CDI Prevention Practices

Cal HQ Change Package 2026

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About Cal HQ

California Alignment for Hospital Quality (Cal HQ) is a statewide collaboration focused on improving hospital quality through aligned action. The initiative is led by Covered California, CalPERS, and Cal Healthcare Compare, with oversight from steering committee members from state agencies, hospitals, health plans, improvement organizations, and patients to identify and advance a common set of hospital quality measures. The Cal HQ Steering Committee provides strategic guidance, ensures industry alignment, promotes Cal HQ's activities, and advises on statewide scaling and dissemination efforts.

Prevent 2,000 Infections over two years

34% overall reduction by 2027

Projected to potentially save approximately $64 million

Projected to potentially save 120 lives

About this Change Package

Change packages are tools to help health care improvement teams make patient care safer and improve outcomes. This change package, developed by a team of experts in patient safety and infection prevention, outlines evidence-based practices. It includes a menu of strategies, change ideas, and specific, actionable steps that your team can implement in your unique context.

All Cal HQ change packages are organized around a driver diagram, a tool to identify, organize, and prioritize improvement activities. Each primary driver has accompanying focus areas (called secondary drivers) and change ideas, or specific actions that a hospital team can take to improve outcomes.

Use this change package as background information, a checklist, reference material or simply a place to start. Learn more about other Cal HQ resources on our website: www.calhq.calhospitalcompare.org.

Part 1: Definition and Scope

What is a *Clostridioides difficile* (*C. difficile*)?

Clostridioides difficile (C. difficile), previously referred to as *Clostridium difficile*, is an anaerobic, spore-forming bacteria spread through fecal-oral transmission.[1] A *C. difficile* infection (CDI) colonizes the large intestine and releases two toxins that can cause several illnesses including diarrhea, colitis and sepsis. Nonetheless, colonized patients do not always present symptoms. *C. difficile* transmission in hospitals occurs primarily from contaminated environments and through the hands of health care personnel.[2,3] *C. difficile* spores are resistant to the bactericidal effects of alcohol and the most used hospital disinfectants. Antimicrobial therapy is the most important risk factor for CDI; the antibiotics destroy normal gut flora, allowing for the overgrowth of *C. difficile*. While all patients taking antibiotics are at risk of CDI, longer courses of antibiotic therapy and multiple courses of antimicrobials increase CDI risk.

Magnitude of the Problem

CDI is the most frequently reported health care-associated infection.[1] A 2011 Centers for Disease Control and Prevention (CDC) surveillance study found that CDI caused almost half of a million infections and directly led to approximately 15,000 deaths in one year.[4] A majority of these deaths occur in Americans aged 65 or older. Additional health care costs related to CDI are estimated at $4.8 billion for acute care facilities alone.[5]

Cases commonly appear in outbreaks and clusters in health care facilities.[6] However, the CDC study estimates that only one-quarter of CDIs occur in hospitals, with other cases occurring in nursing homes and community settings.[4] As a result, CDI prevention efforts should focus on community-based and facility-based antimicrobial stewardship and preventing disease transmission.

Part 2: Measurement

A key strategy for making patient care safer in your hospital is to track your progress toward improvement. Collecting data points at your hospital will guide your quality improvement efforts as part of the Plan-Do-Study-Act (PDSA) process. Tracking your data in this manner will provide valuable information needed to study your data across time and help determine the impact of your improvement initiatives on reducing patient harm.

Nationally Recognized Outcome Measures

- CDI Incidence Rate
    - Numerator: Number of unique positive *C. difficile tests*
    - Denominator: Number of patient days * 10,000

Note: Hospitals may track Healthcare Facility-Onset (HO) and Community-Onset (CO) infections.

- Hospital Facility-Onset (HO): C.*diff* specimen collected on or after Hospital Day 4, where Hospital Day 1 is the day of admission.
- Community-Onset (CO): C. diff specimen collected in an outpatient location or an inpatient location on Hospital Day 1 (day of admission), Hospital Day 2, or Hospital Day 3.

- CDI Standardized Infection Ratio (SIR)
    - Numerator: Observed CDI
    - Denominator: Predicted CDI
    - *SIR is calculated by NHSN and adjusted for several risk factors.*

Part 3: How to Improve

Investigate Your Problem and Implement Best Practices

Driver Diagrams

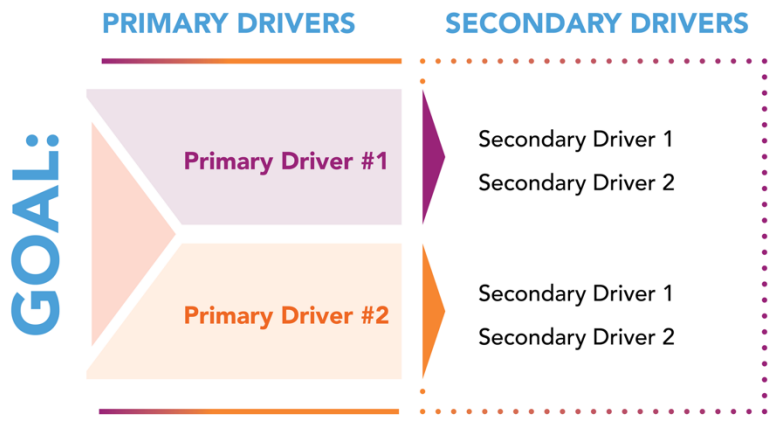
A driver diagram visually demonstrates the causal relationship between change ideas, secondary drivers, primary drivers, and your overall aim. A description of each of these components is outlined in the table below. This change package is organized by reviewing the components of the driver diagram to (1) help your care team identify potential change ideas to implement at your facility and (2) show how this quality improvement tool can be used by your team to tackle new process problems.

Suggested Bundles and Toolkits

Best Practices in the Diagnosis and Treatment of CDI, AHRQ[7]

Core Elements of Antibiotic Stewardship, CDC[8]

Strategies to Prevent CDI in Acute Care Hospitals: 2022 update[9]

