Management of Multidrug-Resistant Organisms In Healthcare Settings, 2006

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Acknowledgement:
The authors and HICPAC gratefully acknowledge Dr. Larry Strausbaugh for his many contributions and valued guidance in the preparation of this guideline.
V. Prevention of transmission of Multidrug Resistant Organisms (Table 3)

The CDC/HICPAC system for categorizing recommendations is as follows:

**Category IA**  Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

**Category IB**  Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

**Category IC**  Required for implementation, as mandated by federal and/or state regulation or standard.

**Category II**  Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

**No recommendation**  Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.

V.A.  General recommendations for all healthcare settings independent of the prevalence of multidrug resistant organism (MDRO) infections or the population served.

V.A.1.  Administrative measures

V.A.1.a.  Make MDRO prevention and control an organizational patient safety priority.(3, 146, 151, 154, 182, 185, 194, 205, 208, 210, 242, 327, 328)  
*Category IB*

V.A.1.b.  Provide administrative support, and both fiscal and human resources, to prevent and control MDRO transmission within the healthcare organization (3, 9, 146, 152, 182-184, 208, 328, 329)  
*Category IB*

V.A.1.c.  In healthcare facilities without expertise for analyzing epidemiologic data, recognizing MDRO problems, or devising effective control strategies (e.g., small or rural hospitals, rehabilitation centers, long-term care facilities [LTCFs], freestanding ambulatory centers), identify experts who can provide consultation as needed.(151, 188)  
*Category II*

V.A.1.d.  Implement systems to communicate information about reportable MDROs [e.g., VRSA, VISA, MRSA, Penicillin resistant S. pneumoniae(PRSP)] to administrative personnel and as required by state and local health
authorities (www.cdc.gov/epo/dphsi/nndsshis.htm). Refer to websites for updated requirements of local and state health departments. *Category II/IC*

V.A.1.e. Implement a multidisciplinary process to monitor and improve healthcare personnel (HCP) adherence to recommended practices for Standard and Contact Precautions(3, 105, 182, 184, 189, 242, 273, 312, 330). *Category IB*

V.A.1.f. Implement systems to designate patients known to be colonized or infected with a targeted MDRO and to notify receiving healthcare facilities and personnel prior to transfer of such patients within or between facilities. (87, 151) *Category IB*

V.A.1.g. Support participation of the facility or healthcare system in local, regional, and national coalitions to combat emerging or growing MDRO problems. (41, 146, 151, 167, 188, 206, 207, 211, 331). *Category IB*

V.A.1.h. Provide updated feedback at least annually to healthcare providers and administrators on facility and patient-care-unit trends in MDRO infections. Include information on changes in prevalence or incidence of infection, results of assessments for system failures, and action plans to improve adherence to and effectiveness of recommended infection control practices to prevent MDRO transmission. (152, 154, 159, 184, 204, 205, 242, 312, 332) *Category IB*

V.A.2. Education and training of healthcare personnel

V.A.2.a. Provide education and training on risks and prevention of MDRO transmission during orientation and periodic educational updates for healthcare personnel; include information on organizational experience with MDROs and prevention strategies. (38, 152, 154, 173, 176, 189, 190, 203, 204, 217, 242, 330, 333, 334) *Category IB*

V.A.3. Judicious use of antimicrobial agents. The goal of the following recommendations is to ensure that systems are in place to promote optimal treatment of infections and appropriate antimicrobial use.

V.A.3.a. In hospitals and LTCFs, ensure that a multidisciplinary process is in place to review antimicrobial utilization, local susceptibility patterns
(antibiograms), and antimicrobial agents included in the formulary to foster appropriate antimicrobial use.\(^{(209, 212, 214, 215, 217, 242, 254, 334-339)}\)  
**Category IB**

V.A.3.b. Implement systems (e.g., computerized physician order entry, comment in microbiology susceptibility report, notification from a clinical pharmacist or unit director) to prompt clinicians to use the appropriate antimicrobial agent and regimen for the given clinical situation.\(^{(156, 157, 161, 166, 174, 175, 212, 214, 218, 254, 334, 335, 337, 340-346)}\)  
**Category IB**

V.A.3.b.i. Provide clinicians with antimicrobial susceptibility reports and analysis of current trends, updated at least annually, to guide antimicrobial prescribing practices.\(^{(342, 347)}\)  
**Category IB**

V.A.3.b.ii. In settings that administer antimicrobial agents but have limited electronic communication system infrastructures to implement physician prompts (e.g., LTCFs, home care and infusion companies), implement a process for appropriate review of prescribed antimicrobials. Prepare and distribute reports to prescribers that summarize findings and provide suggestions for improving antimicrobial use. \(^{(342, 348, 349)}\)  
**Category II**

V.A.4. Surveillance

V.A.4.a. In microbiology laboratories, use standardized laboratory methods and follow published guidance for determining antimicrobial susceptibility of targeted (e.g., MRSA, VRE, MDR-ESBLs) and emerging (e.g., VRSA, MDR-*Acinetobacter baumannii*) MDROs.\(^{(8, 154, 177, 190, 193, 209, 254, 347, 350-353)}\)  
**Category IB**

V.A.4.b. In all healthcare organizations, establish systems to ensure that clinical microbiology laboratories (in-house and out-sourced) promptly notify infection control staff or a medical director/ designee when a novel resistance pattern for that facility is detected.\(^{(9, 22, 154, 162, 169)}\)  
**Category IB**

