C. DIFFICILE INFECTION (CDI) CHANGE PACKAGE

Preventing *Clostridium difficile* transmission and infection

American Hospital Association

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
PARTNERSHIP FOR PATIENTS℠
HealthCare.gov

HRET
HEALTH RESEARCH & EDUCATIONAL TRUST
In Partnership with AHA

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CLOSTRIDIUM DIFFICILE INFECTION (CDI) OVERVIEW

Background

C. difficile infection (CDI) is the leading cause of antibiotic-associated diarrhea and a highly problematic healthcare-associated infection (HAI) in hospitals and other healthcare facilities. CDI is also becoming increasingly important as a community pathogen. CDI infections commonly develop after (1) exposure to antibiotics and (2) new exposure and acquisition of *C. difficile*.

The prevention of *Clostridium difficile* transmission and infection is a top patient safety challenge. Although the Centers for Disease Control and Prevention estimate that over 14,000 people die of CDI in the United States every year, the actual number of deaths may be much higher. According to data from the Agency for Healthcare Research and Quality, more than 9% of *C. difficile*-related hospitalizations end in death (a rate nearly five times higher than for other conditions). Over 30,000 fatalities among nearly 350,000 CDI hospitalizations were reported in 2010; CDIs result in additional healthcare expenditures of at least $1 billion per year. Whereas the rates of other healthcare associated infections (HAI), such as central-line associated bloodstream infections and invasive MRSA infections, have decreased, CDI rates remain at historically high levels. It is critical to prevent, identify, and treat these deadly infections.

Suggested AIM

Reduce healthcare facility-onset (HO) CDI rates by 40 percent by December 8, 2014.

Potential Measures

Outcome: Healthcare facility-onset (HO) CDI rate (the number of HO *C. difficile* infections per 10,000 patient days) (OPT-HEN-CDIFF-6)

Days since last Healthcare facility-onset (HO) CDI (Rural/CAH Data collection Tool)

Process: Compliance with hand hygiene practices adopted by the facility (the number of hand hygiene incidents consistent with facility guidelines; Hand hygiene opportunities is denominator (OPT-HEN-CDIFF-7)

PRIMARY DRIVER	IDEAS TO TEST
Antimicrobial Stewardship	• Monitor Healthcare Effectiveness Data and Information Set (HEDIS) performance measures on antibiotic utilization in pharyngitis, upper respiratory infections, and acute bronchitis. • Evaluate the use of antimicrobials among patients with CDI and provide feedback to medical staff and facility leadership • Educate prescribing clinicians regarding the appropriate selection, dose, timing and duration of antimicrobials. • Determine if antimicrobials predisposing to CDI development are discontinued or therapy is de-escalated when CDI is suspected.
Early, rapid, and accurate identification of *C. difficile* and diagnosis of CDI	• Utilize an Enzyme Immunoassay (EIA) diagnostic test that detects both Glutamate dehydrogenase (GDH) and *C. difficile* toxins; conduct confirmatory Polymerase Chain Reaction (PCR) for indeterminate results • Utilize a diagnostic test (e.g. a DNA amplification test) that will enhance the sensitivity and specificity of diagnosing CDI. • Implement a lab-based alert system to immediately notify the Infection Prevention team and the designated provider of newly identified cases. Ensure that the system includes notification of the designated provider on holidays and weekends. • Establish criteria for when testing for *C. difficile* should be performed on patients with clinically-significant diarrhea (e.g. 3 or more loose stools per day for at least 1-2 days). • Adopt the 'if the stool ain't loose, the test is of no use' rule.
Focus on prevention of CDI by reducing transmission of *C. difficile*	• Utilize a 'diarrhea decision tree'. • Implement a process for providing rapid diagnostic results to patient care areas to ensure isolation precautions are initiated promptly in cases of CDI. • Continue Contact Precautions (e.g. gloves, gowns, private room) for the duration of CDI patient hospitalization unless the diarrhea has resolved and the patient has been transferred to another room. • Because *Clostridium difficile*-infected patients continue to shed organism for a number of days following cessation of diarrhea, consider routinely continuing isolation for either several days beyond symptom resolution or until discharge, depending upon the type of setting and average length of stay. • Implement Chlorhexidine Gluconate (CHG) bathing in selected or all patients. • Instruct patients and families about the importance of hand hygiene and personal hygiene. • Provide patients with a hand sanitizer and emphasize that it should be used after toileting and prior to eating. • Adopt the 'Do the Wave' program to reinforce the importance of hand hygiene (W = Wash, A = Ask questions, V = Vaccinate against flu and pneumonia, E = Ensure safety of medical equipment). • Select a cleaning solution that is effective against *C. difficile* spores and establish appropriate cleaning protocols for its use. • To ensure effective equipment cleaning and disinfection, develop procedures to assign specific responsibilities to specific staff and ensure adequate oversight. (e.g. 'who cleans what' and 'how'; 'who audits cleaning'?). • Directly observe room cleaning and provide coaching, including improvement recommendations and/or positive feedback. • Implement a "Saving Lives 100% – One Room at a Time" program to recognize environmental service team members (see Appendix VII). • Use ATP Bioluminescence to measure organic debris as a surrogate marker for biological contamination and to assess cleaning effectiveness.

CDI DRIVER DIAGRAM

Suggested AIM: Reduce healthcare facility-onset (HO) CDI rates by 40 percent by December 8, 2014.

PRIMARY DRIVERS	SECONDARY DRIVERS	CHANGE IDEAS
Antimicrobial Stewardship	• Audit antimicrobial use prospectively and provide direct feedback to the provider. • Restrict antimicrobial formulary and require preauthorization for antimicrobial prescription and/or administration.	• Monitor Healthcare Effectiveness Data and Information Set (HEDIS) performance measures for pharyngitis, upper respiratory infections, acute bronchitis and antibiotic utilization. • Target specific infections e.g. urinary tract infections (the second most common bacterial infection leading to hospitalization). • Adopt guidelines for management of community-acquired pneumonia using a shorter course of therapy (Johns Hopkins study). • Evaluate the use of antimicrobials among patients with CDI and provide feedback to medical staff and facility leadership. • Educate prescribing clinicians regarding the appropriate selection, dose, timing, and duration of therapy with antimicrobials. • Focus efforts on reducing use of certain antibiotic classes that have a higher risk for CDI, e.g. cephalosporins, clindamycin, and fluoroquinolones. • Eliminate redundant combination therapy. • Develop multidisciplinary standardized order sets incorporating local microbiology and resistance patterns. • Develop antimicrobial order forms to facilitate implementation of practice guidelines. • Ensure all orders have dose, duration, and indications documented. • Obtain cultures before starting antibiotics. • Streamline or de-escalate empirical antimicrobial therapy based upon culture results. • Optimize antimicrobial dosing based upon individual patient characteristics, infection-causative agents, sites of infection, and drug characteristics. • Consider an 'antibiotic timeout' i.e. reassessing antibiotic therapy after 48-72 hours. • Develop a systematic plan for parenteral-to-oral conversion of antimicrobials based upon patient condition. • Develop clinical criteria and guidelines to promote the switch from parenteral to oral agents as soon as possible. • Use healthcare information technology, e.g. electronic medical records, to improve antimicrobial decision-making. • Develop computer-based surveillance to target antimicrobial interventions, track resistance patterns, and identify HAIs and adverse drug events. • Implement collaboration between the clinical microbiology laboratory and the infection prevention department to optimize surveillance and investigation of outbreaks. • Determine if antimicrobials that increase risk for CDI are discontinued or de-escalated when CDI is suspected.