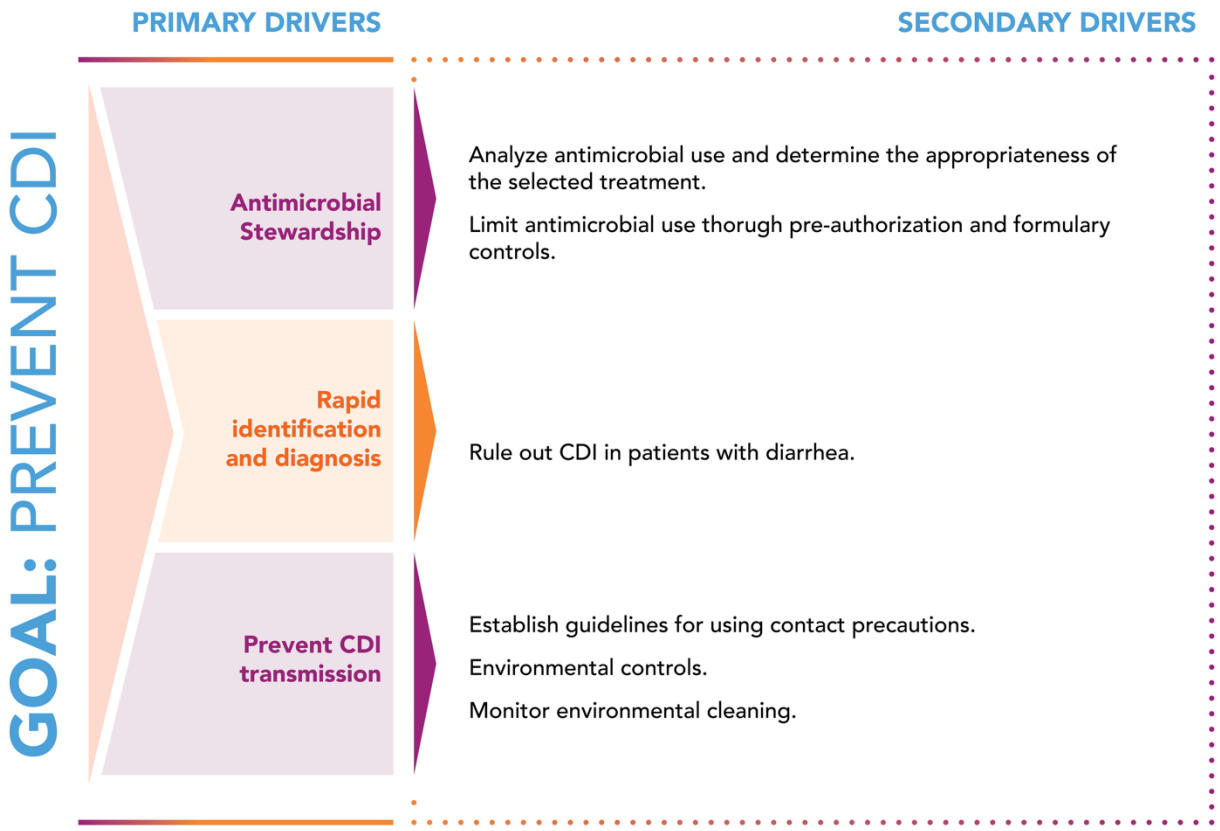


AIM: A clearly articulated goal or objective describing the desired outcome. It should be specific, measurable and time-bound.

PRIMARY DRIVER: System components or factors that contribute directly to achieving the aim.

SECONDARY DRIVER: Action, interventions or lower-level components necessary to achieve the primary driver.

Drivers in this Change Package



Foundational Infection Prevention Practices

This change package builds on foundational infection prevention and control practices that are a crucial component of safe and quality health care delivery:

- Leadership support
- Health care personnel education and training
- Patient, family and caregiver engagement
- Surveillance
- Hand hygiene
- Environmental cleaning and disinfection

You can learn more about these practices in the **Foundational Infection Prevention Practices Change Package**: https://calhq.calhospitalcompare.org/wp-content/uploads/2026/02/CalHQ_FoundationalIPC_TOOLKIT.pdf

Driver 1: Antimicrobial Stewardship

All antibiotics can increase the likelihood that a patient develops CDI. Antimicrobial stewardship is a program that promotes appropriate selection, dose, route and duration of antimicrobial therapy. The primary goal is to optimize clinical outcomes while reducing unintended consequences of antimicrobial use such as toxicity, colonization of pathogenic organisms and antibiotic resistance.

A secondary goal of antimicrobial stewardship is to reduce the health care costs associated with diseases such as CDI and antimicrobial resistance. Comprehensive programs have consistently demonstrated reductions in antimicrobial use that ranged from 22 percent to 36 percent with annual savings of $200,000 to $900,000.[11] Effective antimicrobial stewardship programs can be financially self-supporting, improve patient care and save lives.

Secondary Drivers in this Section

1. Analyze antimicrobial use and determine the appropriateness of the selected treatment.

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Studies have shown that as much as 30 percent to 50 percent of all antibiotic use is inappropriate. Inappropriate use includes a longer than necessary duration of therapy, treatment of nonbacterial diseases and treatment of contaminants or colonizers and meaningless duplicate therapy (e.g., treatment with multiple antibiotics targeting anaerobes simultaneously).[12] A growing body of evidence demonstrates that hospital antimicrobial stewardship programs optimize the treatment of infections and reduce adverse events. Monitoring and analyzing antimicrobial use by disease, location and prescriber can increase organizational knowledge of opportunities for stewardship.

Change Ideas

- Eliminate redundant combination antimicrobial therapy.[11]
- Engage the clinical microbiology laboratory and infection prevention departments in implementation of protocols for antibiotic selection.
- Optimize antimicrobial dosing based on individual patient characteristics, causative agent, infection site and drug characteristics.
- Educate prescribing clinicians about the appropriate selection and use of antimicrobials, including dose, timing and duration of treatment.
- Analyze the data for specific infections (e.g., urinary tract infections) and determine the appropriateness of the selected treatment.
- Monitor Healthcare Effectiveness Data and Information Set (HEDIS) performance measures on antibiotic utilization in pharyngitis, upper respiratory infections and acute bronchitis.[13]
- Adopt guidelines for managing community-acquired pneumonia.[14]
- Evaluate the use of antimicrobials among patients with CDI and provide feedback and recommendations to medical staff and facility leadership regarding treatment options.
- Focus efforts on reducing the use of certain antibiotic classes associated with CDI, such fluroquinolones, third and fourth generation cephalosporins, carbapenems and clindamycin.[15]

Suggested Process Measures for Your Tests of Change

- Percentage of patients where antibiotic indication was documented
- Days of therapy for high-risk antibiotics
- Percentage of patients who received an appropriate antibiotic for a specific diagnosis

2. Limit antimicrobial use through pre-authorization and formulary controls.

Limiting the formulary and requiring pre-authorization for certain antibiotics is a key strategy in reducing unnecessary use of antibiotics. This structure helps prevent unnecessary duplicate coverage as well as misuse, leading to improved microbial resistance patterns.[16]

Change Ideas

- Obtain cultures before starting antibiotics and streamline or de-escalate empirical antimicrobial therapy based upon culture results.
- Enlist a multidisciplinary team to develop standardized order sets incorporating local microbiology and resistance patterns.
- Develop antimicrobial order forms to facilitate implementation of agreed-upon practice guidelines
- Ensure all orders have clear documentation of dose, duration, and indications for antimicrobial therapy.
- Develop clinical criteria and guidelines to promote and facilitate the conversion from parenteral to oral agents.
- Require an antibiotic timeout, reassessing antibiotic appropriateness and necessity daily.

