



INTERVENTIONAL CARE PATIENT CARE ENVIRONMENT OF CARE

A Layered Infection Prevention Approach With UV A University Based Health System Experience

ALICE BREWER, MPH, CIC, CPHQ, FAPIC

Clinical Affairs Director

Marc-Oliver Wright, MT(ASCP), MS, CIC, FAPIC

Clinical Science Liaison, Central Region

Objectives

- Review the concept of the layered approach to infection prevention
- Outline the multi-faceted performance improvement efforts aimed at reducing *Clostridioides difficile* infection at a university hospital setting
- Describe the implementation of UV technology and change in multi-drug resistant organism (MDRO) rates



Recommendations

Practice



Major article

Comparison of control strategies for methicillin-resistant *Staphylococcus aureus*

Mary T. Bessesen MD^{a,*}, Karla Lopez BSN^b, Karen Guerin MS^c, Karen Hendrickson BSN^d,
Shavetta Williams MSPH^d, Susan O'Connor-Wright MS^d, Donald Granger MD^{d,e}

^aDepartment of Veterans Affairs Eastern Colorado Healthcare System, Department of Medicine, University of Colorado-Denver, Denver, CO
^bVeterans Integrated Service Network 18, Denver, CO
^cDepartment of Veterans Affairs Eastern Colorado Healthcare System, Denver, CO
^dDepartment of Veterans Affairs, Salt Lake City Healthcare System, Salt Lake City, UT
^eDivision of Infectious Diseases, Department of Internal Medicine, University of Utah, School of Medicine, Salt Lake City, UT

- Changes to culture practice
- Active surveillance for infection
- Screening for colonization

0.58/1,000 patient days → → → 0/1,000 patient days
 0.57/1,000 patient days → → → 0.09/1,000 patient days

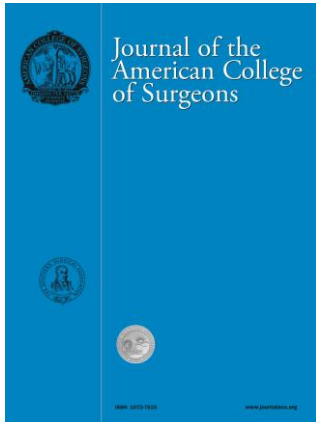


Preventable Patient Harm: a Multidisciplinary, Bundled Approach to Reducing *Clostridium difficile* Infections While Using a Glutamate Dehydrogenase/Toxin Immunochromatographic Assay/Nucleic Acid Amplification Test Diagnostic Algorithm

Katherine Schultz,² Emily Sickbert-Bennett,² Ashley Marx,² David J. Weber,^{1,2} Lauren M. DiBiase,² Stacy Campbell-Bright,^{2,c} Lauren E. Boda,² Mike Baker,² Tom Bellhorn,² Mark Buchanan,² Sherie Goldbach,² Jacci Harden,² Emily Hoka,² Beth Hueninger,² Jonathan J. Julliano,^{2,b} Michael Langston,² Heather Ritchie,² William A. Rutala,² Jason Smith,² Shelley Summerlin-Long,² Lisa Teal,² Peter Gilligan^{2,d,e}

- Antimicrobial prescribing
- Diagnostic stewardship
- Isolation policy
- Cleaning practices

11/10,000 patient days → → → 6.3/10,000 patient days



Multidisciplinary Approach and Clostridium difficile Infection in Adult Surgical Patients

Megan C. Turner, MD, MHS, Shay L. Behrens, BA, Wendy Webster, MA, MBA, Kirk Huslage, MSPH, BSN, Becky A. Smith, MD, Rebekah Wrenn, PharmD BCPS, Regina Woody, RN, Christopher R. Mantyh, MD, FACS

- Antimicrobial stewardship
- **Increased UV cleaning**
- Hand hygiene and PPE signage
- Diagnostic stewardship

1.27% → → → 0.91% (CDI rate among surgical patients)

Why Should We Include UV?

