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Preventing *Clostridioides difficile* Infection with Infection Control and Appropriate Antibiotic Use

Renuga Vivekanandan, MD
Associate Professor
Medical Director Antimicrobial Stewardship
Hospital Epidemiologist
CHI Health Creighton University
@RVivekanandanMD

Disclosures

- MDstewardship

  -consultant and owner

Objectives

1) Describe the changes to the new C diff treatment guidelines

2)Explain the relationship between environmental cleaning and C diff prevention

3) Outline monitoring methods for environmental cleaning

4) Discuss the impact on CDI rates with reduction in treatment of asymptomatic bacteriuria

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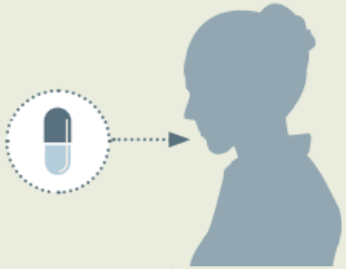
IMPACT

Caused close to half a million illnesses in one year.

Comes back at least once in about 1 in 5 patients who get *C. difficile*.

For people over 65, one in 11 died of a healthcare-associated CDI within a month of receiving a diagnosis with *C. difficile*.[1]

RISK

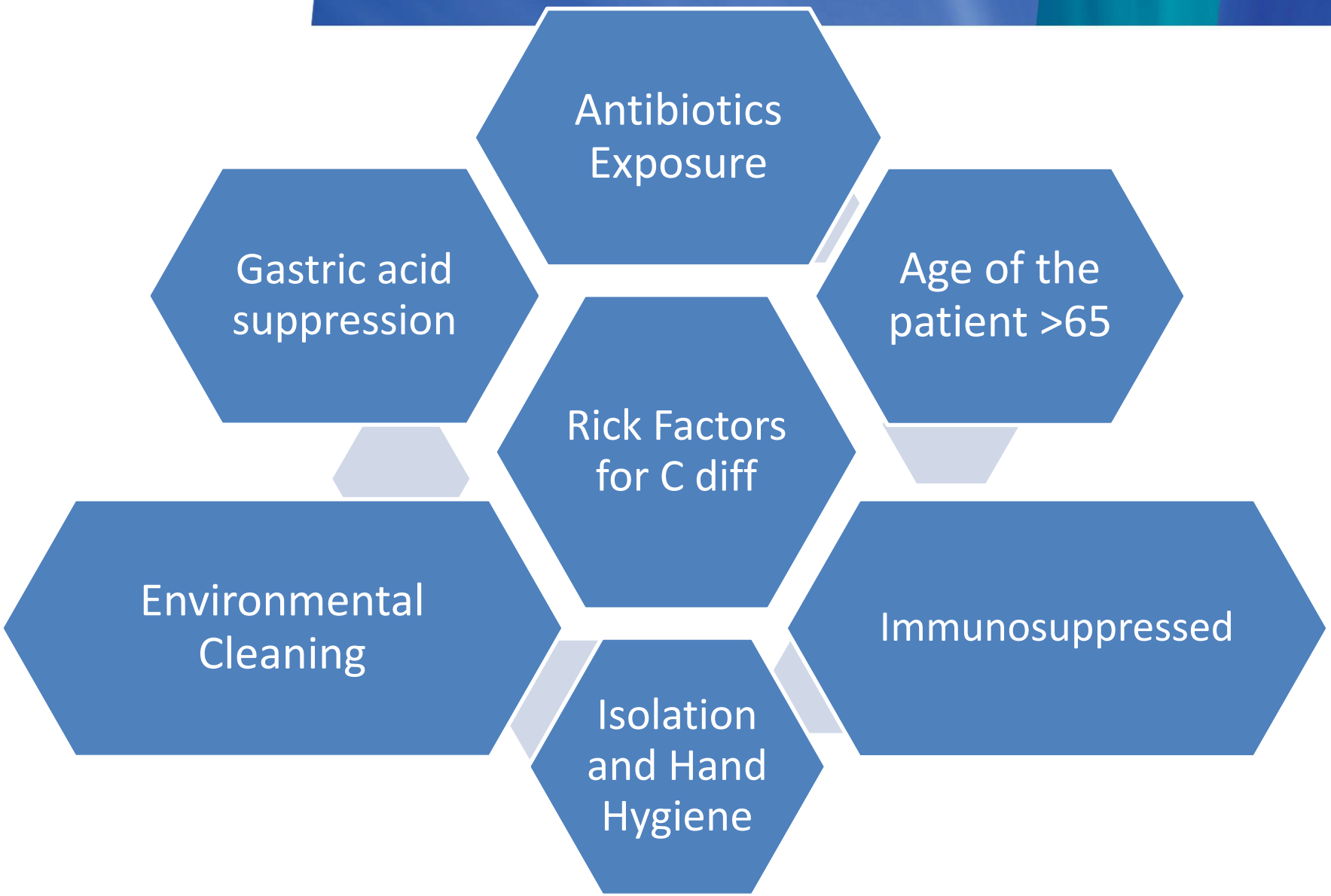


People on antibiotics are 7-10 times more likely to get *C. difficile* while on the drugs and during the month after.

Being in healthcare settings, especially hospitals or nursing homes.

More than 80% of *C. difficile* deaths occurred in people 65 and older.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention


Antibiotics Exposure
Gastric acid suppression
Age of the patient >65
Rick Factors for C diff
Environmental Cleaning
Immunosuppressed
Isolation and Hand Hygiene

Antibiotic Use In Hospital and Costs

- Annually in the United States:
  - 30% of hospital admissions due to infection
  - 2 million people develop HAI
- 30-50% of hospitalized patients receive antibiotics
- 50% of antibiotic orders: unnecessary or inappropriate
- Antimicrobials are 30% of hospital pharmacy budgets

Pharmacotherapy 1999;19:1369
Clin Infect Dis 2007;44:159

Out Patient Antibiotics Stewardship

- 30% of antibiotic prescribed in the outpatient setting are unnecessary
- Most of this unnecessary:
  - colds, bronchitis, sore throats caused by viruses, and even some sinus and ear infections
