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To use or not to use Sporicidal agents everywhere?
Disclaimer

Disclosures: Employee of Clorox HealthCare™ and a volunteer with IPAC Canada™ in many roles as well as a volunteer with the C.diffFoundation™.

Views expressed are those of the presenter and do not reflect the organizations I belong. The funding source for this talk was made possible by funding from Clorox Healthcare™.
Agenda

• Review background of C.difficile and Interventions aimed at preventing transmission.
• Discuss the current state and challenges leading to sustained transmission of C.difficile.
• Discuss universal sporicidal use as a strategy to reduce transmission of C.difficile.
• Highlight Future considerations
• Q&A
Background

1. Clostridium difficile (C. difficile) has become one of the most significant pathogens in acute-care hospital settings in North America.

2. A 2015 report released by Centers for Disease Control and Prevention (CDC), nearly 500,000 Americans suffer from C. difficile infections (CDI) in a single year, in which 1 in 5 patients can exhibit recurrence\(^1\).

3. The epidemiology of C. difficile infection has evolved within the last decade costing hospitals upwards of $4.8 billion each year in excess health care costs\(^1\).

4. Although most cases of C. difficile infections (CDI) are healthcare–related, a percentage of cases (~35%) occurs in the community and appear to be unrelated to antibiotic use or prior health care exposure\(^2\).

5. Nearly 1–3% of healthy adults and 15–20% of infants are asymptomatic C. difficile carriers and part of their normal microbial gut community\(^2\).

6. Despite proactive infection control measures (e.g. hand hygiene, antibiotic stewardship and environmental cleaning), C. difficile associated disease still remains problematic.

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INTERVENTIONS RECOMMENDED FOR REDUCTION OF HACDI
Process of CDI Disease Transmission: Chain of Infection

1. Hand hygiene
2. Contact precautions
3. Identification of cases
4. Appropriate use of antibiotics
5. Environmental disinfection

Take Away From Guidance the Documents

1. Cases on the rise
2. CDI spread is complex
3. EPA Registered Sporicide must be used for C.difficile disinfection
4. C.difficile Management is Multifactorial and Multi Collaborative
5. State concern and concerns from studies
   - Role of community cases
   - Role asymptomatic carriage
   - Human Factors – errors
6. Perform environmental decontamination of rooms of patients with CDI using an approved sporicidal product in an outbreak or hyper endemic setting.

Drivers For C. difficile Management Plan

- Infection Control Best Practices
- Safety Data Sheets
- Organizational Culture
- Local Epidemiology
- Guidance Documents
- OSHA
- HealthCare Facility Policy

Infection Control Strategies For C. difficile
What we know so far

1. Lots of guidance documents
2. We know how to fight C. difficile
CURRENT STATE OF HACDI
C. difficile: Impact

Point Prevalence:
CDC Funded Study\(^1\)
1. 450,000 annual *C. difficile* infections
2. 29,000 attributable deaths annually
3. $1B in excess costs annually
4. 35% (159,700) attributed to community

Trend:
10 year retrospective US patient discharge chart review\(^2\)
2. Little evidence of improvement in patient mortality or hospital LOS

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WHY TRANSMISSION RATES ARE NOT IMPROVING
Why are rates not Falling

1. Outpatient Challenges

2. Inpatient Challenges
C. difficile Sources in the Community

C. difficile  Spores are Everywhere

- Tainted Food Sources
- Pets
- Water
- Soil
- Infants
- Outpatient Antibiotics
- Prior Hospitalization

References:

- Clostridium difficile infection: Early history, diagnosis and molecular strain typing methods Authors C. RodriguezJ. Van Broeck B. Taminiau et al. Source Information August 2016, Volume97(Issue Complete) Page p.59To-78 - Microbial Pathogenesis

C. difficile Epidemiology in General Public

3-5% of General Public Test Positive for C. difficile

1 in 20

Loo et al. NEJM 2011; 365:1693-1703
Why are rates not Falling

1. Outpatient Challenges

2. Inpatient Challenges
CURRENT CHALLENGES IN C. DIFFICILE IN-PATIENT HOSPITAL MANAGEMENT
In Patient Challenges

1. Complex Transmission
2. Tenacity of C. difficile
3. Microbiologic Testing
4. Environmental Contributions
5. Infection Control Laspes
6. Role of asymptomatic or C. difficile Carriers
TRANSMISSION COMPLEXITIES
Mode of Transmission Hospitals

