a MRSA-colonized health-care worker is asymptomatic and not linked to epidemiological transmission, then decolonization is not required.

Conclusion

Although most health-care professionals are familiar with these protocols, many fail to practice effective prevention and control. Healthcare professionals, must hold each other accountable every day,

not only for their own protection but for the safety of their patients.

References:

CDC (2006). Management of Multidrug-Resistant Organisms In Healthcare Settings, 2006. <http://www.cdc.gov/ncidod/dhqp/pdf/ar/MDROGuideline2006.pdf>

Grota, P. G. (2007). Perioperative management of multidrug-resistant organisms in health care settings. *AORN Journal*. Retrieved May 28, 2008 from http://findarticles.com/p/articles/mi_m0FSL/is_3_86/ai_n20525307/print.

2008 National Patient Safety Goals – Disease Specific Care http://www.jointcommission.org/NR/rdonlyres/71E4800A-8C31-46D9-B6C8-E8BD0818B3E1/0/08_DSC_NPSGs_Master.pdf

<http://www.ihl.org/IHI/Topics/CriticalCare/IntensiveCare/ImprovementStories/WhatIsaBundle.htm>

(CE Test Questions)

Complete the following test questions.

1. According to the Centers for Disease Control, researchers have found that MDRO infections have resulted in:

- Increased length of stay
- Increased costs
- High mortality rates from multi-drug resistant gram-negative bacilli and vancomycin-resistant enterococci (VHE)
- All of the above.

2. _____ have a higher prevalence of MDRO infections.

- Emergency department
- Pediatric units
- Intensive care units
- Long-term care facilities (LTCFs)

3. The prevalence of MDROs has increased steadily during the past _____ years.

- 10
- 20
- 30
- 40

4. Potential MDRO prevention strategies are:

- Hand hygiene and easy access to personal protective equipment (PPE)
- Lectures given by pharmacists
- Counseling sessions with a psychiatrist
- Airborne precautions

5. All body fluids except _____ may contain transmissible infectious agents.

- Blood
- Secretions
- Excretions
- Sweat

6. Appropriate PPE in health-care settings commonly include:

- Gloves
- Gowns
- Goggles
- All of the above

7. Active Surveillance Cultures (ASCs) are generally obtained:

- Upon admission
- Before discharge from the hospital
- Ten days after antibiotics have been ordered
- At the follow-up visit in the physicians office

8. Most of the approved hospital disinfectants are not bactericidal until:

- a. The equipment has been autoclaved.
- b. They air-dry.
- c. Random specimen cultures are collected.
- d. They remain on the equipment for 20 minutes.

9. Bundle Care Measures are defined as structured ways of “improving the processes of care and patient outcomes: a small, straightforward set of practices – generally _____ - that, when performed collectively and reliably, have been proven to improve patient outcomes.

- a. One to four
- b. Three to five
- c. Four to six
- d. Five to seven

10. One successful method for eradicating nasal MRSA consisted of a _____ regimen of baths with providine-iodine and nasal therapy with mupirocin.

- a. 24-hour
- b. 48-hour
- c. Three-day
- d. Four-day

Earn One Credit

Registrants who read the self-study article and score at least 75 per cent on the accompanying test will receive one continuing education credit certificate from the Texas Nurses Association, District Four. This article is approved through December 1, 2010.

The author declares no real or perceived conflict of interest that relates to the this educational activity.

Objectives:

At the conclusion of this continuing education self-study, learners will be able to:

- Discuss multiple drug-resistant organisms (MDROs).
- Identify potential (MDRO prevention strategies).
- Identify commonly used MDRO control measures.
- Discuss ways to prevent antimicrobial resistance.

(CE Evaluation for Self-Study)

TITLE: Controlling Infections: What You Need to Know

PURPOSE: This self-study is designed to help nurses understand multiple drug-resistant organisms (MDROs) and how to prevent and control infection.

To receive continuing nursing education credit, the registrant must:

1. Read the self-study.
2. Complete the post-test (score of at least 75 percent).
3. Complete the evaluation form.
4. Mail the post-test (with \$10 payment) and evaluation form to TNA, District Four.

Upon receipt of the required forms (the post-test with a score of at least 75 percent and evaluation form) by TNA, District 4, the registrant will be mailed a CE certificate.

This activity provides 1.0 contact hour for the nurse.

TNA, District Four is an approved provider of continuing nursing education by the Texas Nurses Association.

EVALUATION FORM:

“Controlling Infections: What You Need to Know”

OBJECTIVE: To increase awareness of the incidence of MDROs and their impact on hospital patients and the larger community.

NAME: _____

TELEPHONE: () _____

ADDRESS: _____

CITY: _____

STATE: _____

ZIP: _____

BIRTH MONTH/YEAR/ _____

PROGRAM EVALUATION:

Please rate how well objectives were met by circling the appropriate number:

- 1 Not Met
- 2 Partially Met
- 3 Met
- 4 Well Met

1. Discuss multiple drug-resistant organisms (MDROs).

1 2 3 4

2. Identify potential MDRO prevention strategies.

1 2 3 4

3. Identify commonly used MDRO control measures.

1 2 3 4

4. Discuss ways to prevent antimicrobial resistance.

1 2 3 4

Please rate the quality of teaching materials by circling the appropriate number:

- 1 Strongly Disagree
- 2 Disagree
- 3 Agree
- 4 Strongly Agree

1. The objectives were relevant to overall purpose.

1 2 3 4

2. The teaching/learning materials were effective.

1 2 3 4

3. Program was organized.

1 2 3 4

4. Program was easy to follow.

1 2 3 4

If you answered 1 to any of the above, please provide comments.

How long did it take to complete the program? _____

Date Completed:

MAIL the completed evaluation with your test results and \$10 payment to:

TNA, D-4, P.O. Box 35503, Dallas, Texas 75235.