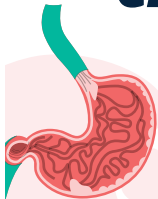


# Clostridioides difficile:

## PRESS PAUSE BEFORE POINTING FINGERS!



The Environmental Association with Hospital-Onset *C. difficile* Infection Risk in Healthcare Facilities

Rebecca Battjes, MPH, CIC, FAPIC



## DISCLOSURES

Rebecca is employed by Diversey—A Solenis Company. Diversey pays speakers' salaries, expenses to travel and present, but has had no input into the presentation from a commercial interest.



## LEARNING GOALS



### REVIEW THE LITERATURE

Including national data and recommendations for environmental disinfection to prevent the risk of *Clostridioides difficile* infection (CDI) in the healthcare environment.



### REVIEW STUDIES OF DISINFECTANT EFFICACY

Why do we do what we do in today's healthcare environmental cleaning & disinfection?



### DISCUSS RISK OF EXPOSURE

Risk factors exist inside and outside healthcare facilities and how patients are likely exposed to *C. difficile* (*C. diff*) in a wide range of locations.



### ACKNOWLEDGE MULTIFACTED HAI ACCOUNTABILITY

*C. diff*, like all HAIs, is complex. Rarely is one department wholly responsible for transmission.



## AN EVS LEADER'S PERSPECTIVE

- Anonymous post on AHE Community by EVS leader with 30+ yrs experience
- Recent spike in *C. diff*
- Excellent satisfaction scores, high visually assessed cleanliness, very high EVS employee engagement with turnover below 20%
- "Our nursing and quality experts are 100% focused on EVS as the reason for the spike in *C. diff*."
- Mandated all bleach cleaning, fluorescent marking with total room reclean if one surface is missed.
- Staff is frustrated, leader is frustrated, and surfaces are being broken down (chlorine corrosion).

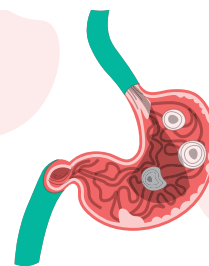


As an IP, have you ever implicated EVS as the primary responsible party for an increase or spike in *C. diff* cases?

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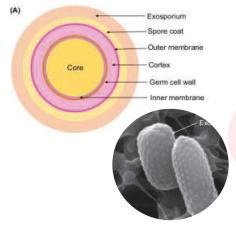
# Clostridioides difficile:

## OVERVIEW



## A quick primer on *Clostridioides difficile* infection

- Anaerobic gram-positive spore forming bacteria (low oxygen tolerance)
  - The spores make *C. difficile* more resistant to many healthcare disinfectants (e.g., quats, alcohols, lower concentrations of hydrogen peroxide).
- C. diff* infection is estimated to cause almost half a million illnesses in the United States each year, and an estimated 29,300 deaths. (Guh et al, 2020)
- Approximately 1 in 6 patients who get *C. diff* will experience recurrence in subsequent 2 to 8 weeks (Guh et al, 2020)
- CDI Lab ID is a CMS reportable condition associated with financial penalties.
  - The 2022 CDC NHSN rebaseline is expected to make achieving an SIR less than 1 more difficult



A Revised Understanding of *Clostridioides difficile* Spore Germination - Scientific Figure on ResearchGate. Available from: [https://www.researchgate.net/publication/340879310/Clostridioides-difficile-Spore-Structure-A-Schematic-cross-sectional-representation-of\\_fig1\\_340879310](https://www.researchgate.net/publication/340879310/Clostridioides-difficile-Spore-Structure-A-Schematic-cross-sectional-representation-of_fig1_340879310) [accessed 22 Apr, 2024]

## Effect of Low/Intermediate Level Disinfectants on Microorganisms

ORGANISM	TYPE	EXAMPLES
Bacterial Spores	Spore	<i>Bacillus anthracis</i> , <i>C. difficile</i>
Mycobacteria	Bacteria	<i>M. tuberculosis</i> , <i>M. terrae</i>
Small non-enveloped virus	Virus	Poliovirus, Norovirus, Hep A
Fungal spores	Fungus	Aspergillus, Penicillium, Trichophyton
Gram negative bacteria	Bacteria	<i>E. coli</i> , Klebsiella including CRE, Pseudomonas
Fungi (Vegetative)	Fungus	Candida species (excluding <i>Candida auris</i> )
Large Virus (non-enveloped)	Virus	Adenovirus, Rotavirus
Gram positive bacteria	Bacteria	Staphylococcus incl MRSA, Enterococcus incl VRE
Virus (enveloped)	Virus	HIV, HBV, HCV, Influenza, Mpox

Adapted from Rutala & Weber. ICHE 2014;35(7):862; McDonnell & Burke, J Hosp Infect 2011;78(3):163-70.

## How *C. difficile* can spread in healthcare ...



Touching unclean surfaces contaminated with feces from an infected person.



