Take Action to Prevent and Manage Multidrug-resistant Organisms and C. difficile in the Nursing Home

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- Dr. Stone has no conflicts of interest to disclose.
Presentation Objectives

- Describe the problem of multidrug-resistant organisms (MDROs) and *C. difficile*
- Review the prevention strategies for managing MDROs and *C. difficile*
- Outline the actions that caregivers should take to minimize the spread of MDROs and *C. difficile*
- Describe national programs developed to support nursing home infection prevention programs in tracking and preventing MDROs and *C. difficile*. 
Bacteria have different characteristics that allow us to identify them in the lab:

- Shape, size, growth patterns, etc.

We often use these characteristics to develop antibiotics.
Common bacteria in healthcare

Gram positive

- Most are cocci, “round bacteria”
  - Examples are *Streptococci*, *Staphylococci*, *Enterococci*

- *Clostridium difficile* (C. diff) is a Gram positive rod

Gram negative

- Most are baccili, “rod-shaped bacteria”
  - Examples are: *E. coli*, *Klebsiella*, *Enterobacter*, *Proteus*
  - *Pseudomonas*
Antibiotics 101

- Antibiotics are drugs that treat and kill bacteria
- They are grouped into classes based on their structure and activity
  - Narrow-spectrum target a few specific bacteria
  - Broad-spectrum can kill a wide variety of bacteria
- Antibiotic resistance = when the bacteria are no longer fully killed by the antibiotic
  - Bacteria with resistance can cause patients to have more severe infections which are harder and more costly to treat
  - Infection prevention programs track certain “bug-drug” combinations for resistance
Understanding multidrug-resistance

- Multidrug-resistant organisms (MDROs) are a group of bacteria with important resistance patterns.
- Sometimes just one key drug will define a MDRO.
  - Methicillin-resistance in *Staphylococcus aureus*.
  - Vancomycin-resistance in *Enterococcus sp.*.
- Sometimes bacteria acquire resistance to several classes of antibiotics, often seen in gram negative rods.
  - Carbapenem-resistance in *E. coli/Klebsiella sp.* is associated with resistance to many other antibiotics.
  - *Pseudomonas* can be resistant to fluoroquinolones, penicillins, cephalosporins, and carbapenems.
# ABC’s of MDROs

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Abbrev.</th>
<th>Antibiotic Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>MRSA</td>
<td>Methicillin-resistant</td>
</tr>
<tr>
<td><em>Enterococcus</em></td>
<td>VRE</td>
<td>Vancomycin-resistant</td>
</tr>
<tr>
<td><em>faecalis/faecium</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Enterobacteriaceae</em></td>
<td>CRE</td>
<td>Carbapenem-resistant</td>
</tr>
<tr>
<td>(E coli/Klebsiella, etc)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pseudomonas/Acinetobacter</em></td>
<td>MDR</td>
<td>Many drug classes</td>
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</tbody>
</table>
NHs are reservoirs of MDROs

- NH residents colonized with MDR-Gram Negative Rods (~20% prevalence)
- NH residents colonized with MRSA (40-50% prevalence)
- NH residents colonized with VRE (5-10% prevalence)
**Clostridium difficile**

- Gram positive bacillus under microscope
  - Cannot multiple when oxygen is in the environment (anaerobic)
  - Forms spores to survive in the environment
- Infections are more severe in older adults
  - Common cause of acute diarrhea in nursing homes
  - Higher rates of hospitalizations and relapses
- Spores contaminate the environment of people with active diarrheal infections
  - Spread to other people on hands of caregivers or shared equipment

Healthy colon → C. difficile colitis
More than half of healthcare associated CDI cases occur in long-term care facilities

A significant number of individuals admitted to LTC are colonized with *C. difficile*

- Up to 20% acquire it while in nursing homes

Fluoroquinolone antibiotics have been associated with CDI with a more severe strain of *C. difficile*

- Longer antibiotic exposure carries higher risk
Healthcare drivers of *C. diff* and MDROs

**DEVELOPMENT**
- Antibiotic pressure
  - Risk for both acquisition and infection
- Medical devices and wounds
  - Biofilm formation

**SPREAD**
- Colonization pressure
- Patient to patient transmission via hands of healthcare personnel
- Contamination of shared environment / equipment
Antibiotic use drives resistance

Figure 1  Levofloxacin use and outpatient *Escherichia coli* resistance to levofloxacin versus time.