Suggested Process Measures for Your Tests of Change

- Percentage of patients who had all relevant cultures obtained before the first dose of antibiotics were administered
- Percentage of parenteral to oral conversions that followed guidelines
- Number of pre-authorizations requested and the number denied
- Percentage of patients in which daily antibiotic indication was documented

Hardwire the Process

Using Donabedian's Quality Framework (structure plus process leads to outcome)[17], (1) remove unnecessary antibiotics from the formulary, (2) restrict options for duplicate antibiotics and antibiotics for special circumstances, (3) provide ongoing surveillance of antibiotic use by pharmacy, (4) escalate to physician leaders as necessary - all of which leads to improved accuracy of antibiotic use. When these strategies are combined with clinician feedback and real-time intervention, care is safer, antimicrobial resistance is reduced, and money is saved.[18,19]

The greatest opportunity for patient and family engagement in preventing CAUTI comes in the daily review of catheter necessity. When patients and families understand the risks of CAUTI and participate in the dialogue about whether indications for the catheter still exist, care providers can raise other issues important to patient safety, such as progressive mobility and care planning.

Driver 2: Rapid Identification and Diagnosis

Rapid diagnosis will lead to prompt treatment and implementation of contact precautions that can limit the spread of CDI in the environment of care.[20] The major risk factors for CDI include antibiotic exposure, advanced age, immunosuppression, recent hospitalization and underlying health conditions. While CDI is primarily associated with healthcare settings, there is a growing increase in community-acquired cases.[21] Diagnoses of CDI will be more accurate if clinicians use higher-sensitivity tests, reduce the frequency of testing for an episode of diarrhea, and pay attention to key risk factors in the patient's history.[22] It is key, however, to recognize that tests with higher sensitivity may over diagnose true CDI in patients with a low pretest probability of having the disease.

An enzyme immunoassay (EIA) test for glutamate dehydrogenase (GDH), an enzyme produced by CDI, is 96 percent to 100 percent sensitive for the presence of the organism. However, this EIA does not test for the CDI toxins and cannot distinguish between nonpathogenic and pathogenic strains of the bacteria. The EIA tests for both toxins A and B to identify pathogenic strains, but these tests are only 70 percent to 80 percent sensitive.[23] Though the toxin tests are relatively inexpensive, their low sensitivity for identifying pathogenic strains reduces their value.

Nucleic acid amplification tests (NAAT) have a sensitivity of 90 percent or greater and a specificity of 95 percent or greater.[24] Guidelines recommend utilizing protocols that include a stool toxin test plus a NAAT or a stool toxin test plus a GDH test.[25]

Diagnosis of CDI

Test interpretation is related to the patient's clinical condition and the probability that the patient has CDI. CDI is a clinical diagnosis; no test makes the diagnosis of CDI. While sensitivity and specificity are important, the accuracy of any test is best determined by its predictive value. Predictive value is determined by sensitivity, specificity and prevalence of a condition in the population being tested ("pretest probability"). Positive predictive value (PPV) means that the test will be positive when the disease is present. Negative predictive value (NPV) means the test will be negative when the disease is absent. When the chances of finding the disease are low, even the most specific and sensitive tests will have a low PPV. In fact, with a typical inpatient population where approximately 10 percent to 15 percent of patients carry *C. difficile*, the PPV for PCR is less than 50 percent.[5] This means that more than half of the positives can be false positives. Note that "false positive" in this situation does not mean the presence of C. difficile without disease; it means that the test falsely identified the bacteria as a being a toxin capable of CDI.

Examples (See Appendix II)

Since the likelihood of CDI (pretest probability) is linked to the clinical situation, a 50-year-old inpatient with loose stools who has not had antibiotics has a much lower likelihood of having CDI than an 80-year-old who has been on antibiotics. In the example shown in Appendix II, the PCR test results for the 50-year-old will have a much lower PPV (a higher false positive rate) than the 80-year-old. If the 50-year-old has had a recent laxative or has just started tube feeding, the PPV is even lower (false positives will likely be higher).

Secondary Drivers in this Section

1. Rule out CDI in patients with diarrhea

1. Rule out CDI in patients with diarrhea.

There are many causes of diarrhea when it develops in a hospitalized patient. Given the significant increase in volume and severity of CDI over the last decade, hospitals appropriately try to quickly identify, treat and isolate CDI cases. The prevalence of C. *difficile* colonization in the community is 3 percent to 7 percent. In patients being admitted to the hospital, the colonization rate ranges from 4.4 percent to 15 percent. For patients in skilled nursing facilities, the rate of colonization can be as high as 50 percent.[26] Age, source of admission, history of hospitalization, and recent use of antibiotics all contribute to the likelihood that a particular patient will have CDI.

- Studies show that only about 5 percent to 10 percent of patients who develop diarrhea in the hospital do so because of CDI.[2] Underlying medical conditions, tube feeding, laxatives and medications other than antibiotics are among the many non-CDI causes of diarrhea.
- Simply stated, more inpatients have diarrhea than have CDI. Given the need for identifying CDI, and the need to not over diagnose CDI, hospitals should optimize practices for rapid and accurate diagnosis, using laboratory tools to aid in clinically determining the presence or absence of CDI.

Change Ideas

- Establish CDI testing criteria for diarrhea (e.g., three or more loose stools per day for at least one to two days)[27] (See Appendix III).
- Assess patients with diarrhea to determine if they have taken laxatives in the prior 24 to 48 hours as a possible explanation of symptoms.
- Establish laboratory criteria for CDI testing (e.g., 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. [27]

- Employ rapid diagnostic testing methods that facilitate prompt CDI diagnosis, isolation, and treatment
- Interpret the diagnostic test results only after considering the patient's clinical condition and pretest probability of having CDI, to maximize the positive predictive value of the tests and avoid false (incorrect) diagnosis and unnecessary treatment.
- Create a "hard stop" to discontinue an order for a CDI stool screening if the patient is admitted with a history of diarrhea yet fails to have an episode in the first two days of admission.
- Utilize EHR alerts to notify clinicians of patients that might not indicate appropriate CDI testing, including patients that have been tested in the prior 7 days and in children < 1 year old

Suggested Process Measures for Your Tests of Change

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

Driver 3: Prevent CDI Transmission

Prompt CDI diagnosis is the first step in outbreak prevention and will trigger the isolation precautions and infection control practices designed to prevent CDI transmission.[28] Fecal incontinence is common in patients with CDI, and the *C. difficile* spores can be a significant threat to other patients and staff in the environment of care. Since the fecal-oral route is the primary mode of *C. difficile* transmission within inpatient health care facilities, contact precautions should be instituted quickly after diagnosis.

Secondary Drivers in this Section

1. Establish guidelines for using transmission-based precautions.
2. Environmental controls.
3. Monitor environmental cleaning.

