Clostridium difficile
Infection Prevention
Objectives

• Describe the etiology and epidemiology of *Clostridium difficile* infection (CDI)
• Review evidence-based CDI prevention strategies
• Describe importance of adherence monitoring and feedback
• Discuss CDI testing and reporting methods
**Clostridium difficile**

- An anaerobic, gram-positive, spore-forming, toxin-producing bacillus
- Transmitted among humans via the fecal-oral route
- Severity *C. difficile* infection (CDI) ranges from mild diarrhea to severe intestinal infection (colitis)
  - death occurs in up to 9% of cases

**Clostridium difficile Infection (CDI)**

- *C. difficile* is not part of the normal gastrointestinal flora
  - 2-7% of healthy adult population colonized with *C. difficile*
- Incubation period between exposure to *C. difficile* and occurrence of CDI is 2-3 days (per multiple studies)
- CDI is the most common healthcare-associated infection (HAI)

CDI Discharge Rate in U.S. Hospitals

![Chart showing CDI discharge rate from 2001 to 2013 with observed and projected trends.

- **Y-axis:** Rate per 1,000 Discharges
- **X-axis:** Year (2001-2013)
Estimated U.S. Burden of CDI

Healthcare-Associated CDI in California

- *C. difficile* is the most frequently reported HAI by California hospitals
  - 10,771 hospital-onset CDI reported in 2015
  - 54% of all the HAI reported
  - CDI incidence increasing since 2011
- Patients often cycle between multiple hospitals, long term acute care, and long term care facilities.
  - 26% of CDI patients are readmitted to another facility within 12 weeks of discharge

Huang et al., Infect Control Hosp Epidemiol, 31(11), 1160-1169, 2010
Epidemic Strain of *C. difficile*

**NAP1/BI/027**

- Epidemic since 2000
- Highly resistant to fluoroquinolones (e.g., Ciprofloxacin)
- Hypervirulent
  - Increased toxin A and B production
  - Toxin B binding factor, more adherence in the gut
- Produces more spores

Warny et al. Lancet, 2005
CDI is a 2-Step Process

The following events may occur separately and in any order, but **both** are required for infection to occur:

1. The normal **intestinal flora must be compromised** (i.e., due to antibiotics) allowing for *C. difficile* to establish itself and proliferate

2. **C. difficile** bacteria or spores must be ingested

Clostridium difficile Pathogenesis

Ingestion of spores transmitted to patients via the hands of healthcare personnel and environment

Germination into growing (vegetative) form

Changes in lower intestinal flora due to antimicrobial use allows proliferation of C. difficile in colon

Toxin A & B production leads to colon damage

CDI Risk Factors

• Acquisition of *C. difficile* bacteria
• Antimicrobial exposure
• Advanced age
• Immunosuppression
• Tube feedings
• Gastric acid suppression
• Prolonged stay in healthcare facility
• Inflammatory bowel disease
• GI surgery
Risk Factors for CDI

- Acquisition of *C. difficile* bacteria (*Modifiable risk factor*)
- Antimicrobial exposure (*Modifiable risk factor*)
- Advanced age
- Immunosuppression
- Tube feedings
- Gastric acid suppression
- Prolonged stay in healthcare facility
- Inflammatory bowel disease
- GI surgery
Diagnosis of CDI

- Presence of symptoms, usually diarrhea
  - >3 unformed stools over 24 hours (i.e., conforms to shape of container)
- Positive stool test for *C. difficile* or toxins
- Diagnostic Imaging
  - Endoscopic or histologic (e.g., pseudomembranous disease)
- CDI relapse occurs in 10-25% cases

CDI Prevention Objectives

National HAI Prevention Action Plan – 2020 Target Goals

• 30% CDI reduction from 2015 baseline

• Recommended by the CDPH HAI Advisory Committee for all California hospitals
CDC Prevention Recommendations

Core Care Practices

- Higher levels of scientific evidence
- Demonstrated feasibility

Supplemental Care Practices

- Some scientific evidence
- Variable levels of feasibility

Implement in addition to primary strategies when infections persist
CDI Prevention – What works?

