Clostridium difficile (CDI) Infections Toolkit

Activity C: ELC Prevention Collaboratives

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Draft - 12/23/09 --- Disclaimer: The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.
Outline

• **Background**
  – Impact
  – HHS Prevention Targets
  – Pathogenesis
  – Epidemiology

• **Prevention Strategies**
  – Core
  – Supplemental

• **Measurement**
  – Process
  – Outcome

• **Tools for Implementation/Resources/References**
Background: Impact

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

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

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

Background: Impact

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

*Per 100,000 US standard population

Background: HHS Prevention Targets

- Case rate per 10,000 patient-days as measured in NHSN
  - National 5-Year Prevention Target: 30% reduction
- Because little baseline infection data, also track administrative data for ICD-9-CM coded *C. difficile* hospital discharges
  - National 5-Year Prevention Target: 30% reduction

http://www.hhs.gov/ophs/initiatives/hai/prevtargets.html
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: Epidemiology

Current epidemic strain of *C. difficile*

- BI/NAP1/027, toxinotype III
- Historically uncommon
  - Epidemic since 2000
  - Increased resistance to fluoroquinolones
- More virulent
  - Increased toxin A and B production
  - Polymorphisms in binding domain of toxin B
  - Increased sporulation

Background: Epidemiology

Risk Factors

- Antimicrobial exposure
- Acquisition of *C. difficile*
- Advanced age
- Underlying illness
- Immunosuppression
- Tube feeds
- ? Gastric acid suppression

Main modifiable risk factors
Prevention Strategies

• Core Strategies
  – High levels of scientific evidence
  – Demonstrated feasibility

• Supplemental Strategies
  – Some scientific evidence
  – Variable levels of feasibility

*The Collaborative should at a minimum include core prevention strategies. Supplemental prevention strategies also may be utilized. Hospitals should not be excluded from participation if they already have ongoing interventions using supplemental prevention strategies. Project coordinators should carefully track which prevention strategies are being utilized by participating facilities.
Prevention Strategies: Core

- Contact Precautions for duration of diarrhea
- Hand hygiene in compliance with CDC/WHO
- Cleaning and disinfection of equipment and environment
- Laboratory-based alert system for immediate notification of positive test results
- Educate about CDI: HCWs, housekeeping, administration, patients, families

http://www.cdc.gov/ncidod/dhqp/id_CdiffFAQ_HCP.html
Prevention Strategies: Supplemental

- Extend use of contact precautions beyond duration of diarrhea
- Presumptive isolation for symptomatic patients pending confirmation of CDI
- Evaluate and optimize testing
- Implement soap and water for hand hygiene before exiting room of a patient with CDI
- Implement universal glove use on units with high CDI rates
- Use sodium hypochlorite (bleach) – containing agents for environmental cleaning
- Implement an antimicrobial stewardship program
Prevention Strategies: Supplemental Rationale for considering extending isolation beyond duration of diarrhea

Prevention Strategies: Supplemental

Consider presumptive isolation for patients with ≥3 unformed stools within 24 hours

• Patients with CDI may contaminate environment and hands of healthcare personnel pending results of diagnostic testing

• CDI responsible for only ~30-40% of hospital-onset diarrhea

• However, CDI more likely among patients with ≥3 unformed (i.e. taking the shape of a container) stools within 24 hours
  – Send specimen for testing and presumptively isolate patient pending results
  – Positive predictive value of testing will also be optimized if focused on patients with ≥3 unformed stools within 24 hours
  – Exception: patient with possible recurrent CDI (i.e. isolate and test following first unformed stool)
Prevention Strategies: Supplemental
Evaluate and optimize test-ordering practices and diagnostic methods

- Most laboratories have relied on Toxin A/B enzyme immunoassays
  - Low sensitivities (70-80%) lead to low negative predictive value
- Despite high specificity, poor test ordering practices (i.e. testing formed stool or repeat testing in negative patients) may lead to many false positives
- Consider more sensitive diagnostic paradigms but apply these more judiciously across the patient population
  - Employ a highly sensitive screen with confirmatory test or a PCR-based molecular assay
  - Restrict testing to unformed stool only
  - Predominantly from patients with ≥ 3 unformed stools within 24 hours
  - Require expert consultation for repeat testing within 5 days

Prevention Strategies: Supplemental Hand Hygiene – Soap vs. Alcohol gel

• Alcohol clearly not effective in eradicating *C. difficile* spores
• One hospital study found that from 2000-2003, despite increasing use of alcohol hand rub, there was no concomitant increase in CDI rates.
• Discouraging alcohol gel use may undermine overall hand hygiene program with untoward consequences for HAIs in general.

