HRET
HEALTH RESEARCH & EDUCATIONAL TRUST

2017 UPDATE

PREVENTING MDRO INFECTIONS

MULTIDRUG-RESISTANT ORGANISM (MDRO) *CHANGE PACKAGE*

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How to Use this Change Package

This change package is intended for hospitals participating in the Hospital Improvement Innovation Network (HIIN) project led by the Centers for Medicare & Medicaid Services (CMS) and Partnership for Patients (PFP); it is meant to be a tool to help you make patient care safer and improve care transitions. This change package is a summary of themes from the successful practices of high performing health organizations across the country. It was developed through clinical practice sharing, organization site visits and subject matter expert contributions. This change package includes a menu of strategies, change concepts and specific actionable items that any hospital can implement based on need or for purposes of improving patient quality of life and care. This change package is intended to be complementary to literature reviews and other evidence-based tools and resources.

PART 1: AEA DEFINITION AND SCOPE

CURRENT DEFINITION OF THE PROBLEM: Multi-drug resistant organisms (MDROs) are defined as microorganisms, predominantly bacteria, that are resistant to one or more antimicrobial agents, and are usually resistant to all but one or two commercially available antimicrobial agents.[1] Common examples of MDROs of clinical concern include:

> Methicillin-resistant Staphylococcus aureus (MRSA)

> Staphylococcus aureus with resistance to vancomycin (VISA/VRSA)

> Vancomycin-resistant Enterococci (VRE),

> Extended spectrum beta-lactamase-producing gram-negative bacilli (ESBLs)

> Multidrug-resistant Streptococcus pneumoniae (MDRSP)

> Carbapenem-resistant Enterobacteriaceae (CRE)

> Multidrug-resistant Acinetobacter baumannii

Magnitude of the Problem and Why this Matters

Antimicrobial resistance has become widespread over the past several decades. Infections caused by MDROs are more likely to result in hospitalization, generate significant costs, require prolonged hospital stays and result in complications. According to the Centers for Disease Control and Prevention (CDC), "Each year in the United States, at least 2 million people become infected with bacteria that are resistant to antibiotics and at least 23,000 people die each year as a direct result of these infections."[2] The challenges of antimicrobial resistance extend outside health care settings and into the community, necessitating a broad approach with multiple partners across the continuum of care. In the case of MRSA, 18 percent to 33 percent of colonized patients will subsequently develop MRSA infection. Community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA) strains also constitute an increasing proportion of hospital-onset MRSA infections. The CDC estimates that over 2 million illnesses and 23,000 deaths per year are attributable to antibiotic resistance. In studies evaluating the cost of MRSA versus methicillin-susceptible Staphylococcus aureus (MSSA), methods and results vary, with reports of between $4,000–$19,000 in incremental costs per infection.[4,5]

> HIIN Reduction Goals:

- Reduce the incidence of lab-identified, hospital-acquired MRSA bacteremia by 20 percent by September 27, 2018.

PART 2: MEASUREMENT

Please download and reference the encyclopedia of measures (EOM) on the HRET HIIN website for additional measure specifications and for any updates after publication at: http://www.hret-hiin.org/data/hiin_eom_core_eval_and_add_req_topics.pdf

Nationally Recognized Measures: Process and Outcome

> HIIN Measures

- Hospital-onset MRSA bacteremia events

PART 3: APPROACHING YOUR AEA

> Suggested Bundles and Toolkits:

- Acute Care Facility Multidrug-resistant Organisms Control Activity Assessment Tool. Centers for Disease Control and Prevention. Retrieved at: www.cdc.gov/hai/pdfs/prevent/mdro-facility-assessment_7_28.pdf.
- Get Smart for Healthcare: Centers for Disease Control and Prevention. Retrieved at: www.cdc.gov/getsmart/healthcare/.
- Implementing an Antibiotic Stewardship Program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis (2016) 62 (10):e51-e77. Retrieved at: http://cid.oxfordjournals.org/content/early/2016/04/11/cid.ciw118.abstract.
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- Facility Guidance for Control of Carbapenem-Resistant Enterobacteriaceae (CRE). Centers for Disease Control and Prevention, November 2015 Update. Retrieved at: http://www.cdc.gov/hai/pdfs/cre/CRE-guidance-508.pdf.
- Health Research & Educational Trust (HRET) Hospital Improvement Innovation Network (HIIN). UP Campaign. Retrieved at: http://www.hret-hiin.org/engage/up-campaign.shtml
- For key tools and resources related to reducing MDRO infections and transmissions, visit http://www.hret-hiin.org/topics/mdro/index.shtml.

Investigate Your Problem and Implement Best Practices

DRIVER DIAGRAMS: A driver diagram visually demonstrates the causal relationship between your change ideas, secondary drivers, primary drivers and your overall aim. A description of each of these components is outlined in the table below. This change package reviews the components of the driver diagram to help you and your care team identify potential change ideas to implement at your facility and to show how this quality improvement tool can be used by your team to tackle new process problems.

AIM	PRIMARY DRIVER	SECONDARY DRIVER	Change Idea
		SECONDARY DRIVER	Change Idea
	PRIMARY DRIVER	SECONDARY DRIVER	Change Idea

AIM: *A clearly articulated goal or objective describing the desired outcome. It should be specific, measurable and time-bound.*

PRIMARY DRIVER: *System components or factors that contribute directly to achieving the aim.*

SECONDARY DRIVER: *Action, interventions or lower-level components necessary to achieve the primary driver.*

CHANGE IDEAS: *Specific change ideas which will support or achieve the secondary driver.*