V.A.4.c. In hospitals and LTCFs, develop and implement laboratory protocols for storing isolates of selected MDROs for molecular typing when needed to
confirm transmission or delineate the epidemiology of the MDRO within the
healthcare setting.(7, 8, 38, 140, 153, 154, 187, 190, 208, 217, 354, 355)

Category IB

V.A.4.d. Prepare facility-specific antimicrobial susceptibility reports as
recommended by the Clinical and Laboratory Standards Institute (CLSI)
(www.phppo.cdc.gov/dls/master/default.aspx); monitor these reports for
evidence of changing resistance patterns that may indicate the emergence
or transmission of MDROs.(347, 351, 356, 357) Category IB/IC

V.A.4.d.i. In hospitals and LTCFs with special-care units (e.g., ventilator-
dependent, ICU, or oncology units), develop and monitor unit-
specific antimicrobial susceptibility reports.(358-361) Category IB

V.A.4.d.ii. Establish a frequency for preparing summary reports based on
volume of clinical isolates, with updates at least annually.(347, 362)
Category II/IC

V.A.4.d.iii. In healthcare organizations that outsource microbiology laboratory
services (e.g., ambulatory care, home care, LTCFs, smaller acute
 care hospitals), specify by contract that the laboratory provide either
facility-specific susceptibility data or local or regional aggregate
susceptibility data in order to identify prevalent MDROs and trends
in the geographic area served.(363) Category II

V.A.4.e. Monitor trends in the incidence of target MDROs in the facility over time
using appropriate statistical methods to determine whether MDRO rates
are decreasing and whether additional interventions are needed.(152, 154,
183, 193, 205, 209, 217, 242, 300, 325, 326, 364, 365) Category IA

V.A.4.e.i. Specify isolate origin (i.e., location and clinical service) in MDRO
monitoring protocols in hospitals and other large multi-unit facilities
with high-risk patients.(8, 38, 152-154, 217, 358, 361) Category IB

V.A.4.e.ii. Establish a baseline (e.g., incidence) for targeted MDRO isolates by
reviewing results of clinical cultures; if more timely or localized
information is needed, perform baseline point prevalence studies of
colonization in high-risk units. When possible, distinguish

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colonization from infection in analysis of these data. (152, 153, 183, 184, 189, 190, 193, 205, 242, 365) Category IB

V.A.5. Infection control precautions to prevent transmission of MDROs

V.A.5.a. Follow Standard Precautions during all patient encounters in all settings in which healthcare is delivered. (119, 164, 255, 315, 316) Category IB

V.A.5.b. Use masks according to Standard Precautions when performing splash-generating procedures (e.g., wound irrigation, oral suctioning, intubation); when caring for patients with open tracheostomies and the potential for projectile secretions; and in circumstances where there is evidence of transmission from heavily colonized sources (e.g., burn wounds). Masks are not otherwise recommended for prevention of MDRO transmission from patients to healthcare personnel during routine care (e.g., upon room entry). (8, 22, 151, 152, 154, 189, 190, 193, 208, 240, 366) Category IB

V.A.5.c. Use of Contact Precautions

V.A.5.c.i. In acute-care hospitals, implement Contact Precautions routinely for all patients infected with target MDROs and for patients that have been previously identified as being colonized with target MDROs (e.g., patients transferred from other units or facilities who are known to be colonized). (11, 38, 68, 114, 151, 183, 188, 204, 217, 242, 304) Category IB

V.A.5.c.ii. In LTCFs, consider the individual patient’s clinical situation and prevalence or incidence of MDRO in the facility when deciding whether to implement or modify Contact Precautions in addition to Standard Precautions for a patient infected or colonized with a target MDRO. Category II

V.A.5.c.ii.1. For relatively healthy residents (e.g., mainly independent) follow Standard Precautions, making sure that gloves and gowns are used for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes/bags. (78-80, 85, 151, 367, 368) Category II
V.A.5.c.ii.2. For ill residents (e.g., those totally dependent upon healthcare personnel for healthcare and activities of daily living, ventilator-dependent) and for those residents whose infected secretions or drainage cannot be contained, use Contact Precautions in addition to Standard Precautions.\(^\text{316, 369, 370}\) \textit{Category II}

V.A.5.c.iii. For MDRO colonized or infected patients without draining wounds, diarrhea, or uncontrolled secretions, establish ranges of permitted ambulation, socialization, and use of common areas based on their risk to other patients and on the ability of the colonized or infected patients to observe proper hand hygiene and other recommended precautions to contain secretions and excretions.\(^\text{151, 163, 371}\) \textit{Category II}

V.A.5.d. In \textit{ambulatory settings}, use Standard Precautions for patients known to be infected or colonized with target MDROs, making sure that gloves and gowns are used for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes and bags. \textit{Category II}

V.A.5.e. In \textit{home care settings}

- Follow Standard Precautions making sure to use gowns and gloves for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes and bags. \textit{Category II}

- Limit the amount of reusable patient-care equipment that is brought into the home of patients infected or colonized with MDROs. When possible, leave patient-care equipment in the home until the patient is discharged from home care services. \textit{Category II}

- If noncritical patient-care equipment (e.g., stethoscopes) cannot remain in the home, clean and disinfect items before removing them from the home, using a low to intermediate level disinfectant, or place reusable items in a plastic bag for transport
to another site for subsequent cleaning and disinfection.