Up to 50% of people admitted to hospital could be C. difficile Positive(1)

Delayed Isolation and detection of C. difficile Patients

50% of surfaces in a C. difficile patients room where positive after cleaning(1)
C. difficile Epidemiology in Acute Care

50% of Adult Inpatients tested positive for C. difficile

10 in 20 on a Hospital Inpatient Unit

Riggs et al Clin Infect Dis. 2007 15;45(8)
**Tenacity Of C. difficile**

- **Bacterial spores:**
  - Clostridium difficile
  - Bacillus atrophaeus

- **Mycobacteria:**
  - Mycobacterium tuberculosis

- **Nonlipid or small viruses:**
  - Rhinovirus
  - Influenza Virus

- **Fungi:**
  - Aspergillus spp.
  - Candida spp.

- **Vegetative bacteria:**
  - Staphylococci spp.
  - Streptococci spp.
  - Escherichia coli

- **Lipid or medium-sized viruses:**
  - Hepatitis B Virus (HBV)
  - Hepatitis C Virus (HCV)
  - Human Immunodeficiency Virus (HIV)
  - Herpes Simplex Virus Types 1 (HSV 1)
  - Herpes Simplex Virus Types 2 (HSV 2)

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**Table 1: Persistence of clinically relevant bacteria on dry inanimate surfaces.**

<table>
<thead>
<tr>
<th>Type of bacterium</th>
<th>Duration of persistence (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter spp.</td>
<td>3 days to 5 months</td>
</tr>
<tr>
<td>Bordetella pertussis</td>
<td>3 – 5 days</td>
</tr>
<tr>
<td>Campylobacter jejuni</td>
<td>up to 6 days</td>
</tr>
<tr>
<td>Clostridium difficile (spores)</td>
<td>5 months</td>
</tr>
<tr>
<td>Chlamydia pneumoniae, C. trachomatis</td>
<td>≤ 30 hours</td>
</tr>
<tr>
<td>Chlamydia psittaci</td>
<td>15 days</td>
</tr>
<tr>
<td>Corynebacterium diphtheriae</td>
<td>7 days – 6 months</td>
</tr>
<tr>
<td>Corynebacterium pseudotuberculosis</td>
<td>1–8 days</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>1.5 hours – 16 months</td>
</tr>
<tr>
<td>Enterococcus spp. including VRE and VSE</td>
<td>5 days – 4 months</td>
</tr>
<tr>
<td>Haemophilus influenzae</td>
<td>12 days</td>
</tr>
<tr>
<td>Helicobacter pylori</td>
<td>≤ 90 minutes</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>2 hours to &gt; 30 months</td>
</tr>
<tr>
<td>Listeria spp.</td>
<td>1 day – months</td>
</tr>
<tr>
<td>Mycobacterium bovis</td>
<td>&gt; 2 months</td>
</tr>
<tr>
<td>Mycobacterium tuberculosis</td>
<td>1 day – 4 months</td>
</tr>
<tr>
<td>Neisseria gonorrhoeae</td>
<td>1 – 3 days</td>
</tr>
<tr>
<td>Proteus vulgaris</td>
<td>1 – 2 days</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>6 hours – 16 months; on dry floor: 5 weeks</td>
</tr>
<tr>
<td>Salmonella typhi</td>
<td>6 hours – 4 weeks</td>
</tr>
<tr>
<td>Salmonella typhimurium</td>
<td>10 days – 4.2 years</td>
</tr>
<tr>
<td>Salmonella spp.</td>
<td>1 day</td>
</tr>
<tr>
<td>Serratia marcescans</td>
<td>3 days – 2 months; on dry floor: 5 weeks</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>2 days – 5 months</td>
</tr>
<tr>
<td>Staphylococcus aureus, including MRSA</td>
<td>7 days – 7 months</td>
</tr>
<tr>
<td>Streptococcus pneumoniae</td>
<td>1 – 20 days</td>
</tr>
<tr>
<td>Streptococcus pyogenes</td>
<td>3 days – 6.5 months</td>
</tr>
<tr>
<td>Vibrio cholera</td>
<td>1 – 7 days</td>
</tr>
</tbody>
</table>
A meta-analysis of the combined data from included studies overwhelmingly indicated an increased risk of acquisition when put in a room that previously housed a patient with C. difficile.

Current environmental cleaning practices fail to reduce the risk of acquisition as spores can be airborne up to 48hrs after discharge of C. difficile Patient.