1. Establish guidelines for using transmission-based precaution.

Early identification of patients with CDI and of those suspected of having CDI provides the opportunity to stop the spread of CDI. Since the organism can be spread by direct human to human contact or by indirect means through fomites[3,29] (e.g., bed rails, equipment, rectal thermometers), contact precautions are critical to prevent spreading infection to staff, visitors and other patients (see Appendix IV). "Adherence to the components of contact precautions will help to break the chain of infection. Fecal incontinence and an increased potential for extensive and prolonged environmental contamination by the organism make patients with CDI a significant threat for disseminating and transmitting the disease. Using presumptive isolation and contact precautions is recommended while awaiting the results of screening for patients who develop health care-associated diarrhea."[29]

Change Ideas

- Reiterate the proper use of gowns, gloves and hand hygiene with soap and water.
- Limit transport or movement of patients as much as possible
- Ensure availability of supplies for personnel entering the patient's room.
- Utilize visual cues, such as signs and colored tape placed on the floor, to identify restricted areas.
- Implement an alert system to notify infection prevention of laboratory identified *C. difficile*.
- Implement a process that flags patients in the electronic health

record, identifying the need for contact precautions.
- Establish nurse-driven protocols to facilitate isolation of suspected or confirmed CDI patients (see Appendix VIII and IX).
- Establish a protocol for discontinuing contact precautions in partnership with infection prevention.
- Establish protocols to cohort CDI patients if private rooms are limited or unavailable.

Suggested Process Measures for Your Tests of Change

- Real-time measurement and intervention of length of time from the moment CDI is suspected to the time contact precautions are implemented
- Regular audits measuring time from the moment CDI is suspected to the time contact precautions are implemented.
- Regular audits regarding availability of all contact precaution supplies necessary for staff and visitors to adhere to proper precautions.
- Regular audits measuring compliance with discontinuation of contact

2. Environmental controls.

The hospital environment plays a significant role in transmitting *C. difficile*. Because *C. difficile* is shed in feces, any environmental surface that becomes contaminated with feces can serve as a source of transmission. *C. difficile* spores can survive on surfaces for as long as five months. *C. difficile* spores were found in 49 percent of the hospital rooms occupied by patients diagnosed with CDI, and in 29 percent of the rooms of asymptomatic CDI carriers. The most heavily contaminated areas were hospital room floors, bed rails and bathrooms.[30] A list of disinfecting products appropriate for preventing the spread of C. difficile can be found on the Registered Disinfectants section of the Environmental Protection Agency website[31]. As important as selecting the correct cleaning solution is ensuring that cleaning staff are well trained in how to use the cleaning supplies. It is important staff have an understanding about where particular cleaning solutions should be used, the frequency of cleaning required, and the amount of contact time needed for effectiveness.

Change Ideas

- Form a multidisciplinary team, including housekeeping, purchasing, and infection prevention, to review, evaluate and make recommendations regarding new

disinfectant agents and infection control practices.
- Clearly define who is responsible for cleaning ventilators, IV pumps and other critical patient care equipment.
- Ensure cleaning materials or wipes are within easy reach to facilitate cleaning
- Use fecal contamination clean-up kits for spills or uncontrolled stools.
- Utilize visual cues that show that a piece of equipment has been cleaned, such as paper strip or sign.
- Use disposable equipment or dedicated equipment to a single patient (e.g., blood pressure cuffs, thermometers, commodes)
- Use audible timers to ensure appropriate contact time for cleaning agents.
- Identify and remove environmental sources of *C. difficile* (e.g., replace thermometers with disposables).
- Use specialized privacy curtains that can be replaced without a ladder and appropriately cleaned
- Use commode liners to limit splashing or contamination when emptying

Suggested Process Measures for Your Tests of Change

- Percentage of proper cleaning contact time using audible timers

3. Monitor environmental cleaning.

Monitoring is required to ensure that cleaning and disinfection practices are consistent and effective. The CDC Environmental Cleaning Procedures outlines the best practices for environmental cleaning, including methods for assessment.[32] It is important to weigh the risks and benefits of the various auditing methods and select those that best fit your facility. Direct observation of cleaning practices provides immediate feedback, but it is time- and labor-intensive and may be a poor indicator of routine practice. While environmental cultures are simple to perform, they can be costly to process and the results can be delayed from 24 to 72 hours.

Fluorescent markers provide immediate results, allow for timely feedback, and furnish visual evidence that the surface has been adequately cleaned. Fluorescent markers, however, do not provide a colony count, so that reduction of bacteria can be logged. One of the best monitoring processes commonly used today is adenosine triphosphate (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.[29]

Change Ideas

- Directly observe room cleaning and provide immediate feedback, recommendations and recognition to cleaning staff (See Appendix IX).
- Use fluorescent markers to indicate physical removal of an applied substance.
- Use environmental cultures to demonstrate the effectiveness of cleaning or identify opportunities for improvement.
- Use ATP bioluminescence, which provides immediate feedback, to measure organic debris as a surrogate marker for biological contamination.
- Implement a program to recognize and acknowledge the efforts of environmental services team members (See Appendix V).
- Include terminal room cleaning test results as a standing item on infection prevention or quality committee agendas.

Suggested Process Measures for Your Tests of Change

- Using real-time data collection, percentage of rooms that are monitored for adherence to your hospital's preferred form of environmental cleaning process(es).
- Absolute number of rooms monitored for environmental cleaning found not to have been cleaned in adherence to your hospital's preferred form of environmental cleaning process(es).

PDSA IN ACTION

Tips on How to use the Model for Improvement

Choice of Tests and Interventions for CDI Reduction

- There are many potential effective interventions to reduce the risks of CDI. Improvement teams should begin their efforts by asking: "What is the greatest need at our facility? Where can we have the greatest impact?"
- Do not wait for the protocol or electronic health record to arrive to implement prevention strategies. Conduct small tests of change using the resources available and then upgrade the processes, equipment and technology over time.

Implement Small Tests of Change

Choose a protocol to adopt

PLAN | Adopt protocols for monitoring effectiveness of environmental cleaning.

DO | Test one protocol with one environmental services (EVS) professional cleaning one room.

STUDY | Ask the physician and/or nurse the following questions:

- Was the protocol clear and understandable?
- Were all the necessary materials present?
- Was it possible to complete the protocol successfully and in a timely manner?

ACT |

- What did you learn from the test?
- What needs to be changed in order to make the next test more likely to succeed?
- If the test worked well, is it time to recruit one or two more EVS professionals to test and see if others can perform as well or find out what needs to be altered to enhance the spread?
- Plan your next small test of change. How soon can you test it?

Common Challenges to Improvement

- Physicians may resist restrictions to antibiotic prescribing.
- Physicians may feel pressure from patients to prescribe antibiotics.[33]
- Pharmacists may be reluctant to call physicians about inappropriate antibiotics or combinations of antibiotics.
- Clinicians may confuse a positive test for C. difficile with a case of CDI, rather than interpreting the test within the clinical context.
- Healthcare professionals may push back against hand hygiene oversight.
- Patients, families and visitors may be reluctant to "call out" staff who do not appear to be following proper precautions and cleaning.