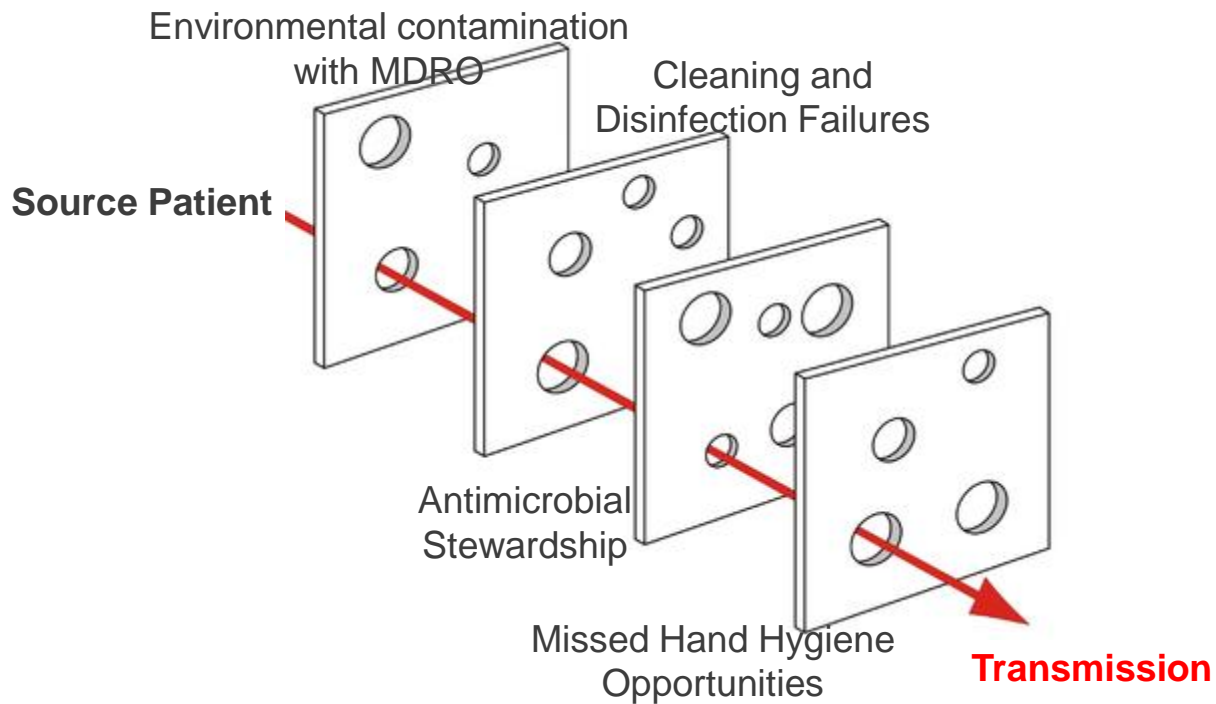
“These interventions (effective surface disinfection, thoroughness indicators) are not enough to achieve consistent and high rates of cleaning/disinfection.”

“What’s New: Strategies in Healthcare Environmental Infection Prevention” Webinar, August 9, 2017, Rutala.

What Makes A Successful Bundle?

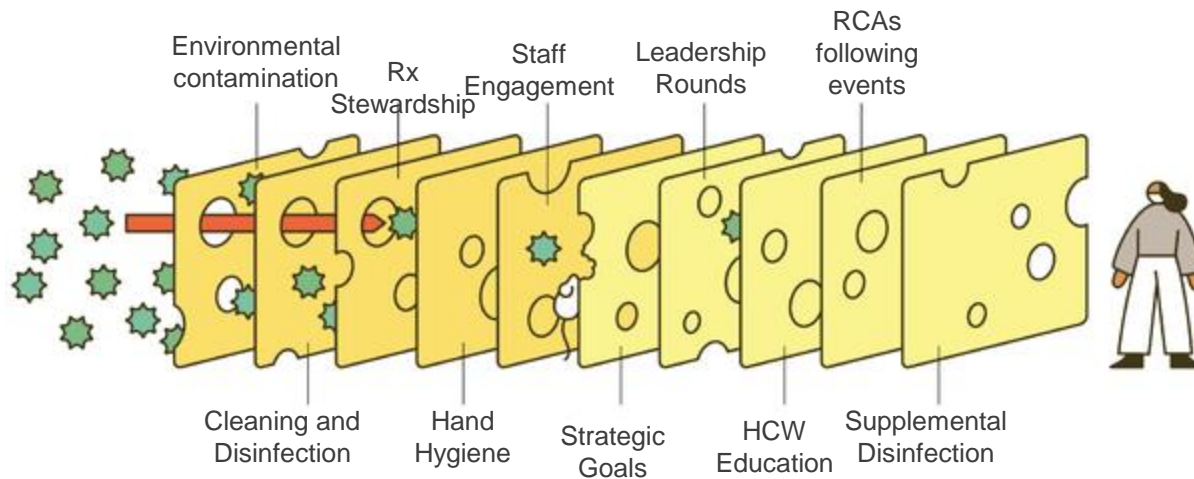
- **Culture, culture, culture**
- **Multidisciplinary teams**
- **Education**
- **Ongoing monitoring**

What Does This Look Like?