Drivers in This Change Package

PREVENT MDRO	ANTIMICROBIAL STEWARDSHIP	ANALYZE ANTIMICROBIAL USE AND DETERMINE APPROPRIATENESS	Change Idea
		LIMIT ANTIMICROBIAL USE THROUGH PRE-AUTHORIZATION AND FORMULARY	Change Idea
	HORIZONTAL PRECAUTIONS TO PREVENT MDRO TRANSMISSION	EARLY IDENTIFICATION OF MDRO INFECTION	Change Idea
		ENSURE ADHERENCE WITH APPROPRIATE PRECAUTIONS	Change Idea
		IMPLEMENT RELIABLE ENVIRONMENTAL CLEANING AND CONTROL	Change Idea
	ASSESS NEED FOR UNIVERSAL DECOLONIZATION OF ICU PATIENTS	CONSIDER DAILY CHLORHEXIDINE BATHING IN ICUs	Change Idea
		EVALUATE USE OF INTRANASAL DECOLONIZATION FOR MRSA CARRIERS	Change Idea
	PATIENT AND FAMILY ENGAGEMENT	INVITE PATIENTS AND FAMILIES TO BE ACTIVE PARTNERS	Change Idea

AIM

PREVENT MULTI-DRUG RESISTANT ORGANISM (MDRO) INFECTION

Primary Driver:

ANTIMICROBIAL STEWARDSHIP

Antimicrobial stewardship promotes appropriate selection, dosing, route and duration of antimicrobial therapy.[6] The primary goal is to optimize clinical outcomes while reducing unintended consequences of antimicrobial use such as toxicity, colonization of pathogenic organisms and antibiotic resistance. A secondary goal of antimicrobial stewardship is to reduce the health care costs associated with infections with multi-drug resistant organisms MDRO, CRE and VRE. Comprehensive programs in both large academic medical centers and smaller community hospitals have consistently demonstrated reductions in antimicrobial use that ranged from 22 percent to 36 percent with annual savings of $200,000 to $900,000.[7]

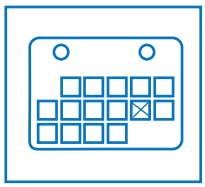
Effective antimicrobial stewardship programs can be financially self-supporting, improve patient care and save lives. The 2015 National Action Plan for Combating Antibiotic-Resistant Bacteria outlines national targets.[8] By 2020, from a 2011 baseline, the plan calls for reducing CRE infections by 60 percent during hospitalization, and for reducing MRSA bloodstream infections by at least 50 percent. Due to the substantial impact of inappropriate antibiotic prescriptions among ambulatory care visits and the inpatient impact of CA-MRSA, hospitals should collaborate with local partners, other sites of care and community providers to tailor antimicrobial stewardship programs across the continuum of care.

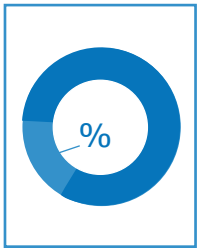
Secondary Driver > ANALYZE ANTIMICROBIAL USE AND DETERMINE THE APPROPRIATENESS OF THE SELECTED TREATMENT

Studies have shown that as much as 30 percent to 50 percent of all antibiotic use is inappropriate.[9] Inappropriate use includes: a longer-than-necessary duration of therapy, treatment of non-bacterial diseases, treatment of contaminants or colonizers and meaningless duplicate therapy (e.g., treatment with multiple antibiotics targeting anaerobes simultaneously).[10] Additionally, clinical outcomes, including both cure and failure rates, have been shown to improve with an antimicrobial stewardship program.[11] Monitoring and analysis of antimicrobial use by disease, unit and practitioner can lead to organizational knowledge of opportunities for stewardship.

Change Ideas

- Partner with community and ambulatory providers to monitor local and regional Healthcare Effectiveness Data and Information Set (HEDIS) performance measures on antibiotic utilization in uncomplicated pharyngitis, upper respiratory infections and acute bronchitis.[12]
- Engage hospital medical staff and affiliated providers in dialogue about the Centers for Disease Control and Prevention (CDC) Get Smart initiative, specifically regarding outpatient antibiotic prescribing patterns for conditions in which antibiotics are not indicated.[13]
- Analyze the culture and sensitivity data for specific infections (e.g., urinary tract infections), as well as antimicrobials ordered, and determine the appropriateness of the selected treatment.
- Engage clinical pharmacists in a collaborative leadership role with physicians in the organizational antimicrobial stewardship program.
- Prospectively review the use of antimicrobials and provide real-time feedback and recommendations to medical staff and facility leadership about treatment options.
- Determine if antimicrobial agents at higher risk of contributing to MDRO are de-escalated or discontinued as soon as possible.
- Eliminate redundant combination antimicrobial therapy.
- Educate prescribing clinicians about the appropriate selection and use of antimicrobials, including dose, timing and duration of treatment.





> Engage the clinical microbiology laboratory and infection prevention departments in optimizing surveillance and investigating outbreaks.

> Optimize antimicrobial dosing based upon individual patient characteristics, causative agent, infection site and drug characteristics.

Suggested Process Measures for Your Test of Change

- Days of therapy (DOT) or defined daily dose (DDD) measure of antibiotic use, per CDC NHSN Antibiotic Use and Resistance Antibiotic Use and Resistance (AUR) Module definitions.[14]
- Number of patients who were prescribed a specific antimicrobial (e.g., a fluoroquinolone, carbapenem or third-generation cephalosporin) for a specific category of infection (e.g., urinary tract infection).
- Percentage of patients who appropriately received a specific antimicrobial (e.g., a fluoroquinolone) based on best evidence.
- Percentage of surgical patients who received appropriate weight-based antimicrobial preoperative dose.
- Percentage of patients who received an appropriate antibiotic for the specific surgical procedure performed, based on best evidence.
- Percentage of patients who had an antimicrobial prescription modification per recommendation of a clinical pharmacist.