- Antibiotics are the most common cause of adverse drug events in children
- A 10% decrease in inappropriate prescribing in the community
  - Can result in a 17% reduction in C diff infection

Open Forum Infectious Diseases

MAJOR ARTICLE

Risk Factors for Community-Associated *Clostridium difficile* Infection in Adults: A Case-Control Study

Alice Y. Guh,[1] Susan Hocevar Adkins,[1] Qunna Li,[1] Sandra N. Bulens,[1] Monica M. Farley,[2,3,4] Zirka Smith,[3,4,5] Stacy M. Holzbauer,[6,7] Tory Whitten,[6] Erin C. Phipps,[8] Emily B. Hancock,[8] Ghinwa Dumyati,[9] Cathleen Concannon,[9] Marion A. Kainer,[10] Brenda Rue,[10] Carol Lyons,[11] Danyel M. Olson,[11] Lucy Wilson,[12] Rebecca Perlmutter,[12] Lisa G. Winston,[13] Erin Parker,[14] Wendy Bamberg,[15] Zintars G. Beldavs,[16] Valerie Ocampo,[16] Maria Karlsson,[1] Dale N. Gerding,[17,18] and L. Clifford McDonald[1]

[1]Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia; [2]Emory University Department of Medicine, Atlanta, Georgia; [3]Georgia Emerging Infections Program, Decatur, Georgia; [4]Atlanta Veterans Affairs Medical Center, Atlanta, Georgia; [5]Atlanta Research and Education Foundation, Decatur, Georgia; [6]Minnesota Department of Health, St Paul, Minnesota; [7]Career Epidemiology Field Officer Program, Centers for Disease Control and Prevention, Atlanta, Georgia; [8]University of New Mexico, New Mexico Emerging Infections Program, Albuquerque, New Mexico; [9]New York Emerging Infections Program and University of Rochester Medical Center, Rochester, New York; [10]Tennessee Department of Health, Nashville, Tennessee; [11]Yale School of Public Health, Connecticut Emerging Infections Program, New Haven, Connecticut; [12]Maryland Department of Health and Mental Hygiene, Baltimore, Maryland; [13]University of California, San Francisco, School of Medicine, San Francisco, California; [14]California Emerging Infections Program, Oakland, California; [15]Colorado Department of Public Health and Environment, Denver, Colorado; [16]Oregon Health Authority, Portland, Oregon; [17]Loyola University Chicago Stritch School of Medicine, Maywood, Illinois; [18]Edward Hines, Jr. Veterans Affairs Hospital, Hines, Illinois

