

Rethinking *C. difficile* Prevention:

Expanding Our Awareness and Prevention Efforts

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Clostridium difficile infection, commonly referred to as CDAD, CDI, or simply *C. diff*, is one of the greatest infection control challenges facing our healthcare system today. Within the past decade, we have witnessed patient mortality from this deadly GI bacteria skyrocket more than 400% with the emergence and evolution of even stronger strains¹. The CDC reports

that *C. diff* causes more than 60% of the 23,000 patient deaths it estimates that occur every year from bacteria that has become resistant to the very antibiotics used to treat them¹. Even this may be grossly underestimated, with independent research suggesting a nearly 8 times (8X) higher rate of mortality, exceeding 109,000 patients annually, from *C. diff* alone². This equates to five patients contracting CDI every minute of every day, and one patient death every 5 minutes from this preventable, though deadly infection². The economic costs of *C. diff* are devastating as well, at up to \$35k for a single inpatient infection and annual cost estimates ranging from \$3 billion to more than \$20 billion in the U. S. alone²⁻⁵. Based on the the critical nature of these risks, the CDC has recently classified *C. diff* as #1 among **Urgent Threats** for antibiotic-resistant pathogens, joined only by CRE (Carbapenem-resistant *Enterobacteriaceae*) and drug-resistant *Neisseria gonorrhoeae* in this highest risk category.¹

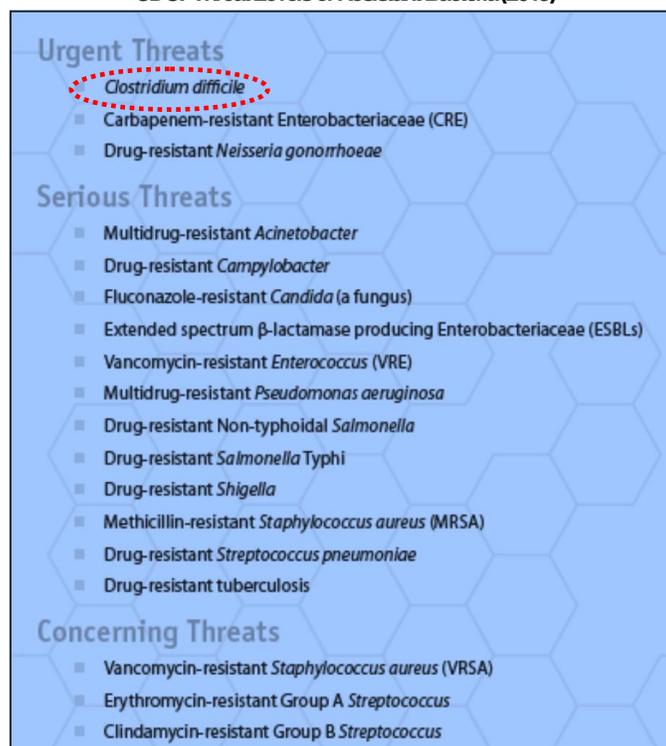
5 Patients are diagnosed with CDI every minute

1 patient dies from CDI every 5 minutes

Despite the significant amount of research focused on reducing the risks and controlling the threat of *C. diff*, admittedly only limited progress has been made in the efforts to tackle this problem that continues to threaten our hospitals and healthcare facilities. In its recent “Pace of Progress” survey, the Association for Professionals in Infection Control (APIC, 2013) stated that even with infections caused by *C. diff* reaching historic highs, only 42% of facilities have seen any decline in their rates of *C. diff* - related HAI’s over the past 3 years.⁶ This same survey reflected an even greater number of facilities (43%) reporting they had been unable to reduce CDI infection rates despite the adoption of additional CDI intervention measures at a vast majority of facilities.

With the converging threats of limited effectiveness in controlling *C. diff* infection, and the growing resistance of this potentially deadly bacteria to the very antibiotics used to treat it, every healthcare provider should be compelled to step back and take an “inventory” of what is currently known about *C. diff*, and acknowledge those additional measures needed to eliminate this threat within our hospitals and healthcare facilities.

CDC: Threat Levels of Resistant Bacteria (2013)



Source: CDC, Antibiotic Resistance Threats in the United States,

EXPANDING THE SCOPE OF PREVENTION EFFORTS

As is often the case when battling multi-drug resistant bacteria, much of the attention and resources employed in CDI prevention efforts have revolved around antibiotic use, hand hygiene, and mandatory reporting requirements to state and national databases. Yet, with more than a two decades of experience where “Antibiotic Stewardship Programs” and Hand Hygiene initiatives have taken center stage in infection control initiatives, *C. diff*-related resistance and patient deaths continue to plague our healthcare system at alarming rates. To add to the dilemma, only limited ground has been gained in the battle against many other most frequently identified MDRO pathogens and the toll they take, whether in terms of patient mortality or a hospital’s “bottom line.”

