Controlling the spread of $C. \textit{difficile}$: A multifaceted approach

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Disclosures

- Research support
  - 3M, GOJO, Pfizer, AvidBiotics, Clorox, EcoLab

- Advisory Board
  - 3M, Merck
Objective

To apply prevention strategies for CDI in your facility

US hospital stays associated with *C. difficile* infection

Agency for Healthcare Research and Quality, Nationwide Inpatient Sample, 1993-2009
# Infections and deaths per year

<table>
<thead>
<tr>
<th></th>
<th>Infections</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>80,461</td>
<td>11,285*</td>
</tr>
<tr>
<td><em>decreased from 21,138 in 2005</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. difficile</td>
<td>&gt;300,000</td>
<td>14,000 to 30,000</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>-----------</td>
<td>17,011</td>
</tr>
<tr>
<td>Multidrug-resistant gram-</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>negative bacilli **</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*32% of healthcare-associated infections due to GNB, but a minority are multidrug-resistant (carbapenem-resistant *P. aeruginosa* 2% and ESBL-producing *K. pneumoniae* 1% of all healthcare-associated infections)

No healthcare facility is an island

20% of hospital-onset cases were recently in a LTCF

52-85% of LTCF-onset cases were recently hospitalized

- ~50% of healthcare-associated CDI cases are diagnosed in the community
- Patients with recent CDI often shed spores during outpatient visits

Transmission of *C. difficile*

- Infected Patient → Environment → Susceptible Patient
Contamination of hands with *C. difficile*

Basic infection control practices

Why do basic practices often fail?

Poor implementation

Strategies to improve environmental disinfection

1. Regular monitoring of cleaning with feedback to housekeepers
2. Automated devices

Improvement in cleaning based on fluorescent marker removal

<table>
<thead>
<tr>
<th>Percent</th>
<th>Baseline</th>
<th>Fluorescent marker intervention</th>
<th>UV disinfection</th>
</tr>
</thead>
</table>
An environmental disinfection odyssey

Baseline Fluorescent markers UV device Enhanced daily & terminal cleaning

Marker removal terminal cleaning Marker removal daily cleaning Cultures after cleaning C. difficile rooms

Why didn’t UV work better?

<table>
<thead>
<tr>
<th>UV device reduction in <em>C. diff</em> spores</th>
<th>Direct exposure to UV</th>
<th>Indirect exposure to UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV device</td>
<td>2 - 4 log</td>
<td>1 - 2.4 log</td>
</tr>
<tr>
<td>Bleach</td>
<td>6 log</td>
<td>6 log</td>
</tr>
</tbody>
</table>

Variability in Environmental Services Employee Performance

Monitoring and feedback is time-consuming

More cleaning, less screening: 
*C. difficile* daily disinfection team

Confusion about products

Confusion about who cleans what

Wall-mounted vital signs equipment

Incorrect use of products

Transfer of *C. difficile* spores by a bleach wipe

Bleach wipe after multiple uses

Fresh wet bleach wipe

What if basic practices are implemented and we are still failing to control *C. difficile*?

Consider Special Approaches

- Preemptive isolation
- Prolong the duration of isolation
- Daily disinfection of high-touch surfaces

Shedding of spores during CDI treatment

Sethi AJ, et al. Persistence of skin contamination and environmental shedding of *C. difficile* during and after treatment of *C. difficile* infection. ICHE 2010;31:21-7
1. Expedite identification and isolation of infected patients
Shedding of spores prior to lab diagnosis

How can we ensure that preemptive isolation is implemented?

Link order for testing to order for contact precautions

### Intervention to reduce delays in diagnostic testing

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Intervention</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test order to result (total)</td>
<td>1.8 days</td>
<td>.8 days</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Order to specimen collection</td>
<td>1.0 day</td>
<td>.54 days</td>
<td>.006</td>
</tr>
<tr>
<td>Collection to receipt in lab</td>
<td>.4 days</td>
<td>.24 days</td>
<td>.005</td>
</tr>
<tr>
<td>Receipt in lab to result</td>
<td>.4 days</td>
<td>.12 days</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

12% of all *C. difficile* tests rejected due to leaking of sample or labeling error

Leaking stool

Mis-labeled samples
2. Prolong the duration of isolation

Sethi AJ, et al. Persistence of skin contamination and environmental shedding of *C. difficile* during and after treatment of *C. difficile* infection ICHE 2010;31:21-7
How many additional days of isolation would be required if precautions were extended until discharge or 1 month after treatment?

