Oregon *Clostridium Difficile* Initiative
from spores to sporicidals

Healthcare-Associated Infections Program
Acute and Communicable Disease Prevention
Oregon Public Health Division
[Ohd.acdp@state.or.us](mailto:Ohd.acdp@state.or.us)
971-673-1111, #3
Overview

• Biology and human disease
• Why is it an healthcare-associated infection (HAI)?
• What is the burden of CDI?
• What we can do? How?
  – Prepare infrastructure, capacity, and processes
  – Early Recognition and Detection
  – Infection control: contact precautions and hand hygiene
  – Infection control: environmental cleaning
  – Antibiotic stewardship
  – Treatment
  – Surveillance
  – Interfacility communication
• What are you doing now?
BIOLOGY & HUMAN DISEASE
Let’s begin at the beginning

- *Clostridium* spp. are ancient spore-forming anaerobes
- Soil, water, food, bodies, waste
- Long-time human toxin-producing pathogens:
  - *Clostridium tetani*…..tetanus
  - *Clostridium botulinum*…..botulism
  - *Clostridium septicum*…..fatal sepsis
  - *Clostridium difficile*…..colitis
**Clostridium difficile** infection

- Fecal-oral transmission of hardy spores
  - Environment
  - Hands of healthcare workers caring for CDI-positive patients
  - CDI-positive persons
  - Asymptomatic carriers

- Spores germinate (vegetative form)

- Make **toxins A & B**

- Incubation: median <7 days

---

**APIC. Guide to Preventing *Clostridium difficile* Infections 2012.**
**Clostridium difficile** disease

- No disease: asymptomatic carrier, antibodies
- Diarrhea with recovery: colitis, develop antibodies
- Diarrhea with recurrence: colitis, no antibodies
- **Diarrhea with severe disease**: pseudomembranous colitis, toxic megacolon, sepsis, death

Phases of pathogenesis of *C. difficile* colitis. APIC, 2013: Figure 10.1
Epidemic strain of *C. difficile*

- B1/NAP1/027, toxinotype III
- Epidemic since 2000; out of eastern Canada
- More resistant to fluoroquinolones
  - Higher MICs
- More virulent
  - Increased toxin A and B production
  - Polymorphisms in binding domain of toxin B
  - Increased sprorulation

- Some testing algorithms include this strain
- **Oregon: 16% (11 of 68) strains** with PFGE performed

---

EIP Oregon data, 2010–2013, partial data.
WHY IS CDI AN HAI?
Why does CDI occur?

Antibiotic use
Underlying health issues*
  Female
  65+ years
Environmental spores
Spores that make Toxin A or B

*Immunocompromised, renal failure, diabetes, chronic pulmonary disease, tube feeds
Why does CDI occur?

Antibiotic use
Underlying health issues*
  Female
  65+ years
Environmental spores
Spores that make Toxin A or B

*Immunocompromised, renal failure, diabetes, chronic pulmonary disease, tube feeds
Why is CDI considered an HAI?

Antibiotic use
Underlying health issues*
Female
65+ years
Environmental spores
Spores that make Toxin A or B

*Immunocompromised, renal failure, diabetes, chronic pulmonary disease, tube feeds
Why does CDI amplify?

Concentration of spores in patient’s environment
Why extend gloves and gowns after diarrhea has ended?

% pts with *C. diff* spores on skin:

- 100% after resolution
- 75% 2 days
- 50% 4 days
- 25% 6 days

Cleaning Tactics

• Bleach kills spores, whereas other standard disinfectants do not
• Limited data suggest bleach (1:10 dilution) reduces *C. difficile* transmission
  – Prepare fresh daily
  – If commercial, EPA-label as “sporicidal” (List K)

LIST K: EPA’s Registered Antimicrobial Products Effective against *Clostridium difficile* Spores

<table>
<thead>
<tr>
<th>EPA Reg. No.</th>
<th>Primary Registered Product Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>777-83</td>
<td>LYSOL BRAND DISINFECTANT BLEACH PLUS</td>
</tr>
<tr>
<td>1043-124</td>
<td>HASTE-SSD-DISINFECTION BLEACH</td>
</tr>
<tr>
<td>1043-125</td>
<td>HASTE-SSD-DISINFECTION BLEACH</td>
</tr>
<tr>
<td>1672-65</td>
<td>AUSTIN A-1 ULTRA DISINFECTING BLEACH</td>
</tr>
<tr>
<td>1672-67</td>
<td>AUSTIN’S A-1 CONCENTRATED BLEACH 8.25%</td>
</tr>
</tbody>
</table>

WHAT IS THE BURDEN OF CDI?
Quick Primer on CDI Surveillance

- Surveillance categorizes CDI by where presumably acquired
  - HO: Healthcare-Onset (hospital or LTCF)
  - CO-HCFA: Community-Onset, Healthcare Facility Associated
  - CA: Community-Associated

Healthcare Facility Exposure

<table>
<thead>
<tr>
<th>Admission</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 weeks</td>
<td>4–12 weeks</td>
</tr>
</tbody>
</table>

Day 1 | Day 4 | HO | CO-HCFA | Indeterminate | CA-CDI | ?  