So how does it happen that the risks of serious infection and mortality from a single bacterial species continues to grow despite all of the research and resources that have been dedicated toward its control and prevention? This is not to suggest that these are not important concepts, but rather to highlight the need for a broader focus and reach in infection control initiatives. It is without argument that appropriate use of antibiotics and appropriate handwashing are critical components of a hospital’s overall infection control process. After all, these aspects commonly form the foundation for infection prevention and risk management strategies across the country. An unintended consequence of overrelying on these commonly misunderstood components can be found in the multiple disconnects that arise from confined thinking, not to mention the lackluster progress we have been able to achieve in our battle against *C. diff* and many other increasingly resistant pathogens.

Limiting the definition of necessary prevention efforts to antibiotic controls and hand hygiene education almost generically places prevention of *C. diff* in the same category as many other resistant pathogens, without a true recognition of the unique characteristics that have made control of this bacteria so elusive. Current experience shows us that relying on these alone is not sufficient. In addition, while mandatory reporting requirements may provide a “feel-good” benchmark to

If a carrier of resistant *C. diff* comes through your hospital doors today, is your facility adequately prepared?

encourage us that we are on the right path, ever changing tracking and coding definitions make it difficult to interpret historic trends and accurately define the challenge. All too often, such ratings can foster a culture of complacency so long as a facility’s report card indicates a lower than expected frequency of reported infections. In terms of resource allocation, many dedicated infection prevention professionals

find themselves spread so thin with tracking and reporting requirements to quantify the problem, there is little time left for the education and collaboration necessary to identify and implement effective solutions to eliminate it in the first place.

Notwithstanding, the true question that defines the ultimate effectiveness of an infection prevention process remains: ***If a carrier of resistant *C. diff* (or other MDRO pathogen) comes through your hospital doors today, are you adequately prepared to eliminate risks to other patients and staff? Are you ready?***

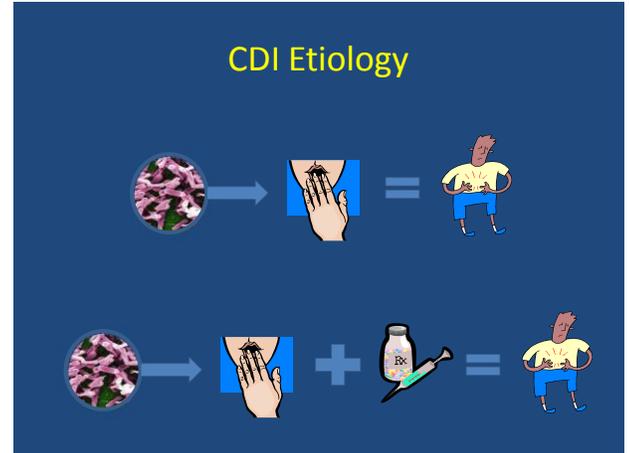
INTEGRATING WHAT WE ALREADY KNOW

One of the greatest ironies of *C. diff* prevention is how much we already know, or at least have learned, about this highly infectious and increasingly deadly bacteria. Since it was first identified in 1935, *C. diff* has become one of the most researched pathogens of our time, especially over the past 2 decades as *C. diff* risks have drastically increased in prevalence. With all of the information and yet mediocre results posted to date, it benefits us all to revisit some of the current perspectives and expand our scope of focus and awareness in facing the *C. diff* challenge.

Clostridium difficile is a gram-positive, spore-forming anaerobic bacillus that originates from the gastrointestinal tract (enteric pathogen). It can be found in two forms: The live cell (non-vegetative) and the spores that it produces (vegetative). The non-vegetative, *C. diff* cell is the active form that can either colonize or overgrow in the GI tract and produce the toxins (“Toxin A” and “Toxin B”) that cause diarrhea and serious infection. In contrast to its anaerobic cells that typically survive only 24-48 hours outside of the body, *C. diff* spores can survive for months or even years on environmental surfaces, and are readily spread throughout a hospital environment.⁷⁻⁸ These spores then infect a new host through hand-to-mouth (contact) transmission, and are re-activated to begin the process anew.⁸⁻⁹

The CDC reports that 94% of *C. diff* infection involves recent exposure to healthcare.^{8,10} Intuitively, this makes sense as a healthcare environment provides the greatest concentration of sick and immunocompromised people. The CDC states the greatest risk factors for acquiring or transmitting *C. diff* include:^{9,11,12}

- Exposure to antibiotics
- Use of Proton Pump Inhibitors (PPI’s)
- Gastrointestinal Manipulation/Surgery
- Length of stay in healthcare facilities
- Serious underlying conditions
- Immunocompromised patients
- Advanced age