**Core Care Practices**
- Contact precautions for duration of diarrhea
- Hand hygiene before, during, and after care of patient
- Cleaning and disinfection of equipment and environment
- Laboratory-based alert system for immediate notification of positive test results
- Education for HCP, housekeeping, administration, patients, families
- Antimicrobial stewardship
- CDI surveillance, analysis, and reporting

**Supplemental Care Practices**
- Extension of contact precautions beyond duration of symptoms (e.g., 48 hours)
- Presumptive isolation for patient with diarrhea pending confirmation of CDI
- Hand washing (soap and water) before exiting room of CDI patient
- Universal glove use on units with high CDI rates (e.g., outbreak setting)
- EPA sporicidal agents for environmental cleaning
- Tracking antibiotics associated with CDI in the facility
- Evaluation and optimization of testing for CDI
CDI Core Practice

**Contact Precautions** for duration of diarrhea

- Emphasize *glove use* and removal of gloves prior to exiting room of CDI patient
- Emphasize compliance with *hand hygiene*
- Extend Contact precautions beyond duration of diarrhea (e.g., for 48 hours after diarrhea ceases) (Supplemental)
CDI Core Practice

Hand Hygiene in compliance with CDC or WHO guidelines

- Gloves are effective at preventing *C. difficile* contamination of hands
- *C. difficile* spores are resistant to alcohol
- During outbreaks or in settings with high CDI rates, hand hygiene with soap and water preferred (Supplemental)
  - Be aware that hand hygiene adherence may decrease when soap and water is only option provided
  - Clinical studies have not found increase in CDI with alcohol-based hand hygiene products, but several did find reductions in MRSA or VRE

CDI Core Practice

Environmental cleaning and disinfection

- CDI patient can shed bacteria and spores into the environment both during and after treatment of CDI
- Ensure thorough cleaning of CDI patient care areas with sporicidal disinfectant daily
- Focus on high-touch surfaces and the bathroom
- Identify and remove environmental sources of transmission
  - Replace electronic thermometers with single use disposable

Environmental cleaning and disinfection (continued)

- Assess **adequacy** of cleaning before changing cleaning products
- Study in 3 hospitals used fluorescence to assess cleaning
  - Showed only 47% high-touch surfaces cleaned
  - Educational intervention with environmental services staff resulted in sustained improvement
- Use of environmental markers a promising method to improve cleaning in hospital

C. difficile Transmission from Prior Room Occupants

110% Increased risk

Shaugnessey et al. Abstract K-4194
IDSA / ICAAC. October 2008
CDI Supplemental Practice

**Bleach** for routine cleaning

- Use during CDI outbreak or continued increased rates of CDI
- Bleach can kill spores - most other standard disinfectants cannot
  
  - Limited data suggest cleaning with bleach (1:10 dilution prepared fresh daily) reduces *C. difficile* transmission
  
  - Two before-after studies showed benefit on units with high endemic CDI rates
  
  - Bleach may be most effective in reducing burden where CDI rates high

- EPA has registered other sporicidal disinfectants

EPA’s Registered Antimicrobial Products Effective against Clostridium difficile Spores:
CDI Supplemental Practice

Isolate patients with diarrhea pending CDI confirmation

• Rationale: Patients with CDI may contaminate environment and hands of healthcare personnel before results of testing known

• Isolate any patient with $\geq 3$ unformed (i.e. conforms to shape of container) stools within 24 hours
  • Isolate when stool specimen sent for *C. difficile* testing

• For patient with possible recurrent CDI, isolate and test following first unformed stool
CDI Supplemental Practice

**Universal glove use** for facilities or units with high CDI rates

- **Rationale:** Spores difficult to remove even with hand washing
- **Asymptomatic carriers play a role in transmission** (though magnitude of contribution unknown)
- **Practical CDI screening tests not available**
- **Adherence to glove use with or without contact precautions is critical to preventing** *C. difficile* transmission via hands of HCP
CDI Testing Methods

• **Testing** should be limited to symptomatic patients with unformed stool
  - Single stool specimen at onset of symptoms is sufficient
  - Repeat testing is of limited value; should be discouraged
  - “Test of cure” not recommended
• Laboratory-based system for **immediate notification** of positive CDI test results *(Core)*
• Evaluate and optimize CDI testing *(Supplemental)*
CDI Core Practice

Implement an **antimicrobial stewardship program**

- Goal is to minimize the **frequency** and **duration** of antimicrobials and the **number** of antimicrobials prescribed
- Target antimicrobials based on local epidemiology and *C. difficile* strain
  - Restricted cephalosporin and clindamycin found most useful (may be used for surgical prophylaxis)
- Reduce use of broad-spectrum antibiotics
  - Enforcing narrow-spectrum antibiotic policy with feedback to prescribing physician resulted in significant CDI reduction in 3 acute geriatric medical wards