Failure to sanitize or clean hands after contact with contaminated surfaces.



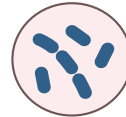
Caring for or working near the patient. Contamination spreads to patient surfaces & is ingested.

Image modified from CDC

## *C. difficile*: What are the risk factors?



Antibiotic exposure is the most important modifiable risk factor for CDI.



Previous infection or colonization with *C. difficile*. Exposure to the germs, which can happen inside or outside of the healthcare.



Older age: 1 in 11 people over 65 diagnosed with a healthcare-associated *C. difficile* infection die within a month.



A weakened immune system (examples: people with HIV/ AIDS, cancer, or who take immune suppressing drugs)



Recent stay at a healthcare facility, like a hospital or nursing home

Lessa FC, Mu YL, Bamberg WM et al. N Engl J Med 2015;372:826-34. DOI: 10.1056/NEJMoa1408913 <https://www.cdc.gov/difftrack.html>

## CDI risk factors summarized

- C. difficile* exposure & colonization occur before developing CDI.
- Exposure & colonization can happen inside or outside healthcare facilities.
- Colonized persons have *C. difficile* in their intestines, but it is not causing signs or symptoms and does not need treatment.
- Antibiotic use is key.
  - 60% of CDI patients took antibiotics in the prior 4 months. This alters the normal gut flora (but does not appear to directly lead to colonization).



Graphic modified from CDC

## ADDITIONAL CDI RISK FACTORS

- Other notes/risk factors:
  - Patients with community-acquired CDI tend to be younger with no antibiotic use in the prior 4 months.
  - Gastric acid suppression, especially proton pump inhibitor (PPI) use
  - Other comorbidities (cancer chemotherapy, GI surgery, enteral feeding tubes, inflammatory bowel disease, and solid organ transplantation)



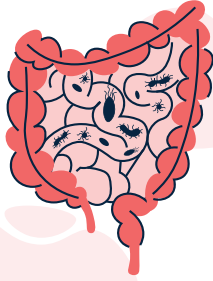
Feuereid P, et al. "The burden of CDI in the United States: a multifactorial challenge. BMC Infect Dis. 2023; 23: 132.  
 Kociolek LK, et al. "Strategies to prevent *Clostridioides difficile* infections in acute-care hospitals: 2022 Update. Infect Cont and Hosp Epidemiol. 2023; 44: 527-549.  
 Anjiewalden S, et al. "Risk factors for *Clostridioides difficile* colonization among hospitalized adults: A meta-analysis and systematic review. Infect Cont and Hosp Epidemiol. 2021; 42: 565-572.

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# C. diff

## DATA & TRENDING



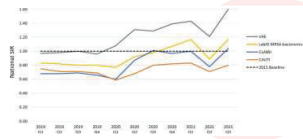
### How are hospital-onset (HO) C. diff rates/SIRs trending at your facility?

① The [Slido app](#) must be installed on every computer you're presenting from

slido

### C. DIFF: HOW ARE HOSPITALS DOING POST-COVID?

- **14% decrease** in hospital-onset (HO) CDI from 2019 to 2021, despite **significant increases** in nearly every other multidrug-resistant organism (MDRO) and other CMS-reportable healthcare-associated infections (HAIs) (see right).
- Authors hypothesized better cleaning & disinfection, hand hygiene & PPE use, **but** this contradicts increases in other environmentally-significant MDROs (*Candida auris*, MDR *Acinetobacter*, etc.).
- **Additional 3% decline** in HO-CDI from 2021 to 2022!
- Observed a **13% decrease** between 2022 and 2023 (CDC 2024)



*C. diff* did not increase throughout the COVID-19 pandemic, though most HAIs did (except for surgical site infections) (Lastinger 2022).

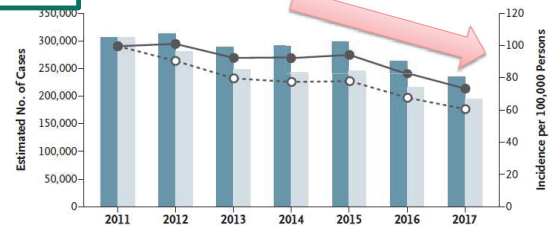
- <https://www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf>
- [https://arjpp.cdc.gov/profile/national-progress-2022/united-states#:~:text=The%202022%20HAIR%20Progress%20Report,to%202021%20\(%20%20\)@urc%201](https://arjpp.cdc.gov/profile/national-progress-2022/united-states#:~:text=The%202022%20HAIR%20Progress%20Report,to%202021%20(%20%20)@urc%201)
- <https://www.cdc.gov/healthcare-associated-infections/data/progress-report.html>

### MORE EVIDENCE SHOWS DECREASES IN HOSPITAL-ONSET C. DIFF

Pre-pandemic data from *The Emerging Infections Program (ten US sites), 2011- 2017.*

