

# *Clostridium difficile* Infection Prevention

Last Updated 2017

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Basics of Infection Prevention  
Healthcare-Associated Infections Program  
Center for Health Care Quality  
California Department of Public Health



# 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

Leffler and Lamont. New Engl J Med ;372:1539-48, 2015

Lessa, et al. New Engl J Med ;372:825-34, 2015

Laffan, et al. J Am Geriatr Soc ;54(7):1068-73, 2006

## *Clostridium difficile* Infection (CDI)

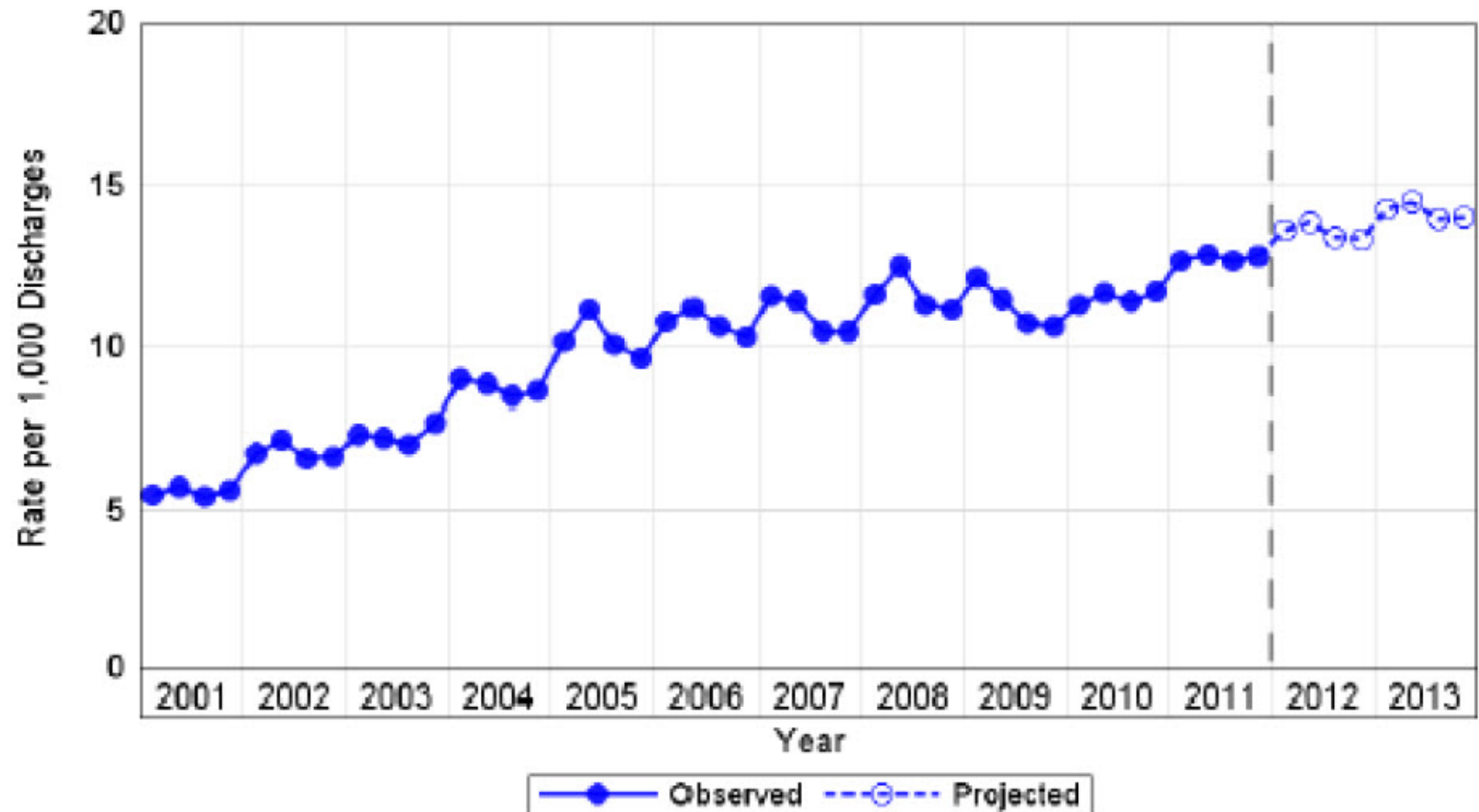
- *C.difficile* is not part of the normal gastrointestinal flora
  - 2-7% of healthy adult population colonized with *C.difficile*
- Incubation period between exposure to *C.difficile* and occurrence of CDI is 2-3 days (per multiple studies)
- CDI is the most common healthcare-associated infection (HAI)

