

Welcome to *California*



Clostridium difficile Infection Prevention



Basics of Infection Prevention
2-Day Mini-Course
2015

Objectives

- Describe the etiology and epidemiology of *C. difficile* infection (CDI)
- Review the evidence-base for CDI prevention
- Discuss core and supplemental strategies to prevent CDI
- Review CDI surveillance
- Review NHSN MDRO Calculator
- Discuss CDI testing methods

Clostridium difficile Bacteria



- Anaerobic, spore-forming bacillus
- Infective form are **spores** that can survive for months in the environment
 - Outer coating 'sticky', allowing firm adherence to environmental surfaces
- Contamination of environment well-documented
 - Contamination most extensive in close proximity to symptomatic patients
- Equipment contamination linked to spread of *C. difficile*
 - Commodes, bed pans, blood pressure cuffs, oral and rectal thermometers
- Not normal flora; transient colonization <2% in adults without recent inpatient healthcare facility exposure

Epidemiology of *C. difficile* Infection (CDI)

- Most common organism to cause HAIs in the United States
- Incidence more than doubled between 2000 and 2009
- Symptoms of CDI begin soon after colonization, with median time to onset of 2-3 days
- 96% patients with CDI received antimicrobials in 14 days prior to onset of diarrhea
 - ALL had received antimicrobial in previous 3 months
- *C. difficile* infection (CDI) ranges in severity from diarrhea to colitis to toxic megacolon to death