Open Forum Infect Dis. 2017 Oct 26;4(4):171

Results

- N= 226 pairs
- 70.4% were female
- 52.2% were ≥60 years old
- More case patients than controls had prior outpatient health care (82.1% vs 57.9%; P < .0001)
- Antibiotic (62.2% vs 10.3%; P < .0001) exposures

Open Forum Infect Dis. 2017 Oct 26;4(4):171

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Clinical Infectious Diseases
IDSA GUIDELINE
IDSA Infectious Diseases Society of America
hivma hiv medicine association
OXFORD

Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults and Children: 2017 Update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA)

L. Clifford McDonald,[1] Dale N. Gerding,[2] Stuart Johnson,[2,3] Johan S. Bakken,[4] Karen C. Carroll,[5] Susan E. Coffin,[6] Erik R. Dubberke,[7] Kevin W. Garey,[8] Carolyn V. Gould,[1] Ciaran Kelly,[9] Vivian Loo,[10] Julia Shaklee Sammons,[6] Thomas J. Sandora,[11] and Mark H. Wilcox[12]

[1]Centers for Disease Control and Prevention, Atlanta, Georgia; [2]Edward Hines Jr Veterans Administration Hospital, Hines, and [3]Loyola University Medical Center, Maywood, Illinois; [4]St Luke's Hospital, Duluth, Minnesota; [5]Johns Hopkins University School of Medicine, Baltimore, Maryland; [6]Children's Hospital of Philadelphia, Pennsylvania; [7]Washington University School of Medicine, St Louis, Missouri; [8]University of Houston College of Pharmacy, Texas; [9]Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts; [10]McGill University Health Centre, McGill University, Montréal, Québec, Canada; [11]Boston Children's Hospital, Massachusetts; and [12]Leeds Teaching Hospitals NHS Trust, United Kingdom

Clin Infect Dis. 2018 Mar 19;66(7):987-994

CDI: Antibiotic Agent Cost (USD)

	Dosing	Duration	Cost
Metronidazole	500 mg po tid	10 days	25.75
Vancomycin liquid	125 mg qid	10 days	78.85
Vancomycin capsule	125 mg qid	10 days	409.59
Fidaxomicin	200 mg bid	10 days	4,187.00
Bezlotoxumab	10mg/kg iv	Single dose	3,000.00

March 2017. Northland Pharmacy, Duluth, MN

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CDI Treatment

Initial Episode

Clinical Definition	Supportive Clinical Data	Recommended Treatment[a]
Initial episode, non-severe	Leukocytosis with a white blood cell count of ≤15000 cells/mL and a serum creatinine level <1.5 mg/dL	• VAN 125 mg given 4 times daily for 10 days, OR • FDX 200 mg given twice daily for 10 days • Alternate if above agents are unavailable: metronidazole, 500 mg 3 times per day by mouth for 10 days
Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR • FDX 200 mg given twice daily for 10 days
Initial episode, fulminant	Hypotension or shock, ileus, megacolon	• VAN, 500 mg 4 times per day by mouth or by nasogastric tube. If ileus, consider adding rectal instillation of VAN. Intravenously administered metronidazole (500 mg every 8 hours) should be administered together with oral or rectal VAN, particularly if ileus is present.

Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

Clin Infect Dis. 2018 Mar 19;66(7):987-994

Risk factors for CDI recurrence

- Advanced age (>65 years)
- Concurrent antibiotic during initial treatment of CDI
- Prior infection with C diff epidemic strain(s)
- Defective humeral immune response against *C. difficile*
- Underlying co-morbid medical conditions
- Continuous gastric acid barrier therapy (H2B, PPI)

Leffler et al. NEJM 2015;372:1539
McDonald EG et al. JAMA Int Med 2015;175(5):784
Gupta SB et al. Clin Infect Dis 2016;63:730
Wilcox MH et al. NEJM 2017;376:305