Cohen et al. Infect Contr Hosp Epidemiol; 31(5):431-55, 2010

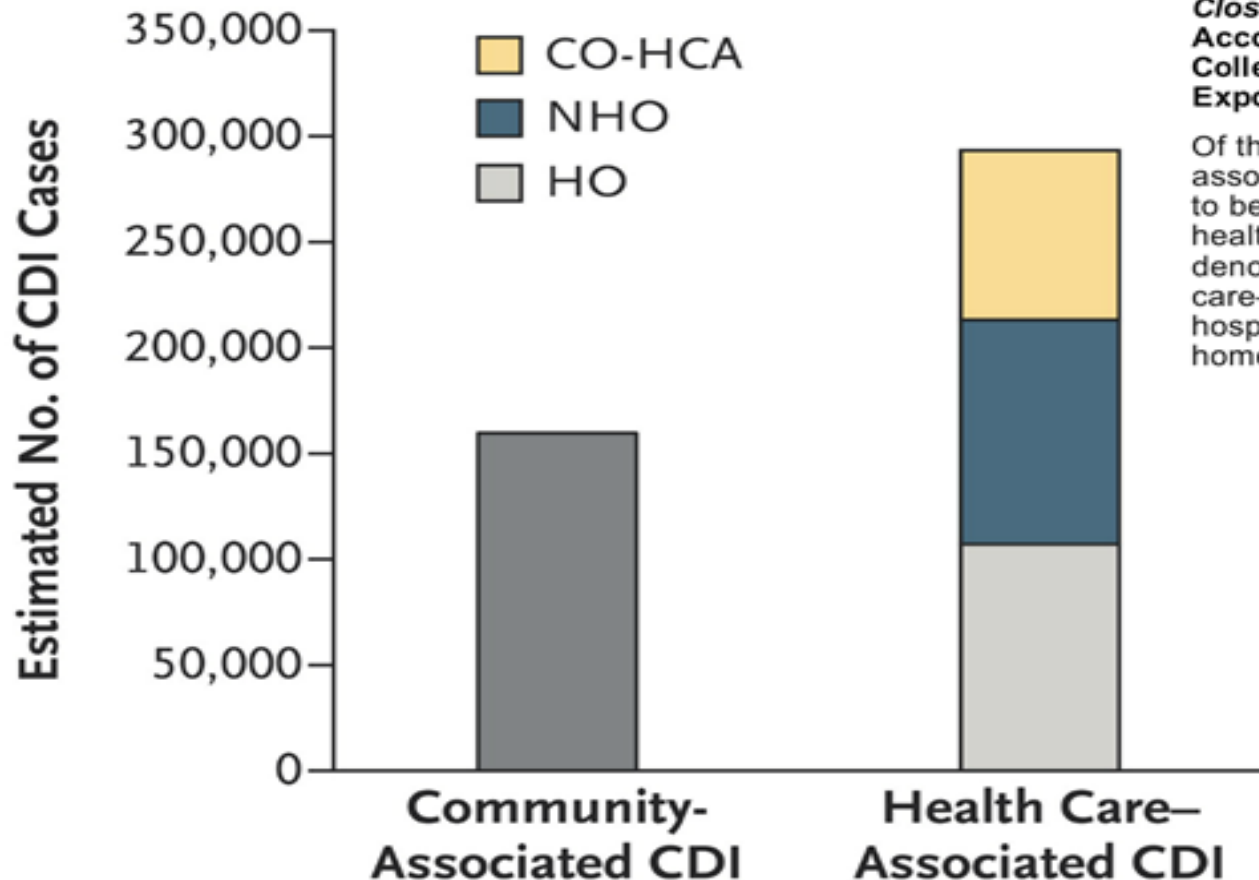
Gladys et al. J Clin Microbiol ;52(7):2406-9, 2014