Conclusion & Action Planning

CDI prevention is multifaceted and cannot be accomplished in silos. Breaking down the approaches into the three primary drivers (antibiotic stewardship, rapid identification and diagnosis, and preventing transmission) can help organizations attack CDI simultaneously from different angles. Look at the secondary drivers and the change ideas. Build upon others' learnings. Gather small multidisciplinary groups of champion clinicians and administrators and design very small tests of change, then take those learnings and design new tests. Quickly repeat this PDSA cycle, learning iteratively. Improvement cannot be created in a meeting room. Improvement happens while learning from doing, and small tests allow for quick learning cycles and more rapid achievement of improvement goals.

Part 5: Appendices

APPENDIX I: C. *Difficile* Top Ten Checklist

Purpose of Tool: A checklist to review current or initiate new interventions for CDI prevention in your facility.

- ☐ Develop or enhance your antibiotic stewardship program to ensure optimal antibiotic prescribing and reduce overuse and misuse of antibiotics.
- ☐ Evaluate the use of antibiotics by infection type and by unit to better understand where the opportunities for stewardship exist; be sure to include patients with urinary tract infections and lower respiratory infections.
- ☐ Evaluate the use of antimicrobials among patients with CDI and provide feedback to medical staff and facility leadership.
- ☐ Develop processes to minimize testing of patients at low probability for CDI to minimize false positive polymerase chain reaction results for CDI.
- ☐ Establish a lab-based alert system to immediately notify the infection prevention team and providers of newly-identified patients with positive CDI lab results. Ensure the system includes holiday and weekend notification.
- ☐ Remembering that CDI is a clinical diagnosis and not a lab diagnosis, develop processes where discussion occurs between physicians and other clinicians when a lab test for CDI is reported as positive.
- ☐ Establish cleaning protocols for a cleaning solution that is effective against CDI 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.

APPENDIX II: Case Examples Illustrating Positive Predictive Value [34]

Purpose of Tool: Illustrate that even with highly sensitive and specific tests, for patients with low pretest probability for C. *difficile* infection (CDI), a high percentage of positive test results will be false positives.

Patient 1

- Age 50
- Admitted from home
- No recent prior acute or long-term care hospitalization
- 3 loose stools after admission
- No antibiotics administered in past 14 days
- Pretest probability of CDI is 4.4 – 15% (mean 10%)[2]

Test to identify CDI toxin genes (PCR)

- Sensitivity = 95%
- Specificity = 95%
- Pretest probability of CDI (prevalence)= 10%

For a population of 1,000 patients like Patient 1:

- 100 patients would have CDI
- 900 would not have CDI
- The test with a sensitivity of 95% would identify 95 of the 100 patients with CDI (95 true positives) and miss 5 of the 100 with CDI (5 false negatives)
- The test with a specificity of 95% would accurately be negative for the 95% of the 900 patients without CDI (855 true negatives) but would also misidentify 5% of the 900 without CDI as (45 false positives) as falsely having CDI.

Of the 95 + 45 (140) total positives the test identified,only 95/140 **= 68% would be true positives (PPV). The false positive rate would be 32%!**

Of the 855 + 5 (860) total negatives the test identified, 855/860 **= 99.5% would be true negatives (NPV). The false negative rate would be 0.5%**

Patient 2

- Age 80
- Admitted from skilled nursing facility 3 loose stools since admission
- On antibiotics for presumed urinary tract infection
- Pretest probability of CDI is approximately 50%[34]

Test to identify CDI toxin genes (PCR)

- Sensitivity = 95%
- Specificity = 95%
- Pretest probability of CDI (prevalence)= 10%

For a population of 1,000 patients like Patient 2:

- 500 patients would have CDI
- 500 would not have CDI
- The test with a sensitivity of 95% would identify 475 of the 500 patients with CDI (475 true positives) and miss 25 of the 100 with CDI (25 false negatives)
- The test with a specificity of 95% would accurately be negative for the 95% of the 500 patients without CDI (475 true negatives) but would also misidentify 5% of the 900 without CDI as falsely having CDI (25 false positives).

Of the 475 + 25 (500) total positives the test identified, 475/500 **= 95% would be true positives (PPV). The false positive rate would be 5%.**

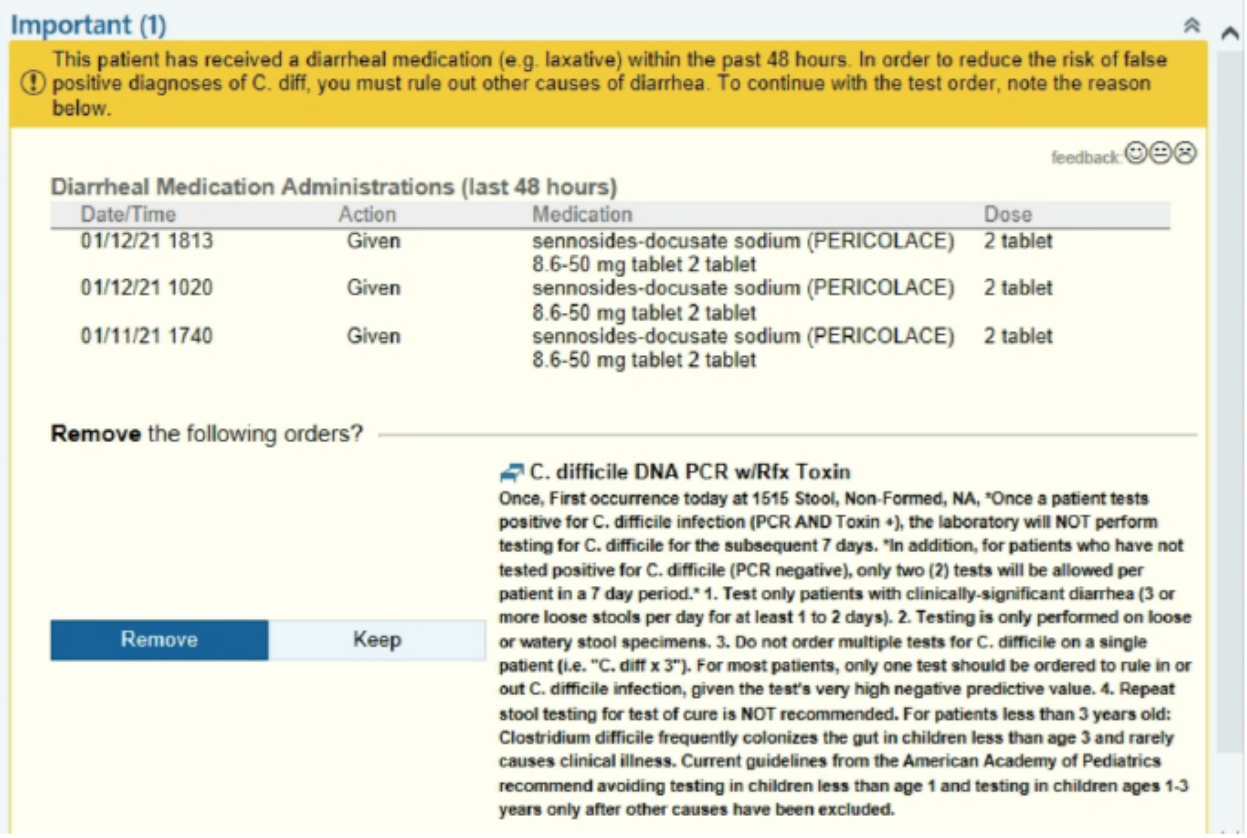
Of the 475 + 25 (500) total negatives the test identified, 475/500 **= 95% would be true negatives (NPV). The false negative rate would be 5%.**