Active infection occurs when *C. diff* overgrowth occurs in the GI tract, and the 2 toxins it produces (Toxins A and B) are present in sufficient quantities to create the diarrhea that is indicative of CDI. Due to increased motility of the bacteria within the GI tract, the “shedding” of *C. diff* is greatest with diarrhea,¹³⁻¹⁴ and it is during this stage that contact transmission and dissemination into the surrounding environment are most likely. The changes in the GI tract that occur from these *C.*

diff toxins can range from diarrhea and dehydration up to a condition known as toxic megacolon, any of which can be life threatening. In economic terms, *C. diff* increases risks of readmission 400%, with 1 in 5 patients expects to experience a recurrence of symptoms, and nearly half of those (45%) likely to have a second recurrence of symptoms within the first 6 months.³³⁻³⁴

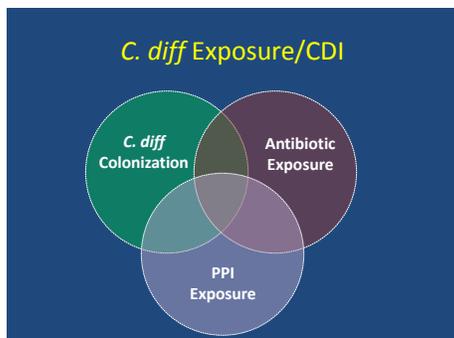
Additional Steps Needed for Effective *C. difficile* Control

- Every healthcare provider, environmental services worker, and support staff should understand what *C. difficile* is, where it comes from, and what they can do to prevent its transmission.
- Task-specific risk assessments (Process Flow Risk Assessment) should be performed at a departmental level to identify and eliminate sources and prevent opportunities for transmission of GI pathogens
- Attention should be paid to identifying where contact with enteric pathogens or secretions are most likely to occur (i.e.: personal care activities, bathrooms, and procedures where GI bacteria are generated or contacted)
- Enhance awareness and implement “Best Practices” such as the implementation of protective barriers for containment of *C. difficile* and other MDRO pathogens at the point of first encounter to reduce environmental dissemination and bacterial loading
- Collaboration should be facilitated among providers, infection prevention, and environmental services to interrupt the transmission chain across the care spectrum
- Understand and adhere to appropriate hand hygiene
- Ensure use of effective disinfectants and appropriate use during cleaning processes

OVERCOMING CHALLENGES WITH CURRENT APPROACHES

The Antibiotic (and PPI) Disconnect

There is perhaps no more widely attributed factor in the development of CDI than the use (or reported overuse) of antibiotics. Due to the nature of how antibiotics work in the body, exposure to antibiotic agents is known to effect and often disrupt the delicate balance of bacteria in the GI tract, allowing bacteria like *C. diff* to overgrow, unchecked by any



“good bacteria” that is eradicated as an unintended consequence of antibiotic use. First described in the 1970’s, methods to decrease the overall use of antibiotics in our health care systems, often referred to as “stewardship programs” or “antibiotic sparing programs,” have become widely discussed or instituted in an effort to reduce the risks of *C. diff* and other pathogens that have developed a resistant to multiple types, or classes, of commonly used antibiotics. Recently, commonly used Proton Pump Inhibitors (PPI’s) have joined antibiotics as a factor potentiating CDI/CDAD due to the changes they create in the acidity of the digestive system.^{3,15-17}

Though any medication or treatment that changes or alters the balance of the GI tract can increase the chances of complications that can include CDI/CDAD, there are a number of inherent risks in placing all of your infection control “chips” in the anti-antibiotic camp:

1. *C. diff* Infection involves a 2-step process

For a patient to develop CDI/CDAD, two things must occur:

First, they must be exposed to *C. diff* or become colonized with *C. diff* from a prior exposure. Contrary to commonly held beliefs, *C. diff* is not a naturally occurring resident flora of the GI tract, as it is estimated that only 2-4% of people are carriers of *C. diff* when they have had no prior healthcare exposure^{4,9,18,19}. In contrast, the CDC reports that 94% of CDI infection occurs in people who have recently received medical care. When hospitalized, 20% of patients are found to be unknown carriers, with 40% of patients becoming colonized or infected after 4 weeks of hospitalization^{9,20} and have been shown to be a reservoir for environmental contamination.

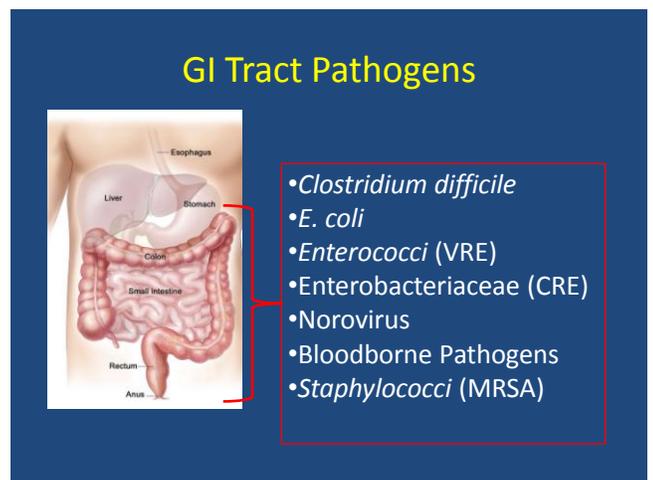
Second, the infected or exposed patient must have or develop a pre-disposing factor that enables the *C. diff* to flourish and produce the toxins that lead to the CDI/CDAD. This is where the changes that can be caused by antibiotics enter the equation. The effect of antibiotics on the flora, or microbiota, of the GI tract can lead to a number of conditions ranging from common antibiotic-associated diarrhea (AAD) to more severe conditions like CDI, but the latter can only occur if *C. difficile* is present or acquired in the time surrounding antibiotic exposure. However, research has indicated that up to half (between 44 and 63 percent) of patients with CDI/CDAD reported no antibiotic exposure prior to onset.^{4,15,21,22} Simply stated, every patient who develops CDI/CDAD acquired *C. diff* prior to onset, but not every CDI/CDAD case can be attributed to antibiotic use or exposure. In contrast, there has not been a single reported case of CDI/CDAD that did not involve prior exposure and colonization.