Magill et al N Engl J Med; 370:1198, 2014

# CDI Discharge Rate in U.S. Hospitals



# Estimated U.S. Burden of CDI



**Figure 1. Estimated U.S. Burden of *Clostridium difficile* Infection (CDI), According to the Location of Stool Collection and Inpatient Health Care Exposure, 2011.**

Of the estimated cases of community-associated CDI, 82% were estimated to be associated with outpatient health care exposure.<sup>11</sup> CO-HCA denotes community-onset health care-associated infection, HO hospital onset, and NHO nursing home onset.

Lessa, et al. New Engl J Med ;372:825-34, 2015

# 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

McDonald et al. N Engl J Med., 2005

Warny et al. Lancet, 2005

Stabler et al. J Med Micro., 2008

Akerlund et al. J Clin Microbiol., 2008



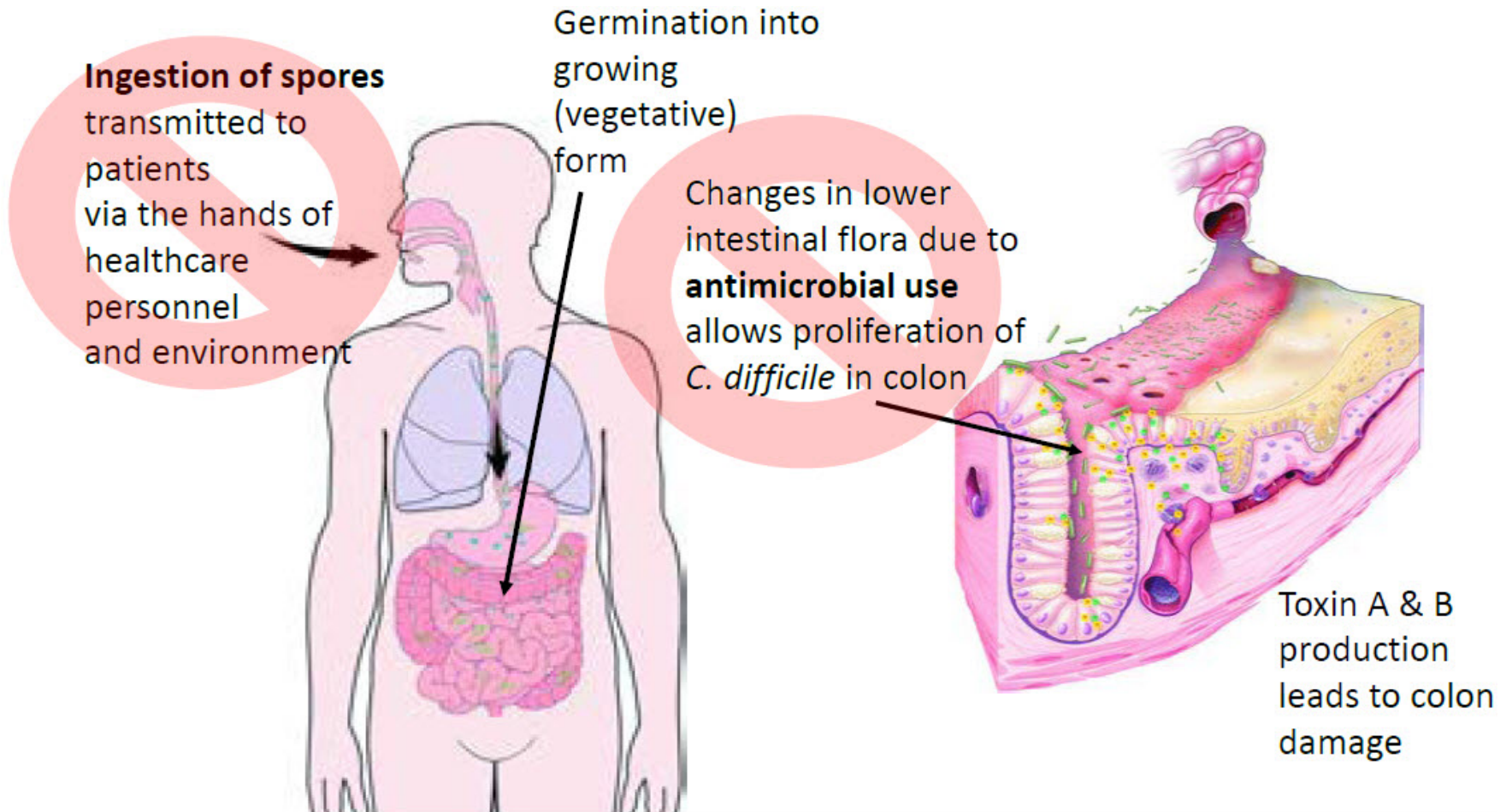
## CDI is a 2-Step Process

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**