#### B Health Care-Associated CDI

Healthcare-associated = CD positive after 3<sup>rd</sup> day in hospital

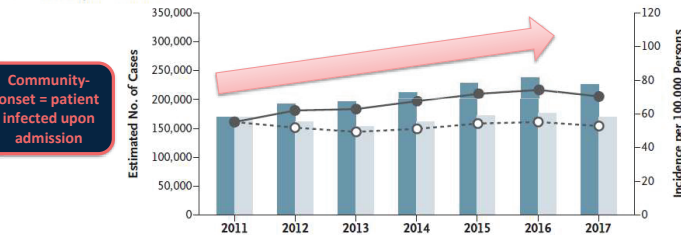


Guh AY, Ma Y, Winston LG, Johnston H, Olson D, Farley MM, Wilson LE, Holzbaumer SM, Phipps EC, Dumyati GK, Beldavs ZG, Kainer MA, Karlsson M, Gerdling DN, McDonald LC, Emerging Infections Program Clostridioides difficile Infection Working Group. Trends in U.S. Burden of Clostridioides difficile Infection and Outcomes. *N Engl J Med.* 2020 Apr 2;382(14):1320-1330. doi: 10.1056/NEJMoa1910215. PMID: 32242357. PMCID: PMC7861882.

### As hospital-onset cases decrease, community cases increase.

Pre-pandemic data from *The Emerging Infections Program (ten US sites), 2011- 2017.*

#### A Community-Associated CDI

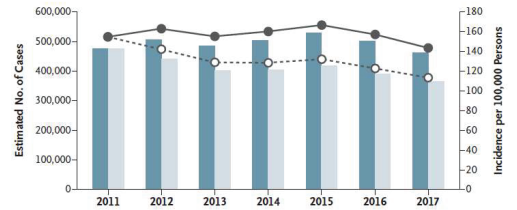


Guh AY, Ma Y, Winston LG, Johnston H, Olson D, Farley MM, Wilson LE, Holzbaumer SM, Phipps EC, Dumyati GK, Beldavs ZG, Kainer MA, Karlsson M, Gerdling DN, McDonald LC, Emerging Infections Program Clostridioides difficile Infection Working Group. Trends in U.S. Burden of Clostridioides difficile Infection and Outcomes. *N Engl J Med.* 2020 Apr 2;382(14):1320-1330. doi: 10.1056/NEJMoa1910215. PMID: 32242357. PMCID: PMC7861882.

### COMBINED C. DIFF BURDEN ON US HEALTHCARE

#### C Total CDI

CDI hasn't disappeared! Many facilities are identifying cases earlier, therefore decreasing HO cases, while increasing CO cases.



Actual burden estimate	476,400	505,700	485,100	505,000	529,700	502,200	462,100
Adjusted burden estimate	476,400	441,600	402,900	405,100	419,800	392,000	365,200
Actual incidence estimate	154.89	163.14	155.38	160.35	166.87	157.35	143.61
Adjusted incidence estimate	154.89	142.47	129.06	128.65	132.26	122.81	113.48

Guh AY, Ma Y, Winston LG, Johnston H, Olson D, Farley MM, Wilson LE, Holzbaumer SM, Phipps EC, Dumyati GK, Beldavs ZG, Kainer MA, Karlsson M, Gerdling DN, McDonald LC, Emerging Infections Program Clostridioides difficile Infection Working Group. Trends in U.S. Burden of Clostridioides difficile Infection and Outcomes. *N Engl J Med.* 2020 Apr 2;382(14):1320-1330. doi: 10.1056/NEJMoa1910215. PMID: 32242357. PMCID: PMC7861882.

# C. diff

## INFECTION PREVENTION & CONTROL RECOMMENDATIONS



### KEY CDC PREVENTION STRATEGIES FOR HOSPITALS



**Isolate & initiate contact precautions** for suspect & confirmed cases.



**Confirm CDI** with lab tests when patients meet testing criteria. Do not over test for CDI.



**Clean & disinfect** environmental surfaces (EPA List K sporicide)



**Develop infrastructure** to support CDI prevention (auditing, education, surveillance, etc.)



Engage facility's **antimicrobial stewardship** program.



**Consider supplemental interventions** (dedicate HCP, use of no-Touch [UV-C], expand sporicidal disinfection)

Centers for Disease Control and Prevention. "CDI prevention strategies: Strategies to prevent Clostridioides difficile infections in acute-care facilities". 2021. Retrieved from: <https://www.cdc.gov/cdiff/clinicians/cdi-prevention-strategies.html>

### EVS IS RESPONSIBLE FOR WHICH CDC RECOMMENDATIONS?



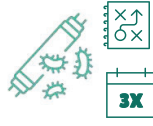
#### PRODUCT SELECTION & CORRECT USE

Use EPA List K sporicidal disinfectant *per label instructions*, daily, at discharge & transfer room cleaning & disinfection of CDI patients.