Time

? = Depends on if patient was in a HCF in 12 weeks prior
LTCF-onset CDI closely related to Hospital rates over time

- NYC CDI Surveillance
- Reviewed 425 LTCF patients diagnosed with CDI

64% (272/425) of new (incident) LTCF residents with CDI had acute care exposure in prior 12 weeks
  - 88% received antibiotics
  - 28% had surgery

Yikes!
Onset of CDI after Hospital Discharge

Day 7

by Day 30 = 51% of all cases

100% Total

Rebecca Smith, NYC EIP CDI Surveillance Update, CDC, 2011
Burden of CDI in United States, 2011

- 34 counties across U.S.; 1 rural Oregon county (pop 66,299)
- 15,461 CDI cases onset 2011
- 66% Healthcare-associated; 24% HO

New CDI Infections, by state

Community-Associated (no healthcare contact in >12 weeks)

Healthcare-Associated (short- or long-term healthcare contact)

New CDI Infections per 100,000 Persons

25 50 75 100 125 150 175

\[\text{New CDI Infection per 100,000 Persons}\]

\[\text{= Oregon site}\]
Estimated Burden of CDI in Oregon

Community-Associated
- U.S.: 51.9 cases per 100,000 persons (range: 26.7–123.7)
- Oregon: 2,060 persons*

Healthcare-Associated
- U.S.: 95.3 cases per 100,000 persons (range: 47.3–159.1)
- Oregon: 3,783 persons*

*U.S. Census, 2014 Oregon population estimate
WHAT CAN WE DO ABOUT CDI?
Five Moments of CDI Prevention

• Surveillance
• Best practice infection control implementation and competency
• Environmental Hygiene
• Antibiotic Stewardship
• Interfacility Transfer
What now?

• What we can do? How?
  – Prepare infrastructure, capacity, and processes
  – Surveillance
  – Core vs. Supplemental Prevention Strategies
  – Early Recognition and Detection
  – Infection control: contact precautions and hand hygiene
  – Infection control: environmental cleaning
  – Antibiotic stewardship
  – Treatment

• Interfacility Communication
Prepare the Groundwork

- **Senior leadership**: Vision, resources, policy, education
- **Local leadership**: Staffing, local knowledge, training
- **Self-leadership**: Responsibility, teamwork
- **Patient expectations**: Education (e.g., HH, antibiotic stewardship)
Surveillance...know the burden

- C. difficile (+) test result
  - Prior (+) within last 8 weeks?
    - yes: CDI LabID Event And Incident (new) case
    - no: CDI LabID Event And Recurrent case
  - Prior (+) within last 2 weeks?
    - yes: Location of onset?
      - yes: Report as LabID Event to NHSN with location of onset
      - no: CDI LabID Event And Recurrent case
    - no: CDI LabID Event And Recurrent case
  - Same location?
    - yes: Duplicate (+) test
    - no: Do NOT report as LabID Event

Location Onset Definitions (NHSN)
- Healthcare Facility-Onset (HO): CDI identified >3 days after admission to the facility (i.e., on or after day 4).
- Community-Onset (CO): CDI identified as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., before or on days 1, 2, or 3 of admission).
- Community-Onset Healthcare Facility-Associated (CO-HCFA): Community onset CDI identified from a patient who was discharged from the facility ≤4 weeks prior to current date of stool specimen collection.
What we count matters

• National Health Safety Network (NHSN)
  – National healthcare-associated infection surveillance system
  – Required for hospitals and LTACHs
  – Optional for LTCFs, but highly recommended
  – More information: http://www.cdc.gov/nhsn/
  – HAI Program can help your facility enroll! hai.comments@state.or.us

• Visualize trends
• Show improvement over time, after intervention
  – *C. difficile*
  – *Catheter-associated urinary tract infections*
  – *Hand hygiene and PPE use over time*
Implement and Verify Best Infection Control Practices