Sunenshine et al. Cleve Clin J Med;73:187-97, 2006

# *Clostridium difficile* Pathogenesis



Sunenshine et al. Cleve Clin J Med ;73:187-97, 2006

## 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
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## 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
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- 
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# 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

Cohen, S., Clostridium difficile Infection: Current Challenges and Controversies, 2008

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# 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

**Standard of practice**

## 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

Mayfield et al. Clin Infect Dis ;31:995-1000,2000

Wilcox et al. J Hosp Infect ;54:109-14, 2003

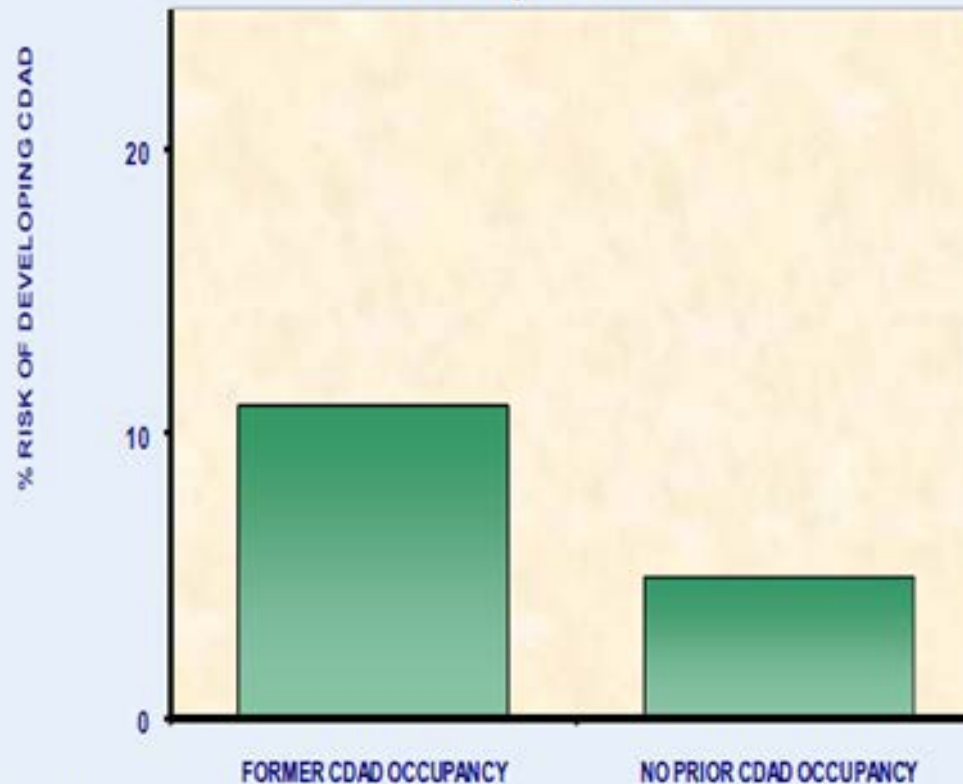
## Environmental cleaning and disinfection (continued)