Jinno S, et al. Potential for transmission of *C. difficile* by asymptomatic acute care patients and LTCF residents with prior CDI. Infect Control Hosp Epid 2012;33:638-9
3. Source control

- Improve bathing to reduce the burden of spores on skin
- Daily disinfection of high-touch surfaces during CDI treatment

![Graph showing percent positive cultures for CDI Diagnosis, Day 3 of treatment, Resolution of diarrhea, and End of treatment. The bars represent stool, skin, and environment samples.](image-url)
Patient hand washing for removal of *C. difficile* spores

Before

After

Why is daily cleaning important?

- An elderly person in your household develops infectious diarrhea. There are young children in the household who interact regularly with the ill person. Do you:

  1. Wait 10 days until the illness has completely resolved before cleaning the bathroom and other objects that the person contacts
  2. Disinfect surfaces daily or after each use of the bathroom to prevent transmission
Daily disinfection of high-touch surfaces

4. Screening for asymptomatic carriers (Not recommended)

Sources of *C. difficile* transmission based on MLVA typing

Most likely transmission route

Transmission by an asymptomatic carrier during 3 hospital admissions

- **Admission 1**: Ward 4B
  - **AC** (2°)

- **Admission 2**: MICU
  - **AC** (2°)

- **Admission 3**: Ward 4A
  - **AC** (2°)
  - **2°**
  - **3°**

Length of stay in acute care (days)

= CDI diagnosis
Shedding of spores by asymptomatic carriers

What percentage of hospitals perform routine testing to detect asymptomatic carriers of *C. difficile*?

- A. 100%
- B. 50%
- C. 25%
- D. <10%
Identification of asymptomatic carriers through inappropriate testing

- 63 y.o. long-term care resident with early satiety (no prior antibiotics, diarrhea, abdominal pain)
- GI consult: “Consider checking stool for C. diff due to colonic thickening on CT”
- Nurse comment: “No bowel movement in 2 days. The plan is to load him up with laxatives to get a stool sample”

Dubberke ER, et al. Impact of clinical symptoms on interpretation of diagnostic assays for CDI. J Clin Microbiol 2011;49:2887-93 (36% of tested patients did not have clinically significant diarrhea and 20% were on laxatives); Kundrapu S, et al. J Clin Microbiol 2013;51:2365-70.
## Horizontal measures for control of MRSA versus *C. difficile*

<table>
<thead>
<tr>
<th>Measure</th>
<th>MRSA</th>
<th><em>C. difficile</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol hand hygiene effective</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Chlorhexidine bathing effective</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Standard environmental disinfectants effective</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
5. Environmental cultures (Not recommended)
You are designing an intervention for CDI. Should you use bleach in all rooms or just in CDI isolation rooms?
C. difficile contamination after terminal cleaning of hospital rooms

Deshpande A, et al. ID Week 2013, poster 1393
Use of non-sporicidal products

Transfer of *C. difficile* spores by a non-sporicidal disinfectant

Culture for *C. difficile* without requirement for an anaerobic chamber

<table>
<thead>
<tr>
<th></th>
<th>Negative</th>
<th>Positive</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaerobic</td>
<td></td>
<td></td>
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Summary

- Effective implementation of basic practices remains a major challenge
- Special approaches that are promising
  - Early identification and isolation of infected patients
  - Source control (e.g., daily disinfection of surfaces, patient hand washing/bathing)
  - Prolonging the duration of isolation
Are floors an underappreciated reservoir for *C. difficile* transmission?

Sock print (MRSA)  
Call button on floor

Deshpande A, et al. ID Week 2013
"Infection control was so much easier before they discovered the fecal cloud."
Preventing Transmission of Clostridium difficile: Is the Answer Blowing in the Wind?

How many times must a doctor be told
   Wash your hands and wear gloves, please?
   Yes, and how many times will another stand by
   Pretending he just doesn’t see?
   And how many times must we remind
   Those things that we touch must be cleaned?
   The answer, my friend, is blowin’ in the wind
   The answer is blowin’ in the wind.