• Make it easy to do the right thing
  – Policy that matches best practices
  – Procedures that work with the work flow
  – Best “environment” for success
  – Competency checks after learning
• **Teach**
  – The difference between cleaning and disinfection
  – Staff about disinfecting high-touch areas
  – Staff how to correctly and safely prepare of bleach or EPA sporicidal solutions

• **Define** who cleans and disinfections what

• **Monitor** adherence with checklists or spot fluorescence checks

• **Troubleshoot** barriers with frontline staff
Early Recognition and Detection

A1. Early Recognition and Testing

1. Resident experiencing new onset of diarrhea
2. Has the resident had ≥3 unformed stools in a 24 hour period?
   - Yes: Contact provider, order lab test for CDI. Do not start empiric treatment before collecting sample
   - No: Do not test asymptomatic residents for CDI
3. Consider creating a standing order for nursing staff to initiate CDI testing

- Collect and submit fresh stool sample
- Collect specimen in clean, watertight container
- Refrigerate (2-8°C; 36-46°F) until testing can be done

Minnesota Department of Health, *Algorithms for CDI in LTCF, 2014*
### Testing

<table>
<thead>
<tr>
<th>Diagnostic test</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nucleic acid amplification</strong> (including PCR)</td>
<td>Excellent sensitivity</td>
<td>Expensive infrastructure for PCR</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>Excellent specificity</td>
<td></td>
<td>Sensitivity ≈97%</td>
</tr>
<tr>
<td></td>
<td>Rapid</td>
<td></td>
<td>Specificity ≈80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PPV ≈81%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NPV ≈97%</td>
</tr>
<tr>
<td><strong>Toxin enzyme immunoassay (EIA)</strong></td>
<td>Inexpensive</td>
<td>Very poor sensitivity</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>Rapid</td>
<td>Poor specificity</td>
<td>Sensitivity ≈47%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Specificity ≈87%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PPV ≈76%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NPV ≈65%</td>
</tr>
<tr>
<td><strong>Glutamate dehydrogenase</strong></td>
<td>Inexpensive</td>
<td></td>
<td>Indirect, followed by direct</td>
</tr>
<tr>
<td></td>
<td>Rapid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good sensitivity</td>
<td>Very poor specificity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good negative predictive value</td>
<td>Requires use of a second-line test</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for toxin detection</td>
<td></td>
</tr>
<tr>
<td><strong>Toxigenic (cytotoxic) culture</strong></td>
<td>Excellent sensitivity</td>
<td>Requires second-line test for toxin detection</td>
<td>Indirect, followed by direct</td>
</tr>
<tr>
<td></td>
<td>Good specificity</td>
<td>3- to 4-day turnaround time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires expertise in culturing C. difficile</td>
<td></td>
</tr>
<tr>
<td><strong>Cell cytotoxicity</strong></td>
<td>Good sensitivity</td>
<td>2-day turnaround time</td>
<td>Indirect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires tissue culture capacity</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from *Guide to Preventing CDIs*, APIC, 2013; Humphries et al. 2013.
While test results are pending:
- Discontinue all non-essential antibiotics
- Discontinue all anti-peristaltic medications
- Initiate fluid replacement if not contraindicated
- Initiate pre-emptive Contact Precautions (gowns, gloves) \( \text{A2} \)

Positive

Contact provider regarding treatment (see IDSA Guidelines) \( \text{T} \)

Place resident in appropriate room \( \text{A3} \)

Do not perform a "test of cure" or re-test if resident is responding to treatment

Test results

Negative

Consider other causes of diarrhea, perform testing for other enteric pathogens

If all testing is negative and symptoms continue

Clinically reassess resident. If PCR was initial testing method, do not re-test for *C. diff*. If initial *C. diff* testing method was relatively insensitive (e.g., EIA) and no other cause of diarrhea is found, consider performing additional diagnostic testing for *C. diff* as clinically indicated \( \text{T} \)
Contact Precautions

A2. Contact Precautions

Always use Standard Precautions with every resident, every time

Resident experiencing new onset of diarrhea

Implement Contact Precautions for suspected infectious diarrhea

Does the diarrhea have an infectious cause? [A1]

No, confirmed non-infectious

Discontinue Contact Precautions if appropriate and continue Standard Precautions

Yes

Continue Contact Precautions

- Include Contact Precaution and cleaning symbol on door signs for residents with CDI to alert staff of Contact Precautions and sporicidal disinfection product requirements
- Gloves are always worn when entering resident's room
- Gowns are worn for direct care and any resident or environmental contact
- Change gloves after caring for one resident and before caring for another
- Use single-use, dedicated, or disposable patient care equipment [A4]
  - If not available, clean and disinfect reusable equipment immediately after each use

- Hand hygiene before donning gloves
- Hand hygiene after removing gloves and gown, before leaving room

- Soap and water is preferred
- Alcohol-based hand rubs can be used except when:
  - Hands are visibly soiled
  - There has been contact with bodily fluids
  - In an outbreak situation
Hand hygiene and *C. difficile*

- Spores may be difficult to eradicate even with excellent hand hygiene
- Adherence to GLOVE USE & Contact Precautions is fundamental!