- 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

Mayfield et al. Clin Infect Dis;31:995-1000,2000

Wilcox et al. J Hosp Infect;54:109-14,2003

## *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

# 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

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Fowler et al. J Antimicrob Chemother;59:990-5, 2007

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

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

High Risk	Medium Risk	Low Risk
Aminopenicillins	Beta-lactam/beta-lactamase inhibitors	Macrolides
Clindamycin	Carbapenems	Trimethoprim/sulfamethoxazole
Cephalosporins		Tetracyclines
Fluoroquinolones		

- 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
      - 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
    - Fewer CDI patients contribute to transmission

Dubberke, et al. Infect Contr Hosp Epidemiol;35(6):628-645, 2014

# 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](http://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
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# Adherence Monitoring Tool - Hand Hygiene

Discip line	What type of HH opportunity was observed? (select/ <input checked="" type="checkbox"/> 1 per line) <b>*Remember:</b> Hand hygiene should be performed before <u>and</u> after glove use	✓ = Successful Ø = Missed
N	<input type="checkbox"/> entering room* <input type="checkbox"/> before task <input type="checkbox"/> after body fluids <input type="checkbox"/> after care* <input checked="" type="checkbox"/> leaving room	✓
	<input type="checkbox"/> entering room* <input type="checkbox"/> before task <input type="checkbox"/> after body fluids <input type="checkbox"/> after care* <input type="checkbox"/> leaving room	
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	<input type="checkbox"/> entering room* <input type="checkbox"/> before task <input type="checkbox"/> after body fluids <input type="checkbox"/> after care* <input type="checkbox"/> leaving room	

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)
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# Adherence Monitoring Tool – Contact Precautions

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

# Adherence Monitoring Tool-Environmental Cleaning

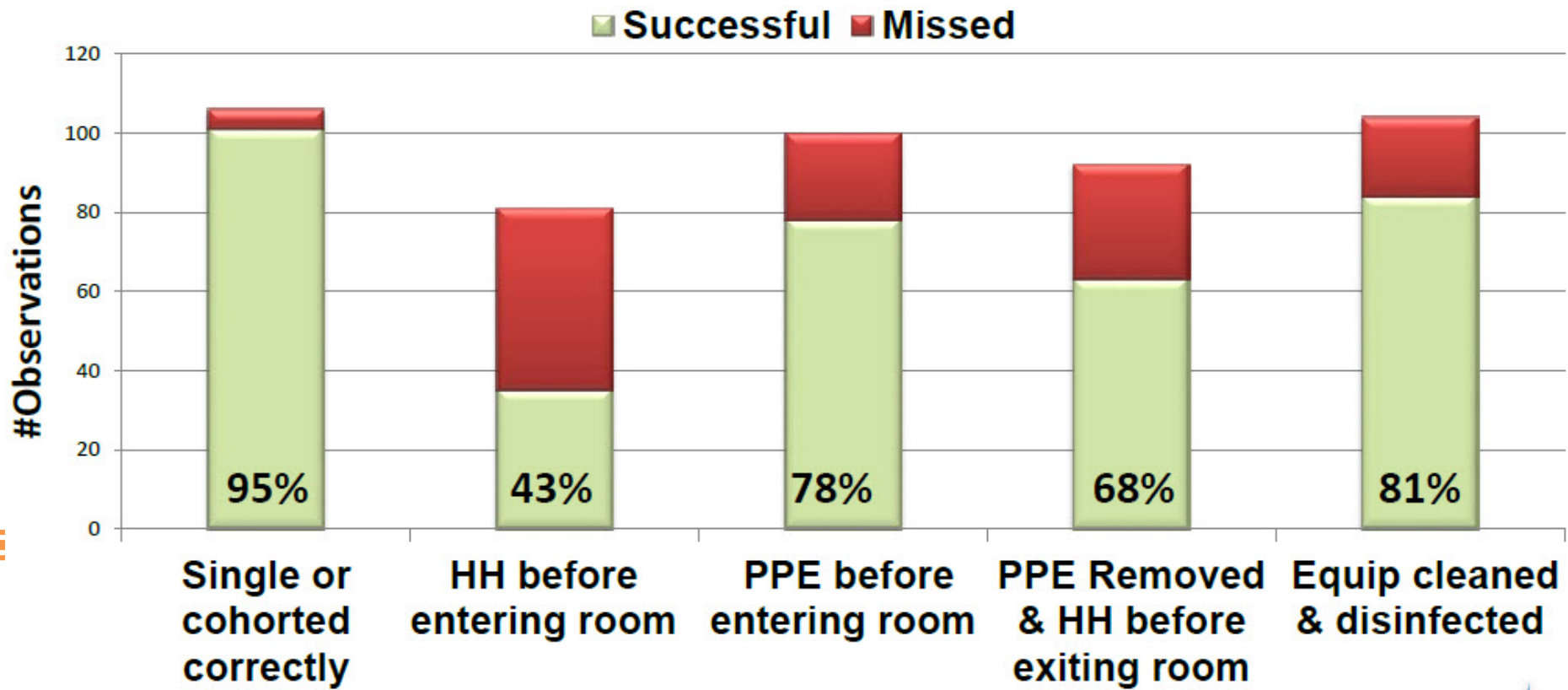
Environmental Cleaning Practices	EVS Staff 1		EVS Staff 2		Adherence by Task	
	Yes	No	Yes	No	# Yes	# Obs
Detergent/disinfectant solution is mixed according to manufacturer's instructions.	Yes	No	Yes	No		
Solution remains in wet contact with surfaces according to manufacturer's instructions.	Yes	No	Yes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