CDI DRIVER DIAGRAM (CONTINUED)

Suggested AIM: Reduce healthcare facility-onset (HO) CDI rates by 40 percent by December 8, 2014.

PRIMARY DRIVERS	SECONDARY DRIVERS	CHANGE IDEAS
Early, accurate and rapid identification of *C. difficile* and diagnosis of CDI	• Identify cases of CDI and rule out CDI in other patients with diarrhea.	• Establish rules for when testing for *C. difficile* should be performed on patients with clinically-significant diarrhea [e.g. if patients have 3 or more loose stools per day for at least 1-2 days] (See Appendix I). • Ensure that patients with diarrhea are assessed to determine if they have been administered laxatives in the prior 24-48 hours as a possible explanation of their symptoms. • Test only loose or watery stool specimens. • Establish a protocol where specimens are submitted to the lab in a clean, leak-proof container as soon as possible. Delays in transporting specimen will lead to delays in diagnosis. • Establish criteria for the lab acceptance of specimens for CDI testing i.e. 'only liquid or unformed stools that conform to the shape of the container will be tested'. • Adopt the 'if the stool ain't loose, the test is of no use' rule. • Ban the ordering of multiple tests for *C. difficile* on a single patient (See Appendix I). • Employ a rapid diagnostic technology to facilitate prompt diagnosis, isolation and treatment. • Utilize an EIA diagnostic test that detects both GDH and *C. difficile* toxins; conduct confirmatory PCR for indeterminate results. • Utilize a diagnostic test (i.e. a DNA amplification test) that will enhance the sensitivity and specificity of diagnosing CDI. • Implement a lab-based alert system to immediately notify the IP team and providers of newly identified cases. Ensure that the system includes procedures for notification on holidays and weekends. • Ban repeat testing for 'test of cure,' as *C. difficile* may persist despite a clinical response to treatment. A positive test at the end of a course of CDI therapy does not predict which patient will develop a recurrence or relapse (See Appendix I).
Focus on prevention of CDI and transmission of *C. difficile*	• Establish guidelines for the empiric institution of and continued use of Contact Precautions.	• Utilize a 'diarrhea decision tree' (See Appendix II and III). • Ensure there is a process for providing rapid results to the patient care area to ensure isolation precautions are initiated promptly. • Reinforce the proper use of gloves and consider universal gloving and gowning practices. • Consider visual cues to identify restricted areas, e.g. a colored tape placed on the floor. • Establish protocols to determine the best CDI patient placement options when private rooms are limited or not available. • Continue Contact Precautions for the duration of hospitalization unless the diarrhea has resolved and patient has been transferred to another room.
	• Establish, maintain, and monitor an effective hand hygiene program.	• Engage patients, visitors and families as partners in prevention. • Instruct patients and families regarding the importance of hand hygiene and personal hygiene. • Provide patients with a hand sanitizer and emphasize its use after toileting and prior to eating. • Adopt the 'Do the Wave' program to reinforce the importance of hand hygiene. (W = Wash, A = Ask questions, V = Vaccinate, E = Ensure safety of medical equipment). • Establish a method of monitoring hand hygiene compliance. • Adopt or adapt creative hand hygiene posters and other educational tools to help patients and families learn and understand the benefits of hand hygiene.

CDI DRIVER DIAGRAM (CONTINUED)

Suggested AIM: Reduce healthcare facility-onset (HO) CDI rates by 40 percent by December 8, 2014.

PRIMARY DRIVERS	SECONDARY DRIVERS	CHANGE IDEAS
	• Environmental controls.	• Identify and remove environmental sources of *C. difficile*, e.g. replace electronic thermometers with disposables. • Create a visual cue to demonstrate that a piece of equipment has been cleaned (e.g. a paper strip or a sign). • Utilize a two-step vs. a one-step cleaning protocol, e.g. with a mobile, fully automated technology using ultraviolet-C radiation or hydrogen peroxide vapor. • Form a team to evaluate new disinfectants and whether they meet the facility's cleaning needs. • Establish cleaning protocols for the cleaning solutions selected. • Evaluate equipment cleaning and disinfection procedures to ensure effective assignments and fulfillment of cleaning responsibilities (e.g. 'who cleans what' and 'how'?). • Utilize audible timers to assure contact time requirements for selected solutions. • Use specialized privacy curtains that permit quick removal and cleaning without need for a ladder. • Use disposable plastic adhesive shields to attach onto privacy curtain sites that may require hand or glove contact. • Spray 3% hydrogen peroxide disinfectant solution on contact areas of privacy curtains during daily room cleaning and at discharge.
	• Monitor environmental cleaning.	• Develop checklists to use when evaluating cleaning practices (see the CDC checklist in the tool section on page 18). • Directly observe room cleaning and provide immediate feedback, recommendations and recognition to cleaning staff. • Use agar slide cultures to provide an easy method for quantifying viable microbial surface contamination. • Utilize swab cultures to demonstrate effectiveness of cleaning or opportunities for improvement. • Utilize fluorescent markers to indicate physical removal of an applied substance. • Utilize ATP Bioluminescence to measure organic debris as a surrogate marker for biological contamination. Provide immediate feedback to cleaning staff. • Implement a "Saving Lives 100% One Room at a Time" program to recognize environmental service team members (See Appendix VII).

ANTIMICROBIAL STEWARDSHIP

In recent decades, some patients prescribed antibiotics were observed to develop an "Antibiotic Associated Colitis" which included symptoms of abdominal pain, distention, and diarrhea. Antibiotics were discovered to destroy normal gut flora, allowing for the overgrowth of pathogenic bacteria (now identified as *C. difficile*) which released toxins that caused significant patient morbidity and mortality. A number of antibiotics have been found to be associated with *C. difficile* colitis; antimicrobials most likely to cause CDI in susceptible patients include fluoroquinolones, clindamycin, and third-generation cephalosporins. *C. difficile* can normally exist in the intestines of up to 10% of the population without causing illness, and is spread from one person to another via the fecal-oral route. Patients who are given certain antibiotics, longer courses of antibiotic therapy, or medications that decrease stomach acid secretion are at increased risk for the development CDI and its serious sequelae.

WHAT IS AN ANTIMICROBIAL STEWARDSHIP PROGRAM?

Antimicrobial Stewardship is a program that promotes appropriate selection, dosing, route, and duration of antimicrobial therapy. The primary goal is to optimize clinical outcomes while reducing the chance of unintended/undesired consequences of antimicrobial use such as toxicity, overgrowth of pathogenic organisms such as *C. difficile*, and the emergence of antibiotic resistance. A secondary goal of antimicrobial stewardship is to reduce health care costs without adversely impacting quality of care.

Effective antimicrobial stewardship programs can be financially self-supporting, improve patient care, and save lives. Comprehensive programs in both large academic medical centers and smaller community hospitals have consistently demonstrated a decrease in antimicrobial use (from 22%-36%) with annual savings of $200,000 to $900,000.

A University of Maryland study described a savings of $17 million over 8 years at one facility after an antibiotic stewardship program was implemented. After the program was discontinued, antibiotic costs increased by over $1 million in the first year (a 23% increase) and continued to increase the following year.