BMJ. 2000 Mar 18; 320(7237): 768–770.
model available [here](#)

What Does a “Layered Approach” Look Like?



model [available here](#)

The Layered Approach in Action

A large university-based healthcare system includes 566 bed university hospital (UH 1979), 87 bed pediatric hospital (2007 conjoined to UH) and 56 bed community hospital (2015)

- 32 inpatient units, 110+ clinics medical school affiliated
- 2.7 million outpatient visits, 50,000 admissions, 16,000 employees
- Net revenue \$3.2 billion 2014-2015 Hospital Compare for CDI:

No. of Infections Reported (A)	Number of Patient Days	Predicted No. Infections (B)	Standardized Infection Ratio (SIR) (A/B)	Evaluation
211	161,597	157.957	1.336	Worse than the National Benchmark

Pre-2016 CDI Prevention Strategies

In 2015 the following were already in place

- Environmental
 - A sporicidal disinfectant for **all** hospital discharges (not just CDI)
 - A QA monitoring program for 18 high touch objects (HTOs)
 - **Some use of UV light supplemental disinfection in select areas (since 2011)**
- Rx Management: An active and engaged antimicrobial stewardship team (since 2002)
- Accountability: Leadership HAI rounds (CNO, Associate CMO) on all units

Testing: Delegation Protocol

In an effort to rapidly identify patients and get them isolated, the organization created a nursing delegated protocol for testing

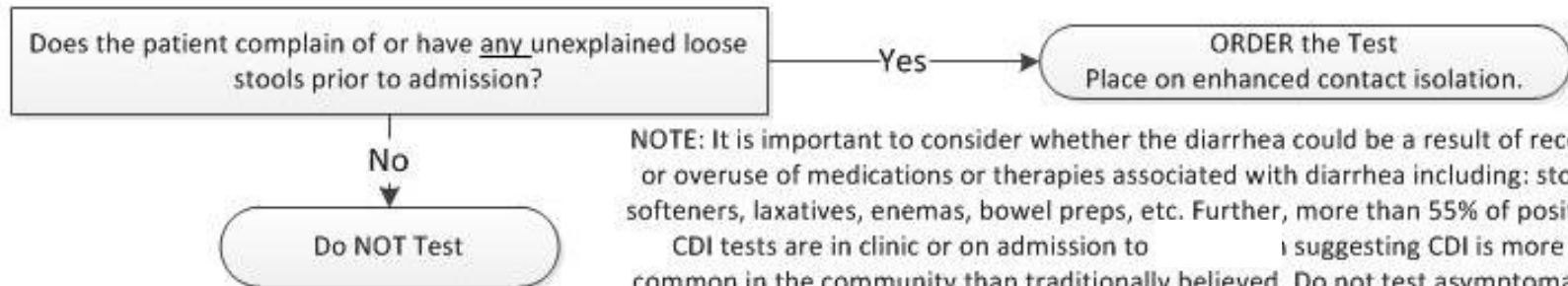
- 3 loose stools and RN can order CDI-PCR

Extensive chart of review of all patients testing positive revealed widespread inappropriate testing across the board