#### ENVIRONMENTAL HYGIENE AUDITING

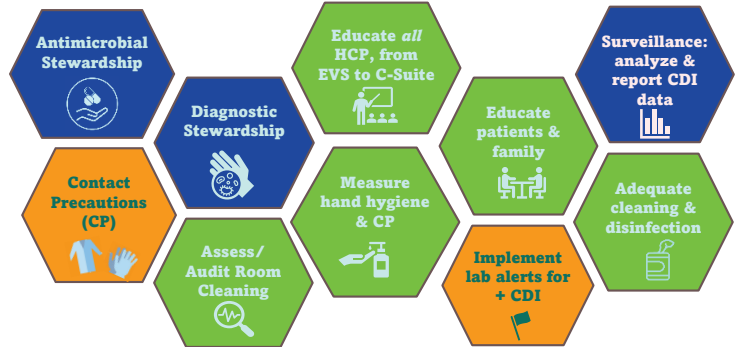
Performing environmental hygiene audits regularly (visual, ATP, fluorescent marking). Provide direct feedback to staff. Report results at Infection Control Committee.



#### INCREASED CLEANING IN OUTBREAK MODE

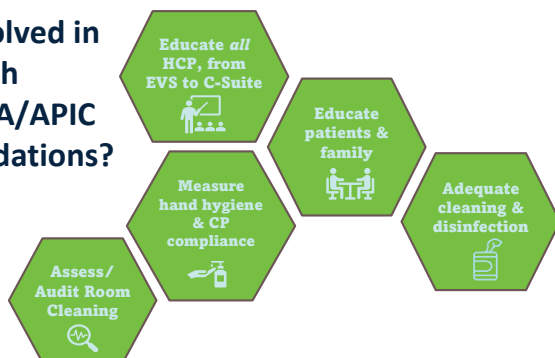
Consider additional measures in cluster or outbreak situations like more frequent cleaning & disinfection, no-touch disinfection technology & assign isolation rooms after non-isolation rooms.

### 2023 SHEA/IDSA/APIC: TEN ESSENTIAL PRACTICES



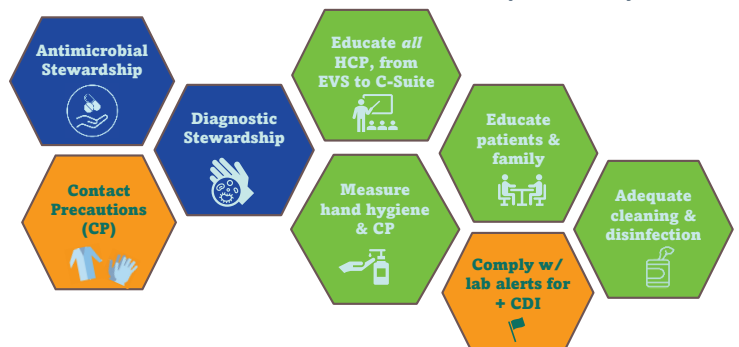
Kociolok LX, et al. "Strategies to prevent Clostridioides difficile infections in acute-care hospitals: 2022 Update. Infect Cont and Hosp Epidemiol. 2023; 44: 527-549"

### EVS is involved in which SHEA/IDSA/APIC recommendations?



Kociolok LX, et al. "Strategies to prevent Clostridioides difficile infections in acute-care hospitals: 2022 Update. Infect Cont and Hosp Epidemiol. 2023; 44: 527-549"

### What about non-EVS, clinical staff's responsibility?



Kociolok LX, et al. "Strategies to prevent Clostridioides difficile infections in acute-care hospitals: 2022 Update. Infect Cont and Hosp Epidemiol. 2023; 44: 527-549"

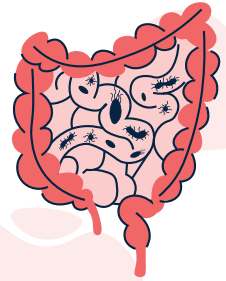
## ADDITIONAL SHEA/IDSA/APIC APPROACHES

The SHEA/IDSA/APIC guidelines *do not include* sporicidal disinfection as an essential practice!

- “Use an EPA-approved sporicidal disinfectant, such as diluted (1:10) sodium hypochlorite, for environmental cleaning/disinfection.
- Implement a system to coordinate with environmental services if it is determined that sodium hypochlorite is needed for environmental disinfection.
- Data **have not been consistent** regarding the ability of sporicidal disinfectants, including diluted sodium hypochlorite, to control CDI through environmental decontamination.”

Kociolok LK, et al. “Strategies to prevent Clostridioides difficile infections in acute-care hospitals: 2022 Update. Infect Cont and Hosp Epidemiol. 2023; 44: 527-549

## OTHER STUDIES ON EXPOSURE & INFECTION RISK



## CDI RISK MUCH HIGHER WHEN COLONIZED ON ADMISSION

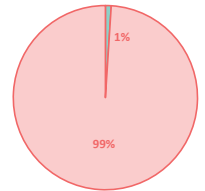
- ICU study of 4,658 patients in the US. Overall, 2% of ICU patients developed CDI.
  - 13.3 times more likely (aOR = 13.3) of developing CDI when colonized on ICU admission
  - 4% of ICU patients were colonized on admission. 15.1% developed CDI.
  - 96% of ICU patients were not colonized. 1.5% developed CDI.