<table>
<thead>
<tr>
<th>Hand Hygiene Product</th>
<th>Log$_{10}$ Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water</td>
<td>0.76</td>
</tr>
<tr>
<td>4% CHD antimicrobial hand wash</td>
<td>0.77</td>
</tr>
<tr>
<td>Non-antimicrobial hand wash</td>
<td>0.78</td>
</tr>
<tr>
<td>Non-antimicrobial body wash</td>
<td>0.86</td>
</tr>
<tr>
<td>0.3% triclosan antimicrobial hand wash</td>
<td>0.99</td>
</tr>
<tr>
<td>Heavy duty hand cleaner used in manufacturing environments</td>
<td>1.21*</td>
</tr>
</tbody>
</table>

*statistically better

Edmonds et al. SHEA 2009; abstract 43
Consider universal glove use on units with high CDI rates

- Maximize all other CDI prevention strategies
- Spores may be difficult to remove from hands
- Asymptomatic carriers may have a role in transmission, although the magnitude of their contribution is uncertain
- Practical screening tests are not available
- Use in addition to Contact Precautions for CDI-positive patients
- Change between patients & perform hand hygiene
- Consider on units with longer lengths of stay
- Enhance environmental cleaning
- Avoid shared medical equipment
# The Great Debate

<table>
<thead>
<tr>
<th>Soap &amp; Water</th>
<th>Alcohol Hand Gel</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Detergent</td>
<td>• Disinfectant</td>
</tr>
<tr>
<td>– Better for biofilms, visible dirt</td>
<td>• Easy to use</td>
</tr>
<tr>
<td>• Needs access to sink</td>
<td>• Residual activity</td>
</tr>
<tr>
<td>• No residual activity</td>
<td>• Bacteria, viruses</td>
</tr>
<tr>
<td>• Bacteria, viruses</td>
<td>• NOT norovirus</td>
</tr>
<tr>
<td></td>
<td>• NOT sporocidal</td>
</tr>
</tbody>
</table>

*Discouraging alcohol use may undermine overall hand hygiene program with poor consequences for HAIs*
When to discontinue Contact Precautions?

- Consider continuing Contact Precautions until CDI treatment is complete, even if diarrhea has resolved.
- Continue gown and glove use beyond 72 hours for residents who are incontinent or need significant assistance with ADLs, due to the risk of prolonged shedding of *C. difficile* bacteria and spore survival.
Room Placement for Residents with CDI

Private room, toilet, and shower/bath are recommended and preferred whenever possible

1st Choice
- Private (single) room with private bathroom
  - Move resident to private (single) room
  - Resident should use only the private bathroom while on Contact Precautions

2nd Choice
- Private (single) room with shared bathroom
  - Move resident to private room
  - Resident with active CDI should use a separate toilet (e.g., dedicated commode) while on Contact Precautions

3rd Choice
- Shared room with shared bathroom
  - Cohort with resident with active C. diff diarrhea
  - No resident meets criteria
    - Move to room with another resident with active diarrhea
    - Move to room with a resident at lower risk for CDI A3.1

- Perform HH and change PPE between each resident
- Keep a minimum 3 foot barrier between living spaces
- Use privacy curtain or tape on floor to emphasize separation
- Resident(s) with active CDI should use a separate toilet (e.g., dedicated commode) while either resident in the room is on Contact Precautions
How to choose a “lower” risk resident:

Primary considerations

Not currently taking antibiotics (1st choice)
- or has not taken antibiotics in previous 4 weeks (2nd choice)
- or has not taken antibiotics in previous 12 weeks (3rd choice)

No history of prior CDI (1st choice)
- or has no CDI in previous 4 weeks (2nd choice)
- or has no CDI in previous 12 weeks (3rd choice)