Receipt of antibiotics by prior bed occupants was associated with increased risk for CDI in subsequent patients. Antibiotics can directly affect risk for CDI in patients who do not themselves receive antibiotics.


Stool Management

1. C. difficile was recoverable from air sampled at heights up to 25 cm above the toilet seat.

2. Contamination could permit transmission of C. difficile from asymptomatic carriers, and thus explain some CDI cases where no apparent linked CDI cases are found.

3. Lidless conventional toilets increase the risk of C. difficile environmental contamination, and we suggest that their use is discouraged, particularly in settings where CDI is common.

1. In cases when you have to use sporicidal disinfectants, is there ever a delay initiating switch to sporicidal products from non sporicidal?—30%--YES

2. Are there ever gaps that lead to failure to use a sporicidal agent for Cdiff patients —40%--Yes/Sometimes

1) Becker's Webinar Registration Survey Results
Asymptomatic Carriage

1. Current guidance suggests isolation should continue until 48 h after diarrhea resolution - our data show that the potential for transmission persisted for up to 8 wk
2. Outbreaks have been linked to asymptomatic patients
3. 1/3 of C. difficile transmissions arise from asymptomatic carriers and there is an severe underestimation of their role
4. 45% of C. difficile cases are genetically unrelated

Diagnosis Challenges

IS IT REAL?
C. Difficile Lab Diagnosis Challenges

1. No single commercial test can be used as a stand-alone test for diagnosing CDI.
2. Therefore, the use of a two-step algorithm is recommended.

<table>
<thead>
<tr>
<th>Diagnostic Test</th>
<th>Description</th>
<th>Advantages/Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell cytotoxin assay</td>
<td>Foster samples are plated on human fibroblasts</td>
<td>Time consuming, laborious, and expensive</td>
</tr>
<tr>
<td></td>
<td>If toxin B is present, this results in cell death</td>
<td>Lacks sensitivity</td>
</tr>
<tr>
<td>Enzyme immunoassay</td>
<td>Immunoassay directed towards both toxins A and B</td>
<td>No longer considered gold standard</td>
</tr>
<tr>
<td>Glutamate dehydrogenase test (GDH)</td>
<td>Relies on the presence of GDH antigen, which is produced by all isolates of C. difficile</td>
<td>Widely used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rapid and easy to perform</td>
</tr>
<tr>
<td>Nucleic acid amplification of toxin A or B gene</td>
<td>Real-time polymerase chain reaction of toxin A or B gene</td>
<td>Excellent negative predictive value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positive test necessitates second confirmatory test to assess whether toxin is present</td>
</tr>
</tbody>
</table>

Cleaning Opportunities

1. C. difficile was recovered on 49% of sites in rooms occupied by patients with CDI and on 29% of sites in rooms occupied by asymptomatic carriers.\(^1,2\)

2. Computer touch screens can be potential reservoirs of opportunistic pathogens in hospitals. Cleaning instructions such as Mild Soap, Lint free cloth and water current increase risk of infection transmission\(^4\)

3. Non Sporicidal agents have been shown to promote sporulation of hyper virulent strains like NAP1\(^2\)

4. Published literature has shown that as levels of environmental contamination increase, so does the prevalence of C. difficile hand carriage among health care workers\(^3\)

References:
1. Guerreiro, Isabelle et al Using expert process to ombat Clostridium difficile infections American Journal of Infection Control, Volume 0, Issue 0
2. Wilcox MH, Fawley WN. Hospital disinfectants and spore formation by Clostridium difficile. Lancet 2000;356:1324
Recap of Challenges in Inpatient Asymptomatic Carriers

- Missed Lab Diagnosis
- Poor Hand Hygiene Compliance
- Missed Case Identification
- Non sporicidal agents
- C. difficile Tenacity
- Toilet Lids
- Touch Screens – Lint Free
- Hazards
- Losses
Should We Screen Everyone
Where is the Break-Down...