Secondary Driver > LIMIT ANTIMICROBIAL USE THROUGH PRE-AUTHORIZATION AND FORMULARY CONTROLS

Limiting the formulary and requiring pre-authorization for broad spectrum antibiotics is a key strategy in reducing unnecessary use of antibiotics. This structure helps prevent unnecessary duplicate coverage as well as misuse, leading to improved microbial resistance patterns.[15]

Change Ideas

> Enlist a team of physicians and pharmacists to develop recommended antibiotic prescribing guidance by suspected source of infection, based on the hospital's antibiogram.

> Consider developing antimicrobial order forms consistent with these hospital guidelines to integrate into the electronic order entry system.

> Obtain cultures before starting antibiotics and streamline or de-escalate empirical antimicrobial therapy based upon culture results.

> Partner with local and state health departments, as well as other hospitals and health care facilities in the region to track local microbiology and resistance patterns.

> Create mechanisms for review within 24 hours of antibiotics ordered outside recommended guidelines, with process for discussion with prescribing physician for any necessary adjustments.

> Track all antibiotics ordered outside of recommendations, to periodically review and update guidelines, as well as to provide transparent physician-level feedback.

> Implement prospective review and feedback after two or three days of antimicrobial treatment to engage with the prescribing physician to optimize antibiotic treatment.

> Ensure all orders have clear documentation of dose, duration and indications for antimicrobial therapy.

> Develop clinical criteria and guidelines to promote and facilitate the conversion from parenteral to oral agents.

Suggested Process Measures for Your Test of Change

- Percentage of patients who had all relevant cultures obtained before the first dose of antibiotics were administered.
- Percentage of parenteral to oral conversions that followed guidelines.
- Number of pre-authorizations requested and number denied.

Hardwire the Process

Key strategies for hardwiring the process include: (1) removal of unnecessary antibiotics from the formulary, (2) restriction of options for duplicate antibiotics and antibiotics for special circumstances, (3) ongoing surveillance of antibiotic use with intervention by pharmacy, as needed, and (4) escalation to physician leaders, as necessary, leading to improved accuracy of antibiotic use. When these strategies are combined with clinician feedback and real-time intervention, care is safer, antimicrobial resistance is reduced, and money is saved.

Primary Driver:

USE HORIZONTAL CONTROL MEASURES TO PREVENT MDRO TRANSMISSION

Prompt diagnosis of active MDRO infection is the first step in preventing an outbreak and will trigger the isolation precautions and infection control and prevention practices designed to prevent transmission. Many infectious disease experts advocate for "horizontal" prevention strategies to reduce the threat of all MDRO, rather than active detection and isolation practices or "vertical infection prevention strategies," intended to reduce colonization or infection from a specific pathogen.[16] One example of a "vertical" approach is utilizing active surveillance culture/testing (ASC/AST) to determine MRSA colonization. The CDC defines ASC/AST as "testing that is intended to identify presence/carriage of microorganisms for the purpose of instituting or discontinuing isolation precautions (e.g., nasal swab for MRSA), or monitoring for eradication of a carrier state" as opposed to identifying microorganisms with cultures or tests performed for diagnosis and treatment purposes.[17] Some states legislatively mandate ASC/AST for MRSA. With respect to preventing the transmission and infection of MRSA in acute care settings, the Society for Healthcare Epidemiology of America (SHEA)/Infection Diseases Society of America (IDSA) Practice Recommendations[18] suggest a "two-tiered" approach, favoring (1) basic practices that should be adopted by all acute care hospitals and (2) special approaches for locations and/or populations within hospitals when hospital-acquired infections are not controlled by use of the basic practices.

Secondary Driver > EARLY IDENTIFICATION OF MDRO INFECTION

Early identification of patients with MDRO infection and of those suspected of having an MDRO infection provides the opportunity to stop the spread of the specific organism. A strong infection surveillance program designed to target key MDROs is the first step in identifying patients with MDRO infection. Using rapid diagnostic tests, with accurate and timely laboratory identification of MDROs for patients with clinical signs of infection, is key to implementing appropriate infection prevention strategies.[19] Laboratory-identified event surveillance and clinical infection surveillance are the two commonly used approaches for MRSA surveillance. As noted in the SHEA/IDSA updated MRSA guidelines,[20] Tier 2 measures should be individualized at each hospital, unless legislated mandates specifically require use of one or more special approaches (e.g., ASC/AST).

Change Ideas

> Implement a surveillance program to monitor incidence of targeted MDROs (e.g., MRSA, CRE, VRE).

> Display data related to the number of cases of hospital-onset versus community-onset MRSA as percentages of total MRSA cases.

> Use surveillance data to implement corrective actions rapidly when transmission of targeted MDROs, increased rates or persistently elevated rates of health care-associated infections are detected.

> Institute a laboratory-based alert system that notifies health care personnel of colonized or infected patients in a timely manner.

> Partner with local or state health departments or both, as well as other hospitals and sites of care, to determine local and regional infection rates and resistance patterns.

> Implement AST as a tier 2 special approach to prevent MRSA transmission when outbreaks occur or in cases where outcomes or organizational risk assessment identifies target populations or units.[21]

> Implement transfer and handover strategies to ensure clear communication upon internal and inter-facility transfers (Appendix II).

Suggested Process Measures for Your Test of Change

- Timeliness of reporting MDROs to external parties (as required by legislative or other mandates)
- Timeliness of reporting MDROs within the organization to relevant units or departments (organization defined)
- Monitoring adherence to MRSA AST — NHSN:
  - Admission AST percent adherence
  - Discharge/transfer AST percent adherence

Hardwire the Process

Hold regular meetings with community partners, other area hospitals and health department representatives to evaluate local patterns of MDRO prevalence and severity of infections. Create internal system controls for updating risk assessment to allow for rapid response to emerging threats. Develop lab protocols for timely notification regarding targeted MDROs. Proactively prepare criteria and protocols for rapid testing, when indicated.