Mackenzie et al, 2023

## GENOMIC TESTING REVEALS THAT ICU CROSS TRANSMISSION OF C. DIFF WAS RARE

- ICU study of 1,289 patients in the US over 9 months. 71.8% received antibiotics. 9.3% of patients were colonized on admission to the ICU.
  - Patients had a 24X higher chance (HR=24.4) of developing HO-CDI if colonized on ICU admission.
  - **Only 1% of CDI patients (6/584) had genomically supported acquisition of toxigenic C. difficile via cross-transmission and were near an index case in the transmission timeframe.**

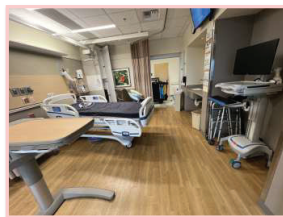


■ Evidence of cross transmission  
■ No evidence of cross transmission

Miles-Jay et al, 2023

## PRIOR ROOM OCCUPANCY MAY AFFECT INFECTION RISK

- A 5-hospital study in the US investigated whether the prior patient having CDI impacted the risk for the next patient.
  - Rooms were considered contaminated for 30 days after a CDI patient was in the room. Patients were tracked for a year.
  - The risk of CDI increased by 27% if exposed in the prior 90 days and 40% if exposed in the prior year.
  - All discharge cleaning in these hospitals was done with a sporicide and UV-C is frequently used as well.



Sood et al, 2022

## PRIOR ROOM OCCUPANCY MAY AFFECT INFECTION RISK

- Significant confounders include that:
  - Does not address whether patients at high risk for CDI were routinely put in the room where CDI patients were treated.
    - **Very significant for hospitals with limited number of private rooms!**
  - No genetic testing was done to establish a genomic link
  - No testing for colonization on admission.
  - No ward contact established
  - Cleaning compliance with the sporicide not measured



Sood G, et al. 2022

## OLDER STUDIES SHOWED A SUBSTANTIAL ENVIRONMENTAL RISK

- A study from the UK (Eyre et al, 2013) of 12,000 patients over 3.6 years
- Of symptomatic CDI patients, ~35% were genetically linked to a prior CDI patient. Patients were not tested for colonization and ward contact was estimated from hospital records
- 45% of CDI cases were genetically distinct (origin unknown) and could not have been in-hospital transmission.
- A 16-month 6 hospital study in Canada (Kong et al, 2019) on colonization and transmission that included testing for genetic relatedness found that for 201 cases of CDI:
  - 52% (105/201) had a genetic link to prior patients (same strain)
  - 40% (81/201) had a plausible ward link (but did not attempt to establish contact)
  - This establishes a ceiling on transmission, but actual in-hospital transmission would likely be a subset of the 40%



## STUDY TRACKING ACTUAL PATIENT CONTACT FINDS LOW TRANSMISSION

- A 9.5-year study in a Swiss hospital (Widmer et al, 2017) investigated 750 patients with CDI. 451 contacts were exposed to 279 index cases.
  - Testing of patient samples determined 6.0% of contacts (27/451) had toxigenic *C. diff* indicating possible transmission.
  - Ribotyping of samples determined probable transmission in 6 of 27 contacts or only 1.3% of total exposures (6/451).
  - Environmental sampling was performed & the toilet seat was the only surface to be contaminated with *C. diff* (2.3% or 3/128 samples).
    - Note sampling was done using cotton swabs which is a less common sampling method and thus may have had poor sensitivity. Typically, RODAC plates or sponge sticks are used for this type of sampling.



## HOW DOES *C. DIFF* EXPOSURE OCCUR OUTSIDE OF HEALTHCARE?



## *C. DIFF* EXPOSURE LITERATURE REVIEW DISCLAIMER

- As we review multiple studies showing where *C. difficile* exists outside of healthcare, don't panic! A few reminders:
- Exposure does not always lead infection or colonization.
- Fecal contamination is inevitable & ubiquitous.
- Good adherence to essential infection prevention & control practices are key preventing disease spread.



## EXPOSURE TO ANIMALS MAY TRANSMIT *C. DIFF*



*C. difficile* has been found in cats, dogs, pigs, cows, sheep, goats, chickens, horses, rabbits, wild birds, raccoon, zebras, kangaroos, elephants, monkeys, and chimpanzees (Knight, 2015)



Humans in contact with pigs were colonized with the same strain of *C. difficile* in 42% of farm workers in a study from 2002-2011 in the Netherlands (Knetsch, 2014)



In a series of studies on pet colonization with *C. difficile*, rates varied from 11-40% (Crobach, 2018)

Pet to owner transmission was documented in 20% of domestic pet contacts. (Loo, 2016)

Dogs routinely have *C. difficile* on their paws (24%) as do owner's shoes (43%) or slippers (28%) (Janezic, 2018)



In a study of pets allowed to visit hospitalized owners, 58% were colonized with *C. difficile* and 71% of those had toxigenic strains (Lefebvre, 2006).