# Feedback Results

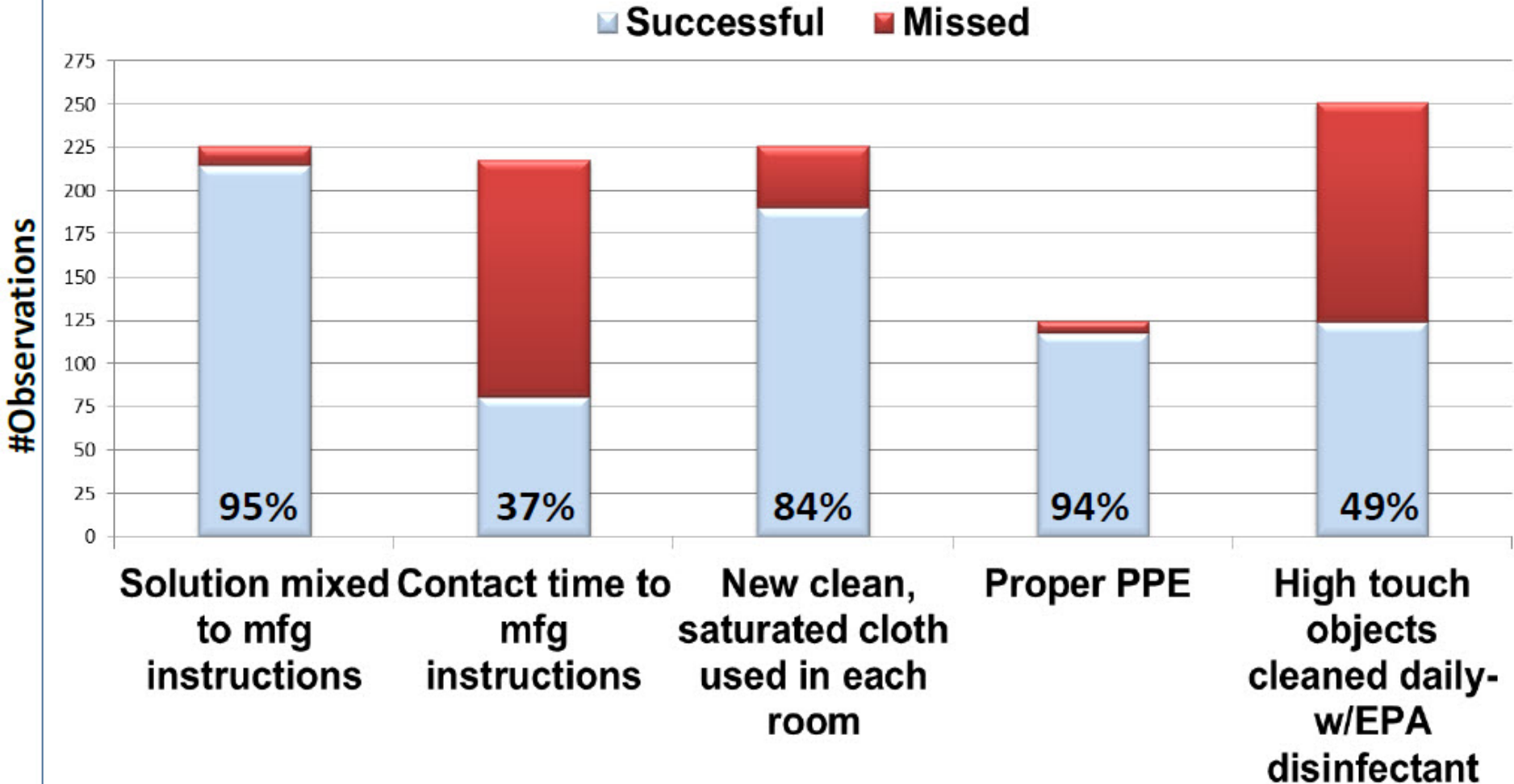
- Share with unit staff
  - Adherence monitoring results
  - CDI incidence
- Present to managers and leadership
  - Use data to focus prevention efforts
  - Use data to get needed resources