Secondary Driver > ENSURE ADHERENCE TO STANDARD AND CONTACT PRECAUTIONS

Hand hygiene is the cornerstone of standard precautions to prevent MDRO transmission. Since MRSA, CRE, VRE, and multi-drug-resistant Gram-negative bacilli all can be spread by direct human to human contact or by indirect means through fomites (e.g., bed rails, equipment, thermometers), contact precautions for all MDRO-infected patients may prevent transmission to staff, visitors and other patients. Contact precautions may lead to unintended adverse events, such as increased risk for depression and anxiety, health care delays, decreased satisfaction and harm associated with reduced health care provider availability.[22,23] The CDC recommends that health care workers assess patients for adverse impact of contact precautions and take measures to address patient needs.

Change Ideas

> Use direct observation methodology to assess compliance with hand hygiene.

> Engage learners, such as nursing students, to conduct hand hygiene compliance observations.

> Use the SOAP UP Start-Up tool to engage front-line staff in increasing reliability to hand hygiene.[24]

> Conduct risk assessments to determine prevalence or organisms in the community to make plans for contact precautions and consider private rooms versus double-room cohorting.[25]

> Consider contact precautions for patients with active MDRO infection, and possibly for known carriers, according to part of institution's infection prevention risk assessment and plan.

> Implement competency-based program for use of personal protective equipment (PPE) and hand hygiene.

> Institute hand hygiene accountability tracking, with individual accountability for adhering to hand hygiene standards and leadership accountability for ensuring adequate, functional and available sinks and supplies (see Appendix III for sample tool).

> Evaluate placement and availability of PPE supplies to ensure compliance with appropriate use.

> Engage interprofessional teams, including materials management, administration, infection prevention, nursing, environmental services and others to ensure mutual support and teamwork in caring for patients in contact precautions.

> Educate and engage patients and families, being certain to guard against the unintended consequences of contact precautions (e.g., greater likelihood of detrimental psychological effects, including anxiety, stress and depression)[26]

Suggested Process Measures for Your Test of Change

- Hand Hygiene Adherence Rate (NHSN measure)
- Monitoring Adherence to Gown and Glove Use as Part of Contact Precautions (NHSN)
- Contact Precaution Adherence Rate
- Percent of observations that demonstrate adequacy of hand hygiene supplies (including adequate levels of soap and gel dispensers, paper towels, etc.)

Hardwire the Process

Integrate hand hygiene and contact precautions education and assessment into interprofessional orientation and annual competency reviews. Improve reliability of hand hygiene and contact precautions through cultural change to peer support and open communication. Employ accountability system or individual and unit-level adherence. Implement process improvement and Lean strategies to ensure adequacy of hand hygiene stations and PPE equipment. Use technology to enhance personal accountability for hand hygiene adherence and promote front-line engagement in peer support and cross-monitoring for standard and contact precautions.

Secondary Driver > IMPLEMENT RELIABLE CLEANING AND CONTROL FOR EQUIPMENT AND THE ENVIRONMENT

Both Healthcare Infection Control Practices Advisory Committee (HICPAC) MDRO Guidelines[27] and the SHEA/IDSA Practice Recommendations to prevent MRSA transmission[28] emphasize the need for proper cleaning of and disinfecting equipment and the environment. The potential role of environmental reservoirs, such as surfaces and medical equipment, in transmitting MDRO requires careful attention to daily cleaning of high-touch surfaces, as well as thorough terminal cleaning after patient discharge from the room. Strict monitoring of staff adherence to environmental cleaning protocols, as well as assessment of staff competencies, are vital strategies for reducing MDRO transmission in any hospital. Sites utilizing reusable medical devices must ensure careful adherence to reprocessing instructions from the manufacturer and the Federal Drug Administration (FDA) to prevent transmission of MDROs.[29]

Change Ideas

- Form a multidisciplinary team (e.g., housekeeping, purchasing, infection prevention, central sterilization) to review, evaluate and make recommendations regarding new disinfectant agents, reprocessing requirements for reusable medical devices, and related infection-prevention practices.
- Develop written protocols for daily and terminal cleaning and disinfecting patient rooms. Protocols should address specifics about types of equipment, proper disinfectants and required contact time, roles, etc.
- Create alert systems from the laboratory for newly identified MDRO patients.
- Provide training and competency assessments related to daily and terminal cleaning, particularly related to high-touch surfaces (e.g., bed rails, overbed tables, TV remotes, nurse call buttons, carts, bedside commodes, door knobs, faucet handles) and patient care equipment (e.g., stethoscopes, blood pressure cuffs).
- Dedicate high-use equipment to individual patient rooms, where possible.
- Engage an interdisciplinary team to optimize reliability, including nurses, environmental services staff, dieticians, laboratory personnel, infection preventionists and physicians.
- Use audible timers to ensure appropriate contact time for cleaning agents.
- Clearly define who is responsible for cleaning ventilators, IV pumps and other critical patient care equipment. Ensure cleaning materials or wipes are within easy reach to facilitate cleaning.
- Implement random or intermittent post-terminal cleaning validation tests with immediate feedback to environmental services personnel.

> Address challenges of room turnover pressures through clear communication and coordination with entire team, allowing ample time for thorough terminal cleaning.

> Evaluate costs and benefits to new technological "no-touch disinfection" (NTD) methods for terminal cleaning, when standard cleaning methods and other infection prevention strategies have not reduced the environmental bioburden of MDROs.

Suggested Process Measures for Your Test of Change

- Percentage of proper cleaning contact time using audible timers
- Percentage of positive terminal cleaning test results (by sampling)
- Adherence Rate to Protocols and Adequacy of Environmental Cleaning (see EOM)

Hardwire the Process

Use alert systems from the laboratory that notify clinical and environmental services staff to newly identified MDRO patients. Create environmental cleaning checklists for high-touch surfaces. Optimize interdisciplinary teams to support communication about special equipment or environment needs for targeted populations.