Epidemiology of CDI - continued

- CDI incidence *and* severity of illness increasing while other HAI decreasing

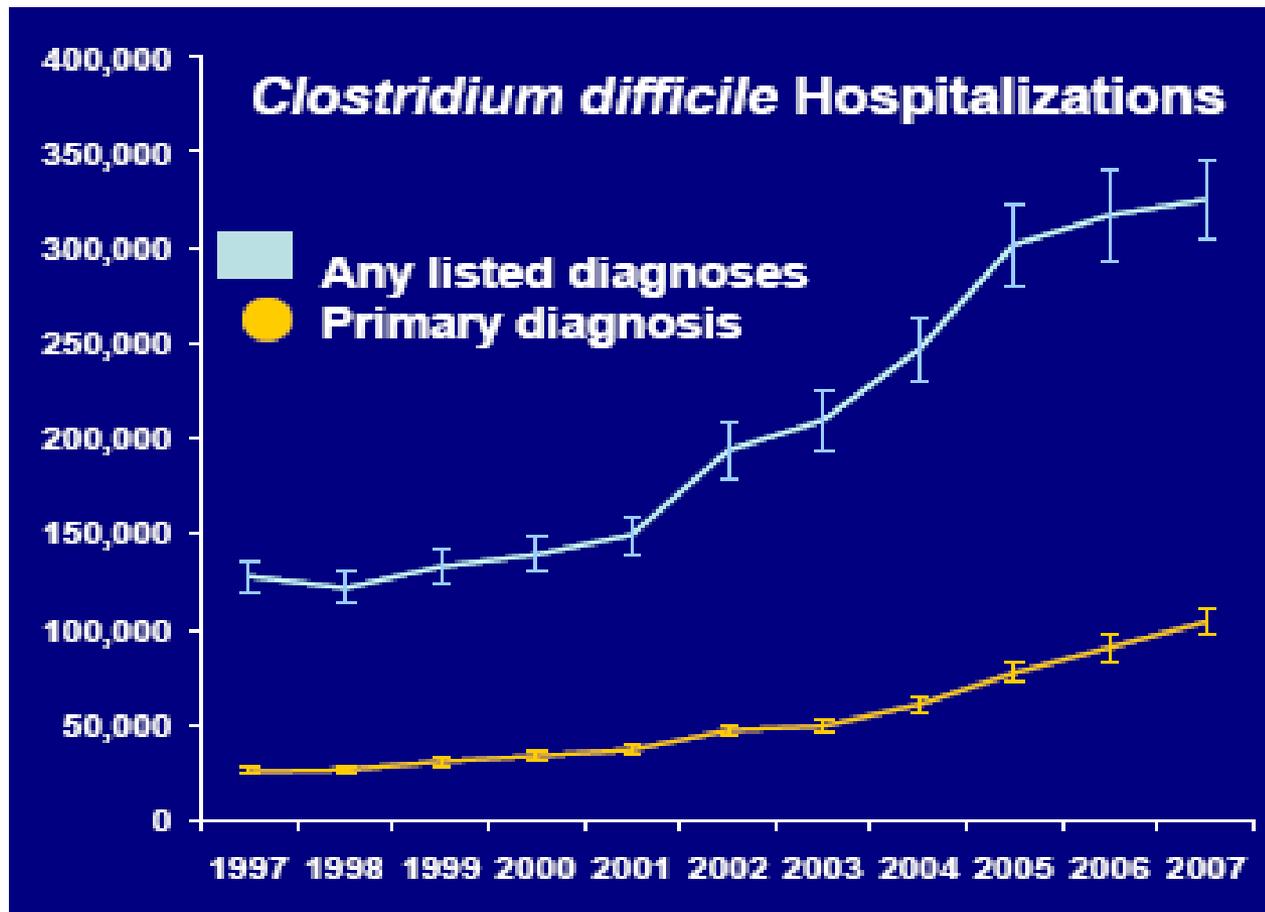
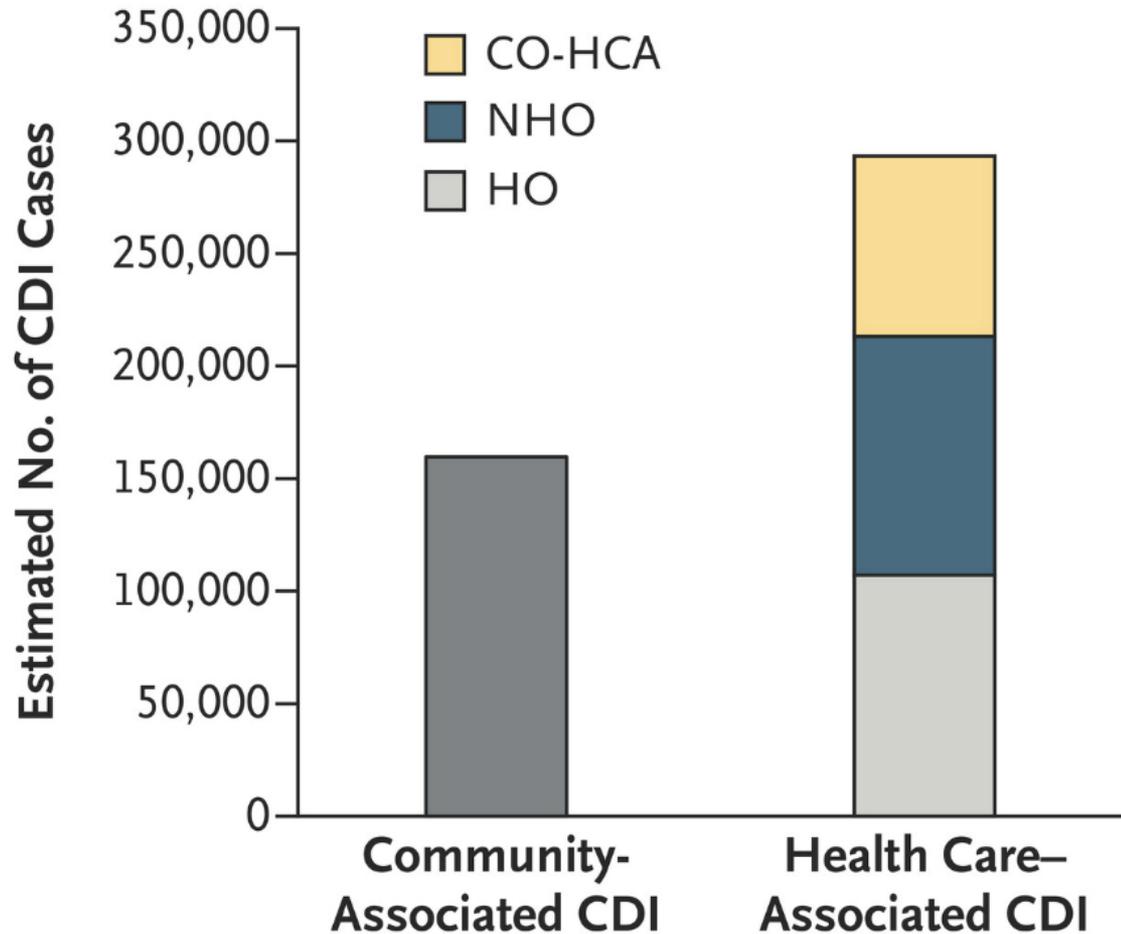