*Category II*

V.A.5.e.i. No recommendation is made for routine use of gloves, gowns, or both to prevent MDRO transmission in ambulatory or home care settings. *Unresolved issue*


*Category IC*

V.A.5.f. Discontinuation of Contact Precautions. No recommendation can be made regarding when to discontinue Contact Precautions. *Unresolved issue* (See Background for discussion of options)

V.A.5.g. Patient placement in hospitals and LTCFs

V.A.5.g.i. When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontained secretions or excretions. (8, 38, 110, 151, 188, 208, 240, 304) *Category IB*

V.A.5.g.ii. When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. (8, 38, 92, 151-153, 162, 183, 184, 188, 217, 242, 304) *Category IB*

V.A.5.g.iii. When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. *Category II*

V.A.6. Environmental measures

V.A.6.a. Clean and disinfect surfaces and equipment that may be contaminated with pathogens, including those that are in close proximity to the patient (e.g., bed rails, over bed tables) and frequently-touched surfaces in the patient care environment (e.g., door knobs, surfaces in and surrounding toilets in patients’ rooms) on a more frequent schedule compared to that for minimal
touch surfaces (e.g., horizontal surfaces in waiting rooms).(111, 297, 373) Category IB

V.A.6.b. Dedicate noncritical medical items to use on individual patients known to be infected or colonized with MDROs.(38, 217, 324, 374, 375) Category IB

V.A.6.c. Prioritize room cleaning of patients on Contact Precautions. Focus on cleaning and disinfecting frequently touched surfaces (e.g., bedrails, bedside commodes, bathroom fixtures in the patient’s room, doorknobs) and equipment in the immediate vicinity of the patient.(109, 110, 114-117, 297, 301, 373, 376, 377) Category IB

V.B. Intensified interventions to prevent MDRO transmission
The interventions presented below have been utilized in various combinations to reduce transmission of MDROs in healthcare facilities. Neither the effectiveness of individual components nor that of specific combinations of control measures has been assessed in controlled trials. Nevertheless, various combinations of control elements selected under the guidance of knowledgeable content experts have repeatedly reduced MDRO transmission rates in a variety of healthcare settings.

V.B.1. Indications and approach

V.B.1.a. Indications for intensified MDRO control efforts (VII.B.1.a.i and VII.B.1.a.ii) should result in selection and implementation of one or more of the interventions described in VII.B.2 to VII.B.8 below. Individualize the selection of control measures according to local considerations(8, 11, 38, 68, 114, 152-154, 183-185, 189, 190, 193, 194, 209, 217, 242, 312, 364, 365). Category IB

V.B.1.a.i. When incidence or prevalence of MDROs are not decreasing despite implementation of and correct adherence to the routine control measures described above, intensify MDRO control efforts by adopting one or more of the interventions described below.(92, 152, 183, 184, 193, 365) Category IB

V.B.1.a.ii. When the first case or outbreak of an epidemiologically important MDRO (e.g., VRE, MRSA, VISA, VRSA, MDR-GNB) is identified
within a healthcare facility or unit.(22, 23, 25, 68, 170, 172, 184, 240, 242, 378) Category IB

V.B.1.b. Continue to monitor the incidence of target MDRO infection and colonization after additional interventions are implemented. If rates do not decrease, implement more interventions as needed to reduce MDRO transmission.(11, 38, 68, 92, 152, 175, 184, 365) Category IB

V.B.2. Administrative measures

V.B.2.a. Identify persons with experience in infection control and the epidemiology of MDRO, either in house or through outside consultation, for assessment of the local MDRO problem and for the design, implementation, and evaluation of appropriate control measures (3, 68, 146, 151-154, 167, 184, 190, 193, 242, 328, 377). Category IB

V.B.2.b. Provide necessary leadership, funding, and day-to-day oversight to implement interventions selected. Involve the governing body and leadership of the healthcare facility or system that have organizational responsibility for this and other infection control efforts.(8, 38, 152, 154, 184, 189, 190, 208) Category IB

V.B.2.c. Evaluate healthcare system factors for their role in creating or perpetuating transmission of MDROs, including: staffing levels, education and training, availability of consumable and durable resources, communication processes, policies and procedures, and adherence to recommended infection control measures (e.g., hand hygiene and Standard or Contact Precautions). Develop, implement, and monitor action plans to correct system failures.(3, 8, 38, 152, 154, 172, 173, 175, 188, 196, 198, 199, 208, 217, 280, 324, 379, 380) Category IB

V.B.2.d. During the process, update healthcare providers and administrators on the progress and effectiveness of the intensified interventions. Include information on changes in prevalence, rates of infection and colonization; results of assessments and corrective actions for system failures; degrees of adherence to recommended practices; and action plans to improve
adherence to recommended infection control practices to prevent MDRO transmission.(152, 154, 159, 184, 204, 205, 312, 332, 381) Category IB

V.B.3. Educational interventions

Intensify the frequency of MDRO educational programs for healthcare personnel, especially those who work in areas in which MDRO rates are not decreasing. Provide individual or unit-specific feedback when available.(3, 38, 152, 154, 159, 170, 182, 183, 189, 190, 193, 194, 204, 205, 209, 215, 218, 312) Category IB

V.B.4. Judicious use of antimicrobial agents

Review the role of antimicrobial use in perpetuating the MDRO problem targeted for intensified intervention. Control and improve antimicrobial use as indicated. Antimicrobial agents that may be targeted include vancomycin, third-generation cephalosporins, and anti-anaerobic agents for VRE(217); third-generation cephalosporins for ESBLs(212, 214, 215); and quinolones and carbapenems(80, 156, 166, 174, 175, 209, 218, 242, 254, 329, 334, 335, 337, 341). Category IB

V.B.5. Surveillance

V.B.5.a. Calculate and analyze prevalence and incidence rates of targeted MDRO infection and colonization in populations at risk; when possible, distinguish colonization from infection(152, 153, 183, 184, 189, 190, 193, 205, 215, 242, 365). Category IB