APPENDIX III: Vanderbilt EHR Screenshots

Associated Hospital/Organization: Vanderbilt University Medical Center, Nashville, TN

Purpose of Tool: Provides electronic alerts to help educate staff and prevent unnecessary CDI stool testing

Reference: Permission provided on December 8, 2015, Vanderbilt University Medical Center.



APPENDIX III: Vanderbilt EHR Screenshots (continued)

Associated Hospital/Organization: Vanderbilt University Medical Center, Nashville, TN

Purpose of Tool: Provides electronic alerts to help educate staff and prevent unnecessary CDI stool testing

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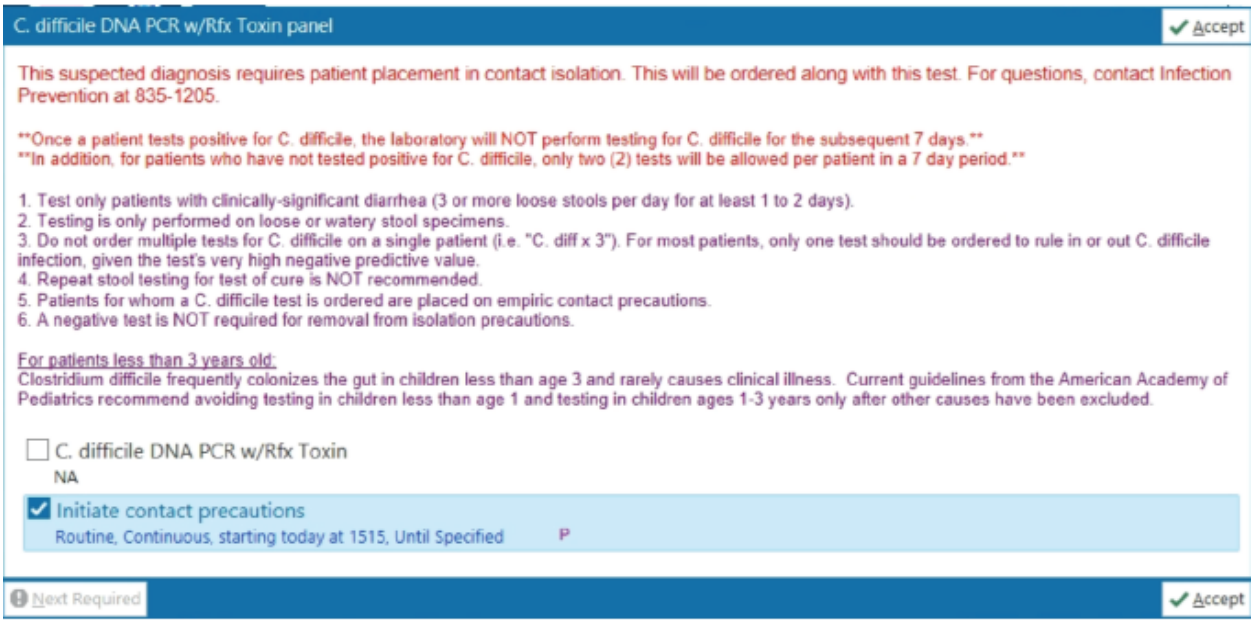


APPENDIX IV: Enhanced Precautions Sign

Associated Hospital/Organization: California Pacific Medical Center (CPMC), San Francisco, CA

Purpose of Tool: Alerts staff and visitors when contact precautions are required as well as the necessary hand hygiene and personal protective equipment

Reference: Permission provided on December 8, 2015, CPMC

APPENDIX IV: Enhanced Precautions Sign (continued)

Associated Hospital/Organization: California Pacific Medical Center (CPMC), San Francisco, CA

Purpose of Tool: Alerts staff and visitors when contact precautions are required as well as the necessary hand hygiene and personal protective equipment

Reference: Permission provided on December 8, 2015, CPMC

APPENDIX V: "One Room at a Time" Certificate

Associated Hospital/Organization: WakeMed Health & Hospitals, Raleigh, NC

Purpose of Tool: Recognition/acknowledgment tool for environmental services workers who are noted to adhere to hospital standards for room cleaning.

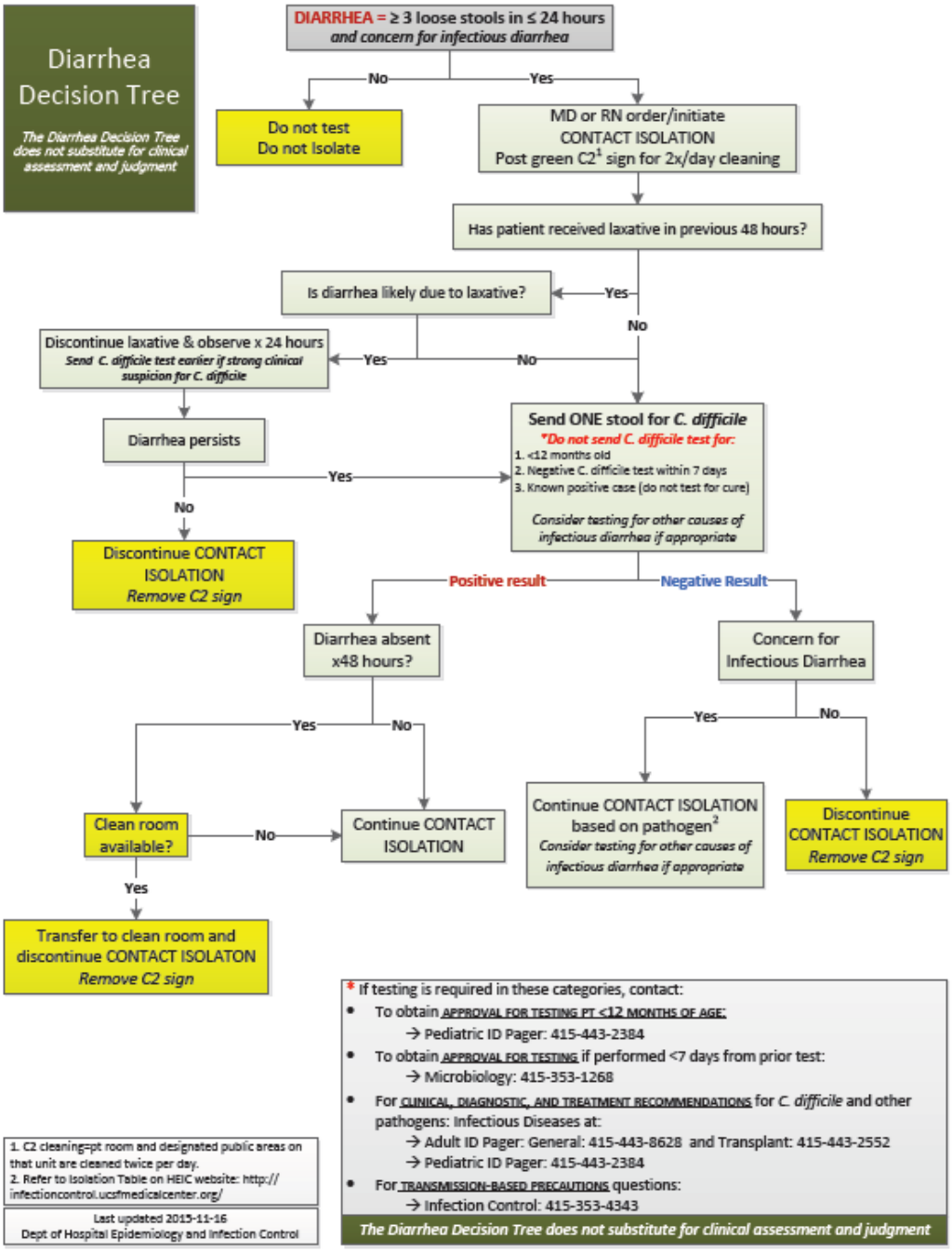
Reference: Permission provided on December 8, 2015, WakeMed Health & Hospitals.