References

Maswoswe JJ, Okpara AU. Enforcing a policy for restricting antimicrobial drug use. American Journal of Healthy Systems Pharm. 1995 (52): 1433-1435

Briceland LL, Nightingale CH, Quintiliani R, Cooper BW, Smith KS. Antibiotic Streamlining from Combination Therapy to Monotherapy Utilizing an Interdisciplinary Approach. Archives of Internal Medicine. 1988 (148): 2019-2022

Glowacki RC, Schwartz DN, Itokazu GS, Wisniewski MF, Kieszkowski P, Weinstein RA. Antibiotic Combinations with Redundant Antimicrobial Spectra: Clinical Epidemiology and Pilot Intervention of Computer-Assisted Surveillance. CID. 2003 (37): 59-64

McGregor JC, Weekes E, Forrest GN, Staniford HC, Perencevich EN, Furuno JP, and Harris AD. Impact of a Computerized Clinical Decision Support System on Reducing Inappropriate Antimicrobial Use: A Randomized Controlled Trial. J Am Med Inform Assoc. 2006; 13: 378-384

The Centers for Disease Control issued a checklist to aid in the assessment of the core elements of an antimicrobial stewardship program. This tool is available at http://www.cdc.gov/getsmart/healthcare/pdfs/core-elements.pdf.

Guidelines for developing institutional programs to enhance antimicrobial stewardship are available in the following reference:

Dellit TH, Owens RC, McGowan Jr., Gerding DN, Weinstein RA, Burke, JP, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis* 2007;44:159-177.

Please note that these guidelines focus on hospital-based stewardship programs and do not include specific outpatient care recommendations. More research is needed in the post-discharge arena.

Secondary Drivers

- Prospective audit of antimicrobial use and provision of feedback to providers regarding treatment options.
- Formulary restriction and preauthorization requirements for prescription and/or administration of antimicrobials.

Change Ideas: Strategies for Antimicrobial Stewardship

- Monitor Healthcare Effectiveness Data and Information Set (HEDIS) performance measures on antibiotic utilization in pharyngitis, upper respiratory infections, and acute bronchitis.
- Target specific infections e.g. urinary tract infections (the second most common bacterial infection leading to hospitalization) as a place to start/focus, and determine the appropriateness of selected treatment.

- Adopt guidelines for the management of community-acquired pneumonia using a shorter course of therapy (Johns Hopkins study).
- Educate prescribing clinicians regarding the appropriate selection and use of antimicrobials, including dose, timing, and duration of treatment.
- Focus efforts on reducing the use of certain antibiotic classes such as cephalosporins, clindamycin, and fluoroquinolones as these antibiotics appear to have a high association with CDI.
- Use healthcare information technology, e.g. electronic medical records, to improve antimicrobial decision-making.
- Enlist a multi-disciplinary team to develop standardized order sets incorporating local microbiology and resistance patterns.
- Optimize antimicrobial dosing based upon individual patient characteristics, causative agent, site of infection and drug characteristics.
- Develop antimicrobial order forms to facilitate implementation of agreed-upon practice guidelines.
- Obtain cultures before starting antibiotics.
- Streamline or de-escalate empirical antimicrobial therapy based upon culture results
- Eliminate redundant combination antimicrobial therapy.
- Ensure all orders have clear documentation of dose, duration, and indications for antimicrobial therapy.
- Consider an 'antibiotic timeout' i.e. reassessing antibiotic appropriateness and necessity after 48-72 hours.
- Develop a systematic plan for conversion of antimicrobial administration from parenteral to oral based upon patient condition.
- Develop clinical criteria and guidelines to promote and facilitate the conversion from parenteral to oral agents.
- Evaluate the use of antimicrobials among patients with CDI and provide feedback and recommendations to medical staff and facility leadership re treatment options.
- Determine if antimicrobial agents at higher risk of contributing to CDI are de-escalated or discontinued if CDI is suspected.
- Enlist the clinical microbiology laboratory and infection prevention (IP) departments to partner to optimize surveillance and investigation of outbreaks.
- Develop computer-based surveillance to collect antimicrobial intervention data, track resistance patterns, and identify Healthcare-Associated Infections and Adverse Drug Events.

Suggested Process Measures

- A monthly audit of the numbers of patients who were prescribed a specific antimicrobial (e.g. a fluoroquinolone) for a specific category of infection (e.g. UTI) in the emergency department.
- A monthly audit of the percentage of surgical patients who received an appropriate weight-based antimicrobial pre-operative dose.

EARLY, ACCURATE AND RAPID IDENTIFICATION AND DIAGNOSIS OF CDI

The sooner a patient suspected of having CDI is accurately diagnosed, the better. Rapid diagnosis will lead to prompt implementation of Contact Precautions; rapid elimination of *C. difficile* as the source of a patient's diarrhea will obviate the need for enhanced infection control precautions and extended patient isolation. Suspicion of CDI in any patient with diarrhea and a history of recent antibiotic use is the most critical step for making a timely diagnosis. However, antibiotic exposure is not a pre-requisite for CDI; patients who are immunocompromised, those receiving chemotherapy, and, in rare cases, even healthy persons may develop diarrhea due to *C. difficile*. Persons with severe disease may also present with sepsis and abdominal pain in the absence of diarrhea. Research has shown that nurses using a "sniff test" were able to predict (with a sensitivity of 55 percent and specificity of 83 percent) which patients' stools were positive for *C. difficile*. A well-publicized report describes a dog named Cliff that was trained to successfully 'sniff out' the presence of *C. difficile* in patients with diarrhea. Obviously, "sniff tests" are not considered adequately reliable or welcome in job descriptions, so a variety of laboratory tests are recommended for identification and diagnosis of CDI.

An Enzyme Immunoassay (EIA) test for glutamate dehydrogenase (GDH), an enzyme produced by *C. difficile*, is 96 to 100% sensitive for the presence of the organism; however this EIA does NOT test for the *C. difficile* toxin and cannot distinguish between non-pathogenic and pathogenic strains of the bacteria. The EIA tests for both toxin A and B do identify pathogenic strains, but these tests are only 70-80% sensitive. Though the toxin tests are relatively inexpensive, their low sensitivity for identifying pathogenic strains reduces their value. It is generally believed that stand-alone EIA tests for clinical diagnosis of CDI are inadequate. A 2-step approach where the stool is first tested for both antigen (Glutamate Dehydrogenase or GDH) and toxin and 'indeterminate' results are followed by a confirmatory Polymerase Chain Reaction (PCR) has become a widely utilized method of

detection. Polymerase Chain Reaction (PCR) tests have shown an impressive 93% sensitivity and 97% specificity; but are relatively expensive and complex to perform and require an enhanced laboratory capacity.

Alternatively a DNA amplification test for *C. difficile* (Sn≥95%) is gaining popularity despite its cost.

Reference

Cohen SH, Gerding DN, Johnson S, Kelly C, Loo VG, McDonald LC, Pepin J, Wilcox MH. Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2-10 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Disease Society of America (IDSA). Infect Control Hosp Epidemiol 2-10;31(5):431-455.

Secondary Drivers

- Rule out CDI in patients with diarrhea or identify cases of CDI in a timely manner.