CDI Testing Algorithm - Part 1

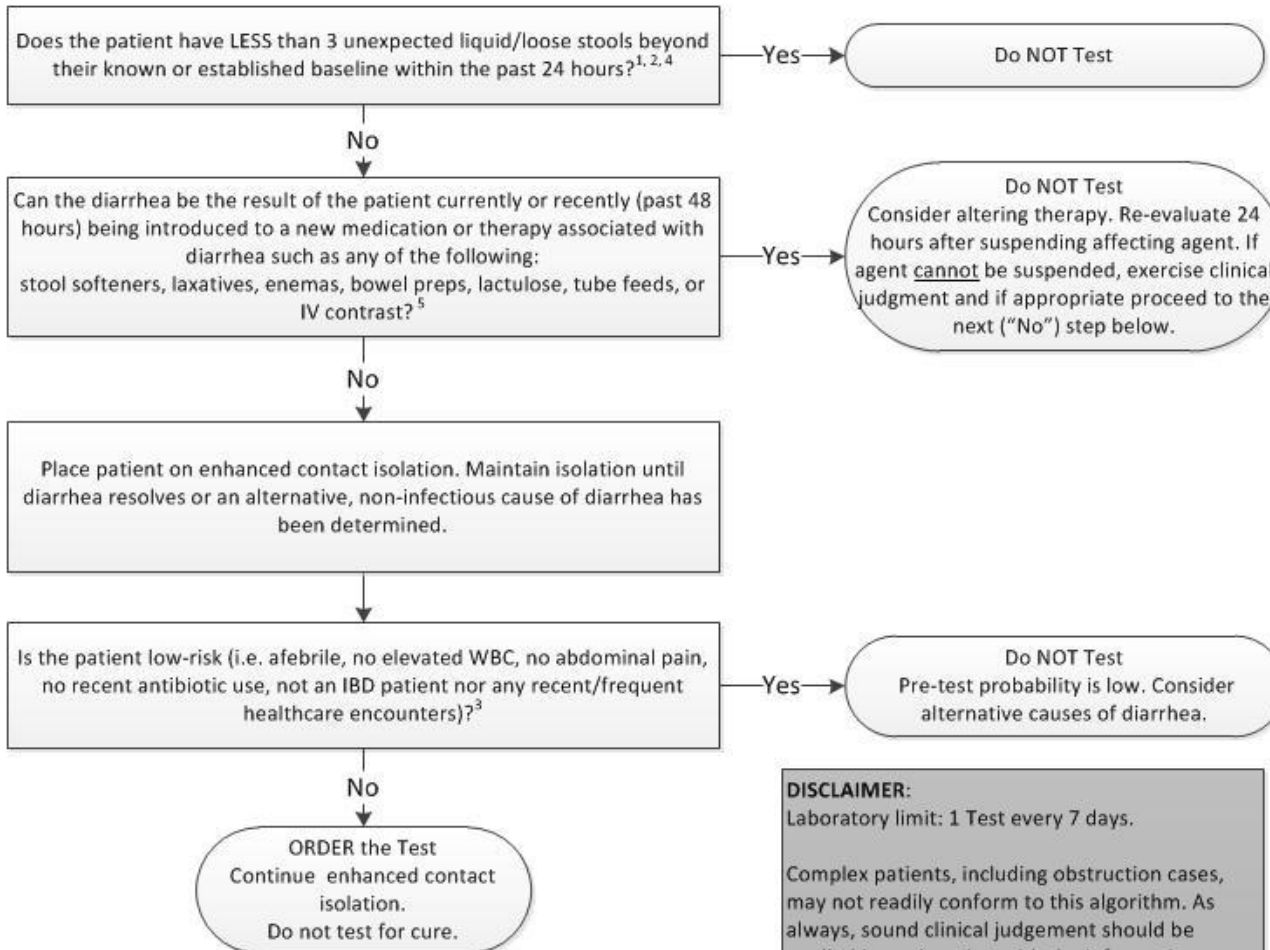
Adult Inpatient Testing Algorithm for *Clostridium difficile* infection (CDI)

In the **FIRST 48 hours** of admission



NOTE: It is important to consider whether the diarrhea could be a result of recent or overuse of medications or therapies associated with diarrhea including: stool softeners, laxatives, enemas, bowel preps, etc. Further, more than 55% of positive CDI tests are in clinic or on admission to suggesting CDI is more common in the community than traditionally believed. Do not test asymptomatic patients but thoroughly evaluate GI symptoms on admission and consider CDI early on as a potential causative pathogen in symptomatic patients

CDI Testing Algorithm - Part 2-OPTION 2



DISCLAIMER:
Laboratory limit: 1 Test every 7 days.

Complex patients, including obstruction cases, may not readily conform to this algorithm. As always, sound clinical judgement should be applied in conjunction with the information provided here. In some instances, expert opinion should be solicited.

References.