## Prevention Strategies: Supplemental Hand Washing: Product Comparison

<table>
<thead>
<tr>
<th>Product</th>
<th>Log10 Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap Water</td>
<td>0.76</td>
</tr>
<tr>
<td>4% CHG 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>

* Only value that was statistically better than others

“These results reinforce the need for contact precautions including gloving when caring for a CD infected patient; and the importance of environmental cleaning and disinfection to reduce environmental spore burden.”

Glove use has the strongest evidence for preventing *C. difficile* transmission via the hands of healthcare workers

Prevention Strategies: Supplemental
Glove Use

Rationale for considering universal glove use on units with high CDI rates

- Although the magnitude of their contribution is uncertain, asymptomatic carriers have a role in transmission
- Practical screening tests are not available
- There may be a role for universal glove use as a special approach to reducing transmission on units with longer lengths of stay and high endemic CDI rates
- Focus enhanced environmental cleaning strategies and avoid shared medical equipment on such units as well
Prevention Strategies: Supplemental Environmental Cleaning

- Bleach can kill spores, whereas other standard disinfectants cannot.
- Limited data suggest cleaning with bleach (1:10 dilution prepared fresh daily) reduces *C. difficile* transmission.
- Two before-after intervention studies demonstrated benefit of bleach cleaning in units with high endemic CDI rates.
- Therefore, bleach may be most effective in reducing burden where CDI is highly endemic.

Prevention Strategies: Supplemental Environmental Cleaning

Assess adequacy of cleaning before changing to new cleaning product such as bleach

- Ensure that environmental cleaning is adequate and high-touch surfaces are not being overlooked
- One study targeted cleaning using a fluorescent environmental marker which showed:
  - only 47% of high-touch surfaces in 3 hospitals were 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 is a promising method to improve cleaning in hospitals.

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

- A prospective, controlled interrupted time-series analysis in 3 acute medical wards for the elderly people in the UK demonstrated the impact of antimicrobial management on reducing CDI.
  - Introduced a narrow-spectrum antibiotic policy
  - Reinforced using feedback
  - Associated with significant changes in targeted antibiotics and a significant reduction in CDI

Summary of Prevention Measures

Core Measures

- Contact Precautions for duration of illness
- Hand hygiene in compliance with CDC/WHO
- Cleaning and disinfection of equipment and environment
- Laboratory-based alert system
- CDI surveillance
- Education

Supplemental Measures

- Prolonged duration of Contact Precautions
- Presumptive isolation
- Evaluate and optimize testing
- Soap and water upon exiting CDI room
- Universal glove use on units with high CDI rates
- Bleach for environmental disinfection
- Antimicrobial stewardship program
Measurement: Process Measures

• Core Measures:
  – Measure compliance with CDC/WHO recommendations for hand hygiene and contact precautions
  – Assess adherence to protocols and adequacy of environmental cleaning

• Supplemental Measures:
  – Intensify assessment of compliance with process measures
  – Track use of antibiotics associated with CDI in a facility
Measurement: Outcome
Categorize Cases by location and time of onset†

Admission

Discharge

HO-HCFA

CO-HCFA

Indeterminate

CA-CDI

2 d

< 4 weeks

4-12 weeks

> 12 weeks

Day 1

Day 4

Time

HO: Hospital (Healthcare) onset
CO-HA: Community Onset Healthcare-associated
CA: Community Associated

* Depending upon whether patient was discharged within previous 4 weeks, CO-HA vs. CA
† Onset defined in NHSN LabID Event by specimen collection date

Measurement: Outcome

Utilize NHSN CDAD Module

<table>
<thead>
<tr>
<th>Facility ID:</th>
<th>Event #:</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Patient ID:</td>
<td>Social Security #:</td>
</tr>
<tr>
<td>Secondary ID:</td>
<td></td>
</tr>
<tr>
<td>Patient Name, Last:</td>
<td>First:</td>
</tr>
<tr>
<td>*Gender: M</td>
<td>F</td>
</tr>
<tr>
<td>Ethnicity (Specify):</td>
<td>Race (Specify):</td>
</tr>
</tbody>
</table>