2. Disproportionate Reliance on Antibiotic Controls Diminishes Infection Prevention Ownership

It is inarguable that bacteria is quickly becoming resistant to the antibiotics commonly used to treat potentially devastating infections. With few new drug discoveries on the forefront, it is more important than ever to take prudent steps to preserve the availability of these lifesaving anti-infectives and slow the rates of resistance development.

However, when it comes to infection control and prevention, those on the frontline who have the first opportunity to identify and prevent sources of infectious bacteria and interrupt steps in the transmission chain are often not directly involved with the prescribing, or control, of antibiotic use. A recent survey indicated a vast majority (88%) of endoscopy nurses stated that CDI/CDAD was caused by antibiotic use, with only 16% indicating that they either had implemented or were considering implementing enhanced measures to combat *C. diff*.²³ The absence of prescribing antibiotics for routine procedures was included as one of the most common comments. Disconnects like these do not reflect or foster the level of ownership that needs to be established across the care spectrum, especially in those areas of a hospital with the highest probability of coming in contact with infectious GI or other bacteria. Such perspectives reinforce the need for breaking down existing silos and establishing a cooperative continuum of prevention activities across the care spectrum.

This is especially true of procedures that carry a high-probability of generating or encountering infectious bacteria or pathogens, including GI procedures (colonoscopy, EGD, EUS) where diagnostic or confirmative testing is commonly performed for CDI/CDAD and other GI infections, and where contacting such bacteria is a predictable and repetitive event. Not to mention that GI procedures and surgeries are among the highest known risk factors for encountering *C. diff*.^{9,11,12,24,25} Think about the lab and tissue specimens taken during these procedures that are carefully double-bagged and cautiously handled for transport to the lab for testing. In contrast, the patient, linens, and stretcher on which these GI procedures are performed are rolled out into recovery/PACU and into the hospital hallways and elevators, seemingly unaware of the dissemination and cross-transmission risks they carry with them. Even though current APIC guidelines call for the enhanced use of protective barriers to contain high risk bacteria within procedure rooms and patient care areas³, and CDC guidelines have long recommended the use of barriers to protect high-touch and exposed surfaces from contamination and cross-transmission of MDRO pathogens^{11,24,25}, practices historically implemented during these procedures has not kept pace with the risks that can be posed by inadequately protected surfaces and uncontained enteric bacteria and pathogens. Implementing simple steps such as establishing a protective barrier for exposed high touch surfaces and enhancing awareness of the process flow during these procedures is a critical component in containing known sources of bacteria and pathogens and protecting patients and facilities as a whole. The alternative would be to implement additional interim cleaning steps, including the replacement of linens, patient gowns, or other difficult to clean surfaces, prior to moving a patient or equipment from a designated or isolation area.



Though this serves as only a single example, this common scenario illustrates a fundamental example of the disparity that can occur in the absence of seamless infection control processes and acceptance of ownership of infection prevention across the continuum of patient care. Whenever and wherever potential sources of infectious bacteria are either generated or may predictably occur, adequate containment steps should be implemented to prevent dissemination to any other part of a hospital or healthcare environment. Effective infection control is everyone's responsibility across the spectrum.

3. Hospitals Treat Sick Patients

Despite any other factors or causative theories, it is a known fact that hospitals predominantly treat very sick and immunocompromised patients. After all, how many patients that are hospitalized do not require either an antibiotic or PPI for one or more of their admission diagnoses? With many admission Quality Measures and surgical procedures mandating the administration of an antibiotic within a pre-defined timeframe (usually 2-4 hours) after presentation, an infection prevention policy that does not also actively identify and address the many other, and often more controllable, *C. diff* transmission risk factors places itself and every other patient at significant risk every time a new admission comes through its doors or surgical procedure is performed. Infection prevention practices and processes should be established at a level of effectiveness that recognizes that patients on antibiotics (or PPI's) may be at increased risk for CDI if exposed, rather than falling into a trap of defining or rationalizing "acceptable casualties." When considering current objectives of APIC's "Targeting Zero HAI's" campaign²⁶ and similar initiatives from the CDC, HHS, CMS and other organizations, only a continuing and steadily decreasing trend in hospital infection rates should be seen as progress towards HAI elimination. Infection prevention is an evolving process and the status quo should not be acceptable.