Primary Driver:

ASSESS NEED FOR UNIVERSAL DECOLONIZATION FOR INTENSIVE CARE UNIT (ICU) PATIENTS

Controversy exists related to the increase during the past decade of the practice of active surveillance testing and isolation of patients with MRSA colonization.[30]

Findings from the REDUCE MRSA study by Huang et al. found that for ICU patients, universal decolonization resulted in a "significantly greater reduction in the rate of all bloodstream infections than either targeted decolonization or screening and isolation."[31] MRSA decolonization is considered a tier 2 "special approach" intervention in the SHEA/IDSA compendium. Using these strategies should be balanced with the potential side effects, such as severe allergic reaction or reduced susceptibility to the agents used (e.g., mupirocin and chlorhexidine).[32,33]

Secondary Driver > CONSIDER DAILY CHLORHEXIDINE BATHING IN ICUs

The REDUCE MRSA study[34] supports daily bathing of ICU patients with chlorhexidine gluconate. This was supported by a multicenter, cluster-randomized, nonblinded crossover trial which determined that daily bathing with chlorhexidine-impregnated cloths significantly reduced the risks of acquiring MDROs and developing hospital-acquired bloodstream infections.[35] According to a recent systematic review and meta-analysis, hospitals should strongly consider daily CHG bathing for ICU patients, as it is estimated that CHG bathing reduces the risk of central line-associated bloodstream infection (CLABSI) by 56 percent and MRSA colonization and bacteremia in the ICU by 41 percent and 36 percent, respectively.[36] CHG bathing appears to be of most clinical benefit when infection rates are high for a given ICU population. The evidence also cautions that CHG bathing alone may be of limited usefulness in reducing MRSA bacteremia; intranasal mupirocin may also be required (see secondary driver below).[37] Organizations may consider CHG bathing as a tier 2 strategy for patients outside the ICU if they have devices such as central lines or indwelling urinary catheters. This must be carefully weighed within the context of the organization's risk assessment, infection rates and infection prevention strategies, acknowledging that there is not yet strong evidence to support this approach outside

the ICU. Patient risk for rare but serious allergic reaction must also be considered. A recent U.S. Food and Drug Administration alert noted that serious allergic reactions have been reported with over-the-counter (OTC) skin antiseptic products containing chlorhexidine gluconate.[38]

Change Ideas

> Conduct an organizational risk assessment to determine MDRO transmission patterns in both ICU and non-ICU settings. Evaluate whether CHG bathing may be indicated as a tier 2 special approach for targeted populations outside the ICU, particularly those with devices, such as central lines and indwelling urinary catheters, and targeted surgical patients preoperatively.

> Ensure that supplies for CHG bathing are readily available.

> Consider approaches that limit use of soap and water bathing, particularly in ICUs (such as eliminating the availability of basins). Evaluate pH-balanced cleansers for patients in non-ICU units.

> Involve interprofessional team members to address CHG bathing in daily rounds to ensure consistency.

> Evaluate CHG alternatives for adjunct patient cleansing, when soiling occurs. Consider pH-balanced cleansers to protect skin integrity.

> Ask patients if they have ever had an allergic reation to an antiseptic before using a CHG product. Monitor for signs and symptoms of allergic reaction.

Suggested Process Measures for Your Test of Change

- Percentage of ICU patients receiving daily CHG bath
- Measure of CHG bathing supply utilization to unit census ratio.

Secondary Driver > EVALUATE USE OF INTRANASAL DECOLONIZATION IN ICU PATIENTS AND FOR MRSA CARRIERS AT HIGH RISK OF INFECTION

Universal decolonization in the REDUCE MRSA Huang et al. study (2013) found that treating all patients with daily CHG baths, plus five days of intranasal mupirocin, significantly reduced MRSA-positive clinical cultures attributed to the ICU by 37 percent, compared with AST and isolation alone. The risk for developing mupirocin resistance, leading to decolonization failure, may increase when mupirocin is used in a widespread fashion.[39] Other decolonization agents may be effective in cases where mupirocin resistance is suspected.[40] There is not yet large-scale evidence to support the effectiveness of alternatives to mupirocin,[41] but hospitals should evaluate the risks and benefits depending on mupirocin resistance patterns.

Change Ideas

> Conduct an organizational risk assessment to determine MDRO transmission patterns in both ICU and non-ICU settings.

> Consider intranasal decolonization in conjunction with CHG bathing for targeted populations, particularly in ICUs.

> Evaluate mupirocin resistance patterns and decolonization failures, considering intranasal decolonization alternatives, as indicated.

> Develop decolonization protocols for patients at high risk of MDRO transmission, particularly with MRSA.

> Involve an interprofessional team including physicians, pharmacists and nurses in discussions regarding decolonization during rounds.

Suggested Process Measures for Your Test of Change

- Percentage of ICU patients receiving five days of intranasal decolonization treatment

Hardwire the Process

Set clear expectations in the infection prevention plan and unit protocols regarding decolonization strategies for targeted populations, particularly when expanded use is necessary for outbreaks or targeted MDROs. Educate staff regarding protocols and conduct team scenario-based competency assessments, incorporating interprofessional rounding communication scenarios for daily management.

Primary Driver:

PATIENT AND FAMILY ENGAGEMENT

Involving and educating patients, families and the public about the risk of unnecessary antibiotic use and community resistance patterns is an essential component of an MDRO reduction plan. Patient and family education focused on the role of the environment and personal items is also a critical component of preventing transmission between close contacts.

Secondary Driver > EDUCATE PATIENTS, FAMILIES AND THE PUBLIC REGARDING RISKS OF ANTIBIOTIC USAGE AND SIGNS OF INFECTION FROM RESISTANT BACTERIA

Provide clear and complete information to patients and families about the risks of overusing antibiotics, as well as the facts about resistant strains. Inform patients and families about the patient's known carrier status, risk of transmission and the difference between colonization and infection. Teach patients that colonization may remain benign or could lead to infection in the future. Engage patients and families about essential hand hygiene, as well as contact precautions, if applicable. The CDC, infection prevention specialty societies, and state and local health departments are good sources of educational materials aimed at increasing knowledge about antimicrobial stewardship and MDRO transmission risks (Appendix IV).