APPENDIX VI: Diarrhea Decision Tree

Associated Hospital/Organization: University of California, San Francisco, CA (UCSF)

Purpose of Tool: Assists staff in determining which patients with diarrhea require enhanced contact precautions.

Reference: Permission provided on December 8, 2015, UCSF Medical Center

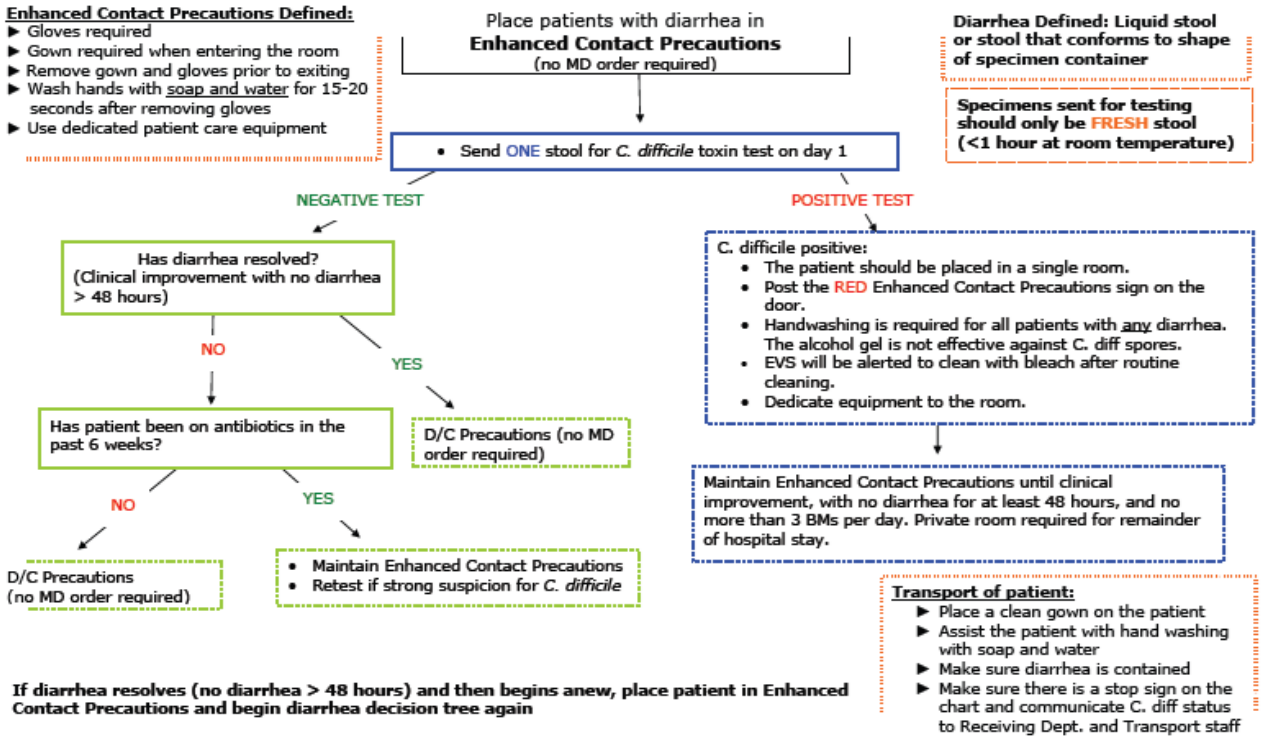


APPENDIX VII: Diarrhea/Enhanced Precautions Decision Tree

Associated Hospital/Organization: California Pacific Medical Center (CPMC), San Francisco, CA

Purpose of Tool: Assists staff in determining which patients with diarrhea require enhanced contact precautions