Change Ideas

- Establish rules for when testing for *C. difficile* should be performed in patients. e.g. with clinically-significant diarrhea (3 or more loose stools per day for at least 1-2 days). (See Appendix I)
- Assess patients with diarrhea to determine if they have been administered laxatives in the prior 24-48 hours as a possible explanation of symptoms.
- Test only loose or watery stool specimens. Adopt the 'if the stool ain't loose, the test is of no use' rule.
- Establish protocol where specimens are submitted to the lab in a clean, leak-proof container as soon as possible. Delay in transporting specimens will lead to delays in diagnosis.
- Establish criteria for acceptance of specimens for CDI testing. e.g. 'only liquid or unformed stools that conform to the shape of the container will be tested'.
- Employ a rapid diagnostic test that facilitates prompt diagnosis, isolation, and treatment of CDI.
- Utilize an EIA diagnostic test that detects both GDH and *C. difficile* toxins; conduct confirmatory PCR for indeterminate results.
- Utilize a diagnostic test (e.g. a DNA amplification test) that will enhance the sensitivity and specificity of CDI diagnosis.
- Implement a lab-initiated alert system to immediately notify the IP team and the patients' providers of newly identified cases. Ensure that the system includes arrangements for notification on holidays and weekends.
- Ban the ordering of multiple tests for *C. difficile* on a single patient.
- Ban repeat testing for 'test of cure' as *C. difficile* toxins may persist despite a good clinical response to treatment. (A positive test at the end of a course of therapy does not predict who will develop a recurrence or relapse.).

Suggested Process Measure

- A monthly audit of the number and percentage of stool specimens sent to the clinical lab that met the designated criteria (e.g. loose or watery stool).

FOCUS ON PREVENTION OF TRANSMISSION OF CDI

Prompt identification of patients suspected of having CDI is the first step in prevention of outbreaks and will trigger the isolation precautions and infection control practices designed to prevent transmission. Because the primary mode of *C. difficile* transmission resulting in disease is person-to-person spread through the fecal-oral route, primarily within inpatient healthcare facilities, Contact Precautions are recommended, as fecal incontinence with its potential for extensive and prolonged environmental contamination can be a significant threat to other patients and staff.

Secondary Driver: Establish guidelines for the implementation and continued use of Contact Precautions.

Change Ideas

- Utilize a 'diarrhea decision tree.' (See Appendix II and III) Develop a process for rapidly providing test results to the patient care area to ensure isolation precautions are initiated promptly.
- Consider visual cues e.g. a colored tape placed on the floor to identify restricted areas.
- Reinforce the proper use of gloves and consider universal gloving practices. Gowns may also be recommended.
- Continue Contact Precautions for the duration of hospitalization unless the diarrhea has resolved and the patient has been transferred to another room (See Appendix IV).
- Implement Chlorhexidine Gluconate (CHG) bathing in selected or all patients.
- Establish protocols to determine the best CDI patient placement options in facilities where private rooms are limited or unavailable.

- Increase curtain inventory to permit changing at discharge for all contact isolation rooms.
- Utilize specialized curtains that permit quick switching without a ladder (e.g. http://www.c-sgroup.com/cubicle-track-curtains/qwik-switch).

Suggested Process Measures

- Monthly audit to determine whether Contact Precautions were discontinued when no longer clinically necessary.
- Monthly audit to measure the length of time from the moment CDI was suspected to CDI diagnosis and the implementation of Contact Precautions.

ESTABLISH, MAINTAIN AND MONITOR AN EFFECTIVE HAND HYGIENE PROGRAM

Effective hand hygiene is the cornerstone of a comprehensive and effective infection prevention program. Hand hygiene is particularly important for CDI prevention as CDI patients have significant diarrhea and commonly shed spores into their environment.

There are varying opinions about the best approach to hand hygiene when caring for CDI patients. The proper use of disposable gloves can significantly reduce the chance that staff and visitor hands will become contaminated with spores.

Unfortunately, *C. difficile* spores may be resistant to alcohol-based hand sanitizers. Antibacterial soap and warm water before and after treating patients is preferred. However, the Society for Healthcare Epidemiology of America (SHEA) recommends that settings continue the utilization of alcohol-based hand sanitizer if a CDI outbreak has not occurred. The hand sanitizers are associated with a decrease in infections with other pathogens such as *S. aureus*.

The general use of alcohol-based hand sanitizer has not shown to increase CDI transmission, nor does the general use of soap and water result in a reduction of CDI. There are no data that demonstrate that using soap/water is more efficacious when caring for a CDI patient in an outbreak setting, though soap and water have been proven more effective at removing *C. difficile* spores. The general recommendation to use soap/water rather than alcohol-based hand sanitizer routinely for CDI patients is driven by the knowledge that glove removal practices may be sub-optimal and additional hand-washing is indicated.

Reference

Cohen, SH, Gerdine DN, Johnson S, Kelly CP, Loo, VG, McDonald LC, Pepen J, Wicox MH. Clinical Practice Guidelines for *Clostridium difficile* Infection in Adulets: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). Infect Control Hops Epidemiol 2010;31(5):431-455.

Change Ideas

- Engage patients, visitors and families as partners in CDI prevention.
- Instruct patients and families about the importance of hand hygiene and personal hygiene.
- Provide patients with a hand sanitizer and emphasize its routine use after toileting and prior to eating.
- Adopt the 'Do the Wave' program to reinforce the importance of hand hygiene (see the U.S. Department of Health Services for additional information).
- Establish a method of monitoring hand hygiene compliance (See Appendix V).
- Adopt or adapt creative hand hygiene posters and other educational tools to attract attention and promote learning and understanding.

Secondary Driver: Environmental Controls

The hospital environment plays a significant role in the transmission of CDI. Because *C. difficile* is shed in feces, any environmental surface or item that becomes contaminated with feces can serve as a source of transmission. *C. difficile* spores are extremely hardy and can survive on surfaces for as long as 5 months. Samore et al reported that spores were found in 49% of the hospital rooms occupied by patients with diagnosed CDI, and in 29% of the rooms of asymptomatic *C. difficile* carriers. Not surprisingly, the areas found to be most heavily contaminated were hospital room floors and bathrooms.

The disinfectants that have historically been used in healthcare environments are quaternary ammoniums and phenolics, neither of which is active against spores. Although many of the currently available EPA-registered germicides are active against the vegetative form of *C. difficile*, they do not kill the spores which are the source of the transmitted infection.

EPA-registered sporicidal agents active against *C. difficile* are now available and acceptable for use in general surface disinfection. As important as selecting the correct germicide is ensuring that cleaning staff are well trained in how to use the agent, e.g. mechanism of delivery, contact time needed for effectiveness.

Change Ideas

- Form a multidisciplinary team to review and evaluate new disinfectant agents and infection control technologies and to recommend those that meet the facility's needs.
- Establish cleaning protocols for cleaning solutions that are effective against *C. difficile* spores.
- Develop equipment cleaning and disinfection procedures to ensure appropriate assignment of duties and implementation of use (e.g. 'who cleans what' and 'how'?).
- Identify and remove environmental sources of *C. difficile* e.g. replace electronic thermometers with disposables.
- Create a visual cue that will show that a piece of equipment has been cleaned (e.g. a paper strip or sign).
- Utilize audible timers to ensure appropriate contact time for cleaning agents.
- Use specialized privacy curtains that can be replaced without a ladder and appropriately cleaned.
- Attach disposable plastic adhesive shields to privacy curtains to prevent glove or hand contact and contamination.
- Spray 3% hydrogen peroxide disinfectant solution on non-shielded areas of the privacy curtains during daily room cleaning and at patient discharge.
- Utilize a two-step cleaning protocol such as mobile, fully automated equipment which releases ultraviolet-C radiation or hydrogen peroxide vapor.