Secondary considerations

- Not currently on proton pump inhibitors (PPIs)
- No GI/bowel condition comorbidities (diverticular disease, inflammatory bowel disease, Crohn's, peptic ulcer disease)
- No PEG/PEJ tube (no tube feeds)
- Not severely immunocompromised (cancer, chemotherapy, or solid organ transplant)
- Not bedbound/heavily dependent on healthcare workers for ADLs
Housekeeping considerations

- Use commode liners, whenever possible
  - Absorbent liners decrease spillage & splash!
- Immediately clean and disinfect commode/toilet and arm rests/grab bars after each use.
- Use the shower, avoid baths
  - Immediately clean and disinfect shower area after every use
  - Whenever possible, have residents with CDI shower last
Environmental Cleaning & Disinfection

A4. Environmental Cleaning and Disinfection

Resident(s) with CDI

Select proper cleaning and disinfection products. Always follow manufacturer's instructions regarding proper storage, shelf life, contact time, dilution, application, and surface appropriateness

Clean first: Use a hospital-grade, EPA-registered cleaner to mechanically remove visible debris

Disinfect second: Must use a hospital-grade product with a sporicidal claim or a 10% bleach solution

Every Shift

- High-Touch Areas:
  - Door handles
  - Bed rails
  - Chairs
  - Call buttons
  - Toilet seats
  - Grab bars
  - Light switches
  - Telephones
  - TV remotes
  - Sink/faucet
  - Toilet flush handle

- Horizontal Surfaces:
  - Bedside tables
  - Tray tables
  - Counters
  - Floors

- Dedicated Equipment:
  - Thermometers
  - Stethoscopes
  - Blood pressure cuffs
  - Oximeters
  - Glucometers

Terminal

Target all areas of the room, including all daily areas, plus:
- Bed frames
- Curtains
- Walls
- Mattresses
- Pillows
- Other furniture
Bathroom cleaning

- Use commode liners whenever possible; if not using, empty commode in resident's toilet (never in the sink)
- Immediately clean and disinfect commode/toilet (including seat, flush handle, arm rests/grab handles) after each use and/or emptying
- Use a separate cloth for cleaning only the commode/toilet
- Always clean bathroom last, and clean from least contaminated (e.g., doorknobs, light switches, handrails) to most contaminated (e.g., sink handles, seat, flush handle)

- Always clean from clean to dirty and from high to low
- Microfiber cloths are preferred over cotton cloths
- Cloths should not be pre-soaked or re-dipped in an open bucket system
- Discard facility items that cannot be disinfected (bag personal items)
- Clean rooms of residents with active CDI last
- Change cleaning solution, mop, bucket, and cloths after cleaning each room
Can my resident with a history of CDI go to social activities?

- Is resident continent or can diarrhea be contained with incontinence products?
  - Yes
    - Resident has mental and physical ability to follow instructions and perform appropriate HH (or can be assisted by staff)?
      - Yes
        - Consider letting resident enter common areas and participate in social activities
          - Ensure resident has clean clothing, a clean, dry incontinence product (if worn), and washes hands with soap and water prior to leaving room
            - In case of accident(s):
              - Clean/disinfect any bodily fluid accidents immediately
              - Return resident to room
              - Shower/bathe resident as needed
              - Change clothes/incontinence products as needed
      - No
          - Consider restricting activities, keeping resident in room unless medically necessary
            - Staff assist resident with HH and resident has clean clothes prior to moving. Staff should wear clean PPE prior to assisting resident with transport
            - Receiving unit or facility should be notified of CDI status and staff should wear PPE
“Lower” risk vs. “Higher” risk residents

- **Is the resident currently having diarrhea?**
  
  _If so, shouldn’t mingle until starts to resolve infection and symptoms_

- **3 C’s**

  - **Clean**
    - Can the resident maintain hand hygiene?
    - Can the resident change into clean clothes before leaving room?

  - **Contained**
    - Is the resident continent?
    - If in continent, can it be contained?
    - Is the resident on treatment?

  - **Coherent**
    - Can the resident follow instructions, perform hand hygiene, stay out of others’ rooms/personal space?
AWARE, Oregon Public Health

Resources for Health Professionals

Oregon Alliance Working for Antibiotic Resistance Education (AWARE) is dedicated to reducing the problem of antibiotic-resistant bacteria in Oregon. Clearly, healthcare professionals have an important role in this initiative.

Research shows that adverse health outcomes are rare when providers are conservative in their prescribing of antibiotics.

Research also shows that patient satisfaction increases in direct proportion to the healthcare provider’s commitment to educating patients about self-care and symptom management for conditions where antibiotics are unnecessary. Evidence shows that patient satisfaction does not increase by fulfilling a patient’s or parent’s expectation of receiving an antibiotics prescription when requested.