V.B.5.a.i. Include only one isolate per patient, not multiple isolates from the same patient, when calculating rates(347, 382). Category II

V.B.5.a.ii. Increase the frequency of compiling and monitoring antimicrobial susceptibility summary reports for a targeted MDRO as indicated by an increase in incidence of infection or colonization with that MDRO. Category II

V.B.5.b. Develop and implement protocols to obtain active surveillance cultures (ASC) for targeted MDROs from patients in populations at risk (e.g., patients in intensive care, burn, bone marrow/stem cell transplant, and oncology units; patients transferred from facilities known to have high
MDRO prevalence rates; roommates of colonized or infected persons; and patients known to have been previously infected or colonized with an MDRO. (8, 38, 68, 114, 151-154, 167, 168, 183, 184, 187-190, 192, 193, 217, 242)  

Category IB

V.B.5.b.i. Obtain ASC from areas of skin breakdown and draining wounds. In addition, include the following sites according to target MDROs:

**V.B.5.b.i.1.** For MRSA: Sampling the anterior nares is usually sufficient; throat, endotracheal tube aspirate, percutaneous gastrostomy sites, and perirectal or perineal cultures may be added to increase the yield. Swabs from several sites may be placed in the same selective broth tube prior to transport. (117, 383, 384)  

Category IB

V.B.5.b.i.2. For VRE: Stool, rectal, or perirectal samples should be collected. (154, 193, 217, 242)  

Category IB

V.B.5.b.i.3. For MDR-GNB: Endotracheal tube aspirates or sputum should be cultured if a respiratory tract reservoir is suspected, (e.g., *Acinetobacter* spp., *Burkholderia* spp.). (385, 386)  

Category IB

V.B.5.b.ii. Obtain surveillance cultures for the target MDRO from patients at the time of admission to high-risk areas, e.g., ICUs, and at periodic intervals as needed to assess MDRO transmission. (8, 151, 154, 159, 184, 208, 215, 242, 387)  

Category IB

V.B.5.c. Conduct culture surveys to assess the efficacy of the enhanced MDRO control interventions.

V.B.5.c.i. Conduct serial (e.g., weekly, until transmission has ceased and then decreasing frequency) unit-specific point prevalence culture surveys of the target MDRO to determine if transmission has decreased or ceased. (107, 167, 175, 184, 188, 218, 339)  

Category IB

V.B.5.c.ii. Repeat point-prevalence culture surveys at routine intervals or at time of patient discharge or transfer until transmission has ceased. (8, 152-154, 168, 178, 190, 215, 218, 242, 388)  

Category IB
V.B.5.c.iii. If indicated by assessment of the MDRO problem, collect cultures to assess the colonization status of roommates and other patients with substantial exposure to patients with known MDRO infection or colonization. (25, 68, 167, 193) Category IB

V.B.5.d. Obtain cultures of healthcare personnel for target MDRO when there is epidemiologic evidence implicating the healthcare staff member as a source of ongoing transmission. (153, 365) Category IB

V.B.6. Enhanced infection control precautions

V.B.6.a. Use of Contact Precautions

V.B.6.a.i. Implement Contact Precautions routinely for all patients colonized or infected with a target MDRO. (8, 11, 38, 68, 114, 151, 154, 183, 188, 189, 217, 242, 304) Category IA

V.B.6.a.ii. Because environmental surfaces and medical equipment, especially those in close proximity to the patient, may be contaminated, don gowns and gloves before or upon entry to the patient’s room or cubicle. (38, 68, 154, 187, 189, 242) Category IB

V.B.6.a.iii. In LTCFs, modify Contact Precautions to allow MDRO-colonized/infected patients whose site of colonization or infection can be appropriately contained and who can observe good hand hygiene practices to enter common areas and participate in group activities. (78, 86, 151, 367) Category IB

V.B.6.b. When ASC are obtained as part of an intensified MDRO control program, implement Contact Precautions until the surveillance culture is reported negative for the target MDRO. (8, 30, 153, 389, 390) Category IB

V.B.6.c. No recommendation is made regarding universal use of gloves, gowns, or both in high-risk units in acute-care hospitals. (153, 273, 312, 320, 391) Unresolved issue

V.B.7. Implement policies for patient admission and placement as needed to prevent transmission of a problem MDRO. (183, 184, 189, 193, 242, 339, 392) Category IB
V.B.7.a.i. Place MDRO patients in single-patient rooms.\(^\text{6, 151, 158, 160, 166, 170, 187, 208, 240, 282, 393-395}\) Category IB

V.B.7.a.ii. Cohort patients with the same MDRO in designated areas (e.g., rooms, bays, patient care areas).\(^\text{8, 151, 152, 159, 161, 176, 181, 183, 184, 188, 208, 217, 242, 280, 339, 344}\) Category IB

V.B.7.a.iii. When transmission continues despite adherence to Standard and Contact Precautions and cohorting patients, assign dedicated nursing and ancillary service staff to the care of MDRO patients only. Some facilities may consider this option when intensified measures are first implemented.\(^\text{184, 217, 242, 278}\) Category IB

V.B.7.a.iv. Stop new admissions to the unit of facility if transmission continues despite the implementation of the enhanced control measures described above. (Refer to state or local regulations that may apply upon closure of hospital units or services.).\(^\text{9, 38, 146, 159, 161, 168, 175, 205, 279, 280, 332, 339, 396}\) Category IB