*Johnson et al. Am J. Med. 2008; 121: 876-84*
Biofilm formation on device surfaces

- Biofilm: An collection of bacteria within a sticky film that forms a community on the surface of a device
- Antibiotics can’t penetrate the biofilm
  - Bacteria in the biofilm are sheltered from the antibiotic and develop resistance

http://www.ul.ie/elements/Issue7/Biofilm%20Information.htm
Colonization pressure on risk of acquisition

- Colonization pressure: High burden of other MDRO carriers on a unit will increase the risk of MDRO acquisition for others
- Studies have demonstrated the impact of colonization pressure on acquisition of C. difficile
- Both asymptomatic carriers and clinically infected individuals contribute to the reservoir for transmission on a unit

Dubberke ER et al. Arch Intern Med. 2007 May 28;167(10):1092-7
Colonization pressure: CDI example

Unit A
Fewer patients with active CDI
=lower risk of acquiring CDI

Unit B
More patients with active CDI
=higher risk of acquiring CDI

CDI pressure = 1 × days in unit

CDI pressure = 5 × days in unit

Dubberke ER et al. Arch InternMed.2007;167(10):1092-7
CLEAN HANDS SAVE LIVES
Protect patients, protect yourself

Alcohol-rub or wash before and after EVERY contact.
Bacterial contamination of HCW hands prior to hand hygiene in a LTCF

- Gram negative bacteria were the most common bugs cultured from hands of staff
- Most Gram neg. bacteria live in the GI tract or colonize the urine

The invisible reservoir of MDROs

X marks the locations where VRE was isolated in this room


Slide courtesy of Teresa Fox, GA Div PH
Duration of environmental contamination by MDROs

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Survival</th>
<th>Data Strength</th>
<th>Transmission Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>C. difficile</em></td>
<td>Months</td>
<td>3+</td>
<td>Healthcare facilities</td>
</tr>
<tr>
<td>MRSA</td>
<td>Days-weeks</td>
<td>3+</td>
<td>Burn units</td>
</tr>
<tr>
<td>VRE</td>
<td>Days-weeks</td>
<td>3+</td>
<td>Healthcare – higher risk areas</td>
</tr>
<tr>
<td><em>Acinetobacter</em></td>
<td>33 days</td>
<td>2/3+</td>
<td>Wet or dry environments</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>7 hours</td>
<td>1+</td>
<td>Wet environments</td>
</tr>
</tbody>
</table>

Prevention strategies for MDRO/ C. diff

- Consistent performance of hand hygiene (HH)
- Using gowns and gloves appropriately
- Recognizing residents with risk factors for colonization
- Cleaning and disinfection of shared equipment, rooms/surfaces
- Assessment of antibiotic use in the facility
- Awareness of use and management of medical devices
Hand hygiene (HH) opportunities

- Before and after physical contact with a resident
- Before donning gloves and after removing gloves
- After handling soiled or contaminated items and equipment, including linens
- Before performing an invasive procedure
- Before handling sterile or clean supplies
- When hands are visibly dirty or soiled with blood and/or bodily fluids*
- After care of a resident with known or suspected infectious diarrhea*
- Before and after eating or handling food*
- After personal use of bathroom*

*Situations where soap and water preferred over alcohol-based hand rub
Knowledge and perceptions of HH Guidelines

- Data from survey responses from 1,143 nursing home staff representing 17 facilities in 6 states
  - 1108 respondents classified: Nurses (34%), CNAs (33%), other HCWs (33%)
- 30% of respondents stated “would not change personal HH practices based on the 2002 CDC Hand Hygiene Guidelines”
  - 20% reported the “Guidelines were impractical”
- Only 29.6% scored >85% correct on a 19 question knowledge survey

Ashraf MS et al. ICHE 2010; 31(7):758-762
Reported barriers to HH compliance

- Lack of access to appropriate HH supplies
  - 16.2% lack of available sink; 27.5% lack of alcohol-based hand rub

- No HH because of glove use
  - 23% nurses, 17% CNAs, 26% other HCWs

- Forgot HH because of workload
  - 35% of nurses, 22% CNAs, 44% other HCWs

- Lack of access to HH feedback or periodic education
  - 55% never to rarely received personal feedback on HH practices

Ashraf MS et al. ICHE 2010; 31(7):758-762
Hand Hygiene and C. difficile

- Hand hygiene is the primary means of preventing transmission of infections...
- However, confusion exists about when soap and water are preferred over alcohol hand rubs

VS.