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CDI Treatment

Recurrence

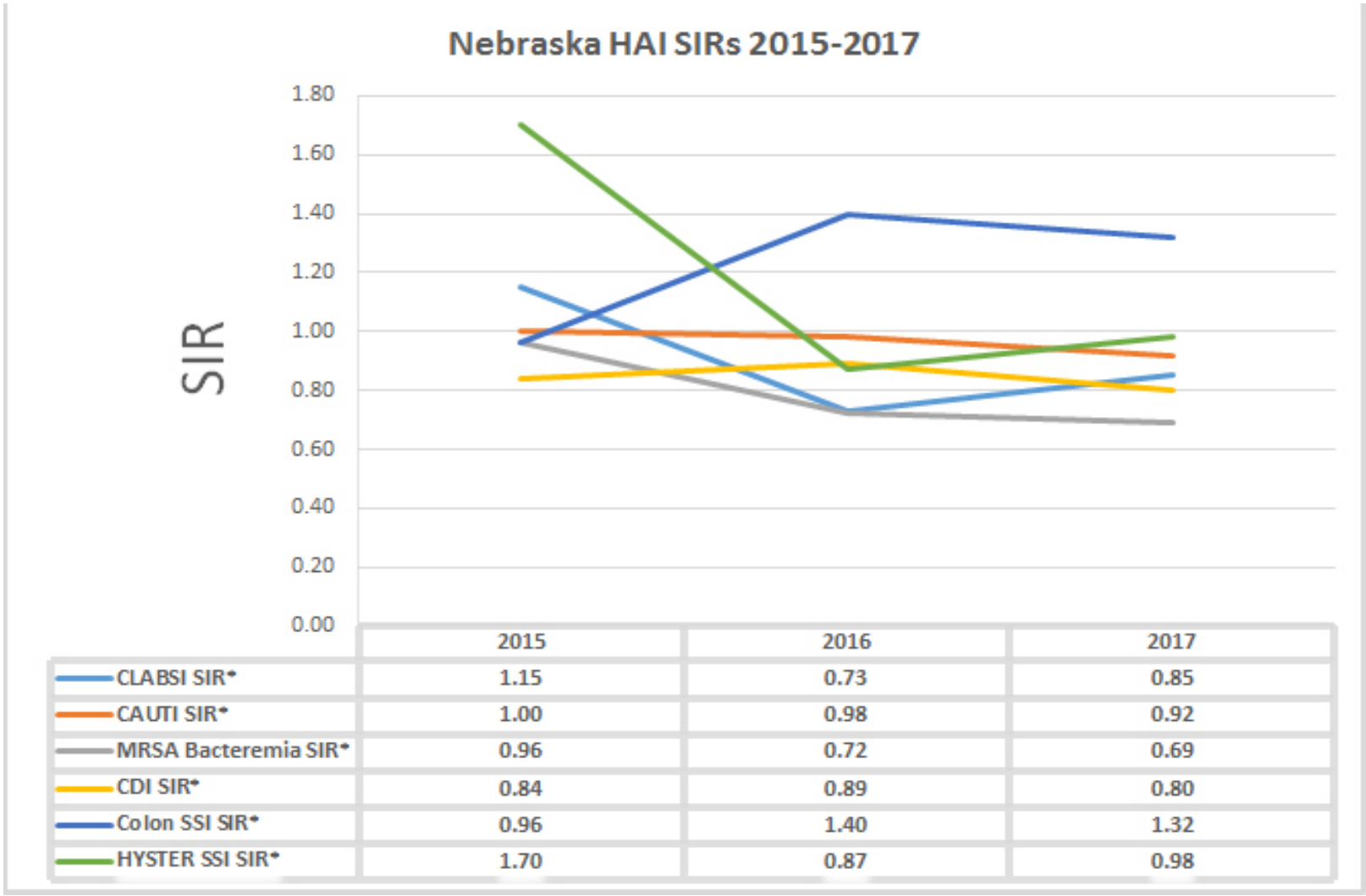
Clinical Definition	Supportive Clinical Data	Recommended Treatment[a]
First recurrence	…	• VAN 125 mg given 4 times daily for 10 days if metronidazole was used for the initial episode, OR • Use a prolonged tapered and pulsed VAN regimen if a standard regimen was used for the initial episode (eg, 125 mg 4 times per day for 10–14 days, 2 times per day for a week, once per day for a week, and then every 2 or 3 days for 2–8 weeks), OR • FDX 200 mg given twice daily for 10 days if VAN was used for the initial episode
Second or subsequent recurrence	…	• VAN in a tapered and pulsed regimen, OR • VAN, 125 mg 4 times per day by mouth for 10 days followed by rifaximin 400 mg 3 times daily for 20 days, OR • FDX 200 mg given twice daily for 10 days, OR • Fecal microbiota transplantation[c]

Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

Clin Infect Dis. 2018 Mar 19;66(7):987-994

Nebraska HAI Rates

As of January 1, 2017



	2015	2016	2017
CLABSI SIR*	1.15	0.73	0.85
CAUTI SIR*	1.00	0.98	0.92
MRSA Bacteremia SIR*	0.96	0.72	0.69
CDI SIR*	0.84	0.89	0.80
Colon SSI SIR*	0.96	1.40	1.32
HYSTER SSI SIR*	1.70	0.87	0.98

http://dhhs.ne.gov/Pages/HAI-Rates-in-Hospitals.aspx

Nationally, among acute care hospitals, the highlights in this report include

- Nebraska we had about 13% statistically significant decrease in CDI infections between 2016 and 2017

Risk of organism acquisition from prior room occupants: a systematic review and meta-analysis

B.G. Mitchell [a, b, *], S.J. Dancer [c], M. Anderson [a], E. Dehn [a]

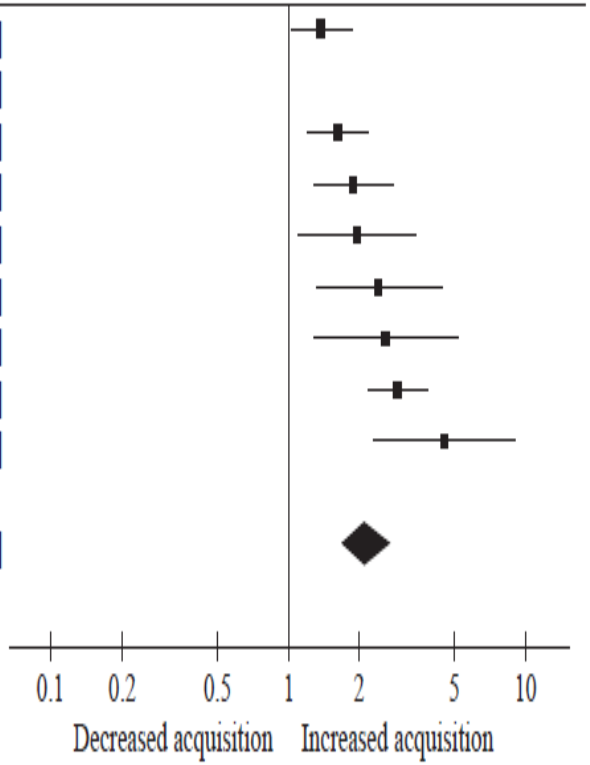
- Odds ratio for study pathogens was 2.14 [95% confidence interval (CI): 1.65-2.77]
  - Methicillin-resistant Staphylococcus aureus (MRSA)
  - Vancomycin-resistant enterococcus (VRE)
  - Clostridium difficile
  - Acinetobacter
  - Extended-spectrum b-lactamase-producing organism (ESBL)
  - Pseudomonas
- Gram-positive and Gram-negative organisms, the pooled acquisition odds ratio for Gram-negatives was 2.65 (95% CI: 2.02-3.47) and 1.89 (95% CI: 1.62-2.21) for Gram positives

J Hosp Infect. 2015 Nov;91(3):211-7. doi: 10.1016/j.jhin.2015.08.005. Epub 2015 Aug 22

Study or Subgroup	Decreased acquisition Events	Total	Control Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Huang (MRSA)	57	1454	248	8697	16.2%	1.39 [1.04, 1.86]
Nseir (ESBL producing Gram neg)	8	50	50	461	0.0%	1.57 [0.70, 3.52]
Huang (VRE)	58	1291	256	9058	16.2%	1.62 [1.21, 2.16]
Ajao (Klebsiella sp. or Escherichia coli)	32	648	235	8723	14.2%	1.88 [1.29, 2.74]
Nseir (Pseudomonas)	21	85	61	426	10.4%	1.96 [1.12, 3.45]
Drees (VRE)	19	138	31	500	9.7%	2.42 [1.32, 4.43]
Shaughnessy (Clostridium difficile)	10	91	77	1679	8.3%	2.57 [1.28, 5.15]
Mitchell (MRSA)	74	884	163	5344	16.4%	2.90 [2.18, 3.86]
Nseir (Acinetobacter)	16	52	41	459	8.6%	4.53 [2.32, 8.86]
Total (95% CI)		4643		34886	100.0%	2.14 [1.65, 2.77]
Total events	287		1112			

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 21.32$, df = 7 (P = 0.003); $I^2 = 67\%$