Appropriate Hand Hygiene Is More Than Just a Metric

The important role of hand hygiene infection prevention was first introduced almost 200 years ago, with formal guidance from the CDC first appearing in 1975. Yet, with almost 40 years of dedicated focus and education, monitoring protocols, and the advent of waterless hand sanitizers, hand hygiene compliance rates continue to hover between 40 and 60 percent based on CDC reports²⁷⁻²⁸. There is no denying that adequate and appropriate hand hygiene is one of the most important components of preventing infections. After all, it is the hands of healthcare professionals that ultimately provide the final step in the care of the patients we serve. However, these can also unintentionally become a mechanism of transmitting infectious bacteria and other nosocomial pathogens.

So why in this day and age, with so much emphasis over the past 4 decades on the importance of performing this simple step, along with the increased availability and use of waterless hand sanitizers, does monitoring hand hygiene compliance continue to consume so much of an infection control department's limited time and resources? Does compliance "monitoring" even actually measure whether hand hygiene is performed when it is truly needed (i.e. interim points during care activities), or are we simply collecting metrics for hand hygiene activities completed upon entering and exiting a patient room in order to "check the box" and satisfy infection control requirements for Joint Commission or health department surveyors?

It is well established that ensuring clean hands includes the primary components of traditional hand washing (soap and water), hand sanitizers (gels, foam, etc), and the use of gloves when indicated. Though this seems simple on the surface, common reasons attributed to low compliance rates include: skin irritation to the soaps or sanitizers available, time pressures in care delivery, allergies to the gloves or components, and many others that have been reported and discussed in great detail.

Though often overlooked, critical aspects to establishing and engendering a true commitment to hand hygiene also requires the following:

- 1. Enhancing awareness of the reciprocal nature of pathogen transmission.** Hand hygiene, including the use of gloves, serves the dual purpose of protecting a caregiver from contacting pathogens, blood, or other potentially infectious material (OPIM), and preventing patients from being exposed to anything that can or could be carried on a caregivers hands. Equally important is gaining an awareness and understanding of the bacteria and pathogens themselves, their mechanisms for transmission, and strategies for prevention. More simply stated,

these are the types of pathogens that can be on your hands, and this is how infections can be spread to other patients or parts of your facility. Though this may seem intuitive on the surface, unless truly understood and consistently integrated across the continuum of care delivery, cross-transmission can readily occur through even seemingly casual interactions.

2. Task-specific risks of encountering or transmitting bacteria and pathogens. The wide array of activities in a hospital or healthcare facility present varying risks of exposure and ongoing transmission of infectious bacteria and other pathogens. There may not be a “one-size fits all” hand hygiene program that is adequate for everyone in every department. For instance, special attention would be warranted in endoscopy, for instance, where risk of encountering and disseminating enteric pathogens (including *C. diff*, VRE, CRE) into the hospital environment are significant due to the nature of the procedures performed and secretions and fluids encountered. In contrast, an outpatient exam room may carry a lower risk depending on the level of anticipated contact with mucous membranes, fluids, or secretions that may likely occur. Encouraging a department or provider to break down the step by step process (patient flow) of care delivery can provide great insight in identifying those points where additional infection control steps, including enhanced attention to hand hygiene, is of critical importance²⁹⁻³⁰.

3. Understanding limitations of hand hygiene products and processes: Understanding the strengths, and limitations, of hand hygiene products is of vital importance in the fight against *C. diff*. For example, as alcohol-based hand sanitizers are known to be ineffective against *C. diff* and its spores, relying on it in the presence of *C. diff* can leave a provider with a false sense of hand cleanliness. If caring for a patient with a known or suspected *C. diff* colonization or infection, traditional soap and water is the only effective means for removal of spores from the hands^{24,31}.

Effective use of PPE and Isolation Precautions for High Risk Patients:

While a primary purpose of gloves and other PPE is to establish a barrier for the protection of the caregiver, these do not magically eliminate risks of cross-transmission. These must be used consistently and appropriately, and disposed of properly. Any surface touched with gloved hands can contaminate either the gloves or the surfaces touched, depending on the specific sequence of activities performed. When in a situation where gloves, gowns, or other PPE is indicated, their use should include an enhanced awareness of when these are donned, consideration of those items or surfaces that will or may be touched during the course of care delivery or interaction, and ensure the process for safe removal and performance of appropriate hand hygiene immediately afterward.