Figure 1. Estimated U.S. Burden of *Clostridium difficile* Infection (CDI), According to the Location of Stool Collection and Inpatient Health Care Exposure, 2011.



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



Lessa, F.C, Bamberg, W.M., Zintars, G.B, et al, 2015, Burden of *clostridium difficile* infection in the United States; NEJM, 372; 825-34

Epidemiology of CDI - continued

- *Clostridium difficile* accounts for
 - 12.1% of all HAIs in the US.¹
 - 56% of HAIs reported by California hospitals, 2014
 - 10,553 CDI cases of the 18,780 total HAI reported
- 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 discharge²

1. Magill et al., 2014

2. Huang et al., 2010

New Epidemic Strain of *C. difficile*

NAP1/BI/027

- Historically uncommon – epidemic since 2000
- Highly resistant to fluoroquinolones (e.g. Cipro)
- Hypervirulent
 - Increased toxin A and B production
 - Toxin B binding factor, more adherence in the gut
- Increased sporulation

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

Risk Factors for CDI

- 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

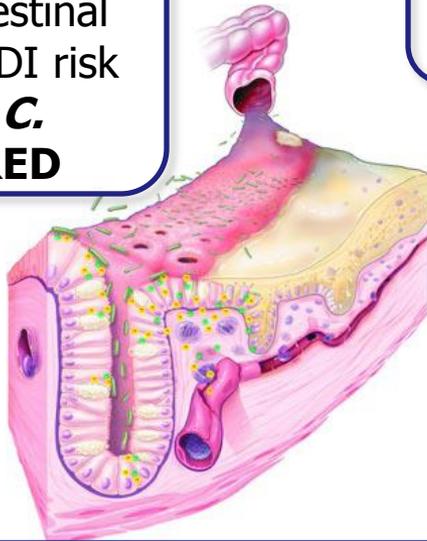
- Acquisition of *C. difficile* bacteria
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Modifiable risk factors

- Gastric acid suppression
- Prolonged stay in healthcare facility
- Inflammatory bowel disease
- GI surgery

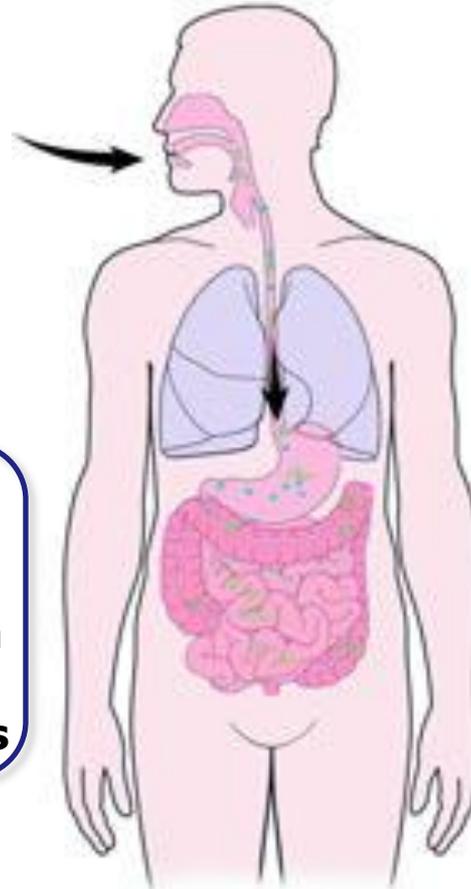
Role of Transmission and Antimicrobial Use in CDI Pathogenesis

Antimicrobial exposure changes lower intestinal flora, increasing CDI risk for ~3 months **IF *C. difficile* ACQUIRED**