V.B.8. Enhanced environmental measures

V.B.8.a. Implement patient-dedicated or single-use disposable noncritical equipment (e.g., blood pressure cuff, stethoscope) and instruments and devices.\(^\text{38, 104, 151, 156, 159, 163, 181, 217, 324, 329, 367, 389, 390, 394}\) Category IB

V.B.8.b. Intensify and reinforce training of environmental staff who work in areas targeted for intensified MDRO control and monitor adherence to environmental cleaning policies. Some facilities may choose to assign dedicated staff to targeted patient care areas to enhance consistency of proper environmental cleaning and disinfection services.\(^\text{38, 154, 159, 165, 172, 173, 175, 178-181, 193, 205, 208, 217, 279, 301, 327, 339, 397}\) Category IB

V.B.8.c. Monitor (i.e., supervise and inspect) cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and HCP (e.g.,
bedrails, carts, bedside commodes, doorknobs, faucet handles). (8, 38, 109, 111, 154, 169, 180, 208, 217, 301, 333, 398) Category IB

V.B.8.d. Obtain environmental cultures (e.g., surfaces, shared medical equipment) when there is epidemiologic evidence that an environmental source is associated with ongoing transmission of the targeted MDRO. (399-402) Category IB

V.B.8.e. Vacate units for environmental assessment and intensive cleaning when previous efforts to eliminate environmental reservoirs have failed. (175, 205, 279, 339, 403) Category II

V.B.9. Decolonization

V.B.9.a. Consult with physicians with expertise in infectious diseases and/or healthcare epidemiology on a case-by-case basis regarding the appropriate use of decolonization therapy for patients or staff during limited periods of time, as a component of an intensified MRSA control program. (152, 168, 170, 172, 183, 194, 304) Category II

V.B.9.b. When decolonization for MRSA is used, perform susceptibility testing for the decolonizing agent against the target organism in the individual being treated or the MDRO strain that is epidemiologically implicated in transmission. Monitor susceptibility to detect emergence of resistance to the decolonizing agent. Consult with a microbiologist for appropriate testing for mupirocin resistance, since standards have not been established. (289, 290, 304, 308) Category IB

V.B.9.b.i. Because mupirocin-resistant strains may emerge and because it is unusual to eradicate MRSA when multiple body sites are colonized, do not use topical mupirocin routinely for MRSA decolonization of patients as a component of MRSA control programs in any healthcare setting. (289, 404) Category IB

V.B.9.b.ii. Limit decolonization of HCP found to be colonized with MRSA to persons who have been epidemiologically linked as a likely source of ongoing transmission to patients. Consider reassignment of HCP
if decolonization is not successful and ongoing transmission to patients persists.\cite{120, 122, 168} \textit{Category IB}

V.B.9.c. No recommendation can be made for decolonizing patients with VRE or MDR-GNB. Regimens and efficacy of decolonization protocols for VRE and MDR-GNB have not been established.\cite{284, 286, 288, 307, 387, 405} \textit{Unresolved issue}
Table 1. Categorization of Reports about Control of MDROs in Healthcare Settings, 1982-2005

<table>
<thead>
<tr>
<th>MDRO</th>
<th>MDR-GNB</th>
<th>MRSA</th>
<th>VRE</th>
</tr>
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<tbody>
<tr>
<td>No. of Studies Reviewed/category</td>
<td>30</td>
<td>35</td>
<td>39</td>
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Types of Healthcare Facilities from which Study or Report Arose

<table>
<thead>
<tr>
<th>Type of Facility</th>
<th>MDR-GNB</th>
<th>MRSA</th>
<th>VRE</th>
</tr>
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<tbody>
<tr>
<td>No. (%) from academic facilities $^a$</td>
<td>30 (100)</td>
<td>28 (80)</td>
<td>33 (85)</td>
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<tr>
<td>No. (%) from other hospitals</td>
<td>0</td>
<td>4 (11)</td>
<td>3 (8)</td>
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<tr>
<td>No. (%) from LTCFs</td>
<td>0</td>
<td>1 (3)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>No. (%) from multiple facilities in a region</td>
<td>0</td>
<td>2 (6)</td>
<td>1 (2)</td>
</tr>
</tbody>
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Unit of Study for MDRO Control Efforts

<table>
<thead>
<tr>
<th>Unit of Study</th>
<th>MDR-GNB</th>
<th>MRSA</th>
<th>VRE</th>
</tr>
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<tbody>
<tr>
<td>Special unit $^b$</td>
<td>20</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Hospital</td>
<td>10</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>LTCF</td>
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<td>1</td>
<td>2</td>
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<tr>
<td>Region</td>
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<td>2</td>
<td>1</td>
</tr>
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</table>

Nature of Study or Report on MDRO Control $^c$

<table>
<thead>
<tr>
<th>Nature of Study</th>
<th>MDR-GNB</th>
<th>MRSA</th>
<th>VRE</th>
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<tbody>
<tr>
<td>Outbreak</td>
<td>22</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>Non-outbreak</td>
<td>8</td>
<td>16</td>
<td>11</td>
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Total Period of Observation after Interventions Introduced

<table>
<thead>
<tr>
<th>Period of Observation</th>
<th>MDR-GNB</th>
<th>MRSA</th>
<th>VRE</th>
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<tbody>
<tr>
<td>Less than 1 year</td>
<td>17</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>1-2 years</td>
<td>6</td>
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</tr>
<tr>
<td>2-5 years</td>
<td>5</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Greater than 5 years</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Numbers of Control Measures Employed in Outbreaks/Studies