Secondary Driver: Monitor environmental cleaning

In order to ensure that cleaning and disinfection practices are consistent and effective, monitoring is required. Direct observation of cleaning practices can provide immediate feedback, but is time- and labor-intensive and may not accurately reflect routine practice. Swab cultures are simple to perform but they can be costly to process and their results may be delayed as long as 24-72 hours. Agar slide cultures provide a simple way to quantify viable microbial surface contamination. Fluorescent markers provide immediate results, allow for timely feedback, and demonstrate visual evidence that the 'soil' has been removed. They don't, however, provide a colony count so that reduction of bacteria can be logged. One of the best monitoring processes commonly used today is ATP Bioluminescence which measures organic debris. ATP Bioluminescence does not identify an actual pathogen but it does serve as a surrogate marker for biological contamination.

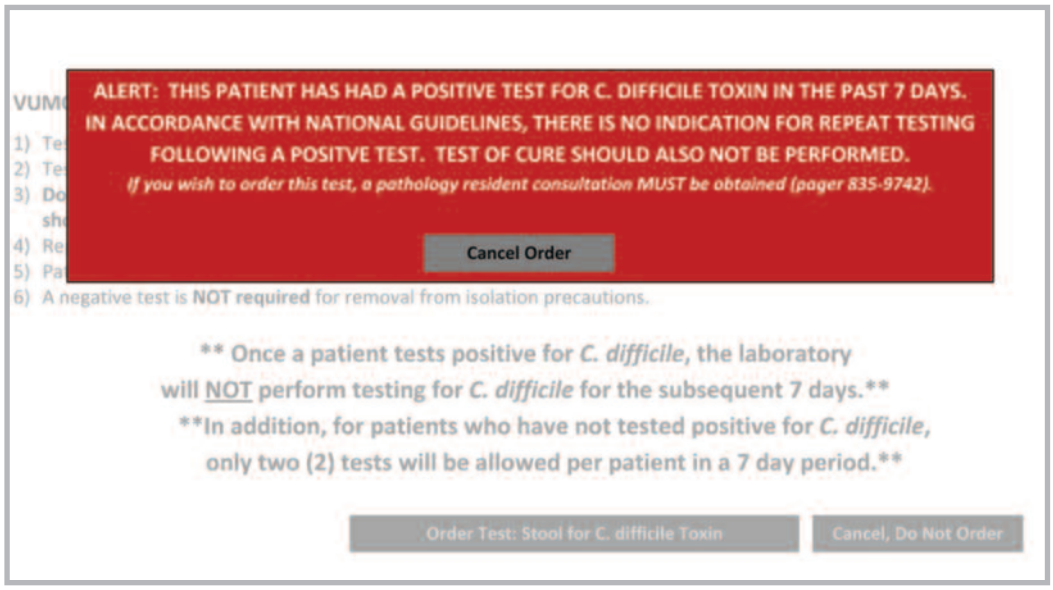
Change Ideas

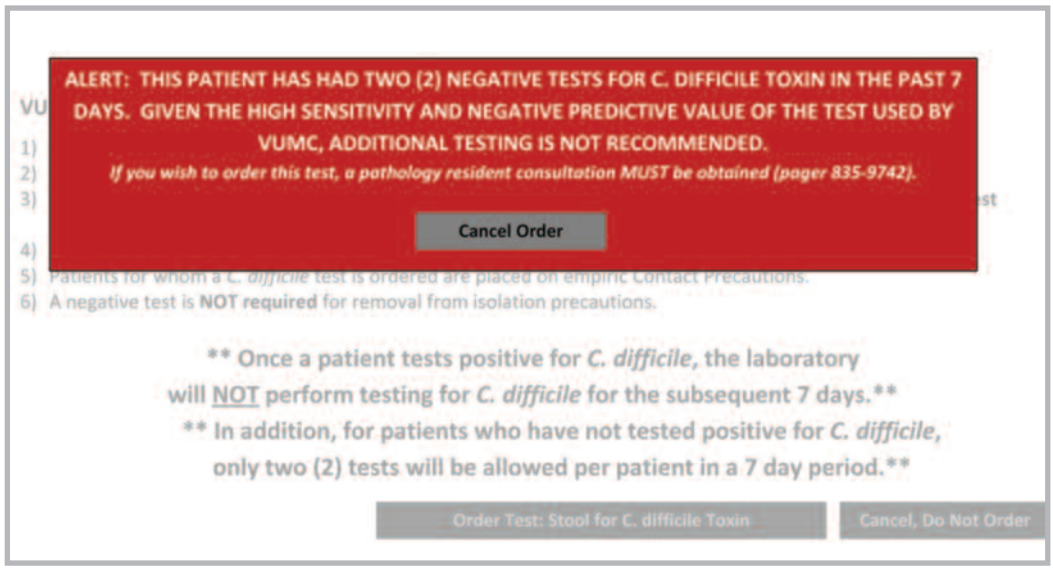
- Develop checklists to use when auditing and evaluating cleaning practices (See Appendix VI).
- Directly observe room cleaning and provide immediate feedback, recommendations, and recognition to cleaning staff.
- Utilize swab cultures to demonstrate effectiveness of cleaning or opportunities for improvement
- Use agar slide cultures to provide an easy method for quantifying viable microbial surface contamination.
- Utilize fluorescent markers to indicate physical removal of an applied substance.
- Utilize ATP Bioluminescence, which provides immediate feedback, to measure organic debris as a surrogate marker for biological contamination.
- Implement a "Saving Lives 100% One Room at a Time" program to recognize and acknowledge the efforts of environmental service team members (See Appendix VII).

SUMMARY

The prevention of CDI is multi-faceted and is a problem that cannot be solved in silos. The following is a comprehensive summary of the factors that impact CDI along with change ideas that should be considered by any healthcare organization working on finding ways to reduce the risk of CDI in their patient population (See Appendix VIII).