## CDPH Hospital Antimicrobial Stewardship Program (ASP) - 11 Elements

<table>
<thead>
<tr>
<th>Basic</th>
<th>Intermediate and Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Antimicrobial stewardship policy/procedure</td>
<td>5. Annual antibiogram, with distribution &amp; education of medical staff</td>
</tr>
<tr>
<td>2. Physician-supervised multidisciplinary committee</td>
<td>6. Institutional guidelines for management of common infection syndromes</td>
</tr>
<tr>
<td>3. Program support by physician or pharmacist with specific stewardship training</td>
<td>7. Monitoring antibiotic usage patterns using DDD or DOT</td>
</tr>
<tr>
<td>4. Reporting program activities to hospital quality improvement committees</td>
<td>8. Regular education to medical staff/committees about antimicrobial stewardship</td>
</tr>
<tr>
<td></td>
<td>9. Antimicrobial formulary reviewed annually, changes based on antibiogram</td>
</tr>
<tr>
<td></td>
<td>10. Prospective audits with intervention/feedback</td>
</tr>
<tr>
<td></td>
<td>11. Formulary restriction with preauthorization</td>
</tr>
</tbody>
</table>

*As recommended by the HAI Advisory Committee, December 2013*
ASP Strategies Specifically Targeting CDI

- Restrict antimicrobials with high risk for CDI and promote use of lower risk antimicrobials

<table>
<thead>
<tr>
<th>High Risk</th>
<th>Medium Risk</th>
<th>Low Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminopenicillins</td>
<td>Beta-lactam/beta-lactamase inhibitors</td>
<td>Macrolides</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Carbapenems</td>
<td>Trimethoprim/sulfamethoxazole</td>
</tr>
<tr>
<td>Cephalosporins</td>
<td></td>
<td>Tetracyclines</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Stop unnecessary antibiotics in patients with new CDI diagnoses
Examples of CDI-Targeted ASP Interventions

• Formulary restriction and prospective audit with feedback
  • Target antibiotic(s) most associated with CDI at your facility
  • Recommend lower-risk alternatives, and optimizing dosing, route and duration of therapy
• Target patients with CDI diagnoses for medication review to identify and discontinue unnecessary antibiotics
Broad and Targeted Antimicrobial Stewardship Interventions to Reduce CDI Incidence

• Improve overall antimicrobial prescribing
  • Fewer patients on antimicrobials
    • Fewer patients develop CDI
      o Fewer CDI patients contribute to transmission

• Stop unnecessary antibiotics in patients with new CDI diagnoses
  • Improve clinical response to treatment and reduce risk of recurrent CDI
    o Fewer CDI patients contribute to transmission

California Antimicrobial Stewardship Initiative

• CDPH HAI Program activity

• Objective: Assist California hospitals and long-term care facilities to optimize antimicrobial use to improve patient outcomes

• CDPH Antimicrobial Stewardship Program Initiative web page
  [www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CA_AntimicrobialStewardshipProgramInitiative.aspx]
IP Role in CDI Prevention

• Ensure policies reflect current evidence based practice recommendations
  • CDC guidelines
• Ensure staff competency upon hire and at least annually
  • New hire orientation
  • Annual skills fair
  • Return demonstration to ensure competency
• Establish adherence monitoring program for core care practices
  • Use available adherence monitoring tools
  • Ensure feedback provided to frontline staff
• Present adherence results and CDI incidence to leaders
**Adherence Monitoring Tool - Hand Hygiene**

*Remember: Hand hygiene should be performed before and after glove use*

<table>
<thead>
<tr>
<th>Discipline</th>
<th>What type of HH opportunity was observed? (select ☑ 1 per line)</th>
<th>= Successful</th>
<th>= Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☑ leaving room</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☐ leaving room</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☐ leaving room</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☐ leaving room</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☐ leaving room</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☐ leaving room</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ entering room* ☐ before task ☐ after body fluids ☐ after care* ☐ leaving room</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CNA = Nurse Assistant  P = Physician  S = Student  W = Social Worker
D = Dietary  RT = Respiratory Therapist  VIS = Visitor  OTH = Other, Specify
N = Nurse  VOL = Volunteer  U = Unknown