The following are resources for healthcare professionals to support the judicious use of antibiotics.

Hot Topics

Google: AWARE Oregon
Common Medications used for CDI

<table>
<thead>
<tr>
<th>Medication</th>
<th>Route</th>
<th>Dose</th>
<th>Pros/Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metronidazole</td>
<td>PO</td>
<td>500 mg TID, 10–14d</td>
<td>Metallic taste</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>500 mg q8h</td>
<td>Medication interactions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IV for severe infections with vanco</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>PO</td>
<td>125 mg QID, 10–14d</td>
<td>Frequent dosing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expensive</td>
</tr>
<tr>
<td>Fidoxomicin</td>
<td>PO</td>
<td>200 mg BID, 10d</td>
<td>Newly approved; may be related to increased recurrence</td>
</tr>
<tr>
<td>Nitazoxanide</td>
<td>PO</td>
<td>500 mg BID, 10d</td>
<td>Cheap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evidence pending to prove non-inferior to metronidazole and vancomycin</td>
</tr>
<tr>
<td>Stool transplant</td>
<td>NG or rectal</td>
<td>per protocol</td>
<td>Specialty centers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Donor screening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FDA special license</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New adverse effects appearing</td>
</tr>
<tr>
<td>Probiotics</td>
<td>PO</td>
<td>per product</td>
<td>Adjunct; may decrease risk of primary infection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not for use in immunocompromised patients or neonates.</td>
</tr>
</tbody>
</table>
Interfacility Transfer Communication

• Inadequate precautions spread MDROs
• Awareness of MDRO or other pathogens before and at time of transfer allows receiving facility to prepare
• Information available across multiple types of health care facilities
  – Need same information even if different actions
  – E.g., MRSA colonization in a hospital vs. LTCF
• Medical transport needs high-level information
  – E.g., type of precautions
How *C. difficile* spreads:

George, a 68-year-old man, goes to the doctor’s office and is diagnosed with pneumonia. He is prescribed antibiotics, drugs that put him at risk for *C. difficile* infection for several months.

George breaks his leg and goes to a hospital. A health care worker spreads *C. difficile* to him after forgetting to wear gloves when treating a *C. difficile* infected patient in the next room.

George transfers to a rehabilitation facility for his leg and gets diarrhea. He is not tested for *C. difficile*. The health care worker doesn’t wear gloves and infects other patients.

George goes back to the hospital for treatment of diarrhea and tests positive for *C. difficile*. He is started on specific antibiotics to treat it. Health care workers wear gloves and do not spread it.

SOURCE: CDC, 2012
1. When a referring facility transfers or discharges a patient who is infected or colonized with a multidrug-resistant organism (MDRO) or pathogen which warrants Transmission-based Precautions, it must include written notification of the infection or colonization to the receiving facility in transfer documents. The referring facility must ensure that the documentation is readily accessible to all parties involved in patient transfer (for example, referring facility, medical transport, emergency department, receiving facility).
2. When a facility becomes aware that it received in transfer one or more patients with an MDRO or pathogen that warrants Transmission-based Precautions, and that was isolated from a patient specimen collected within 48 hours after transfer, it must notify the referring facility.

3. When a facility becomes aware that it transferred or discharged one or more patients who have an MDRO or pathogen that warrants Transmission-based Precautions, the referring facility must notify the receiving facility.
Rule 333-019-0052

4. If a facility transfers or discharges a patient with laboratory-confirmed, carbapenemase-producing Enterobacteriaceae**, the facility must notify the local health department communicable disease staff within one working day of the date and destination of the transfer or discharge.

**NOTE: only 9 identified since 2010
# Inter-facility Infection Control Transfer Form

**SENDING FACILITY TO COMPLETE FORM and COMMUNICATE TO ACCEPTING FACILITY**

*Please attach copies of latest culture reports with susceptibilities, if available*

<table>
<thead>
<tr>
<th>Patient/Resident Last Name</th>
<th>First Name</th>
<th>Date of Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Print or place Patient Label

<table>
<thead>
<tr>
<th>Sending Facility Name</th>
<th>Sending Facility Unit</th>
<th>Sending Facility Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

DX: __________________________

Does the patient/resident have pending cultures? □ NO □ YES

Is the patient/resident currently on precautions? □ NO □ YES

Type of Precautions (check all that apply) □ Contact □ Droplet □ Airborne □ Other: __________________________