Test for overall effect: Z = 5.74 (P < 0.00001)



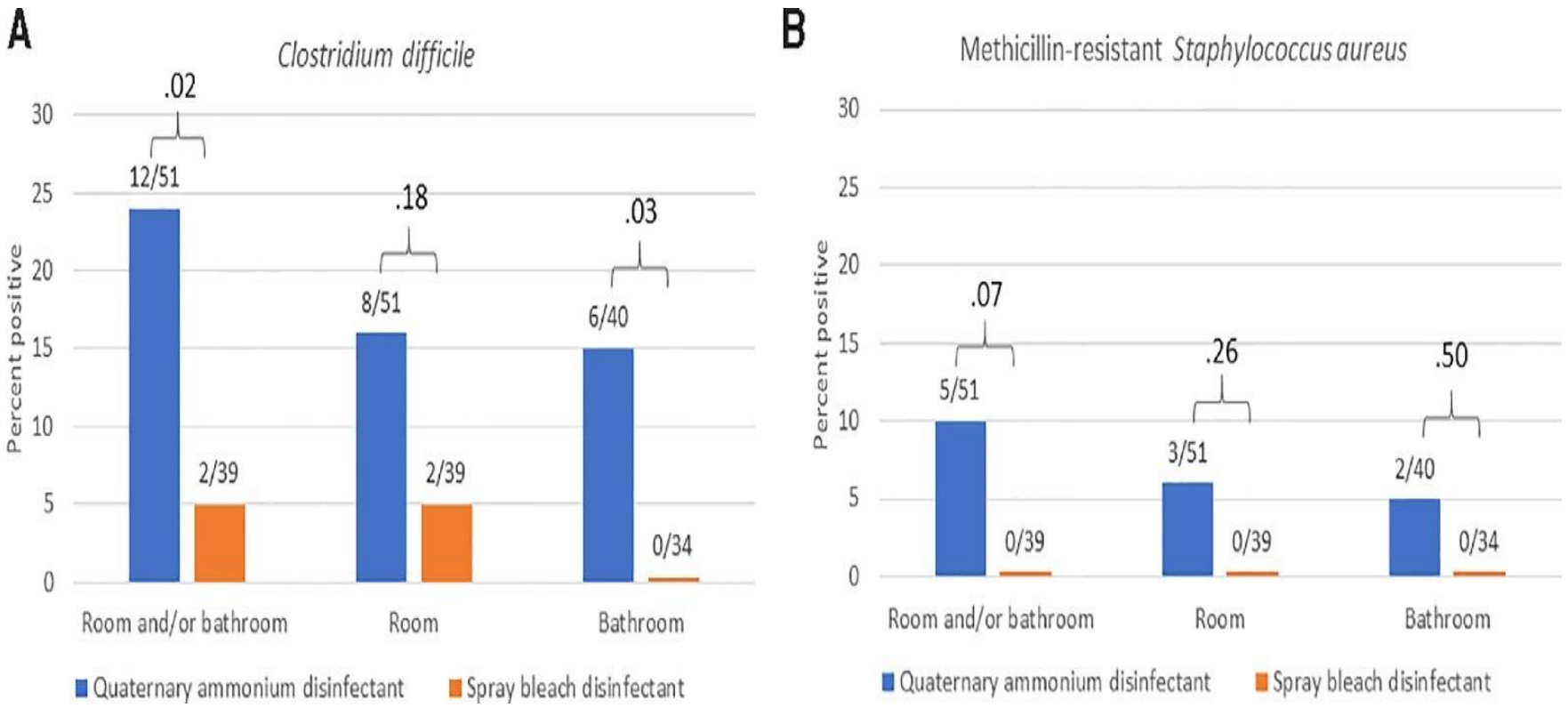
J Hosp Infect. 2015 Nov;91(3):211-7. doi: 10.1016/j.jhin.2015.08.005. Epub 2015 Aug 22

Impact of routine use of a spray formulation of bleach on *Clostridium difficile* spore contamination in non-*C difficile* infection rooms

- Ng Wong YK, Alhmidi H, Mana TSC, Cadnum JL, Jencson Al, Donskey CJ.