[Image of soap and water] [Image of alcohol hand sanitizer]
Hand hygiene issues with *C. difficile*

- Alcohol not effective against *C. difficile* spores but, more effective against all other MDROs
- Soap and water recommended after caring for CDI patients (during outbreaks at a minimum)
- Encourage and provide feedback on HH practices
- Considerations:
  - Most effective intervention is **glove use** because spores may be hard to remove even with soap and water
  - **Avoid discouraging use of alcohol-based products in general**
  - Ensure adequate access to soap and water/alcohol-based hand gels

Ellingson K, McDonald C. Infect Control Hosp Epidemiol 2010;31:571-3
Contact Precautions

- Involves use of gown and gloves for direct resident care
  - Don equipment prior to room entry
  - Remove prior to room exit
- Use of dedicated non-essential items may help decrease transmission due to contamination
  - Blood pressure cuffs; Stethoscopes; IV poles and pumps
- Private rooms or cohorting residents if possible
  - Separate toileting equipment for roommates who can’t be cohorted
- Observe adherence to practices - particularly high-risk situations – and provide feedback
LTCF staff perceptions of contact isolation for MRSA/VRE

- Responses from 356/440 (81%) nursing staff members in 7 community NHs
  - <40% would change their practices if aware of an MDRO
  - 97% expressed isolation could negatively impact a resident’s psychosocial well-being
  - 5% expressed that isolation could lead to neglect of residents

Furuno, JP et al. AJIC. 2011; 1-5 epub
Challenges with Contact Precautions in LTC settings

- Lack of private rooms / limited ability to move residents
  - Moving rooms is disrupting to residents and staff
  - Ability to identify carriers to cohort is limited (no active surveillance in most facilities)
- Determining duration of contact precautions
  - Unable to restrict resident mobility and participation in social events/therapy for prolonged periods
  - Unlikely to document clearance of carriage
- Large population of residents with unrecognized C. difficile carriage
  - Underestimating the sources of potential transmission
Strategic placement of residents based on risk factors

- Focus on resident risk factors for MDRO carriage
  - High risk: Antibiotic use; presence of medical devices or wounds; bowel/bladder incontinence; lack of mobility

- New roommate assignments based on resident characteristics and history of MDRO carriage
  - Try to avoid placing two high risk residents together

- Don’t change stable room assignments just because of a culture result unless it poses new risk
  - Roommates who’ve been together for a long time have already had opportunity to share organisms in the past (even if you only learned about it recently)
Tiered strategy: Consider gown/glove use during direct care

- High risk exposures for MDRO transmission if known carrier (also high risk for acquisition if non-carrier)
  - Presence of wounds (fresh/new, multiple, increased stage/size, active drainage)
  - Indwelling devices (IV lines, urinary catheters, tracheostomy, PEG tubes)
  - Incontinence
  - Current antibiotic use
Tiered strategy: Consider gown/glove use and restricted movements

- Active symptoms of a contagious infection
  - Nausea/vomiting
  - New or worsening diarrhea
  - New or worsening respiratory symptoms
  - New, undiagnosed fever
- Precautions and restrictions time-limited
  - Only until diagnosis made (e.g. infection excluded) and/or symptoms resolve
Discontinuing Contact Precautions

- There is no single ‘best’ strategy for discontinuation of contact precautions for MDRO carriers (in any setting)
- Generally, resume standard precautions once high risk exposures or active symptoms have discontinued
- Some studies advocate extending gown/glove use for care of residents with recent *C. difficile* infection
  - Individuals can shed spores for several days after diarrhea has resolved
- **Communication to caregivers about policies and clear documentation of rationale is key**
Cleaning and disinfection

- Contaminated surfaces and equipment can contribute to spread of MDROs and C. diff
  - Organisms have been cultured from bed rails, bedside tables, blood pressure cuffs, toilets, call buttons, door knobs, IV poles

- Room contamination rates for infected/colonized individuals vary by pathogen
  - Up to 30% by MRSA; up to 60% by VRE; up to 75% by C. diff; up to 50% by gram-negatives like Acinetobacter

- Individuals have acquired MDROs from being admitted into rooms occupied by known carriers

Boyce J. J. Hosp Infect. 2007;65(S2): 50–54
Weber et al. Curr Opin Infect Dis 2013, 26:338–344
Frequency of *C. difficile* Culture Positive Sites in Study Areas

Environmental cleaning

- Ensure that environmental cleaning is adequate and high-touch surfaces are not being overlooked.