C. difficile Screening on Admission

1. 63% Reduction HACDI Cases
2. 5% of all patients swabbed were noted to be carriers

Use Sporicidal Disinfectants on all Cases
SPORICIDES
1) WHAT ARE THEY
2) DISADVANTAGES
3) PROOF OF CONCEPT OF UNIVERSAL SPORICIDAL USE
Disinfection and C. difficile

Spore Form

C. difficile

Non Spore Form

E.P.A Registered Sporicide
1. Sodium Hypochlorite
2. Peracetic/Hydrogen Peroxide Combination

Non Touch
1. Ultraviolet Light Devices
2. Fogging Systems
3. Spray Systems

A current list of EPA-approved disinfectants with sporicidal claim is available at:
http://www.epa.gov/pesticide-registration/list-k-epas-registered-antimicrobial-products-effective-against-clostridium

# Properties of an Ideal Disinfectant

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Question to Ask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kill Claims</td>
<td>Does the product kill the most prevalent healthcare pathogens</td>
</tr>
<tr>
<td>Kill Times and Wet-Contact Times</td>
<td>How quickly does the product kill the prevalent healthcare pathogens. Ideally, contact time greater than or equal to the kill claim.</td>
</tr>
<tr>
<td>Safety</td>
<td>Does the product have an acceptable toxicity rating, flammability rating</td>
</tr>
<tr>
<td>Ease-of-Use</td>
<td>Odor acceptable, shelf-life, in convenient forms (wipes, spray), water soluble, works in organic matter, one-step (cleans/disinfects)</td>
</tr>
<tr>
<td>Other factors</td>
<td>Supplier offer comprehensive training/education, 24-7 customer support, overall cost acceptable (product capabilities, cost per compliant use, help standardize disinfectants in facility</td>
</tr>
</tbody>
</table>

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Arguments For Sporicidal Use

• Efficacy
• Guidance Documents
• Endemic C.difficile Rates
• Asymptomatic Colonization or Carriers
• Error Reduction/Human Factors/Swiss Cheese
• Hyper Virulent Strains
• Proactive versus Reactive Strategy

Sporicidal Agents Get Better C. difficile Log Reduction

- Meticulous cleaning with any cleaner/disinfectant reduces the number of spores in the environment\(^1\)
- However, greater reduction and inactivation of spores is achieved when a sporicidal agent is used\(^1\)
- Removal of spores influenced by contact time (duration of wetness) and texture of surface being cleaned\(^2\)

<table>
<thead>
<tr>
<th>Technique</th>
<th>Reduction in Spores</th>
<th>Dry Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiping with any disinfectant</td>
<td>&gt; 2.9 log(_{10})</td>
<td>2-6 minutes</td>
</tr>
<tr>
<td>Spraying (no wipe) with sporicide</td>
<td>3.4 log(_{10})</td>
<td>28-40 minutes</td>
</tr>
<tr>
<td>Wiping with sporicide</td>
<td>3.9 log(_{10})</td>
<td>2-6 minutes</td>
</tr>
</tbody>
</table>

Reducing CDI Using a Sporicidal Wipe for Cleaning

- Before/after study in two high-risk medical wards
- Intervention:
  - **Daily** and **terminal** cleaning of all rooms with ATP monitoring before/after (similar pass rate)
  - Quaternary ammonium compound **before**
  - Hypochlorite wipes with 10 minute contact time **after**
- **Results:** 24.2 to 3.6 cases per 10,000 patient-days (85% decline)
CHALLENGES TO USING SPORICIDE

SURFACE COMPATIBILITY (DEGRADATION TO EQUIPMENT, RESIDUE, COLOR SAFE, ), GUIDANCE DOCUMENTS, OCC CONCERNS, COST, ODOR, TOXICITY
Survey Results

Why do you dislike Sporicidal Agents

- Cost: 30.21%
- Damage to Equipment: 21.08%
- Other: 18.27%
- Residue: 7.26%
- Smell: 1.64%
- They Don't Work: 3.51%
Concerns against Sporicidal Use

- Safety concerns from patients and staff
- Damage to equipment and the environment.
- Damage to patient equipment
- Cost
- Limited indications as per local guidance document or facility policy

1. Healthcare Occupational clinical symptoms (Dermatitis, respiratory symptoms e.g. asthma) as a result of chemical exposures, including low-level disinfectants, are exceedingly rare.

2. The scientific evidence does not support that the use of low-level disinfectants by HCP is an important risk for the development of asthma or contact dermatitis.

DESPITE THESE CHALLENGES BENEFITS OUTWEIGH THE DISADVANTAGES SHOW WINS
Proof of concept for Facility Wide Disinfection

1. Bleach wipes can be used for both daily and discharge cleaning of patient rooms with little impact on patient or employee satisfaction.

2. Involving patients in Process Improvement decisions assured staff-driven improvements are tolerated and accepted by patients.