In terms of Contact Transmission and Isolation precautions, the consistent use of PPE also serves the purpose of establishing a removable protective barrier to prevent the hands, skin, or underlying clothing of caregivers or visitors from becoming contaminated and carried out of the procedure area or patient room. Contact Isolation is not a room or defined area, but rather an enhanced process implemented to contain and confine infectious pathogens within a designated zone or area²⁴. The purpose is to prevent opportunities for exposure and dissemination of bacteria or pathogens present, particularly those known to be transmitted through touching and cross-transmission. In its true form, Contact Precautions and Isolation are indicated when exposure to infectious pathogens is anticipated. In practice, though, this is most commonly seen in healthcare setting in the designation of signage outside the room of a high risk patient.

When implementing Contact Isolation, education of staff and visitors is essential as there is often a reluctance to require consistent use. This is primarily due to varying perceptions as to its purpose. An endoscopy physician, for instance, may insist on wearing the same gown for multiple procedures, or may not wear one at all due to a low perception of risk to

them personally, as the perception is that the gown serves the purpose of preventing them from getting anything on their scrubs or clothes during the procedure. However, this type of perception does not recognize or achieve the purpose of isolating bacteria and pathogens within the procedure room. At the patient room level, a spouse or close family member may not want to observe isolation precautions, stating that they had been exposed to the patient at a previous point. True as this may be, it does not address the risks a family member can pose to other patients when they leave the confines of the isolation room and go to the cafeteria, lounge, or other common areas. Like the PPE itself, observance of isolation precautions serves the dual purpose of protecting the caregivers who enter the room, the patient themselves, as well to provide a mechanism for confining infectious bacteria and prevent its cross-transmission to other surfaces outside of the isolation or procedure room.

Once indicated and established, strict and consistent adherence to contact isolation must be maintained in order to be effective. Any breach in this process can potentially render the entire concept ineffective. Though the necessity and effectiveness of isolation is often discussed, containing and confining bacteria where it is known to exist is the only practical way to prevent its spread and dissemination to other patients and care areas.

Additionally, any discussion about the implementation of isolation would be remiss to not address the potential psychological aspects for the isolated patient and perceptions about its purpose and quality of care provided. Ensuring adequate education, communication, and understanding are critical components to overcoming most obstacles. As previously discussed, a spouse or caregiver may initially resist or question isolation PPE due to prior exposure or a low perception of risk to themselves. Even so, family members and visitors need to be aware of the risks of taking something in with them and exposing an already sick patient, or carrying something out on their clothing or skin that could pose a risk to another patient outside of the isolation room. Just as is the case with staff and providers, isolation is not just to protect oneself, but to eliminate risks to other patients and the facility as a whole. Infection Control and Prevention is everyone's responsibility.

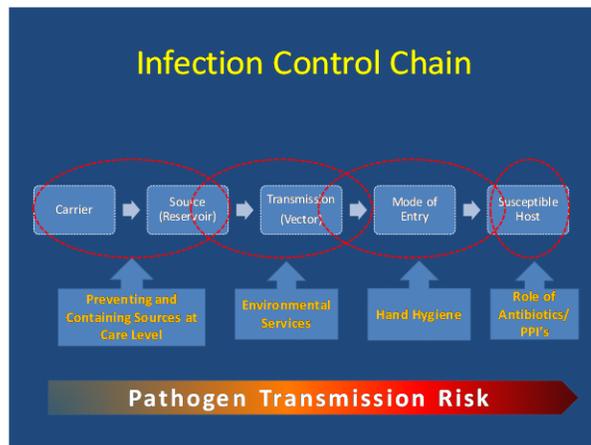
AVOIDING PITFALLS OF THE BLAME GAME

Effective infection prevention in the dynamic environments of our hospitals and healthcare facilities requires collaboration and cooperation at all levels. Given the nature of healthcare, this includes front line caregivers, environmental services, support staff, and even the patients and visitors themselves. Considering that bacteria can readily be spread from a single contaminated source to hundreds of environmental surfaces very quickly, recognizing opportunities to prevent source bacteria from entering the hospital environment should begin as early on in the transmission chain as possible.

Unfortunately, the ominous task of preventing cross-transmission is often disproportionately shifted to the cleaning performed by environmental services. The disconnect in this process, however, is that a significant amount of cross-transmission has most likely already occurred by the time many surfaces can even be cleaned. Since environmental services is not typically in patient rooms and procedure areas when care is delivered, they may have only a limited awareness of the surfaces and items most likely to have been touched or were contaminated during the process.