If antimicrobial exposure disrupted normally protective bacteria in lower intestines, bacteria proliferate. **Incubation period until CDI (diarrhea, toxin production) is 2-3 days**

C. difficile spores are transmitted **via hands of healthcare personnel** transiently contaminated after contact with a CDI symptomatic patient or that patient's surrounding environment



Uninfected patient ingests spores
Spores germinate into growing, vegetative bacteria

Diagnosis of CDI

- Symptoms - usually diarrhea
 - ≥ 3 unformed STOOLS over 24 hours (conforms to shape of cup)
- Positive stool test for presence of *C. difficile* or toxins
- Diagnostic Imaging
 - Endoscopic or histologic (pseudomembranous disease)
- Relapse occurs in 10-25% cases



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

Stone ND, Ashraf MS, Calder J et al. CDC/SHEA Surveillance Definitions for Infections in Long-term Care Facilities: Revisiting the McGeer Criteria, 2012

Recommendations for CDI Prevention

Four principals:

1. Improve antibiotic use
2. Early and reliable detection of CDI
3. Isolate symptomatic patients
4. Reduce contamination of healthcare environmental surfaces



CDC Prevention Strategies

Core Strategies

Higher levels of scientific evidence

Demonstrated feasibility

- Should become standard practice

Supplemental Strategies

Some scientific evidence

Variable levels of feasibility

- Consider implementing in addition to Core when infections persist or rates are high

Strategies for CDI Prevention

Core Strategies

- Antimicrobial stewardship
- Rapid testing and immediate notification of positive test results
- Contact Precautions for duration of diarrhea
- Hand hygiene
- Cleaning and disinfection of equipment and environment
- Comprehensive CDI education

Supplemental Strategies

- Extend use of Contact Precautions beyond duration of diarrhea
- Presumptive isolation for patients with diarrhea
- Limit hand hygiene to only handwashing
- Universal glove use
- Sodium hypochlorite (bleach) agents for environmental cleaning



Antimicrobial Stewardship (Core)

- 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 use of cephalosporin and clindamycin found most useful (may be used for surgical prophylaxis)
- Reduce use of broad-spectrum antibiotics
 - Enforcement of narrow-spectrum antibiotic policy with feedback to prescribing physician resulted in a significant reduction in CDI in 3 acute geriatric medical wards



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

CDPH ASP Definition – 11 Elements Recommended by the HAI Advisory Committee

Basic	Intermediate	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	

ASP Strategies Specifically Targeting CDI

- Restricting antimicrobials with high risk for CDI, and promoting 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		

Stopping unnecessary antibiotics in patients with new CDI diagnoses



California Antimicrobial Stewardship Initiative

- Component of the CDPH HAI Program
- Goal is to assist all California hospitals and long-term care facilities optimize antimicrobial use to improve patient outcomes
- www.cdph.ca.gov/programs/hai/pages/AntimicrobialStewardshipProgramInitiative.aspx

Identify, Notify, and Isolate (**Core**)

- **Test** should be performed on symptomatic patients with unformed stool
 - Single specimen at onset of symptoms is sufficient
 - Repeat testing is of limited value and should be discouraged
- Laboratory-based system for **immediate notification** of positive CDI test results
- **Isolate** symptomatic patients with positive CDI test in private room
 - If unavailable, cohort but provide dedicated commode for each patient

Contact Precautions (**Core**)

- 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. 48 hour
 - consider if rates of CDI persist

(Supplemental)

Universal Glove Use (Supplemental)

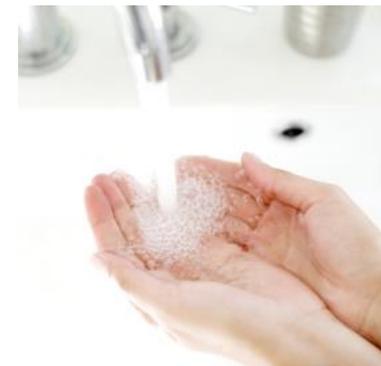
- Rationale: Spores difficult to remove even with hand washing
 - Asymptomatic carriers play a role in transmission (though magnitude of contribution unknown)
 - Practical CDI screening tests not available
- Adherence to glove use (with or without Contact precautions) critical to preventing *C. difficile* transmission via hands of HCW
- For facilities or units with high CDI rates, consider adopting routine glove use for ALL patient care (“universal”)