Appendix I: Screen shots from Vanderbilt Medical Center in Nashville, TN





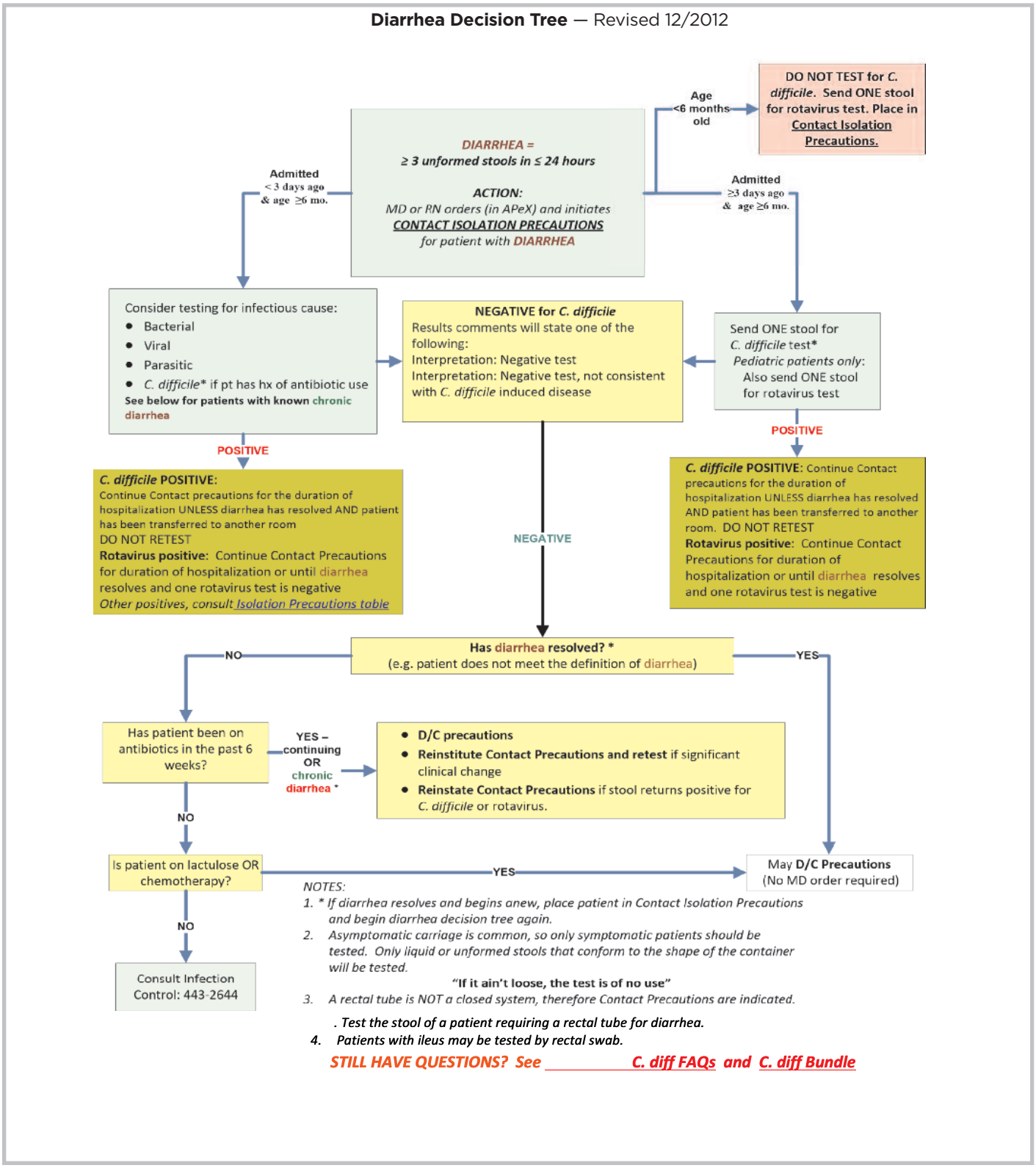
VUMC Guidelines for *C. difficile* testing:

1) Test only patients with clinically-significant diarrhea (3 or more loose stools per day for at least 1 to 2 days).
2) Testing is only performed on loose or watery stool specimens.
3) Do not order multiple tests for *C. difficile* on a single patient (i.e. "*C. diff* x 3"). For most patients, only one test should be ordered to rule in or out *C. difficile* infection, given the test's very high negative predictive value.
4) Repeat stool testing for test of cure is NOT recommended.
5) Patients for whom a *C. difficile* test is ordered are placed on empiric Contact Precautions.
6) A negative test is NOT required for removal from isolation precautions.

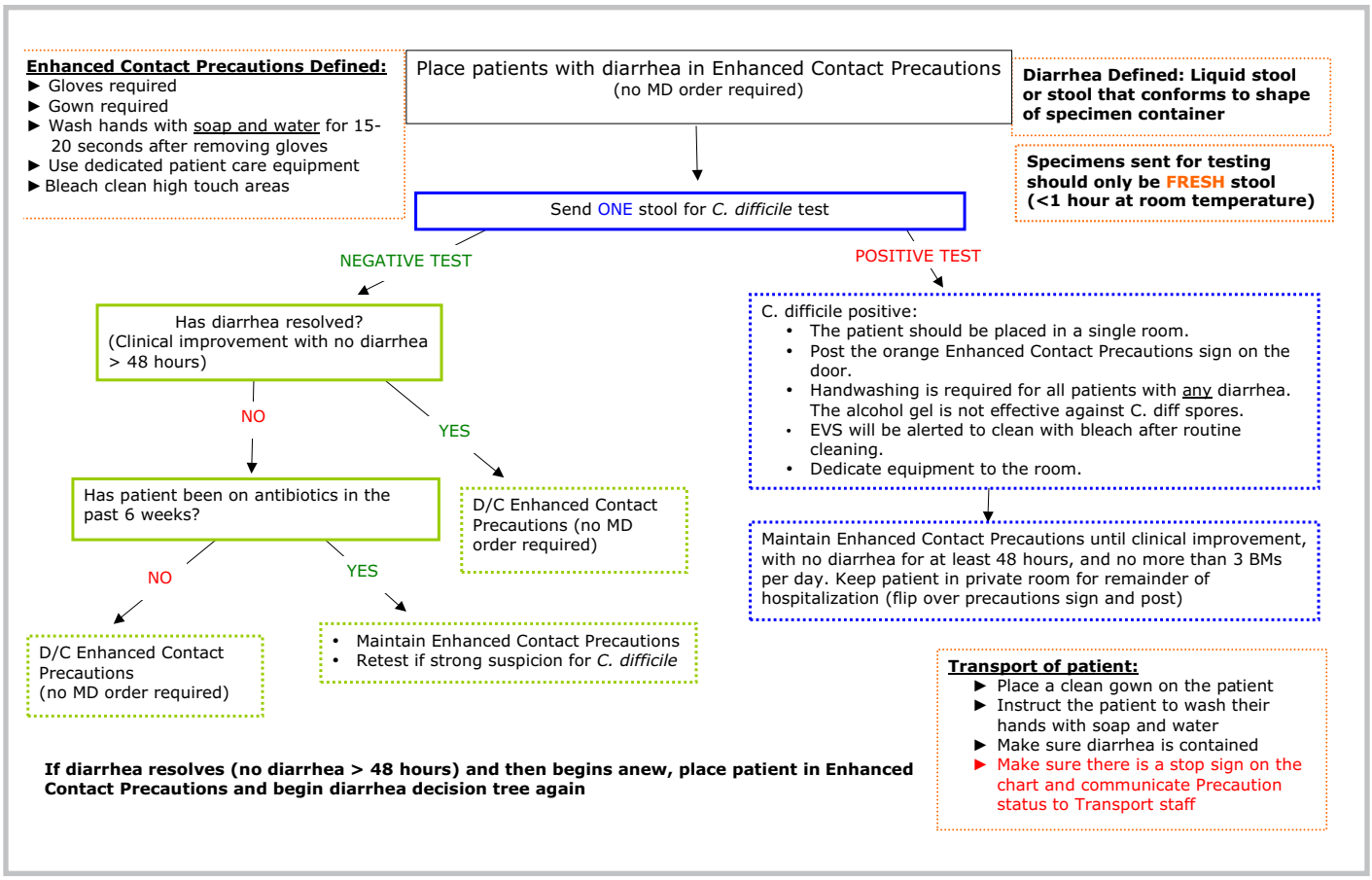
**** Once a patient tests positive for *C. difficile*, the laboratory will NOT perform testing for *C. difficile* for the subsequent 7 days.****
**** In addition, for patients who have not tested positive for *C. difficile*, only two (2) tests will be allowed per patient in a 7 day period.****

Order Test: Stool for C. difficile Toxin | Cancel, Do Not Order

Appendix II: Diarrhea decision tree from the University of California, San Francisco (UCSF)



Appendix III: Diarrhea/Enhanced Precautions decision tree from California Pacific Medical Center (CPMC), San Francisco, CA



Appendix IV: Enhanced Precautions sign from California Pacific Medical Center (CPMC), San Francisco, CA

ENHANCED CONTACT PRECAUTIONS

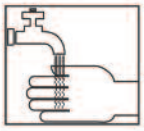
ALL FAMILY & VISITORS REPORT TO NURSES' STATION

TODA FAMILIA Y VISITANTES DE REPORTARSE
A LA ESTACION DE ENFERMERAS

Enhanced Contact Precautions are in addition to Standard Precautions.
All patients will be treated with Standard Precautions at all times.