To illustrate this concept, imagine a construction worker performing a drywall repair at your home or business. The necessary processes of taping and sanding predictably generates dust that can be readily tracked throughout during normal walking and traffic. If steps are taken to predict and contain this dust as it is created, the end cleanup will be much more effective. In the alternative, if adequate proactive steps are not taken and responsibility shifted to the cleaning crew when the work is completed (i.e. "They will clean it up when I am done."), a significant amount of white dust would have been tracked during the interim and found on surfaces all over your house, making the task much more difficult. Now imagine this scenario happening over and over again in the same space, with a cleaning crew trying to keep up with an ongoing flow of dust created from the construction process. Only this time, replace the annoyance of white drywall dust with invisible and potentially deadly bacteria, and a blindfolded cleaning team charged with the responsibility of cleaning it all up with

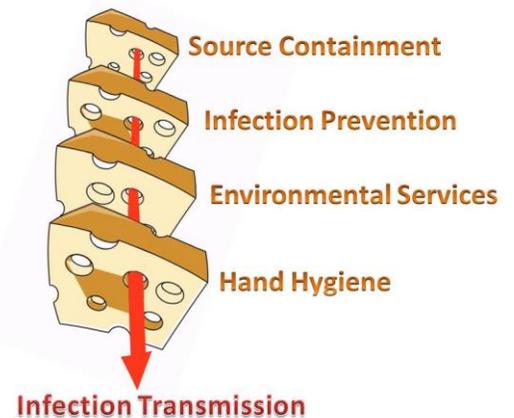
only a limited awareness of where it came from in the first place. This is the cyclical nature of the chain of pathogen transmission, where the earliest opportunity for control begins at the earliest source, with the risks for cross-transmission growing exponentially at every point after.



Such is the challenge in preventing the ongoing spread of bacteria in our hospitals and healthcare facilities, where maintaining a hygienic environment of care is of critical importance in light of the populations of sick and immunocompromised patients they serve. In terms of reducing the risks caused by *C. diff* and other enteric bacteria, consider that the contents of the GI tract (fecal contamination and secretions), for example, contain up to 1 trillion (1×10^{12}) bacteria per gram³². Even a minute amount of enteric bacteria can serve as a significant source for cross-transmission, quickly spreading to hundreds of other surfaces unless adequate awareness and preventative measures are implemented.

The elimination of source bacteria early on in the continuum of care is a critical step in exposure reduction for the facility as a whole. Routine and terminal cleaning processes should ultimately be viewed as a necessary adjunct to earlier efforts, providing an additional level of assurance to maintain a clean and safe care environment.

The process of preventing infections has long been compared to preventing a lining up of the holes in Swiss cheese. This analogy illustrates the multiple overlapping opportunities for preventing the spread of infectious pathogens, all of which must work together to interrupt the transmission and cross-transmission of infectious pathogens. Though beneficial in helping to visualize the concurrent processes needed for effective infection prevention, it does somewhat oversimplify the exponential growth of cross-transmission risks as you move further down the chain. Early on, a risk may be a single source or reservoir where identification and containment is more clear and achievable. As you move through the process, however, what started off as a single, containable risk can be spread to hundreds or thousands of other surfaces by the time it reaches the environmental services level, for instance. In the purest terms of a risk analysis, anything that finds its way through the weaknesses (“holes”) of the process is seen as a latent failure in the workings of the system itself.



As such, communication is critical for ensuring the collaborative efforts necessary for effective, facility-wide infection prevention initiatives.

The closer departments work together the tighter their processes will be, as is the case with narrowing the gaps between the layers of Swiss cheese.

CONCLUSION

Though risks of increasingly resistant pathogens such as *C. diff* have continued to grow, prevention of this potentially deadly menace to our healthcare system is achievable. As is all too often the case, our greatest limitation can be ourselves and any perceptions we hold that prevent us from identifying and implementing effective solutions. While it is true that *C. diff* is only one of many pathogens being battled on the infection control front in our hospitals and healthcare facilities, re-evaluating and enhancing our prevention efforts based on an increased awareness of this single pathogen raises the bar for the control of many other resistant bacteria. Given the extensive knowledge we already have with regards to *C. diff*, the solution for effective prevention and control likely already exists. We are, after all, smarter than the bacteria and have the ability to adapt our processes to stay one step ahead of them in our fight against HAI's.