Change Ideas

> Develop or customize available patient and family education materials and FAQ sheets for use in hospital and community ambulatory care sites.[42]

> Use teach-back strategies[43] to review a patient's known carrier status, transmission risks and infection status, as well as specific infection prevention and control strategies in use to protect the patient, his or her family and others.

> Convene a diverse group of community partners, including the local health department, other community health care providers, patients, business partners, churches, athletic organizations, churches, etc., to increase community awareness and action related to the risks of antimicrobial resistance.

> Include patients and families on infection prevention improvement committees.

> Integrate patient stories into staff and community awareness programs.

Suggested Process Measures for Your Test of Change

- Percentage of patients infected with MDRO with documented education about infection prevention measures
- Qualitative data about patient preferences for education, as well as understanding and behaviors linked to teach-back and other patient-centric education methods

Hardwire the Process

Implement electronic health record prompts for documenting patient and family education about antimicrobial resistance for patients on antibiotics. Hardwire family education regarding MDRO transmission, hand hygiene and contact precautions for patients diagnosed with MDRO infection.

PDSA In Action | Tips on How to Use the Model for Improvement

Choice of Tests and Interventions for MDRO Reduction:

> Daily chlorhexidine (CHG) daily bathing in ICU

IMPLEMENT SMALL TESTS OF CHANGE	Daily chlorhexidine gluconate (CHG) bathing for ICU patients
PLAN	After evaluating your hospital's organizational risk assessment, as well as device-associated infection rates and MDRO infections, assemble a small group of interprofessional team members in an identified ICU.
DO	Select one nurse to bathe his or her patients with chlorhexidine on one day.
STUDY	Gather qualitative feedback from patients. Conduct a debrief during the following day's interprofessional rounds. Consider patient feedback, as well as nurse feedback, about the availability of supplies, effectiveness of cleaning, impact on daily work and team suggestions for next-level testing.
ACT	Using feedback from the debrief, make adaptations to supply needs, time of bathing, etc. Plan the next test of CHG bathing with a larger group of nurses and patients in the same ICU. For future cycles of testing, consider nasal decolonization, as well as implications for other ICUs.

Potential Barriers

> Lack of hospital awareness about local and regional MDRO colonization and transmission rates. Variation exists related to size of hospital and geographic location, creating challenges in planning for resource allocation.

> Challenges regarding the need to influence and change provider prescribing practices for antimicrobial use, both in the community and in the hospital.

> Smaller hospitals, particularly critical access hospitals, may lack the infection prevention and infectious disease resources in their facility needed to assist in developing an organizational risk assessment and action plan, as well as to guide development of specific protocols to address antimicrobial stewardship and prevent MDRO transmission.

> Hospitals must weigh the risks and benefits of establishing contact precautions for large numbers of patients. Challenges may include lack of private rooms, costs of personal protective equipment and the unintended consequences of isolation, such as risk of other patient incident, patient depression and dissatisfaction.

- Inefficient work design, lack of supplies and equipment, and staffing assignments can negatively impact staff adherence to hand hygiene and contact precautions.
- The evidence regarding strategies to prevent MDRO transmission is ever-evolving and sometimes conflicting. Prevention requires dedicated attention to continuously update policies, procedures and protocols to align with national guidance.

Enlist administrative leadership as sponsors to help remove or mitigate barriers

- Recruit a senior leader, physician and pharmacist to champion antimicrobial stewardship and prevent MDRO transmission.
- Involve leaders and staff from nursing, environmental services, infection prevention, along with physician leaders, to provide the necessary support for hospital and community-wide antimicrobial stewardship and engagement in proactive hospital infection prevention strategies.
- Inappropriate antibiotic prescribing is a modifiable contributor to antibiotic resistance. Physician leadership, with pharmacy engagement, is essential to reduce prescribing and promote de-escalating antibiotics. Track antibiotic prescribing in all clinical settings, and share transparent provider-level data to promote appropriate prescribing practices.
- Provide dedicated infection prevention resources, including budgetary support for personnel, equipment, work design and supplies.
- Senior leaders should lead daily safety briefings to include discussion about barriers and solutions to infection prevention challenges, as well as to celebrate successes with reductions in MDRO transmission and infection rates.
- Consider protocols and patient room design to accommodate a "safe zone" for visual and verbal patient check-ins without donning full PPE for contact precautions.

Change not only the practice, but also the culture

- Focus on developing core professional behavior expectations, accompanied with adherence and accountability programs for hand hygiene, contact precautions and other infection prevention strategies.
- Convene daily safety briefings to engage all departments and leaders in dialogue about risks, breaches and mitigation strategies.
- Focus on strong teamwork and communication across departments and professions, using team tools like TeamSTEPPS to empower front-line staff to speak up to prevent patient incidents and optimize patient handovers.

- Integrate transparent hospital-level and unit-level data about key measures of MDRO transmission and infection, as well as hand hygiene and contact precautions adherence.
- Celebrate improvements with interprofessional team to enhance pride and joy in work.

PART 4: CONCLUSION AND ACTION PLANNING

Preventing multi-drug resistant organism (MDRO) transmission and resulting infections requires a comprehensive approach based on a hospital's individual infection risk assessment. The prevalence of MDRO burden varies across geographical regions, by size and type of hospital, and even within settings. An integrated systems approach is required to quickly identify new emerging MDRO strains, as well as to address the challenges of increased resistance patterns in the hospital and surrounding communities. The first and primary step in reducing MDROs is to implement a sound antimicrobial stewardship program. This should be coupled with effective strategies, including a cross-cutting analysis across infection categories; attention to reliable standard and contact precautions, and the implementation of "horizontal" infection prevention approaches aimed at reducing all MDRO rather than simply targeting individual organisms. Facilities must collaborate with community partners and adopt infection prevention strategies that align with epidemiological patterns and local challenges.