GLOVES REQUIRED when entering the room

GOWN REQUIRED when entering the room



PRIVATE ROOM REQUIRED

Use **SOAP and WATER ONLY** for hand hygiene

DISINFECT all surfaces with **BLEACH**

WHEN CONTACT PRECAUTIONS NO LONGER INDICATED, FLIP SIGN OVER AND KEEP POSTED DURATION OF ADMISSION

Appendix IV: Enhanced Precautions sign from California Pacific Medical Center (CPMC), San Francisco, CA (continued)

Appendix V: Hand hygiene observation tool: Centers for Disease Control

CDC Dialysis Collaborative *Facility Name:_____ Date:_____ Start time:_____AM / PM*
Day: M W F Tu Th Sa Shift: 1st 2nd 3rd 4th Observer:_____ Location within unit:_____

Audit Tool: Hemodialysis hand hygiene observations

(Use a "√" for each 'hand hygiene opportunity' observed. Under 'opportunity successful', use a "√" if successful, and leave blank if not successful)

Discipline	Hand hygiene		Describe any missed attempts (e.g., during medication prep, between patients, after contamination with blood, etc.):
	Hand hygiene opportunity	Opportunity successful	

Discipline: **P**=physician, **N**=nurse, **T**=technician, **S**=student, **D**=dietitian, **W**=social worker, **O**=other

Duration of observation period = _____ minutes Number of successful hand hygiene opportunities observed = _____

Total number of patients observed during audit = _____ Total number of hand hygiene opportunities observed during audit = _____

** See hand hygiene opportunities on back page

Making dialysis safer for patients

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Appendix V: Hand hygiene observation tool: Centers for Disease Control (continued)

Guide to Hand Hygiene Opportunities in Hemodialysis

Hand hygiene opportunity category	Specific examples
1. Prior to touching a patient	• Prior to entering station to provide care to patient • Prior to contact with vascular access site • Prior to adjusting or removing cannulation needles
2. Prior to aseptic procedures	• Prior to cannulation or accessing catheter • Prior to performing catheter site care • Prior to parenteral medication preparation • Prior to administering IV medications or infusions
3. After body fluid exposure risk	• After exposure to any blood or body fluids • After contact with other contaminated fluids (e.g., spent dialysate) • After handling used dialyzers, blood tubing, or prime buckets • After performing wound care or dressing changes
4. After touching a patient	• When leaving station after performing patient care • After removing gloves
5. After touching patient surroundings	• After touching dialysis machine • After touching other items within dialysis station • After using chairside computers for charting • When leaving station • After removing gloves

Please make note of the following during this session.			
	Yes	No	Comments
There is a sufficient supply of alcohol-based hand sanitizer			
There is a sufficient supply of soap at handwashing stations			
There is a sufficient supply of paper towels at handwashing stations			
There is visible and easy access to hand washing sinks or hand sanitizer			

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Division of Healthcare Quality Promotion

CDC

Appendix VI: Environmental check list for terminal cleaning: Centers for Disease Control

CDC Environmental Checklist for Monitoring Terminal Cleaning[1]

Date:	
Unit:	
Room Number:	
Initials of ES staff (optional):[2]	

Evaluate the following priority sites for each patient room:

High-touch Room Surfaces[3]	Cleaned	Not Cleaned	Not Present in Room
Bed rails / controls			
Tray table			
IV pole (grab area)			
Call box / button			
Telephone			
Bedside table handle			
Chair			
Room sink			
Room light switch			
Room inner door knob			
Bathroom inner door knob / plate			
Bathroom light switch			
Bathroom handrails by toilet			
Bathroom sink			
Toilet seat			
Toilet flush handle			
Toilet bedpan cleaner			

Evaluate the following additional sites if these equipment are present in the room:

High-touch Room Surfaces[3]	Cleaned	Not Cleaned	Not Present in Room
IV pump control			
Multi-module monitor controls			
Multi-module monitor touch screen			
Multi-module monitor cables			
Ventilator control panel			

Mark the monitoring method used:

☐ Direct observation ☐ Fluorescent gel
☐ Swab cultures ☐ ATP system ☐ Agar slide cultures

---

[1]Selection of detergents and disinfectants should be according to institutional policies and procedures
[2]Hospitals may choose to include identifiers of individual environmental services staff for feedback purposes.
[3]Sites most frequently contaminated and touched by patients and/or healthcare workers