<table>
<thead>
<tr>
<th>Control Measures</th>
<th>MDR-GNB</th>
<th>MRSA</th>
<th>VRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>2-12</td>
<td>0-11</td>
<td>1-12</td>
</tr>
<tr>
<td>Median</td>
<td>7</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Mode</td>
<td>8</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

$^a$ Variously described as university hospitals, medical school affiliated hospitals, VA teaching hospitals, and, to a much lesser extent, community teaching hospitals

$^b$ Includes intensive care units, burn units, dialysis units, hematology/oncology units, neonatal units, neonatal intensive care units, and, in a few instances, individual wards of a hospital

$^c$ Based on authors’ description – if they called their experience an outbreak or not; authors vary in use of term so there is probable overlap between two categories
Table 2. Control Measures for MDROs Employed in Studies Performed in Healthcare Settings, 1982-2005

<table>
<thead>
<tr>
<th>Focus of MDRO (No. of Studies)</th>
<th>MDR-GNB (n=30)</th>
<th>MRSA (n=35)</th>
<th>VRE (n=39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education of staff, patients or visitors</td>
<td>19 (63)</td>
<td>11 (31)</td>
<td>20 (53)</td>
</tr>
<tr>
<td>Emphasis on handwashing</td>
<td>16 (53)</td>
<td>21 (60)</td>
<td>9 (23)</td>
</tr>
<tr>
<td>Use of antiseptics for handwashing</td>
<td>8 (30)</td>
<td>12 (36)</td>
<td>16 (41)</td>
</tr>
<tr>
<td>Contact Precautions or glove use</td>
<td>20 (67)</td>
<td>27 (77)</td>
<td>34 (87)</td>
</tr>
<tr>
<td>Private Rooms</td>
<td>4 (15)</td>
<td>10 (28)</td>
<td>10 (27)</td>
</tr>
<tr>
<td>Segregation of cases</td>
<td>4 (15)</td>
<td>3 (9)</td>
<td>5 (14)</td>
</tr>
<tr>
<td>Cohorting of Patients</td>
<td>11 (37)</td>
<td>12 (34)</td>
<td>14 (36)</td>
</tr>
<tr>
<td>Cohorting of Staff</td>
<td>2 (7)</td>
<td>6 (17)</td>
<td>9 (23)</td>
</tr>
<tr>
<td>Change in Antimicrobial Use</td>
<td>12 (41)</td>
<td>1 (3)</td>
<td>17 (44)</td>
</tr>
<tr>
<td>Surveillance cultures of patients</td>
<td>19 (63)</td>
<td>34 (97)</td>
<td>36 (92)</td>
</tr>
<tr>
<td>Surveillance cultures of staff</td>
<td>9 (31)</td>
<td>8 (23)</td>
<td>7 (19)</td>
</tr>
<tr>
<td>Environmental cultures</td>
<td>15 (50)</td>
<td>14 (42)</td>
<td>15 (38)</td>
</tr>
<tr>
<td>Extra cleaning &amp; disinfection</td>
<td>11 (37)</td>
<td>7 (21)</td>
<td>20 (51)</td>
</tr>
<tr>
<td>Dedicated Equipment</td>
<td>5 (17)</td>
<td>0</td>
<td>12 (32)</td>
</tr>
<tr>
<td>Decolonization</td>
<td>3 (10)</td>
<td>25 (71)</td>
<td>4 (11)</td>
</tr>
<tr>
<td>Ward closure to new admission or to all patients</td>
<td>6 (21)</td>
<td>4 (12)</td>
<td>5 (14)</td>
</tr>
<tr>
<td>Other miscellaneous measures</td>
<td>6 (22)</td>
<td>9 (27)</td>
<td>17 (44)</td>
</tr>
</tbody>
</table>

α Contact Precautions mentioned specifically, use of gloves with gowns or aprons mentioned, barrier precautions, strict isolation, all included under this heading

β includes signage, record flagging, unannounced inspections, selective decontamination, and peer compliance monitoring (1 to 4 studies employing any of these measures)

χ includes requirements for masks, signage, record tracking, alerts, early discharge, and preventive isolation of new admissions pending results of screening cultures (1 to 4 studies employing any of these measures)

δ includes computer flags, signage, requirement for mask, one-to-one nursing, changing type of thermometer used, and change in rounding sequence (1 to 7 studies employing any of these measures)

References for Tables 1 and 2

MDR-GNBs: (6, 8, 9, 11, 16, 38, 174, 175, 180, 209, 210, 213-215, 218, 334, 388, 406, 407)

MRSA: (68, 89, 152, 153, 165-173, 183, 188, 194, 204, 205, 208, 240, 269, 279, 280, 289, 304, 312, 327, 365, 392, 397, 408-412)
## Tier 1. General Recommendations for Routine Prevention and Control of MDROs in Healthcare Settings