## PEOPLE ARE LIKELY EXPOSED TO *C. DIFF* FROM SOME FOODS

- A recent meta-analysis of 60 studies in 20 countries found an overall food contamination of 6.3% (Borji et al, 2023)
  - Side Dishes 0.8% to Seafood 10.3%
  - Cooked food 4%
- (Crobach 2018, Gould 2010): Retail meat is routinely positive for *C. difficile* (6-63%) including ground beef, ready-to-eat beef, ground pork, ground turkey, and pork sausage.
  - Most of the isolates in Gould were toxigenic. Not all studies reported whether the *C. difficile* was toxigenic.
- (Weese 2009) Ground beef and pork positive for *C. difficile* in 12% of samples
- (Tkalec 2019) Vegetables were positive for *C. difficile* in 18.2% of samples including potatoes (28.0%), leaf vegetables (9.4%), ginger root (6.7%).
- Bakri (2009) found *C. difficile* in 7.5% of ready to eat salads.

Borji S, et al. Global prevalence of Clostridioides difficile in 17,148 food samples from 2009 to 2019: a systematic review and meta-analysis. J of Health, Population and Nutrition. 2023; 42: 36.

## STUDIES OF HOSPITAL FOOD FIND *C. DIFF*, BUT RARELY



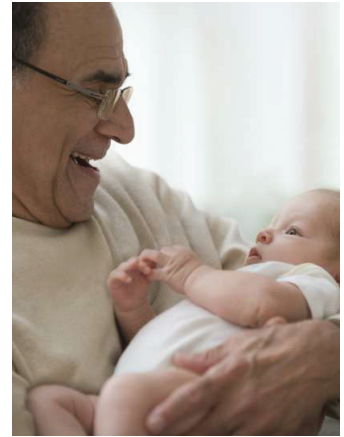
- A study from Italy of 350 food samples (296 cooked foods, 54 raw foods) found *C. difficile* in only 0.3% of food samples.
- A study from the US of 149 patients and 910 food samples found *C. difficile* in 0.2% of food samples. This study included modeling which suggests:
  - 12.7 patients per 1000 admissions are exposed to *C. difficile* through food.
  - 6.1 patients per 10,000 admissions would become colonized
- The authors viewed this as a low risk of causing colonization in patients.
- Unclear why hospital food contamination rates are so much lower than for the other studies cited.

• Primavilla S, et al. Contamination of hospital food with Clostridium difficile in Central Italy. *Anaerobe*. 2019; 55: 8-10.

• Kwon JH, et al. An Evaluation of Food as a Potential Source for Clostridium difficile Acquisition in Hospitalized Patients. *Infect Cont and Hosp Epidemiol*. 2016; 37(12): 1401-1407.

## INFANTS ARE COMMONLY COLONIZED WITH *C. DIFF*

- Up to 70% of healthy newborns may become colonized in the first months of life, and most remain asymptomatic, even in the presence of large numbers of toxin-producing bacteria
- *C. difficile* testing is **not recommended** for infants under 1 year.
- *C. difficile* strains known to cause disease in adults have been isolated from asymptomatic neonates



Centers for Disease Control and Prevention. *Clostridioides difficile* in Neonatal Intensive Care Unit Patients: A Systematic Review. Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Healthcare Quality and Promotion, Atlanta, GA. August 30, 2018. (<https://www.cdc.gov/nczcr/reviews/cdiff-nicu/index.html>)

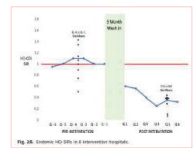
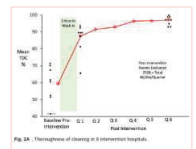
## HOW DOES PATIENT ROOM CLEANING & DISINFECTION IMPACT *CDI* RATES?

*It's complicated*



## ONE RECENT STUDY SHOWED A SUBSTANTIAL *CDI* REDUCTION

- Carling (2023) did an 18-month study across 8 hospitals and found that the *CDI* SIR decreased from 1.03 to 0.6. The intervention included improved cleaning compliance, education and training, use of a daily sporicide, and structured monitoring and feedback for EVS staff.
  - Cleaning compliance increased from 59% to 86% and then to 93.6%.
- Important Confounders include:
  - No genetic epidemiology used to show where transmission is linked.
  - No surface swabbing to show that improved cleaning compliance and disinfectant change reduced surface contamination.
  - Antibiotic prescription would have a big impact on *CDI* rates, but this is not discussed.
  - Possible diagnostic/testing changes. Six of 8 hospitals engaged in nursing education, which may impact sample collection and testing.
  - Hand hygiene compliance and use of PPE are not measured in the study.