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5. Brazier JS. J Antimicrob Chemother 1998; 41
6. <http://www.uptodate.com/contents/clostridium-difficile-in-adults-treatment>
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Last reviewed/ revised: 10/2015
Contact CCKM for revisions.

Clostridium difficile – Pediatric/Adult – Inpatient/Ambulatory Guideline

ENVIRONMENT OF CARE



Prevent Transmission: Environmental

The organization used a sporicidal agent for all patient rooms (regardless of CDI) for years

- Bleach til Apr 2015 → H₂O₂+peroxyacetic acid

The organization used a quality assurance monitoring program starting in 2011

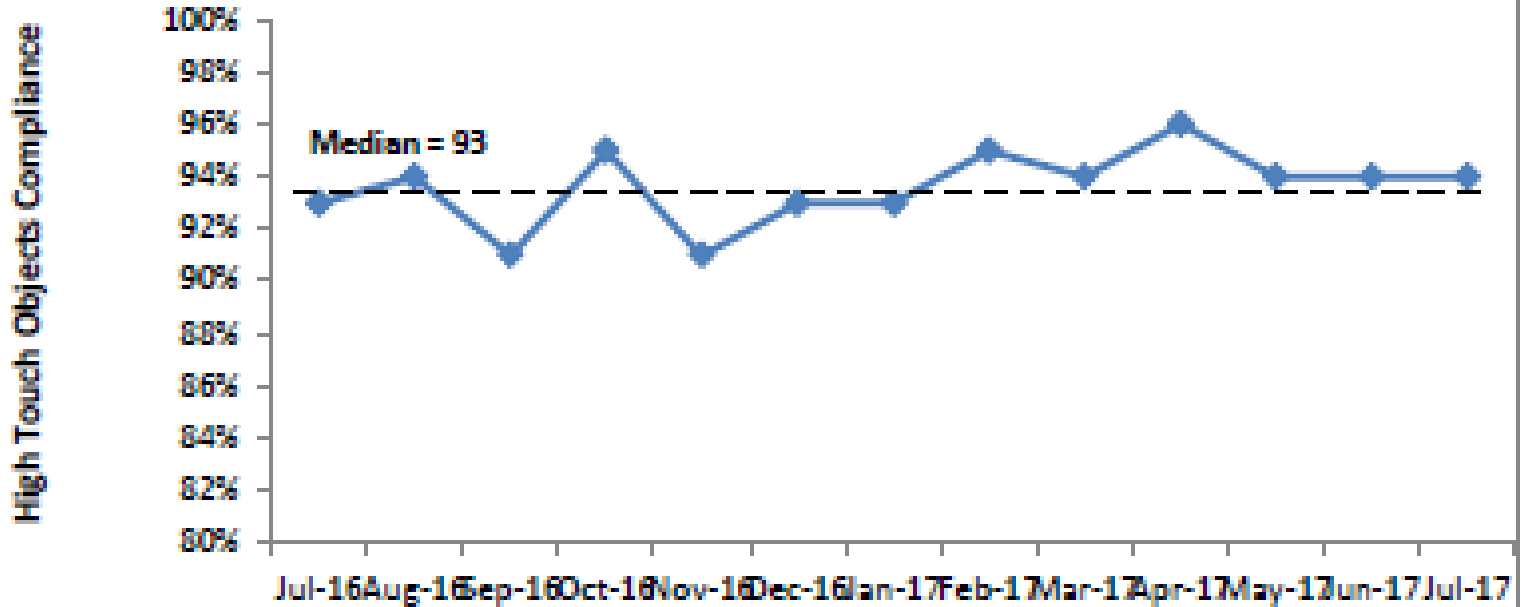
- Expanded list of “HTOs” from 18 (CDC default) → 36

The Expanded List

Room Door Handle-Outside
Nurse Server Handle Pulls
Alcohol Gel Dispenser
Chair: Arm *
Chair: Seat
Dry Erase Marker
Patient Visitor Guide
In Room Dining Menu
Room Door Handle-Inside *
and Push Buttons
Call Button/TV Remote *
IV Pole *
Patient Belonging Shelf
Window Sill/Ledge
Monitor Screen
BloodPressure Cuff
Telephone *
Flashlight