Total # HH Successful (“# ✓”): ________
Total # HH Opportunities Observed: ________
Adherence: ________%  
(Total # HH Successful ÷ Total # HH Opportunities Observed x 100)

CDPH Adherence Monitoring tools: [www.cdph.ca.gov/hai](http://www.cdph.ca.gov/hai)
## Adherence Monitoring Tool – Contact Precautions

<table>
<thead>
<tr>
<th>Contact Precautions Practices</th>
<th>Pt/Res 1</th>
<th>Pt/Res 2</th>
<th>Adherence by Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves and gowns are available near point of use.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Signs indicating the patient/resident is on contact precautions are clear and visible.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>The patient/resident housed in single-room or cohorted based on a clinical risk assessment.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hand hygiene is performed before entering the patient/resident care environment.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Gloves and gowns are donned before entering the patient/resident care environment.</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Gloves and gowns are removed and discarded, <strong>and</strong> hand hygiene is performed before leaving the patient/resident care environment. <em>Soap &amp; water if C. difficile infection.</em></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Dedicated or disposable noncritical patient-care equipment (e.g. blood pressure cuffs) is used</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Total #Yes_____ Total #Observed_____ Total #Yes/Total #Observed =   % Adherence______ %

CDPH Adherence Monitoring tools: [www.cdph.ca.gov/hai](http://www.cdph.ca.gov/hai)
## Adherence Monitoring Tool-Environmental Cleaning

<table>
<thead>
<tr>
<th>Environmental Cleaning Practices</th>
<th>EVS Staff 1</th>
<th>EVS Staff 2</th>
<th>Adherence by Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detergent/disinfectant solution is mixed according to manufacturer’s instructions.</td>
<td>Yes</td>
<td>No</td>
<td># Yes</td>
</tr>
<tr>
<td>Solution remains in wet contact with surfaces according to manufacturer’s instructions.</td>
<td>Yes</td>
<td>No</td>
<td># Obs</td>
</tr>
<tr>
<td>A new clean, saturated cloth is used in each room. The cloth is also changed when visibly soiled</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>and after cleaning the bathroom.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Services staff use appropriate personal protective equipment (e.g. Gowns and gloves are used for patients/residents on contact precautions upon entry to the contact precautions room.)</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Objects and environmental surfaces in patient care areas that are touched frequently* are</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>cleaned and then disinfected when visibly contaminated or at least daily with an EPA-registered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disinfectant.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# Yes

# Observed

#Yes/#Observed = % Adherence

CDPH Adherence Monitoring tools: [www.cdph.ca.gov/hai](http://www.cdph.ca.gov/hai)
Feedback Results

• Share with unit staff
  • Adherence monitoring results
  • CDI incidence
• Present to managers and leadership
  • Use data to focus prevention efforts
  • Use data to get needed resources
CDPH Contact Precautions Observations, 131 Facilities, 2016

- Single or cohorted correctly: 95%
- HH before entering room: 43%
- PPE before entering room: 78%
- PPE Removed & HH before exiting room: 68%
- Equip cleaned & disinfected: 81%

The chart shows the percentage of successful and missed observations for various contact precautions in 131 facilities in 2016.
CDPH Environmental Cleaning Observations, 131 Facilities, 2016

- **Solution mixed to mfg instructions**: 95%
- **Contact time to mfg instructions**: 37%
- **New clean, saturated cloth used in each room**: 84%
- **Proper PPE**: 94%
- **High touch objects cleaned daily-w/ EPA disinfectant**: 49%
Are the CDI Prevention Core Care Practices Used Routinely in YOUR facility?

- Contact precautions for duration of diarrhea
- Hand hygiene before, during, and after patient care
- Daily cleaning and disinfection of equipment and environment
- Laboratory-based alert system
- Education for HCP, housekeeping, patients, families
- Antimicrobial stewardship
- CDI surveillance, analysis, and reporting

You won’t know if you don’t monitor!
CDI Prevention Summary

- Preventing CDI requires commitment to evaluate care practices in all hospital patient care locations
- Appropriate specimen collection and testing is an important component of a CDI reduction plan
- Perform adherence monitoring of care practices and feedback results with CDI SIR to all units and leadership
Additional References and Resources

Additional References and Resources


Questions?

For more information, please contact any HAI Liaison IP Team member

Or email

HAIProgram@cdph.ca.gov