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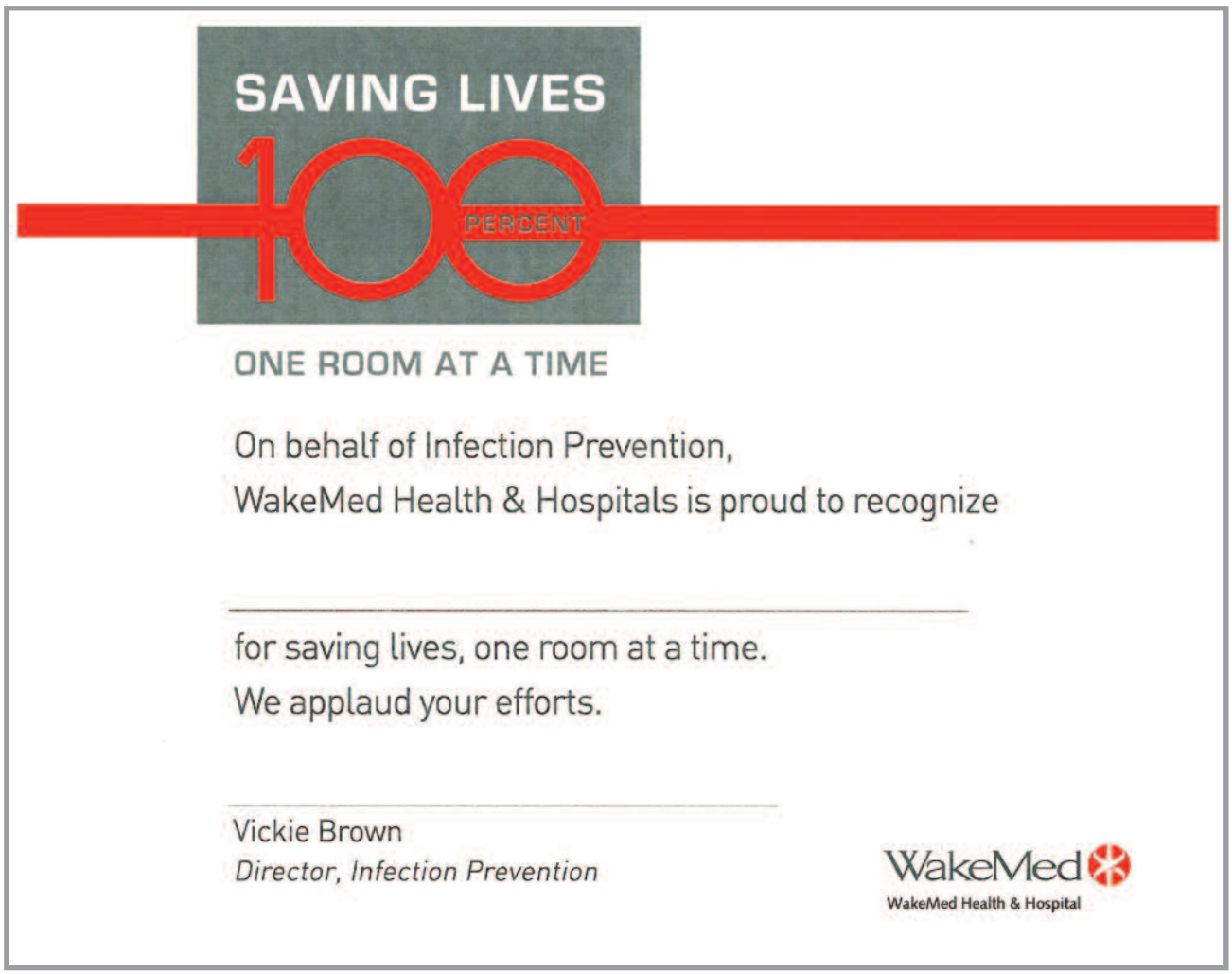
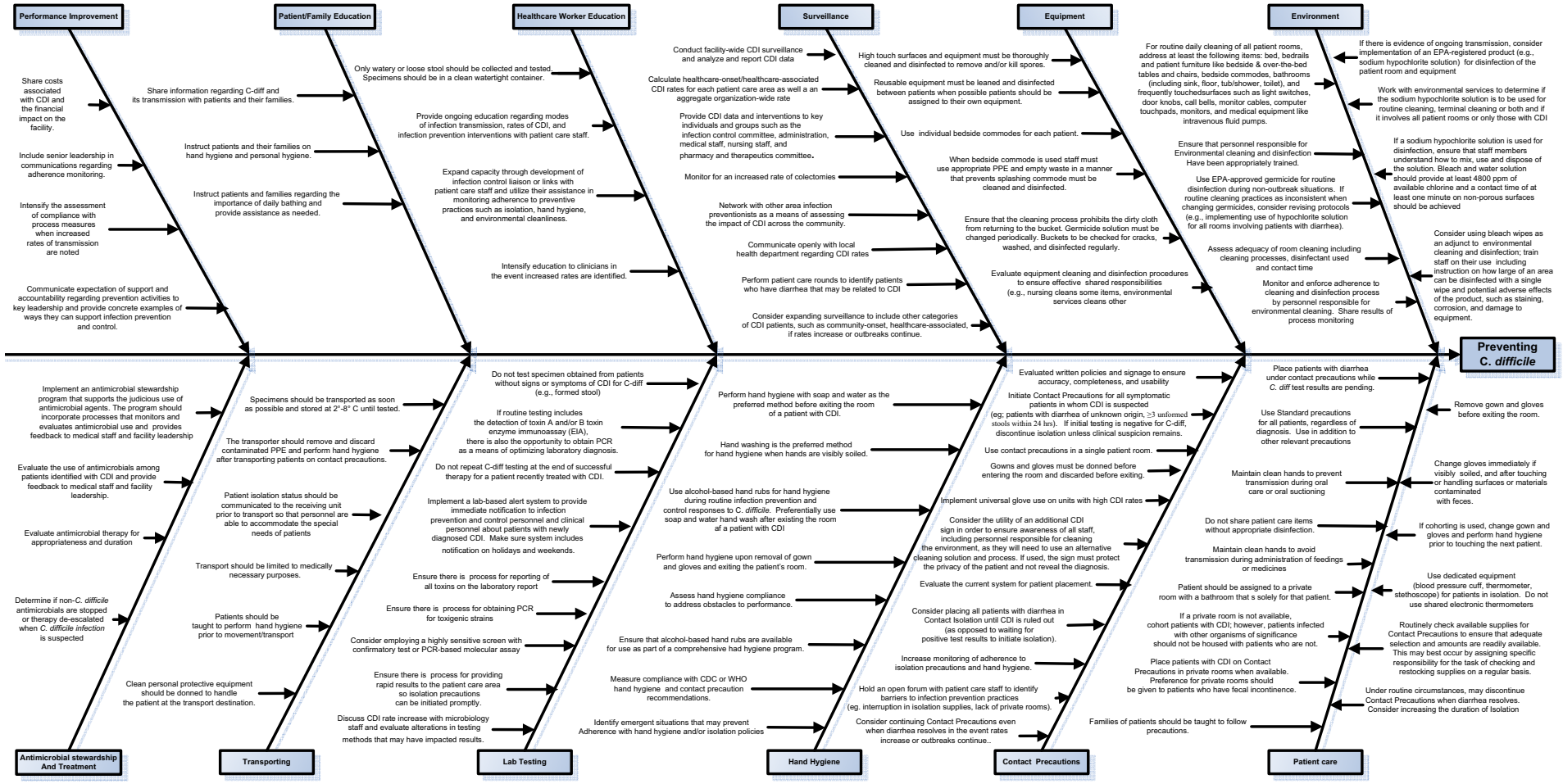
Appendix VII: "One Room at a Time" Certificate: WakeMed Health & Hospitals, Raleigh, North Carolina



Appendix VIII: CDI Fishbone: Ruth Carrico, University of Louisville, Louisville, Kentucky

Preventing Transmission of *Clostridium difficile* in Healthcare Settings



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April 2013

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Appendix IX: CDI Top Ten Checklist

Clostridium difficile Infection (CDI) Top Ten Checklist

TOP TEN EVIDENCE BASED INTERVENTIONS				
PROCESS CHANGE	**IN PLACE**	**NOT DONE**	**WILL ADOPT**	**NOTES (RESPONSIBLE AND BY WHEN?)**
Utilize checklist to assess key elements and actions to ensure optimal antibiotic prescribing and limit overuse and misuse of antibiotics.	☐	☐	☐	
Evaluate the use of antimicrobials among patients with CDI, and provide feedback to medical staff and facility leadership.	☐	☐	☐	
Utilize a diagnostic test (e.g. a 2-step approach where indeterminate GDH/toxin results are f/u with confirmatory PCR or use DNA amplification test) that will enhance the sensitivity and specificity of diagnosing CDI to facilitate prompt diagnosis, isolation, and treatment.	☐	☐	☐	
Establish a lab-based alert system to immediately notify the infection prevention team and providers of newly-identified cases of CDI; ensure the system includes holiday and weekend notification.	☐	☐	☐	
Establish rules for when testing for *C. difficile* should be performed on patients with clinically significant diarrhea (e.g. 3 or more loose stools/day for at least 1-2 days).	☐	☐	☐	
Establish a process for providing rapid results to patient care areas and providers to ensure isolation precautions are initiated promptly.	☐	☐	☐	
Establish cleaning protocols for a cleaning solution that is effective against *C. difficile* spores.	☐	☐	☐	
Utilize a monitoring system to evaluate and validate effective room-cleaning, and to provide feedback, reward and recognition to those responsible.	☐	☐	☐	
Engage and educate patients, visitors,families, and community partners (e.g. home care agencies, nursing homes), to prevent CDI across the continuum of care.	☐	☐	☐	
Establish and maintain an effective, creative, innovative, and engaging hand hygiene program.	☐	☐	☐	

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DISPOSABLE PRIVACY CURTAINS

HP Spray: 2012 APIC conference poster session (Rutala) described a process of spraying HP disinfectant solution on the "grab area of the privacy curtain during daily room cleaning and at discharge.

INCREASE CURTAIN INVENTORY TO PERMIT CHANGING AT DISCHARGE FOR ALL CONTACT ISOLATION ROOMS

Specialized curtains that permit quick switching without a ladder (e.g. http://www.c-sgroup.com/cubicle-track-curtains/qwik-switch).

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