<table>
<thead>
<tr>
<th>Does patient currently have an infection, colonization OR a history of a multidrug-resistant organism (MDRO)?</th>
<th>Colonization or history Check if YES</th>
<th>Active infection on treatment Check if YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA (methicillin-resistant <em>Staphylococcus aureus</em>)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>VRE (Vancomycin-resistant <em>Enterococcus</em>)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>C. diff (Clostridium difficile, CDI)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td><em>Acinetobacter</em> spp., multidrug-resistant</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Gram-negative organism resistant to multiple antibiotics* (e.g., E. coli, Klebsiella, Proteus etc.)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>CRE (carbapenem-resistant <em>Enterobacteriaceae</em>)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other**:</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

*Culture report with multiple antibiotics marked resistant (R); send copy of report with susceptibilities.
**Other: lice, scabies, shingles, norovirus, influenza, tuberculosis, etc.

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

☑ Cough or requires suctioning □ Central line/ICCC
☑ Diarrhea □ Hemodialysis catheter
☑ Vomiting □ Urinary catheter
☑ Incontinent of urine or stool □ Suprapubic catheter
☑ Open wounds or wounds requiring dressing change □ Percutaneous gastrostomy tube
☑ Drainage (source) □ Tracheostomy

Notes:

<table>
<thead>
<tr>
<th>Printed Name of Person completing form:</th>
<th>Signature:</th>
<th>Date:</th>
<th>Name and phone of individual at receiving facility who received information:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient/Resident Last Name</td>
<td>First Name</td>
<td>Date of Birth</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Print or place Patient Label

<table>
<thead>
<tr>
<th>Sending Facility Name</th>
<th>Sending Facility Unit</th>
<th>Sending Facility Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Does the patient/resident have pending cultures? □ NO □ YES

Is the patient/resident currently on precautions? □ NO □ YES 

Type of Precautions (check all that apply) □ Contact □ Droplet □ Airborne □ Other: ____________________________

Does patient currently have an infection, colonization OR a history of a multidrug-resistant organism (MDRO)?

<table>
<thead>
<tr>
<th>MDRO Description</th>
<th>Colonization or history</th>
<th>Active infection on treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA (methicillin-resistant Staphylococcus aureus)</td>
<td>□ Check if YES</td>
<td>□ Check if YES</td>
</tr>
<tr>
<td>VRE (Vancomycin-resistant Enterococcus)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>C. diff (Clostridium difficile, CDI)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Acinetobacter spp., multidrug-resistant</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Gram-negative organism resistant to multiple antibiotics* (e.g., E. coli, Klebsiella, Proteus etc.)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>CRE (carbapenem-resistant Enterobacteriaceae)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Other**</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

*Culture report with multiple antibiotics marked resistant (R); send copy of report with susceptibilities.
**Other: lice, scabies, shingles, norovirus, influenza, tuberculosis, etc.

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
□ Hemodialysis catheter
□ Urinary catheter
□ Suprapubic catheter
□ Percutaneous gastrostomy tube
□ Tracheostomy
## Sample IFT form

**SENDING FACILITY TO COMPLETE FORM and COMMUNICATE TO ACCEPTING FACILITY**

*Please attach copies of latest culture reports with susceptibilities, if available*

<table>
<thead>
<tr>
<th>Patient/Resident Last Name</th>
<th>First Name</th>
<th>Date of Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Print or place Patient Label*

<table>
<thead>
<tr>
<th>Sending Facility Name</th>
<th>Sending Facility Unit</th>
<th>Sending Facility Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Does the patient/resident have pending cultures? □ NO □ YES

Is the patient/resident currently on precautions? □ NO □ YES

Type of Precautions (check all that apply)  □ Contact □ Droplet □ Airborne □ Other: ______________________
**Sample IFT form**

<table>
<thead>
<tr>
<th>Does patient currently have an infection, colonization OR a history of a multidrug-resistant organism (MDRO)?</th>
<th>Colonization or history</th>
<th>Active infection on treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA (methicillin-resistant <em>Staphylococcus aureus</em>)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>VRE (Vancomycin-resistant <em>Enterococcus</em>)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><em>C. diff</em> (<em>Clostridium difficile</em>, CDI)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><em>Acinetobacter spp.</em>, multidrug-resistant</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Gram-negative organism resistant to multiple antibiotics* (e.g., <em>E. coli</em>, <em>Klebsiella</em>, Proteus etc.)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><em>CRE</em> (carbapenem-resistant <em>Enterobacteriaceae</em>)</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>Other</strong>**:**</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

*Culture report with multiple antibiotics marked resistant (R); send copy of report with susceptibilities.