Light Switch: Room *, Bathroom *
Other
Toilet Seat: Bottom
Toilet Seat: Top *
Toilet Flush Handle *
Toilet BedPan Sprayer *
Shower Faucet
Shower Door Handle
Bathroom Door Handle-Inside *
Bathroom Door Handle-Outside
Bathroom Hand Rail *
Mattress
Bed Rail *
Bed Controls
BedSide Table Top *
Bedside Table Handle *
Soap Dispenser
Trash Can Lid
Horizontal Sink Surface
Sink Handles *

HTO Expansion



	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17
HTOs Passed Compliance	93%	94%	91%	95%	91%	93%	93%	95%	94%	96%	94%	94%	94%
HTOs Passed	573	1307	487	760	1987	2031	2156	2081	1809	1668	1454	1743	1743

New UV

Brought in 14+ machines throughout all units of to adult and pediatric units

- Reviewed one year's worth of discharge data to determine number of CDI isolation discharges/transfers
- Strategically placed machines to maximize efficiency between units

Patient discharge/transfer notifications to EVS included isolation room status

All rooms turned over in usual manner-via sporicidal disinfectant-before UV utilized

UV instruments track utilization by room

UV By the Numbers

56,536 in 39 months

The organization used the machines on average **1,481** times per month

1. All inpatient room terminal discharge or transfer cleans that are for patients in enhanced (CDI) contact precautions. (91.6%, ~85 times a month)
2. All inpatient room terminal discharge or transfer cleans that are for patient in other isolation precautions (e.g. contact, droplet, airborne). (79.6% ~485 times a month)
3. Inpatient room terminal discharge or transfer cleans in 6 high patient risk units whenever possible due to the population's inherent high risk for infection. (82.5% ~900 times a month)
4. Burn unit tub and shower rooms at end of day (100%)

From That (2014) to This (2019)

No. of Infections Reported (A)	Number of Patient Days	Predicted No. Infections (B)	Standardized Infection Ratio (SIR) (A/B)	Evaluation
211	161597	157.957	1.336	Worse than the National Benchmark

▼ Table 6 of 6 *Clostridium difficile* (C.diff.) intestinal infections

No. of Infections Reported (A)	Number of Patient Days ⁱ	Predicted No. Infections (B)	Standardized Infection Ratio (SIR) ⁱ (A/B)	Evaluation
69	175254	135.347	0.510	Better than the National Benchmark

Standardized infection ratio (SIR) national benchmark = 1.
 Lower SIRs are better. A score of (0) – meaning no C.diff. infections - is best.

What role did UV play? How can you tell?

Same rules as MRSA Blood and CDI LabID event applied to all resistant organisms.

- Retrospectively reviewed back to 9/1/2015
- Period 1: 9/1/2015 – 8/31/2016
- Washout: September 2016
- Period 2: 10/1/2016 – 10/31/2018

- Note there are more patient days in Period 2

MRSA, VRE, extended spectrum beta-lactamase (ESBL) Gram-negative organisms and Amp-C beta-lactamases (Amp-C)

MDROs

Organisms	Pre-UV		Post UV		Rate Ratio, (95% CI), p-value
	9/2015-8/2016	rate	10/2016 - 9/2018	rate	
Methicillin-Resistant <i>Staphylococcus aureus</i>	64	3.97	84	2.51	0.63 (0.45, 0.89) p=0.008
Vancomycin-Resistant Enterococci	46	2.85	67	2.00	p=0.08
AmpC	2	0.12	4	0.12	
AmpC and ESBL	7	0.43	6	0.18	
ESBL	26	1.61	57	1.70	p=0.92
<i>Clostridium difficile</i>	151	9.57	186	5.69	0.60 (0.48, 0.74) p= 0.000
All Organisms (Total)	296	18.76	404	12.37	0.66 (0.57, 0.79) p=0.000
Total minus CDI	145	8.98	218	6.52	0.73 (0.59, 0.90) p=0.004

Summary

Neither failure nor success can usually be attributed nor sustained due to a single intervention.

A layered approach, especially as it relates to the disinfecting the environment improves the probability of sustained success in the long term.

Supplemental disinfection strategies, such as using UV disinfection following routine environmental cleaning and disinfection can have a statistically significant impact on MDRO acquisition, including C. diff infections and other MDROs when deployed as part of a comprehensive program.

UV was successfully integrated into the organization's standard operating procedure and its use is associated with a dramatic and sustained reduction in MDROs

Thank you



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