Clostridium difficile

Quick Facts



What is <i>Clostridium difficile</i> ?	<ul style="list-style-type: none"> • Gram-positive, spore-forming bacillus • Obligate anaerobe • 2 forms: <ul style="list-style-type: none"> ○ non-vegetative (cell) ○ vegetative (spore)
Where does <i>C. difficile</i> come from?	Comes from the GI tract (enteric microflora) of humans and animals. When found anywhere else, it still ultimately originated from the GI tract (i.e. contaminated surfaces in a hospital or bathroom, or natural fertilizer used in a farm field, animal droppings, etc)
How long can <i>C. difficile</i> survive on surfaces outside the body?	A “live” or non-vegetative <i>C. difficile</i> cell lasts only 24-48 hours outside of its host. However, <i>C. difficile</i> cells produce highly resistant spores that can survive and remain viable for up to 2 yrs on environmental surfaces.
Everyone carries <i>C. diff</i> , right?	Wrong. <i>C. diff</i> is found in the enteric microflora (microbiota) of less than 5% of people. It is not a natural inhabitant, or flora, of the GI tract. When it is present, it may not cause disease in its host (asymptomatic colonization) but can still be spread to others
How is it Transmitted?	Fecal-Oral Route (contact transmission). <i>C. difficile</i> spores are ingested and introduced to their new “host” after contact with a contaminated surface. The spores are then able to germinate within the GI tract and are “reactivated.” Some research suggests there can also be airborne spread, but fecal-oral route remains the primary route of transmission
But antibiotics cause <i>C. diff</i> !	They can contribute to the development of CDI, <u>but this is not always the case</u> . Antibiotics do not “give you” <i>C. diff</i> . As they pass through and are excreted from the body, antibiotic exposures in the GI tract can alter the delicate balance of the flora, eradicating good bacteria that keep <i>C. diff</i> from overgrowing. Though many patients first exhibit symptoms of <i>C. diff</i> (CDI/CDAD) while taking antibiotics, the development of <i>C. diff</i> infection is a 2 step process that requires ingestion or introduction of the <i>C. diff</i> spore (or non-vegetative cell) and concurrent changes of the balance of flora in the GI tract. To date, there is not a single reported case of a patient developing CDI from antibiotic exposure <i>without</i> exposure to <i>C. diff</i> (ingestion).
What are risk factors for developing <i>C. difficile</i> infection?	The CDC reports the following are risks factors for acquiring or developing <i>C. difficile</i> infection (CDI): <ul style="list-style-type: none"> ✓ Exposure to healthcare facilities (94% of <i>C. difficile</i> is connected to getting medical care) ✓ Exposure to antibiotics or PPI’s ✓ Gastrointestinal manipulation/surgery (<i>C. difficile</i> originates from the GI tract) ✓ Advanced age ✓ Immunocompromise or serious illness ✓ Length of hospitalization/extended LOS
How does <i>C. difficile</i> cause disease in the body?	Active infection occurs when <i>C. difficile</i> overgrowth occurs in the GI tract, and the 2 toxins it produces (Toxins A and B) are present in sufficient quantities to create the diarrhea that is indicative of CDI. Due to increased motility of the bacteria within the GI tract, the “shedding” of <i>C. difficile</i> is greatest with diarrhea. It is during this stage that potential for extensive environmental contamination is at its greatest, as GI secretions contain up to 1 trillion (1×10^{12}) bacteria per gram. The changes in the GI tract that occur from these toxins can range from diarrhea and dehydration up to a condition known as toxic megacolon, any of which can be life threatening.
But our nurses “foam-in and foam-out” over every patient room and our hand hygiene compliance is off the charts.	Congratulations, as hand hygiene is a fundamental aspect of infection control. Though foams and hand sanitizing gels can reduce the risks of cross transmission of many types of bacteria and pathogens, they are not effective against <i>C. difficile</i> spores . This can lead to a false sense of security in the adequacy of hand hygiene practices. Thorough handwashing with soap and water is the only effective means of removing the spores from your hands.
Our sanitizer wipes kill <i>C. difficile</i> in 1 minute	This may be worth checking again, as the labeling for many commonly used sanitizer wipes and disinfectants have been required to update their claims regarding <i>C. difficile</i> . Previously, many stated they were active only against the non-vegetative forms in claims of <i>C. difficile</i> effectiveness. Similar to antibiotic activity, disinfectants require full exposure for the indicated “dwell times”, which are the shortest duration it takes for them to work against specific pathogens. Don’t think companies would not like to have these times shorter, as these are based on their most favorable data. Historically, only bleach has historically carried an EPA registered activity against <i>C. difficile</i> spores, though there are a handful of products being marketed that now include claims for activity against <i>C. difficile</i> . However, “dwell times” to reach this efficacy can be 10 minutes or longer, likely requiring reapplication to maintain the indicated exposure times.
It sounds like our environmental services department needs to heighten their awareness as to <i>C. difficile</i> risks	Taking steps to eliminate the risk factors of <i>C. difficile</i> and other MRDO pathogens in our healthcare facilities is everyone’s responsibility: from the staff caring for known carriers of <i>C. difficile</i> , to the nurse or tech who first encounters GI bacteria during a colonoscopy procedure, to the family members who visit a patient under contact isolation, and of course to those who work hard to clean our hospitals and facilities to ensure the health and safety of patients, visitors, and staff. A universal culture of prevention and hygiene must be owned across the continuum of patient care, as no amount of retrospective cleaning can erase all of the cross-transmission that can occur in a dynamic healthcare setting. Otherwise, your environmental services department is left with a task similar to trying to bail out the titanic with a teaspoon.
What additional steps does our facility need to take to prevent <i>C. diff</i> ?	Prevention starts with identifying and addressing the first (or earliest) origins, or sources, for <i>C. difficile</i> , preventing its initial entry and rapid dissemination into a facility or its environment. Consider the number of infectious pathogens that come from the GI tract: <i>E. coli</i> that causes UTI’s, VRE mediated wound infections, and yes, <i>C. difficile</i> Infection, just to name a few. The good news is infection prevention efforts for all of these risks often overlap, especially if practices and protocols are established at a level adequate to contain <i>C. difficile</i> , the most challenging of the group.

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