**Event Details**

| Event Type: LabID | *Date Specimen Collected: |
| *Specific Organism Type: (Check one) |
| ☐ MRSA | ☐ MSSA | ☐ VRE | ☐ MDR-Klebsiella | ☐ MDR-Acinetobacter | ☐ C. difficile |
| *Outpatient: Yes | No | *Specimen Source: |
| *Date Admitted | *Location: | *Date Admitted |
Measurement: Outcome
Focus on Laboratory Identified (LabID) Events in NHSN

Figure 2. CDAD Test Result Algorithm for Laboratory-Identified (LabID) Events
Based on data submitted to NHSN, LabID Events are categorized as:

- **Incident**: specimen obtained >8 weeks after the most recent LabID Event
- **Recurrent**: specimen obtained >2 weeks and ≤ 8 weeks after most recent LabID Event
Measurement: Outcome

NHSN Reporting: Definitions

Incident cases further characterized based on date of admission and date of specimen collection:

- **Healthcare Facility-Onset (HO):** LabID Event collected >3 days after admission to facility (i.e., on or after day 4)

- **Community-Onset (CO):** LabID Event collected as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., days 1, 2, or 3 of admission)

- **Community-Onset Healthcare Facility-Associated (CO-HCFA):** CO LabID Event collected from a patient who was discharged from the facility ≤4 weeks prior to date stool specimen collected
Measurement: Outcome

Calculating CDI Incidence Rates

• **Facility CDI Healthcare Facility-Onset Incidence Rate** = Number of all Incident HO CDI LabID Events per patient per month / Number of patient days for the facility x 10,000

• **Facility CDI Combined Incidence Rate** = Number of all Incident HO and CO-HCFA CDI LabID Events per patient per month / Number of patient days for the facility x 10,000
Evaluation Considerations

• Assess baseline policies and procedures

• Areas to consider
  – Surveillance
  – Prevention strategies
  – Measurement

• Coordinator should track new policies/practices implemented during collaboration

Standardized questions forthcoming
References


References


References


References


References


References


SHEA/IDSA Compendium of Recommendations

Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals

Erik R. Dubberke, MD; Dale N. Gerding, MD; David Classen, MD, MS; Kathleen M. Aries, MS, CIC; Kelly Podgorsky, RN, MS, CPHQ; Deverick J. Anderson, MD, MPH; Helen Burstin, MD; David P. Cahee, MD, MS; Susan E. Coffin, MD, MPH; Victoria Fraser, MD; Frances A. Griffin, BRT, MPA; Peter Grossi, MD; Keith S. Kaye, MD; Michael Klompas, MD; Evelyn Lo, MD; Jonas Marshall, MD; Leonard A. Merrel, DO, SCM; Lindsay Nicolle, MD; David A. Pegues, MD; Trish M. Perl, MD; Sanjay Saint, MD; Cassandra D. Salgado, MD, MS; Robert A. Weinstein, MD; Robert Wise, MD; Deborah S. Yokoe, MD, MPH


Additional resources

CDC

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Additional Reference Slides

- The following slides may be used for presentations regarding CDI.
- Explanations are available in the notes section of the slides.
Prevention Strategies: Supplemental 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 antibiotics soap</td>
<td>1.51 (1.12–1.91)</td>
</tr>
<tr>
<td>Warm water and antibiotics 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>Cold water and plain 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>Antiseptic hand wipe</td>
<td>0.06 (–0.34 to 0.45)</td>
</tr>
</tbody>
</table>

Prevention Strategies: Supplemental
Hand Hygiene – Alcohol Hand Rub Use 2000-2003

\[ P < .001 \]

**FIGURE 1.** Use of alcohol hand rub by healthcare workers, in liters per 1,000 patient-days, per quarter, 2000-2003.

Prevention Strategies: Supplemental

Hand Hygiene – CDI Rates 2000-2003

![Bar chart showing CDI rates from 2000 to 2003.]

**Figure 2.** Number of patients with 1 or more tests positive for *Clostridium difficile* toxin per 1,000 patient-days, 2000-2003.

Prevention Strategies: Supplemental Glove Use

Glove Use Role of asymptomatic carriers?
Rationale for universal glove use on units with high CDI rates

Prevention Strategies: Supplemental Environmental Cleaning

How Much Can be Achieved via Environmental Decontamination?

Prevention Strategies: Supplemental Environmental Cleaning

Assess adequacy of cleaning before changing to new cleaning product

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