# CDPH Contact Precautions Observations, 131 Facilities, 2016



# CDPH Environmental Cleaning Observations, 131 Facilities, 2016



# 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!**

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## 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

- American Society for Microbiology. Why C. Difficile Causes Disease: It's Hungry. *ScienceDaily*, May 28, 2007
- Ananthakrishnan, A. N., Issa, M., Binion, D. G. Clostridium difficile and Inflammatory Bowel Disease. *Gastroenterology, Clinics of North America*, 38, 711-738, 2009
- CDC. Impact of antibiotic stewardship programs on Clostridium difficile infections, 2010, <https://www.cdc.gov/antibiotic-use/healthcare/evidence/asp-int-cdiff.html>
- Lanis, J.M., Barua, S., Ballard, J.D. Variations in TcdB activity and the hypervirulence of emerging strains of Clostridium difficile. *PLoS Pathog* 6(8): e1001061, 2010
- McDonald LC, Coignard B, Dubberke E, et al. Ad Hoc CDAD Surveillance Working Group. Recommendations for surveillance of *Clostridium difficile*-associated disease. *Infect Control Hosp Epidemiol*, 28:140-5, 2007

## Additional References and Resources

- Riggs MM, Sethi AK, Zabarsky TF, et al. Asymptomatic carriers are a potential source for transmission of epidemic and nonepidemic *Clostridium difficile* strains among long-term care facility residents. *Clin Infect Dis*, 45:992–8, 2007
- Rupnik, M., Wilcox, M.H., & Gerding, D. N. Clostridium difficile infection: new developments in epidemiology and pathogenesis. *Nature Reviews Microbiology*, 7, 526-536, 2009
- Stone ND, Ashraf MS, Calder J et al. CDC/SHEA Surveillance Definitions for Infections in Long-term Care Facilities: Revisiting the McGeer Criteria, 2012. [www.jstor.org/stable/10.1086/667743](http://www.jstor.org/stable/10.1086/667743)
- SHEA/IDSA Compendium of Recommendations. *Infect Control Hosp Epidemiol*, 35:628-644, 2014

# Questions?

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