Strong guidance is available from national specialty and professional groups, including the CDC's HICPAC, IDSA, SHEA, APIC and others. Despite the national attention about the need for establishing antimicrobial stewardship programs and reducing MDROs, evidence-based practice is still emerging, and study results and policy may differ on certain points (e.g., the benefit of active surveillance testing, or AST). To keep pace with evidence-based strategies, leaders should invest in building competencies in infection prevention and establish connections with infectious disease consultants, as well as regional and state health department resources. Foundational culture change is needed to hardwire accountable hand hygiene behaviors and adherence to infection prevention strategies. This will require leadership, teamwork, accountability, patient and family engagement and a culture of safety and transparency.

PART 5: APPENDICES

APPENDIX I: TOP TEN CHECKLIST

Associated Hospital/Organization: HRET HIIN

Purpose of Tool: A checklist to review current interventions or initiate new ones for CDI prevention in your facility

Reference: www.hret-hiin.org

Multi-Drug Resistant Organism (MDRO) Infections Top Ten Checklist

- Institute an antimicrobial stewardship program incorporating prospective review and transparent data feedback. Design a program that includes preauthorization and/or prospective audit and feedback regarding antimicrobial usage. Programs should decide whether to include one strategy or a combination of approaches, depending on organizational gap analysis and availability of resources.
- Avoid inappropriate antimicrobial prescriptions. Involve physicians and pharmacists to design formulary controls and targeted ordering guidance based upon likely source of infection.
- Approach MDRO transmission as a cross-cutting harm. Integrate MDRO prevention strategies into all HAI infection prevention approaches, focusing on institutional cultural changes to hardwire key strategies (e.g., antibiotic de-escalation, reducing unnecessary urine cultures and treatment for asymptomatic bacteriuria and instituting antibiotic "time outs" after a designated treatment period).
- Engage community partners, physicians, patients and other health care facilities in developing a community action plan to reduce MDRO burden in your region.
- Develop a surveillance plan based upon organizational risk assessment, focusing on rapid identification of MDRO and measures to control known risks. Include lab-identified event surveillance, plus clinical surveillance, implementing special approaches for identified risk areas or consistent with regulatory requirements (i.e., AST).
- Hardwire hand hygiene. Engage all direct care staff and providers in peer-supported hand hygiene adherence effort, incorporating direct observation measurement strategy and individual accountability with strong peer support model.
- Formulate strategy for contact precautions to prevent MDRO transmission. Consider organizational gap analysis, MDRO environmental and community burden and availability of staff and other resources (e.g., PPE and private rooms verses cohorting). Develop clear guidance and evidence-based protocols for instituting contact precautions (CP), with measurement of adherence to glove and gown use for patients in CP.
- Focus on team-based strategies to ensure reliable cleaning of equipment and environment. Assess competencies for high-touch surface cleaning. Utilize technology to support communication regarding patient room assignments and discharges for timely terminal cleaning.
- Consider universal decolonization through chlorhexidine bathing and nasal decolonization for ICU patients. Match decolonization strategies to risk assessment and surveillance findings to target appropriate units and populations.
- Educate patients and families using teach-back regarding the risks of antimicrobial use, as well as infection prevention measures.

APPENDIX II: INTER-FACILITY INFECTION CONTROL TRANSFER

Associated Hospital/Organization: Centers for Disease Control and Prevention Inter-facility Infection Control Transfer Form

Purpose of Tool: The Centers for Disease Control and Prevention provide an example of an inter-facility infection control patient transfer form that can "assist in fostering communication during transitions of care" between facilities. This concept and draft was developed by the Utah Healthcare-associated Infection Work Group and shared with the CDC and state partners, courtesy of the Utah State Department of Health. Per the CDC, this tool can be modified and adapted by facilities and other quality improvement groups engaged in patient safety activities

Reference: www.cdc.gov/hai/pdfs/toolkits/infectioncontroltransferformexample1.pdf. Last accessed January 3, 2017.

Inter-facility Infection Control Transfer Form

This form must be filled out for transfer to accepting facility with information communicated prior to or with transfer

Please attach copies of latest culture reports with susceptibilities if available

Sending Healthcare Facility:

Patient/Resident Last Name	First Name	Date of Birth	Medical Record Number
		___/___/_____	

Name/Address of Sending Facility	Sending Unit	Sending Facility phone

Sending Facility Contacts	NAME	PHONE	E-mail
Case Manager/Admin/SW			
Infection Prevention			

Is the patient currently in isolation? □ **NO** □ **YES**
Type of Isolation (check all that apply) □ **Contact** □ **Droplet** □ **Airborne** □ **Other:** _____

Does patient currently have an infection, colonization OR a history of positive culture of a multidrug-resistant organism (MDRO) or other organism of epidemiological significance?	**Colonization or history** *Check if YES*	**Active infection on Treatment** *Check if YES*
Methicillin-resistant Staphylococcus aureus (MRSA)		
Vancomycin-resistant Enterococcus (VRE)		
Clostridium difficile		
Acinetobacter, multidrug-resistant*		
E coli, Klebsiella, Proteus etc. w/Extended Spectrum B-Lactamase (ESBL)*		
Carbapenemase resistant Enterobacteriaceae (CRE)*		
Other:		

Does the patient/resident currently have any of the following?