## IMPROVING CLEANING COMPLIANCE MAY NOT REDUCE *CDI* RATES

- A systematic review and meta-analysis of 10 studies using environmental hygiene bundles to reduce *CDI* rates found while fluorescent marker removal, and percent of rooms with a positive *C. difficile* culture improved, **there was no significant effect on *CDI* rates.** (Chau 2020)

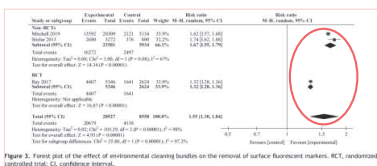


Figure 3. Forest plot of the effect of environmental cleaning bundles on the removal of surface fluorescent markers, BCT, randomized controlled trial, CI, confidence interval.

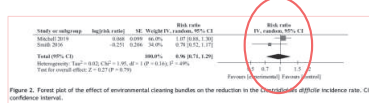


Figure 2. Forest plot of the effect of environmental cleaning bundles on the reduction in the Clostridium difficile incidence rate, CI, confidence interval.

Journal of Hospital Infection  
 Effects of environmental cleaning bundles on reducing healthcare-associated Clostridioides difficile infection: a systematic review and meta-analysis  
 J.P.C. Chau, X. Liu, S.H.S. Lo, W.T. Chen, X. Wan

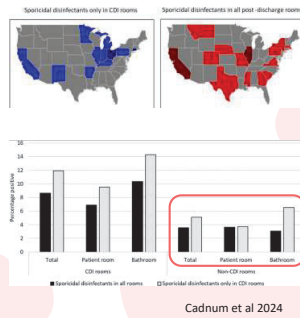
## Two large studies focusing on cleaning compliance showed minimal impact

- Ray 2017: A 12-month, 16 hospital study improved cleaning compliance from 63% to 82% for discharge and 52% to 69% for daily cleaning.
  - Number of rooms positive for *C. difficile* decreased from 13% to 3%
  - *CDI* rates increased from 5.6 to 5.8 per 10K patient days despite the use of bleach wipes.
- Mitchell 2019: An 11-hospital study in Australia (the REACH study) using a bundled intervention including improved cleaning compliance (Bedroom: 55% to 76% and Bathroom: 64% to 86%).
  - VRE rates dropped, which was the most significant result
  - *CDI* and MRSA rates did not improve

A Multicenter Randomized Trial to Determine the Effect of an Environmental Disinfection Intervention on the Incidence of Healthcare-Associated Clostridium difficile Infections  
 Mitchell RB, et al. *Clin Infect Dis*. 2019; 68(12): 1805-1812.  
 An environmental cleaning bundle and health care-associated infections in hospitals (REACH) randomized trial  
 Ray D, et al. *Clin Infect Dis*. 2017; 64(12): 1555-1562.

## Using Sporicidal Disinfectants for All Terminal Cleaning Did Not Result in Significantly Less *C. diff* Environmental Contamination

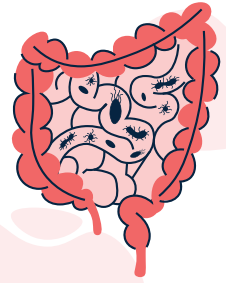
- APIC & VA collaborative research publication
- 30 hospitals completed a survey assessing effectiveness of post-discharge (terminal) patient room cleaning & disinfection
  - 17 (57%) used either PAA or chlorine-based disinfectant for all DCs
  - 13 (43%) used PAA or chlorine only for CDI+ DCs
- Hospital IPs performed environmental culturing in CDI and non-CDI rooms post cleaning & disinfection
- Rates of spore contamination in non-CDI rooms was lower, but not by much (no statistical significance)
- Conclusion: "Our results suggest that routine use of sporicidal disinfectants in non-CDI rooms might be less effective than anticipated in real-world settings."



Cadnum et al 2024

## OTHER INTERVENTIONS, BUNDLES & IMPACT ON CDI REDUCTION

*It's also complicated.*



## A STUDY TESTING MULTIPLE INTERVENTIONS DETERMINED CLEANING HAD LOW IMPACT

- A 4-hospital system conducted a stepped-wedge design study over 11 months to reduce CDI rates by testing **8 different interventions** (Peterson et al, 2020).
  - Interventions included terminal cleaning with bleach, soap and water hand hygiene, hand hygiene compliance, PPE compliance, use of UV-C unit, cleaning compliance, monitoring *C. difficile* patient testing, patient swabbing on admission for high-risk patients.
  - HAI rates dropped from 14.64 to 6.67 (i.e. 54%) per 10K patient days.
  - **Patient screening on admission had the highest impact on reducing CDI rates.** 8.3% of tests were positive.
  - Hand hygiene significantly improved but had no impact on CDI rates.
  - **Cleaning compliance and use of UV-C went down, indicating little impact on CDI rates.**
  - PPE compliance improved from 87% to 92% and then declined to 87%, indicating little impact on CDI rates.
  - Diagnostic testing and antibiotic prescription practices had modest changes and likely had little impact on CDI rates.
  - No significant changes to other HAI rates during the study.