85% decrease in CDI facility wide

Proof of concept for Facility Wide Disinfection

Prevention of Hospital-Onset *Clostridium difficile* Infection in the New York Metropolitan Region Using a Collaborative Intervention Model

Brian S. Koll, Rafael E. Ruiz, David P. Calfee, Hillary S. Jalon, Rachel L. Stricof, Audrey Adams, Barbara A. Smith, Gina Shin, Kathleen Gase, Maria K. Woods, Ismail Sirtalan

1. Environmental Cleaning Approach: Standardize cleaning using a hypochlorite based disinfectant for both routine and terminal cleaning areas


$2.6-6.8$ Million- In Estimated Cost Savings with reduced HAI rates

NON TOUCH SYSTEMS
Clinical trials using UV or HP devices for terminal room disinfection to reduce health care–associated infections

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Design</th>
<th>Setting</th>
<th>Modality tested</th>
<th>Pathogen(s)</th>
<th>Outcome (HAI)</th>
<th>Assessment of HH compliance</th>
<th>Assessment of EVS cleaning</th>
<th>Other HAI prevention initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boyce, 2008</td>
<td>Before-after (CDI high-incidence wards)</td>
<td>Community hospital</td>
<td>HPV (Bioquell)</td>
<td>CDI</td>
<td>2.28 to 1.28 per 1,000 Pt days ($P = .047$)</td>
<td>No</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Cooper, 2011</td>
<td>Before-after (2 cycles)</td>
<td>Hospitals</td>
<td>HPV (NS)</td>
<td>CDI</td>
<td>Decreased cases (incidence NS)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Levin, 2013</td>
<td>Before-after</td>
<td>Community hospital</td>
<td>UV-PX, Xenex</td>
<td>CDI</td>
<td>9.46 to 4.45 per 10,000 Pt days ($P = .01$)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Passaretti, 2013</td>
<td>Prospective cohort (comparison of MDRO acquisition; admitted to rooms with or without HPV decontamination)</td>
<td>Academic center</td>
<td>HPV (Bioquell)</td>
<td>MRSA</td>
<td>2.3 to 1.2 ($P = .30$)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Manian, 2013</td>
<td>Before-after</td>
<td>Community hospital</td>
<td>HPV (Bioquell)</td>
<td>VRE</td>
<td>7.2 to 2.4 ($P &lt; .01$)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hass, 2014</td>
<td>Before-after</td>
<td>Academic center</td>
<td>UV-PX, Xenex</td>
<td>CDI</td>
<td>2.4 to 1.0 ($P = .19$)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Mitchell, 2014</td>
<td>Before-after</td>
<td>Acute care hospital</td>
<td>Dry hydrogen vapor (Nocospray)</td>
<td>MRSA (colonization and infection)</td>
<td>12.6 to 6.2 per 1,000 Pt days ($P &lt; .01$)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Miller, 2015</td>
<td>Before-after</td>
<td>Urban hospital</td>
<td>UV-PX, Xenex</td>
<td>CDI</td>
<td>9.0 to 5.3 per 10,000 Pt days ($P = .001$)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Nagaraja, 2015</td>
<td>Before-after</td>
<td>Academic center</td>
<td>UV-PX, Xenex</td>
<td>CDI</td>
<td>23.3 to 8.3 per 10,000 Pt days ($P = .02$)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Pegues, 2015</td>
<td>Before-after</td>
<td>Academic center</td>
<td>CV-C (Optimum)</td>
<td>CDI</td>
<td>30.34 to 22.85 per 10,000 Pt days (IRR = 0.49; 95% CI, 0.26-0.94; $P = .03$)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Anderson, 2015</td>
<td>RCT</td>
<td>9 hospitals</td>
<td>UV-C (Tru-D)</td>
<td>MRSA, VRE, CDI</td>
<td>513 to 33.9 per 10,000 Pt days ($P = .036$)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

CDI, Clostridium difficile infection; CI, confidence interval; EVS, environmental service; GNB, gram-negative bacteria; HAI, health care–associated infections; HH, hand hygiene; HP, hydrogen peroxide; HPV, hydrogen peroxide vapor; IRR, incidence rate ratio; MDRO, multidrug-resistant organism; MRSA, methicillin-resistant Staphylococcus aureus; NA, not applicable; NS, not stated; Pt, patient; RCT, randomized clinical trial; UV, ultraviolet light; UV-PX, ultraviolet light, pulsed-xenon device; VRE, vancomycin-resistant enterococci.