“Presumptive” Isolation (**Supplemental**)

- Rationale: Patients with CDI may contaminate environment and hands of healthcare personnel before results of testing known
- For any patient with ≥ 3 unformed (i.e. taking shape of container) stools within 24 hours
 - Send stool specimen for *C difficile* testing
 - Isolate patient pending results
- For patient with possible recurrent CDI (isolate and test following first unformed stool)

Only Handwashing (**Supplemental**)

- **Soap and water handwash** instead of alcohol gel options
- Rationale: Physical removal with running water important. Alcohol hand gels not sporicidal
- Recommended after ANY contact with CDI patient or environment
- Hand washing with plain soap or antimicrobial agent are equally effective in removing *C.difficile* spores from hands of healthcare workers



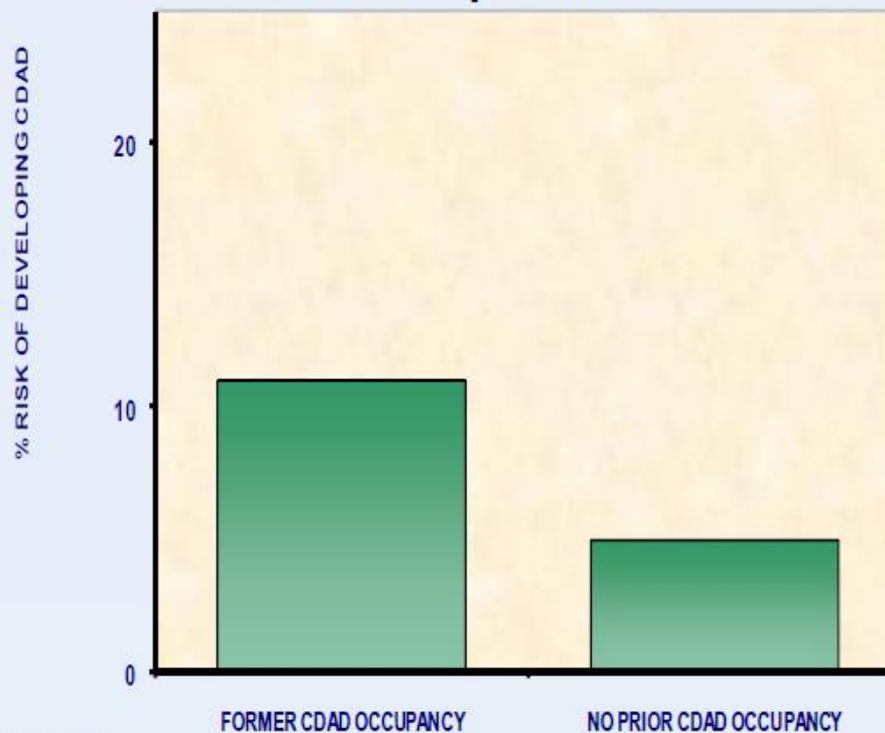
Environmental Cleaning (**Core**)

- Ensure thorough cleaning of CDI patient care areas
 - Focus on high-touch surfaces and bathroom
- Identify and remove environmental sources of transmission
 - Replace electronic with single use disposable thermometers
- Assess **adequacy** of cleaning before making decisions to change 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 2000;31:995-1000.
Wilcox et al. J Hosp Infect 2003;54:109-14.

C. difficile Transmission from Prior Room Occupants



110%
Increased
risk

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

Bleach for Routine Cleaning (**Supplemental**)

- Use if 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 recently registered other sporicidal disinfectants

No Recommendation

- Probiotics
 - Naturally occurring live bacteria
 - Rationale for use is to prevent CDI by restoring normal flora
- Decolonization
 - No data to support decolonization
- Fecal transplants
 - Promising!