## DIAGNOSTIC TESTING & ANTIBIOTIC STEWARDSHIP IMPACT RATES/RATIOS

- A 6-year study in a US hospital (Doll et al, 2020) tested a series of interventions including 2 step cleaning, UV-C, contact precautions plus handwashing with soap and water, sporicidal disinfectant, and use of the EMR to guide physicians in ordering testing.
  - **The only intervention to substantially decrease HO-CDI rates was the EMR guided testing protocol, which decreased CDI rates 27%.**
  - Some portion of this reduction may have been related to fewer tests being ordered, which affects the number of patients diagnosed.
- A 16-year study in the UK (Dingle et al, 2017) from several hospital groups investigated CDI rates and found:
  - Antibiotic stewardship was likely responsible for a decline in CDI rates.
  - Improved infection control practices appeared to have little impact on rates.



## ANTIBIOTIC STEWARDSHIP STRONGLY IMPACTS CDI RATES

- An analysis by the CDC of 7 years of antibiotic use in 921 US hospitals.
- "In a cross-sectional multivariable analysis, overall antibiotic use was significantly associated with the facility-level HO-CDI rate.
- For every 50 days of therapy (DOT) per 1,000 patient days (PD) increase in antibiotic use, there was a 2.8% increase in the HO-CDI rate (rate ratio [RR], 1.028; P < .001)."
- Decreasing use of antibiotics consistently resulted decreased in HO-CDI rates.



Kaazkova SV, et al. Associations of facility-level antibiotic use and hospital-onset Clostridioides difficile infection in US acute-care hospitals, 2012-2018. Infect Cont and Hosp Epidemiol. 2022;43:1067-1069.

## ANTIBIOTIC STEWARDSHIP STRONGLY IMPACTS CDI RATES

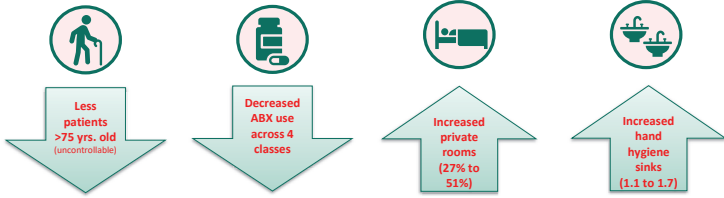
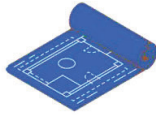


- A 25-month study by Dancer in the UK investigated reducing the use of certain antibiotics.
  - **Hospital-acquired CDI rates reduced by 77%**
  - Defined daily doses (DDD) of ceftriaxone reduced by 95%, ciprofloxacin reduced by 72.5%,
  - Meropenem use was also reduced and had a weak correlation with CDI rates, but was not commonly used, so it was harder to evaluate.

Dancer SJ, et al. Approaching zero: temporal effects of a restrictive antibiotic policy on hospital-acquired Clostridium difficile, extended-spectrum  $\beta$ -lactamase-producing coliforms and methicillin-resistant Staphylococcus aureus. Int J of Antimicrob Agents. 2013; 41: 137-142.

## MOVING TO A NEW HOSPITAL IMPROVED CDI RATES

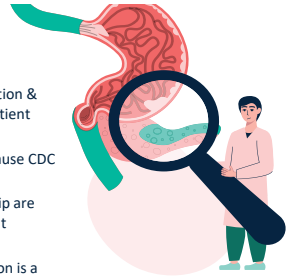
- A hospital in Japan moved to a new building:
  - Overall, **81% reduction in cases of HO-CDI**.
  - Decline continued over 3.5 years after move at a rate of 11% every 3 months. However, CO-CDI declined as well by ~70%.



Shiode J, et al. Correlation between hospital-onset and community-onset Clostridioides difficile infection incidence: Ward-level analysis following hospital relocation. *Am J of Infect Cont.* 2022; 50: 1240-1245.

## BOTTOM LINES

- Peer-reviewed evidence is **very inconsistent** related to reduction & control of CDI using sporicidal disinfectants in both +/- CDI patient rooms.
  - BUT we'll continue to use sporicide in CDI+ rooms because CDC says we should
- Non-EVS initiatives** like diagnostic & antimicrobial stewardship are most consistently impacting HO-CDI rates/ratios in the current literature.
- New studies show patient colonization at the time of admission is a major risk factor.
- Include clinical teams in environmental outbreak investigations!**
  - Portable medical equipment is often implicated in outbreaks but is **not EVS's responsibility!**
- Before assigning blame, **investigate compliance with all the evidence-based strategies**—not just EVS cleaning and disinfection!



## QUESTIONS?



Thank you!

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