- One study using a fluorescent environmental marker to assess cleaning showed:
  - Only 47% of high-touch surfaces were adequately cleaned.
  - Sustained improvement in cleaning of all objects, especially in previously poorly cleaned objects, following educational interventions with the environmental services staff.

- The use of environmental markers to audit practices is a promising method to improve cleaning.

- Assess efficacy of cleaning products being used – C. *diff* spores need sporicidal products for removal.

Equipment cleaning

- Ensure that all shared equipment is being cleaned and disinfected between resident use
  - Some equipment, like glucose meters must be designed for multi-person use, otherwise frequent cleaning may affect the functioning of the device
- Make sure nursing staff and environmental services agree to which pieces of equipment they are assigned to clean
- Maintain log books of cleaning/disinfection for large equipment like wheel-chairs, transport stretchers, etc.
- Dedicate single use, disposable equipment for residents with MDRO/C. diff when possible
  - Make sure these items aren’t re-used by other residents
Careful Device Utilization

- Know the patients/residents with indwelling medical devices
  - May require focused infection surveillance
- Continually assess the ongoing need for devices
  - Develop a bladder protocol for urinary catheter removal
  - Make device use part of daily assessments
- Ensure staff are comfortable and trained on handling/maintenance of medical devices
  - Document device insertion/maintenance practices
  - Standardize assessment of device functionality
Antibiotic Stewardship

- Careful antibiotic use is a critical component in the control of MDROs and *C. difficile*

- Know the frequency/indications for antibiotic use by medical providers in your facility
  - Apply criteria to assess utilization in a standard way

- Develop standard protocols for assessing residents who are suspected to have new infections
  - Standardize information provided during communication between nursing staff and clinicians
  - Ensure documentation of signs/symptoms is complete
  - Reassess need for antibiotics once further data is available
The Department of Health and Human Services developed a national plan to address infections in LTCFs.

Priority goals include reporting and prevention of *C. difficile* infections in nursing homes and skilled facilities.

National infection reporting system

- CDC managed web-based system designed for healthcare facility reporting of infections
- Uses standardized infection definitions to identify events
- Data used by facilities for surveillance and internal quality improvement
- Data used by CDC to establish national benchmarks and track overall improvement in efforts to prevent healthcare-associated infections
NHSN Long-term care facility component

- NHSN reporting option specifically for LTCFs – Over 150 facilities have enrolled since its launch in Sept 2012

National Healthcare Safety Network (NHSN)

Tracking Infections in Long-term Care Facilities

Eliminating infections, many of which are preventable, is a significant way to improve care and decrease costs. CDC’s National Healthcare Safety Network provides long-term care facilities with a customized system to track infections in a streamlined and systematic way. When facilities track infections, they can identify problems and track progress toward stopping infections. On the national level, data entered into NHSN will gauge progress toward national healthcare-associated infection goals.

NHSN’s long-term care component is ideal for use by: nursing homes, skilled nursing facilities, chronic care facilities, and assisted living and residential care facilities

To report C. difficile, MRSA, and other drug-resistant infections, click here.
- Enrollment into NHSN
- Forms
- Protocols

To report urinary tract infections, click here.
- Enrollment into NHSN
- Forms
- Protocols

1 to 3 million serious infections occur every year in long-term care.
As many as 380,000 patients die of the infections they contract.
Infections are among the most frequent reasons LTC patients get admitted to hospitals

www.cdc.gov/nhsn/ltc
Tracking MDRO/C. diff using NHSN

- Laboratory Identified (Lab-ID) events
  - Laboratory cultures used as a proxy for surveillance
  - Definitions match the Lab-ID event criteria being applied across healthcare settings
- This method is based solely on laboratory data and limited resident admissions/transfer data
  - This includes results of testing performed on residents while at the facility
  - Clinical evaluation of resident is not required, and therefore this surveillance option is less labor intensive
CDC LTCF infection prevention website

www.cdc.gov/longtermcare
## Advancing Excellence Infections Goal

### Infections

<table>
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<tr>
<th>Explore Goal</th>
<th>Identify Baseline</th>
<th>Examine Process</th>
<th>Improve</th>
<th>Leadership</th>
<th>Monitor &amp; Sustain</th>
<th>Celebrate</th>
</tr>
</thead>
</table>

Deciding what you want to change is the first step of the quality improvement cycle. These goal descriptions provide general information about the goal and its benefits to share with your team.