APIC Guide to the elimination of *Clostridium difficile*, 2008; updated 2013

Monitor CDI Rates to Assess Prevention Progress **(Core)**

Perform surveillance

- LabID method is the nationally-recognized quality measure for the surveillance of CDI (NQF endorsed)
- Requires no clinical review or further evaluation of positive lab finding
- Include ALL *C. difficile* toxin-positive tests from inpatients, and ED patients if admitted to your hospital the same calendar day

CDI LabID Surveillance

NHSN algorithm categorizes CDI cases according to the admission and testing dates you enter

Community-Onset (CO)	For Inpatient surveillance, a LabID event collected ≤ 3 days after admission to the facility (i.e., days 1, 2, 3 or admission)
Healthcare Facility-Onset (HO)	LabID event collected > 3 days after admission to the facility (on or after day 4)

Community-Onset Healthcare Facility - Associated (CO-HCFA)	LabID event collected from a patient who was discharged from the facility ≤ 4 weeks prior to current date of stool specimen collection
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CDI LabID Surveillance

NHSN also tracks if CDI case is new or recurrent

- Considered **recurrent** if >2 weeks and ≤ 8 weeks after last CDI event reported for that patient
- There is no advantage to not identifying and entering into NHSN all CDI cases



Interpreting CDI Surveillance Data

- Differences/changes in laboratory testing method and patient populations make it difficult to compare CDI rates over time in the same hospital or among different hospitals
- NHSN analysis uses a CDI risk adjustment method
 - Adjusted for type of laboratory test, prevalence of CDI (community onset CDI rates), and hospital size



LabID Event Protocol MDRO and CDI Module (New 2015)

- Add Emergency Department (ED) and 24hr Observation Units to NHSN Locations
 - Hospitals must set up mapping in NHSN
 - **All** MRSA and VRE blood specimens and CDI from these locations are now reported
 - No longer attribute the infection to the location to which the patient is admitted unless they come from another affiliated outpatient location and are admitted on the same calendar day
 - For denominator, must enter monthly ED and 24 hour observation encounters (i.e. visits)



MDRO & CDI LabID Event Calculator Ver 1.0

Welcome to the Multidrug-resistant Organism and Clostridium difficile LabID Event Calculator (LabID Calculator) which implements the National Healthcare Safety Network (NHSN) MDRO and C. difficile surveillance definitions. The calculator is designed as a learning tool for understanding the intricacies of LabID event identification and reporting to NHSN. No data is reported from this calculator nor is your data stored on any computer. This is by design so as to insure the privacy and confidentiality of the information should real data be used. You can however, print screens for archival purposes. Be sure to read and study the LabID event protocol which may be found [here](#).

The calculator implements facility wide determination of MDROs and C. difficile, one organism, one patient, and one month at a time. Should you wish to do location specific reporting, just choose "All Specimen Types" below and only enter data for those locations under surveillance. Location names may be typed in or you may use a generic set of facility locations. If you choose to type in your locations, there is an auto-complete mechanism which finishes your location name after you have typed it in initially. [less...](#)

Enter a Reporting Plan...

Choose an organism to track ▲

- MRSA
- MSSA
- VRE
- CephR-Klebsiella
- CRE-Ecoli
- CRE-Klebsiella
- MDR-Acinetobacter
- CDIF-C. difficile ▼

All Specimen Types: Blood Specimens Only:

Use Generic Locations: Type In Your Own:

Choose a reporting month ▼

Choose a reporting year ▼

Next...

New MDRO/CDI LabID Event Calculator

A web-based tool designed to

- Help users learn how to accurately apply the MDRO & CDI LabID Event algorithms and
- Assist users in making the correct MDRO & CDI LabID Event determinations

Note: California hospitals are required to report all CDI from inpatient, ED and 24 hour observation locations.

[www.cdc.gov/nhsn/labid-calculator/
index.html#](http://www.cdc.gov/nhsn/labid-calculator/index.html#)

References and Resources

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- 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* 2007; 45:992–8.

References and Resources

- Rupnik, M., Wilcox, M.H., & Gerding, D. N. (2009). Clostridium difficile infection: new developments in epidemiology and pathogenesis. *Nature Reviews Microbiology*, 7, 526-536.
- Stone ND, Ashraf MS, Calder J et al. CDC/SHEA Surveillance Definitions for Infections in Long-term Care Facilities: Revisiting the McGeer Criteria, 2012.
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Questions?

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

Thank you