<table>
<thead>
<tr>
<th>Administrative Measures/Adherence Monitoring</th>
<th>MDRO Education</th>
<th>Judicious Antimicrobial Use</th>
<th>Surveillance</th>
<th>Infection Control Precautions to Prevent Transmission</th>
<th>Environmental Measures</th>
<th>Decolonization</th>
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</thead>
<tbody>
<tr>
<td>Make MDRO prevention/control an organizational priority. Provide administrative support and both fiscal and human resources to prevent and control MDRO transmission. (IB) Identify experts who can provide consultation and expertise for analyzing epidemiologic data, recognizing MDRO problems, or devising effective control strategies, as needed. (II) Implement systems to communicate information about reportable MDROs to administrative personnel and state/local health departments. (II) Implement systems to designate patients known to be colonized or infected with a targeted MDRO and to notify receiving healthcare facilities or personnel prior to transfer of such patients within or between facilities. (III) Support participation in local, regional, and/or national coalitions to combat emerging or growing MDRO problems. (III) Provide updated feedback at least annually to healthcare providers and administrators on facility and patient-care unit MDRO infections. Include information on changes in prevalence and incidence, problem assessment and performance improvement plans. (III) Provide education and training on risks and prevention of MDRO transmission during orientation and periodic educational updates for HCP; include information on organizational experience with MDROs and prevention strategies. (IB) In hospitals and LTCFs, ensure that a multi-disciplinary process is in place to review local susceptibility patterns (antibiograms), and antimicrobial agents included in the formulary, to foster appropriate antimicrobial use. (IB) Implement systems (e.g., CPOE susceptibility report comment, pharmacy or unit director notification) to prompt clinicians to use the appropriate agent and regimen for the given clinical situation. (III) Provide clinicians with antimicrobial susceptibility reports and current trends, updated at least annually, to guide antimicrobial prescribing practices. (III) In settings with limited electronic communication system infrastructures to implement physician prompts, etc., at a minimum implement a process to review antibiotic use. Prepare and distribute reports to providers. (III) Use standardized laboratory methods and follow published guidelines for determining antimicrobial susceptibilities of targeted and emerging MDROs. Establish systems to ensure that clinical micro labs (in-house and outsourced) promptly notify infection control or medical director/designee when a novel resistance pattern for that facility is detected. (IB) In hospitals and LTCFs: develop and implement laboratory protocols for storing isolates of selected MDROs for molecular typing when needed to confirm transmission or delineate epidemiology of MDRO in facility. (IB) Establish laboratory-based systems to detect and communicate evidence of MDROs in clinical isolates. (IB) Prepare facility-specific antimicrobial susceptibility reports as recommended by CLSI; monitor reports for evidence of changing resistance that may indicate emergence or transmission of MDROs (IA/IC) [Develop and monitor special-care unit-specific antimicrobial susceptibility reports (e.g., ventilator-dependent units, ICUs, oncology units). (IB) Monitor trends in incidence of target MDROs in the facility over time to determine if MDRO rates are decreasing or if additional interventions are needed. (IA) Follow Standard Precautions in all healthcare settings. (IB) Use of Contact Precautions (CP): — In acute care settings: Implement CP for all patients known to be colonized/infected with target MDROs (IB) — In LTCFs: Consider the individual patient’s clinical situation and facility resources in deciding whether to implement CP (II) — In ambulatory and home care settings, follow Standard Precautions (IB) — In hemodialysis units: Follow dialysis specific guidelines (IC) No recommendation can be made regarding when to discontinue CP. (Unresolved issue) Masks are not recommended for routine use to prevent transmission of MDROs from patients to HCWs. Use masks according to Standard Precautions when performing splashing generating procedures, caring for patients with open tractocutaneous wounds with potential for projectile secretions, and when there is evidence for transmission from heavily colonized sources (e.g., burn wounds). Patient placement in hospitals and LTCFs: When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontrolled secretions or excretions. When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. (IB) When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. (II) Follow recommended cleaning, disinfection and sterilization guidelines for maintaining patient care areas and equipment. Dedicate non-critical medical items to use on individual patients known to be infected or colonized with an MDRO. Prioritize room cleaning of patients on Contact Precautions. Focus on cleaning and disinfecting frequently touched surfaces (e.g., beds rails, bedside commodes, bathroom fixtures in patient room, doorknobs) and equipment in immediate vicinity of patient.</td>
<td>Follow recommended cleaning, disinfection and sterilization guidelines for maintaining patient care areas and equipment. Dedicate non-critical medical items to use on individual patients known to be infected or colonized with an MDRO. Prioritize room cleaning of patients on Contact Precautions. Focus on cleaning and disinfecting frequently touched surfaces (e.g., beds rails, bedside commodes, bathroom fixtures in patient room, doorknobs) and equipment in immediate vicinity of patient.</td>
<td>Not recommended routinely</td>
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### Tier 2. Recommendations for Intensified MDRO Control Efforts

Institute one or more of the interventions described below when 1) incidence or prevalence of MDROs are not decreasing despite the use of routine control measures; or 2) the first case or outbreak of an epidemiologically important MDRO (e.g., VRE, MRSA, VISA, VRSA, MDR-GNB) is identified within a healthcare facility or unit. (B) Continue to monitor the incidence of target MDRO infection and colonization; if rates do not decrease, implement additional interventions as needed to reduce MDRO transmission.