- ☐ Cough or requires suctioning
- ☐ Diarrhea
- ☐ Vomiting
- ☐ Incontinent of urine or stool
- ☐ Open wounds or wounds requiring dressing change
- ☐ Drainage (source)_____
- ☐ Central line/PICC (Approx. date inserted ___/___/_____)
- ☐ Hemodialysis catheter
- ☐ Urinary catheter (Approx. date inserted ___/___/_____)
- ☐ Suprapubic catheter
- ☐ Percutaneous gastrostomy tube
- ☐ Tracheostomy

Is the patient/resident currently on antibiotics? □ **NO** □ **YES:**

Antibiotic and dose	Treatment for:	Start date	Anticipated stop date

Vaccine	Date administered (If known)	Lot and Brand (If known)	Year administered (If exact date not known)	Does Patient self report receiving vaccine?	
Influenza (seasonal)				o yes	o no
Pneumococcal				o yes	o no
Other:_____				o yes	o no

Printed Name of Person completing form	Signature	Date	If information communicated prior to transfer: Name and phone of individual at receiving facility

APPENDIX III: HAND HYGIENE AUDIT TOOL (ADAPTED WITH PERMISSION FROM STANFORD HEALTH CARE, PALO ALTO, CALIFORNIA)

Associated Hospital/Organization: Stanford Health Care

Purpose of Tool: This tool can be used to track both hand hygiene compliance and the availability of appropriate resources that may affect compliance.

Reference: Permission granted by Sasha Madison, MPH, CIC, Director Infection Prevention and Control Department, Stanford Health Care on 2/7/17.

Stanford HEALTH CARE

Hand Hygiene Audit Form

The purpose of this form is to monitor compliance with specific hand hygiene practices as listed in the chart below.

Instructions:

- Do not share with anyone that you are conducting the audit
- Observe all staff-nurses, physicians, RT's, housekeeping staff, etc. (see other side of form for Staff Codes)
- Observe for 30 minutes. This may be broken up in small increments of time. *OR,*
- Observe at least 15 staff members

Unit/Department _____ **Date** _____ **Time** _____

Indicate below what activity was observed and check the one box that applies to that activity

PERSON ENTERED THE ROOM FOR DIRECT CONTACT WITH THE PATIENT OR ENVIRONMENT	HAND HYGIENE SUPPLIES (SOAP, HAND SANITIZER, TOWELS) ARE ADEQUATE		DID YOU SEE HIM/HER USE SOAP OR ALCOHOL GEL WHEN ENTERING THE ROOM?		PERSON EXITED THE ROOM AFTER DIRECT CONTACT WITH THE PATIENT OR ENVIRONMENT	DID YOU SEE HIM/HER USE SOAP OR ALCOHOL GEL WHEN EXITING THE ROOM?		PERSON EXITED THE ROOM WITH GLOVES ON AFTER DIRECT CONTACT WITH THE PATIENT OR ENVIRONMENT	DID YOU SEE HIM/HER USE SOAP OR ALCOHOL GEL AFTER REMOVING GLOVES?	
Enter Staff Code	**Yes**	**No**	**Yes**	**No**	**Enter Staff Code**	**Yes**	**No**	**Enter Staff Code**	**Yes**	**No**
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										
14.										
15.										
Total # of Staff Observed	Total		Total	Total	Total # of Staff Observed	Total	Total	Total # of Staff Observed	Total	Total

APPENDIX III: HAND HYGIENE AUDIT TOOL (ADAPTED WITH PERMISSION FROM STANFORD HEALTH CARE, PALO ALTO, CALIFORNIA) *(continued)*

Associated Hospital/Organization: Stanford Health Care

Purpose of Tool: This tool can be used to track both hand hygiene compliance and the availability of appropriate resources that may affect compliance.

Reference: Permission granted by Sasha Madison, MPH, CIC, Director Infection Prevention and Control Department, Stanford Health Care on 2/7/17.

Staff Codes:

RN	Registered Nurse
LVN	Licensed Vocational Nurse
NA	Nurse Aide
MDA	Attending Physicians
MDH	Intern, Resident, Fellow
MS	Medical Student
CH	Chaplaincy Service staff
Diet	Dietician, Dietary Worker
GS	Guest Services staff, Volunteers
HSK	Housekeeping
LT	Lab Tech, Phlebotomist
Pharm	Pharmacy Technician, Pharmacist
PTOT	Physical Therapist, Occupational Therapist, Speech Therapist
RAD	Radiology Techs-including Nuclear Med, CT scan
RT	Respiratory Therapist
SS	All Social Services Staff, Case Managers
TR	Transporter
Other	Specify a department
Unknown	

Adapted with permission from Stanford Health Care, Palo Alto, CA

APPENDIX IV: PATIENT AND FAMILY EDUCATIONAL RESOURCES

Educate patients and families about the risks of antimicrobial resistance and specific multi-drug resistant organisms using teach-back methods. Patient- and family-focused educational materials are available through the Centers for Disease Control and Prevention and state and local health departments. Several examples are provided here:

- FAQs About "MRSA" (SHEA/CDC): Retrieved at: https://www.cdc.gov/mrsa/pdf/shea-mrsa_tagged.pdf Last accessed December 30, 2016.
- About Antimicrobial Resistance (CDC): Retrieved at: https://www.cdc.gov/drugresistance/about.html. Last accessed December 30, 2016.
- Antibiotic/Antimicrobial Resistance: Protecting Yourself and Your Family (CDC): Retrieved at: www.cdc.gov/drugresistance/protecting_yourself_family.html. Last accessed December 30, 2016.
- MRSA web materials for home, schools, workplaces and law enforcement (Tacoma-Pierce County Health Department): Retrieved at: www.tpchd.org/health-wellness-1/mrsa-methicillin-resistant-staphylococcus-aureus/. Last accessed December 30, 2016.
- Antibiotic Fact Sheet for Hospitalized Patients (CDC): Retrieved at: https://www.cdc.gov/getsmart/healthcare/pdfs/16_265926_antibioticfactsheet_v7_508-final.pdf Last accessed December 30, 2016.

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