**Other**: lice, scabies, shingles, norovirus, influenza, tuberculosis, etc.

For a copy of the form, go to: [https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/HAI/Prevention/Pages/Interfacility-Communication.aspx](https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/HAI/Prevention/Pages/Interfacility-Communication.aspx)
Sample IFT form

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

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

Notes:

Printed Name of Person completing form:  Signature:  Date:  Name and phone of individual at receiving facility who received information:

For a copy of the form, go to:
https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/HAI/Prevention/Pages/Interfacility-Communication.aspx
**Summary of Prevention Strategies**

**CORE**
- Contact Precautions for duration of diarrhea
- Hand hygiene per CDC/WHO guidelines
- Clean & disinfect of equipment & environment
- Lab-based notification
- CDI Surveillance
- Education: Everyone!

**SUPPLEMENTAL**
- Contact Precautions beyond diarrhea
- Presumptive precautions for suspect CDI patients
- Add soap & water for hand hygiene leaving CDI
- Universal glove use on units with high CDI rates
- Use bleach to disinfect
- Antimicrobial Stewardship

---

High level of scientific evidence
Demonstrated feasibility

Some scientific evidence
Variable feasibility
How to measure progress?

**CORE**
- Measure compliance with CDC/WHO hand hygiene and Contact Precautions
- Assess adherence to environmental cleaning

**SUPPLEMENTAL**
- Track use of antibiotics in the facility
  - Associated with CDI
  - Most frequent indications (e.g., urinary tract infections)
- Intensify assessment with process measures
WHAT IS YOUR FACILITY DOING?
Five Moments of CDI Prevention

• Surveillance
• Best practice infection control implementation and competency
• Environmental Hygiene
• Antibiotic Stewardship
• Interfacility Transfer
WHAT IS YOUR 1ST GOAL?
CDC CDI Infections Toolkit, ELC 2009

EXTRA SLIDES
Impact of *C. difficile*

- **Hospital-acquired, hospital onset:**
  - 165,000 cases
  - $1.3 billion in excess costs
  - 9,000 deaths annually

- **Hospital acquired, post-discharge (up to 4 weeks):**
  - 50,000 cases
  - $0.3 billion in excess costs
  - 3,000 deaths annually

- **Nursing home onset:**
  - 263,000 cases
  - $2.2 billion in excess costs
  - 16,500 deaths annually

Supplemental Prevention Strategies: Universal Glove Use
Role of asymptomatic carriers?
Rationale for universal glove use on units with high CDI rates

### Supplemental Prevention Strategies:

**Rationale for Soap and Water: Lack of efficacy of alcohol-based handrub against *C. difficile***

<table>
<thead>
<tr>
<th>Interventions compared</th>
<th>Mean log reduction (95% CI), log$_{10}$ CFU/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm water and plain soap</td>
<td>2.14 (1.74–2.54)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>2.08 (1.69–2.47)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>1.88 (1.48–2.28)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>1.82 (1.43–2.22)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>1.57 (1.18–1.96)</td>
</tr>
<tr>
<td>Warm water and antibacterial soap</td>
<td>1.51 (1.12–1.91)</td>
</tr>
<tr>
<td>Warm water and antibacterial soap</td>
<td>1.46 (1.06–1.85)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>1.31 (0.92–1.71)</td>
</tr>
<tr>
<td>Warm water and antibacterial soap</td>
<td>0.94 (0.55–1.34)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>0.63 (0.23–1.02)</td>
</tr>
<tr>
<td>Antiseptic hand wipe</td>
<td>0.57 (0.17–0.96)</td>
</tr>
<tr>
<td>Antiseptic hand wipe</td>
<td>0.51 (0.12–0.91)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>0.37 (−0.03 to 0.76)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>0.26 (−0.14 to 0.66)</td>
</tr>
<tr>
<td>Alcohol-based handrub</td>
<td>0.06 (−0.34 to 0.45)</td>
</tr>
</tbody>
</table>

Background: Pathogenesis of CDI

1. Ingestion of spores transmitted from other patients via the hands of healthcare personnel and environment

2. Germination into growing (vegetative) form

3. Altered lower intestine flora (due to antimicrobial use) allows proliferation of *C. difficile* in colon

4. Toxin A & B Production leads to colon damage +/- pseudomembrane

Background: Impact

Age-Adjusted Death Rate* for Enterocolitis Due to C. difficile, 1999–2006

*Per 100,000 US standard population

Supplemental Prevention Strategies: Audit and feedback targeting broad-spectrum antibiotics