*Outcome includes new colonization plus HAI.

Effectiveness of ultraviolet devices and hydrogen peroxide systems for terminal room decontamination: Focus on clinical trials Authors Source Information May 2016, Volume44(Issue Supplement) Page p.e77To-e84
CALL TO ACTION

GUIDANCE DOCUMENTS TO CATCH UP-RECOMMENDATIONS, ROLE AS CARRIERS
TOUGHER EQUIPMENT
GENTLER DISINFECTANTS
ENGINEERED SPORICDIAL APPLICATIONS THAT WORK ALL THE TIME
CONCLUSIONS
Recap of Challenges in Inpatient

Hazards
- Asymptomatic Carriers
- Non sporicidal agents
- C. difficile Tenacity
- Missed Lab Diagnosis
- Poor Hand Hygiene Compliance
- Missed Case Identification
- Touch Screens –Lint Free
- Toilets & stool
- Aerosol

Successful translation of evidence-based practice guidelines requires that the “work system” as well as the behavioral patterns of the providers are addressed.

Guidance Document Era

Studies Available before Guidance Document compilation

1935 to 2007

Studies Available after Guidance Document Compilation

2008 to 2016 October

Guidance Documents Under review
1. There is a considerable need for high quality CPGs because they are often used for patient care.
2. Future guidelines of CDI prevention should be developed using validated methodological standards.
3. Furthermore, there is a need for higher quality primary research on this topic, to better inform recommendations.

# C. difficile Interventions Recommendations

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Horizontal/Universal (All the time)</th>
<th>Vertical/Targeted (Sometimes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Hygiene</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Antimicrobial Stewardship</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Environmental Disinfection with Sporicide</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Error Reduction and Safety by Sporicide Everywhere

https://www.cdc.gov/niosh/topics/hierarchy/
Hospital Cleaning Staff Member Question

C. difficile Outbreak

Outbreak resolved

Sporicidal introduction

Remove sporicide
IP and EVS Wish List

1. **Ideal disinfectants**
   Better surface compatibility, Faster Contact times, minimal Occupational Health Concerns

2. **Updated Guidance Documents**
   Reflecting current changes, Revisions with new data and Considerations of complexity of C.difficile transmission pathways

3. **Improved Surfaces and Equipment**
   Tougher surfaces, special covers, procurement of equipment that’s hardy,
Summary..

1. Multiple sources of CDI--Asymptomatic carriage is relevant
2. Human Factors is an important consideration in hospital disinfection
3. Better innovation on disinfectants needed
4. Guidance documents are up for renewal
5. Universal Sporicidal Disinfectant use is an effective C.difficile control strategy
References

• Department of Health (2012) Updated Guidance on the Diagnosis and reporting of Clostridium Difficile


Nagaraja, Aarathi et al. Clostridium difficile infections before and during use of ultraviolet disinfection American Journal of Infection Control, Volume 43 , Issue 9 , 940 - 945


<table>
<thead>
<tr>
<th><strong>Do you use sporicidal agents in all declared Cdiff outbreaks in your facility?</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>5.62%</td>
</tr>
<tr>
<td>Not Applicable</td>
<td>25.53%</td>
</tr>
<tr>
<td>Yes</td>
<td>68.85%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>In cases when you have to use sporicidal disinfectants, is there ever a delay initiating switch to sporicidal products from non sporicidal?</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All the time</td>
<td>1.87%</td>
</tr>
<tr>
<td>Never</td>
<td>37.00%</td>
</tr>
<tr>
<td>Not applicable'</td>
<td>27.87%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>28.10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Are there ever gaps that lead to failure to use a sporicidal agent for Cdiff patients</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>26.00%</td>
</tr>
<tr>
<td>Not applicable</td>
<td>25.53%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>31.85%</td>
</tr>
<tr>
<td>Yes</td>
<td>9.60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Why do you dislike using sporicidal disinfectant</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>3.51%</td>
</tr>
<tr>
<td>Damage to Equipment</td>
<td>30.21%</td>
</tr>
<tr>
<td>Other</td>
<td>21.08%</td>
</tr>
<tr>
<td>Residue</td>
<td>7.26%</td>
</tr>
<tr>
<td>Smell</td>
<td>18.27%</td>
</tr>
<tr>
<td>They Don't Work</td>
<td>1.64%</td>
</tr>
</tbody>
</table>
Thank You