Reference: Permission provided on December 8, 2015, CPMC

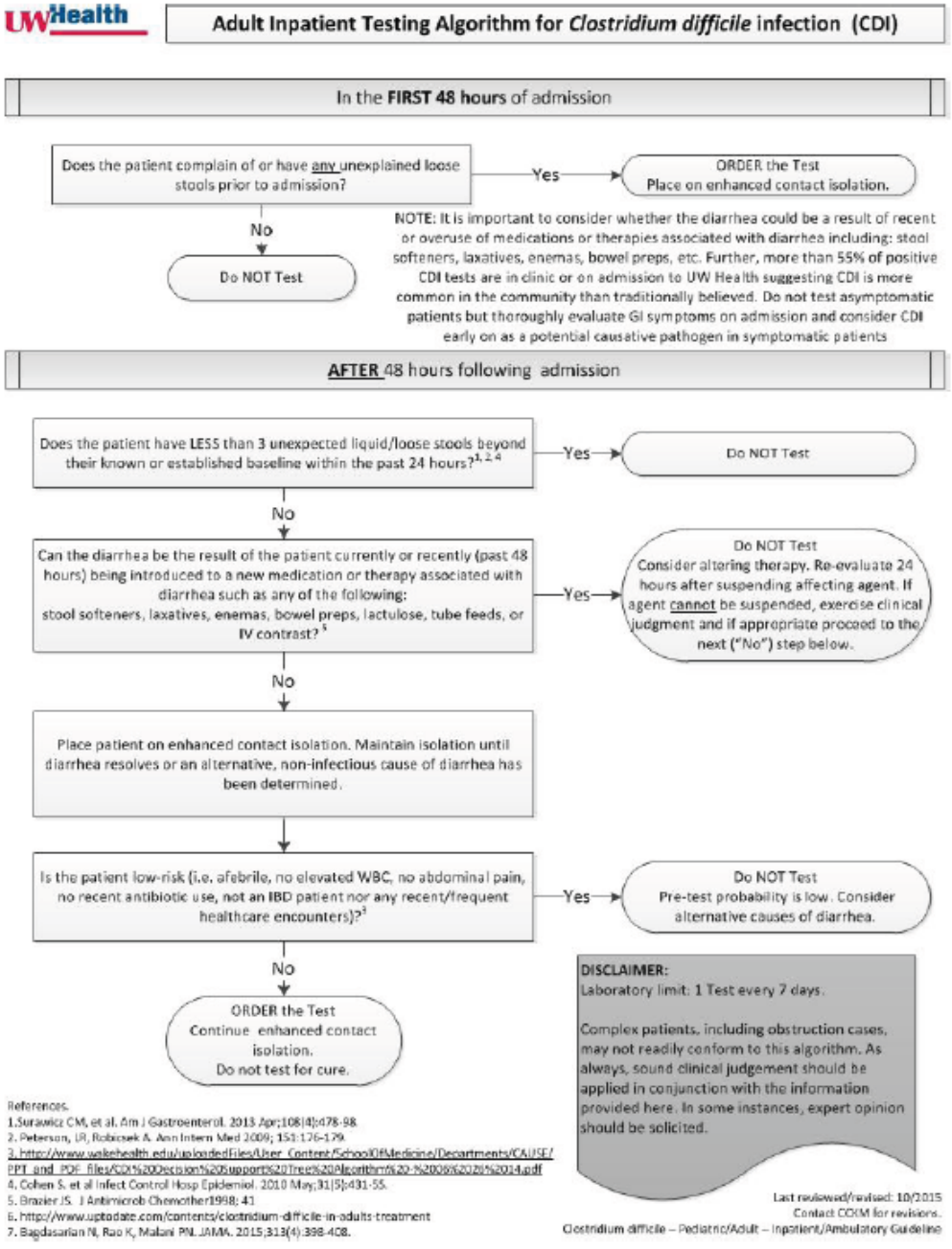


APPENDIX VIII: UW Health Adult Inpatient Testing Algorithm for CDI

Associated Hospital/Organization: University of Wisconsin Health

Purpose of Tool: Assists staff in diagnosing CDI

Reference: Permission provided on June 30, 2016, UW Health University

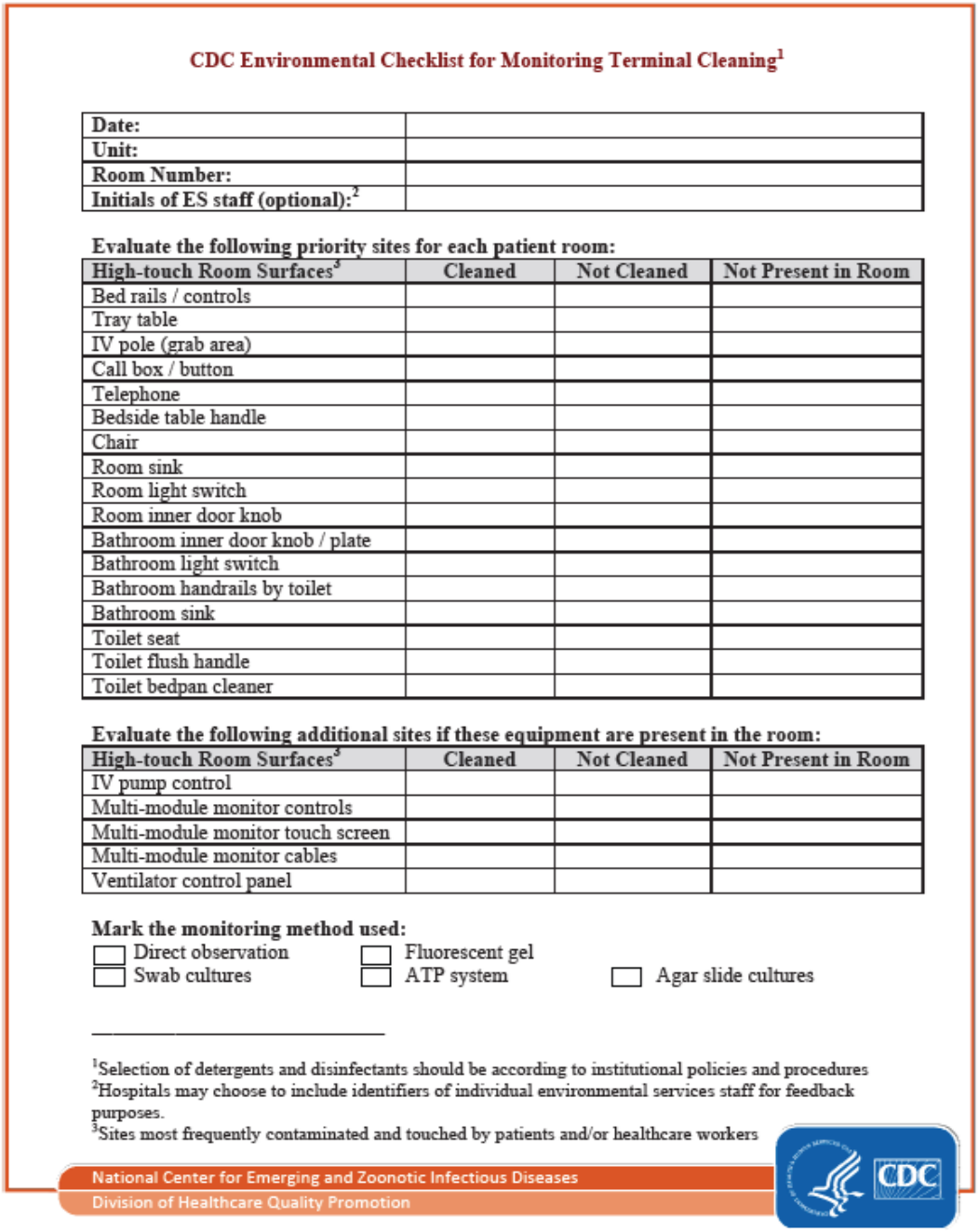


APPENDIX IX: CDC Environmental Checklist for Monitoring Terminal Cleaning

Associated Hospital/Organization: Centers for Disease Control and Prevention (CDC)

Purpose of Tool: Provides environmental services checklist for terminal room cleaning

Reference: https://www.cdc.gov/healthcare-associated-infections/hcp/cleaning-global/procedures.html



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

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

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