<table>
<thead>
<tr>
<th>Administrative Measures/Adherence Monitoring</th>
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<th>Environmental Measures</th>
<th>Decolonization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain expert consultation from persons with experience in infection control and the epidemiology of MDROs, either in-house or through outside consultation, for assessment of the local MDRO problem and guidance in the design, implementation, and evaluation of appropriate control measures. (B)</td>
<td>Intensify the frequency of educational programs for healthcare personnel, especially for those who work in areas where MDRO rates are not decreasing. Provide individual or unit-specific feedback when available. (B)</td>
<td>Review the role of antimicrobial use in perpetuating the MDRO problem targeted for intensified intervention. Control and improve antimicrobial use as indicated. Antimicrobial agents that may be targeted include vancomycin, third-generation cephalosporins, anti-anaerobic agents for VRE; third-generation cephalosporins for ESBLs, and quinolones and carbapenems. (B)</td>
<td>Calculate and analyze incidence rates of target MDROs (single isolates/patient; location-, service-specific) (B). Increase frequency of compiling, monitoring antimicrobial susceptibility summary reports (IB). Implement laboratory protocols for storing isolates of selected MDROs for molecular typing; perform typing if needed (IB). Develop and implement protocols to obtain active surveillance cultures from patients in populations at risk. (B) (See recommendations for appropriate body sites and culturing methods.) Conduct culture surveys to assess efficacy of intensified MDRO control interventions. Conduct serial (e.g., weekly) unit-specific point-prevalence culture surveys of the target MDRO to determine if transmission has decreased or ceased. (IB) Repeat point-prevalence culture surveys at routine intervals and at time of patient discharge or transfer until transmission has ceased. (IB) If indicated by assessment of the MDRO problem, collect cultures to assess the colonization status of roommates and other patients with substantial exposure to patients with known MDRO infection or colonization. (IB) Obtain cultures from HCP for target MDROs when there is epidemiologic evidence implicating the staff member as a source of ongoing transmission. (IB) Use of Contact Precautions: Implement Contact Precautions (CP) routinely for all patients colonized or infected with a target MDRO. (A) Don gowns and gloves before or upon entry to the patient’s room or cubicle. (IB) In LTCFs, modify CP to allow MDRO-colonized/infected patients whose site of colonization or infection can be appropriately contained and who can observe good hand hygiene practices to enter common areas and participate in group activities. When active surveillance cultures are obtained as part of an intensified MDRO control program, implement CP until the surveillance culture is reported negative for the target MDRO (IB). No recommendation is made for universal use of gloves and/or gowns. (Unresolved issue) Implement policies for patient admission and placement as needed to prevent transmission of the problem MDRO. (IB) When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontained secretions or excretions. When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. (IB) When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. (IB) Stop new admissions to the unit or facility if transmission continues despite the implementation of the intensified control measures. (IB) Implement patient-dedicated use of non-critical equipment (IB). Intensify and reinforce training of environmental staff who work in areas as targeted for intensified MDRO control. Some facilities may choose to assign dedicated staff to targeted patient care areas to enhance consistency of proper environmental cleaning and disinfection services (IB). Monitor cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and HCPs (e.g., bedrails, carts, bedside commodes, doorknobs, faucet handles) (IB). Obtain environmental cultures (e.g., surfaces, shared equipment) only when epidemiologically implicated in transmission (IB). Vacate units for environmental assessment and intensive cleaning when previous efforts to control environmental transmission have failed (IB) Consider different cleaning materials and agents when previous cleaning efforts have failed. (IB)</td>
<td>Consult with experts on a case-by-case basis regarding the appropriate use of decolonization therapy for patients or staff during limited periods of time as a component of an intensified MRSA control program (IB). When decolonization for MRSA is used, perform susceptibility testing for the decolonizing agent against the target organism (or the MDRO strain epidemiologically implicated in transmission). Monitor susceptibility to detect emergence of resistance to the decolonizing agent. Consult with microbiologists for appropriate testing for mucin resistance, since standards have not been established. Do not use topical mupirocin routinely for MRSA decolonization of patients as a component of MRSA control programs in any healthcare setting. (IB) Limit decolonization to HCP found to be colonized with MRSA who have been epidemiologically implicated in ongoing transmission of MRSA to patients. (IB) No recommendation can be made for decolonization of patients who carry VRE or MDR-GNB.</td>
<td></td>
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</tbody>
</table>
CLINICAL ALERT
ADMISSION SURVEILLANCE CULTURES PROTOCOL

To be implemented when an inpatient meets inclusion criteria for Admission Surveillance Cultures. In order to prevent the spread of multidrug-resistant organisms (MDROs), admission surveillance cultures should be collected and the patient placed in contact precautions. Please follow the instructions below.

**Inclusion criteria:** Patient has been admitted and has one of the following risk factors for MDROs:
- hospitalization for 2 consecutive days or more in the preceding 90 days
- residence in a nursing home or extended/long term care facility
- presence of decubitus ulcer or a draining wound

**Protocol Guidelines**
1. Each culture should be ordered as “Admission Surveillance Culture” in Meditech.
2. Collect all swab specimens using the red aerobic culture stick.
3. Specimen source must be clearly identified on the specimen itself before being sent to Microbiology.
4. Patients should remain in Contact Isolation until ALL FINAL culture results are received from the Microbiology Laboratory and demonstrate no MDROs.
5. Culture results positive for MDROs will warrant continued isolation of the patient—until discharge, and on subsequent hospitalizations.
6. **If by Day 7 of hospital course, no cultures are positive, then contact isolation should be discontinued.**

**Protocol Checklist**

<table>
<thead>
<tr>
<th>Initials</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

- Place the patient in Contact Isolation and collect cultures as indicated below
- Rectal swab (all patients who meet inclusion criteria)

**Respiratory/ Nasal specimens (CHECK ONLY ONE)**

<table>
<thead>
<tr>
<th>Initials</th>
<th>Date</th>
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<tbody>
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</table>

- Nasal swab (if not intubated and not having productive cough)
- Sputum (if not intubated but with productive cough)
- Endotracheal aspirate (if intubated)

**Drainage from any wounds** (specify sites)

<table>
<thead>
<tr>
<th>Initials</th>
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- ______________________
- ______________________
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- ______________________

**Other**

<table>
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<th>Initials</th>
<th>Date</th>
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</table>

- Urine (from catheterized patients only)
- Patient education on protocol completed

_______________________________  _____________________________
Nurse Signature              Nurse Signature

Fax this completed sheet to Infection Control at the Addressograph