Nursing home residents are at increased risk of infections for many reasons. As more people enter nursing homes following hospital stays, nursing homes are providing more hands-on, complex medical care to residents, such as wound care and maintenance of indwelling devices, which can lead to increased exposure to bacteria and infection. The shared living environment of a nursing home can allow the spread of easily transmissible viral infections which cause respiratory or...

**Let the Quality Improvement Cycle be your Guide...**

- **Click through the tabs** to view resources for each goal. The tabs represent each step of the quality improvement cycle.

**Getting Started** provides an overview of the complete quality improvement cycle.

[www.nhqualitycampaign.org](http://www.nhqualitycampaign.org)
Infection goal prevention strategies

- Goal is focused on *C. difficile* prevention
- Four prevention strategies identified for process improvement
  - Early diagnosis/rapid containment of CDI
  - Hand hygiene
  - Environmental cleaning/disinfection
  - Antibiotic stewardship

- *Successful implementation of many of these strategies will reduce spread of other MDROs in the nursing home in addition to C.diff*
Resources to support the AE Infection goal

- Fact sheets about *C. difficile* infection prevention
  - Consumers; nursing home staff; leadership
- Assessment checklists for each of the 4 prevention strategies with questions assessing
  - Knowledge and competency
  - Infection prevention policies and infrastructure
  - Monitoring practices
- Links to websites with tools and resources to help address gaps identified by the assessment checklists
  - Resources identified by working group members through online searches
  - New resources could be developed with provider input
Example of the Hand Hygiene Assessment Checklist

Assessment of Current CDI Prevention Activities:

HAND HYGIENE

Advancing Excellence in America’s Nursing Homes is a national campaign that began in November 2005. Our goal is to improve the quality of care and life for the 15 million people served by nursing homes in the United States. Nursing homes and their staff, along with residents and their families and consumers can play a role in this effort by working on the campaign goals that are designed to improve quality. We do this by providing tools and resources to help nursing homes achieve their quality improvement goals. To learn more about the campaign, visit


Background/Rationale:

- Hand hygiene is the most important way to prevent the spread of bacteria which cause infections.
- Improving healthcare personnel adherence to hand hygiene practices can reduce both infections and the spread of antibiotic-resistant bacteria.
- Although most bacteria and viruses are effectively killed by alcohol-based hand rubs or washing with soap and water, C. difficile spores are not killed by alcohol hand rubs or removed by hand washing.
- Use of gloves in addition to hand hygiene is very important to prevent hand contamination from C. difficile. But, gloves are not a substitute for performing hand hygiene.
- Hand hygiene adherence among healthcare personnel remains disappointingly low; many studies report less than half of health care personnel perform appropriate hand hygiene.
- Proper hand hygiene must be understood by all people working in a healthcare facility.
- Effective hand hygiene programs must go beyond training to identify and address barriers to hand hygiene, including availability of and satisfaction with hand hygiene products.
- Providing feedback about hand hygiene performance can raise hand hygiene awareness and promote better adherence among healthcare personnel.

SECTION 1. KNOWLEDGE AND COMPETENCY

| Q1 | Does your nursing home have an annual hand hygiene training program for all healthcare personnel? | YES | NO | N/A |
| Q2 | Can healthcare personnel describe situations when hand washing with soap and water is preferred over use of alcohol-based hand products? | YES | NO | N/A |
| Q3 | Does your nursing home assess healthcare personnel hand hygiene technique (i.e., whether they do hand hygiene properly)? | YES | NO | N/A |
| Q4 | Does your nursing home assess healthcare personnel knowledge of indications for hand hygiene during resident care activities? | YES | NO | N/A |
| Q5 | Do residents and family members receive education about the importance of hand hygiene in preventing the spread of infections? | YES | NO | N/A |

Take Home Points

- MDROs and *C. difficile* are a growing problem in long-term care settings
  - The population entering nursing homes have many risk factors for infection and colonization with these organisms
- Understanding how MDROs emerge and spread can focus infection prevention at the bedside
  - Select 1-2 infection prevention improvement goals for your facility every year
  - Use existing resources to support your efforts
- Education is only the first step in improving our infection prevention practices
  - We must provide monitoring and feedback to staff at all levels to maintain their awareness and engagement