Am J infect Control 2019 Jan 31. pii: S0196-6553(18)31205-7. doi: 10.1016/j.ajic.2018.12.023

C diff & MRSA in Rooms with Ammonium Disinfectant and Spray Bleach Disinfectant



Am J infect Control 2019 Jan 31. pii: S0196-6553(18)31205-7. doi: 10.1016/j.ajic.2018.12.023

Results

- Suggest that use of sporicidal disinfectants for all post discharge room disinfection might be helpful in reducing the risk for C diff transmission from contaminated surfaces
- Future studies are needed to determine if routine use of sporicidal disinfectants in non-CDI rooms will result in a reduction in rates of CDI

Modern technologies for improving cleaning and disinfection of environmental surfaces in hospitals

- John M. Boyce

Antimicrobial Resistance & Infection Control 2016

Fluorescent Marker “Black Light” On High Touch Surface

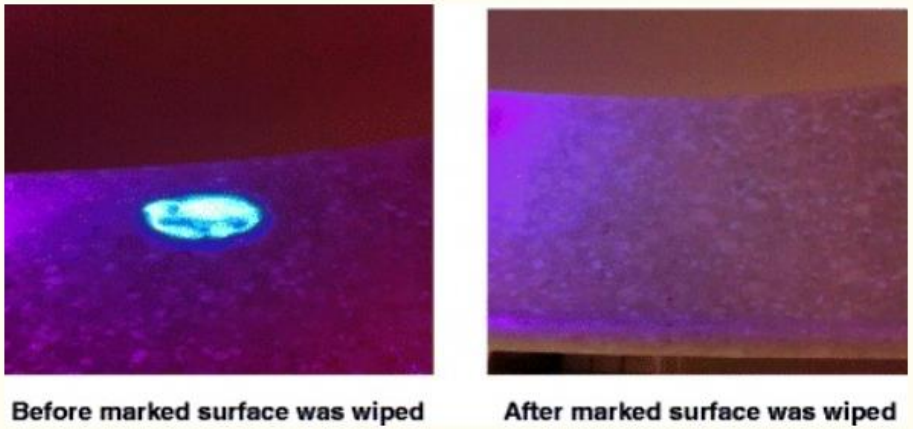


Fig. 2

Photographs of a fluorescent marker visible with a “black light” on a high touch surface before cleaning (*left*), and absence of the fluorescent marker after cleaning was performed (*right*)

High Touch Surface Monitoring

- Fluorescent Markers
  - Fluorescent gel, powder, and lotion - marking high touch objects prior to room cleaning
- Fluorescent gel dries transparent on surfaces, resists abrasion
  - there are several studies demonstrating the accuracy of the system
- Fluorescent markers are all designed to indicate physical removal of an applied substance
  - surfaces that are effectively disinfected but less effectively cleaned may be more likely flagged as failing to meet a quality standard

https://www.cdc.gov/hai/pdfs/toolkits/Environ-Cleaning-Eval-Toolkit12-2-2010.pdf

ATP Bioluminescence For Monitoring Cleanliness

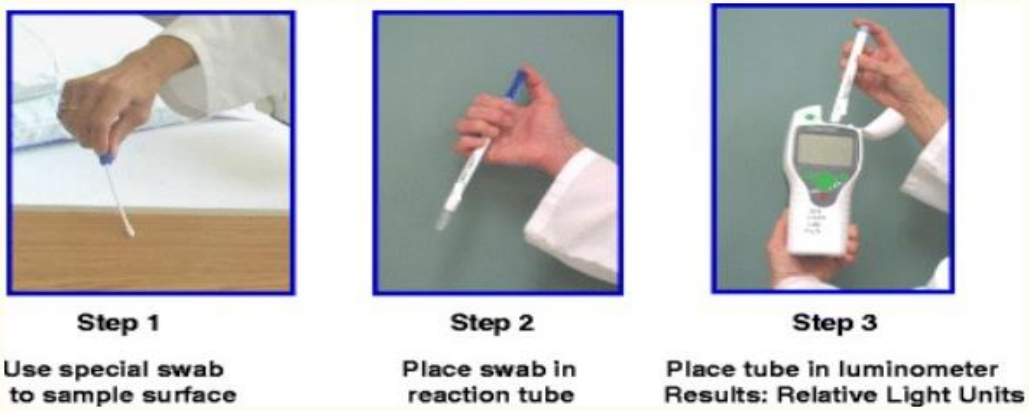


Fig. 3

Three steps of an ATP bioluminescence assay for monitoring cleanliness of surfaces. Step 1: a special swab is used to sample the surface. Step 2: the swab is placed in a reaction tube and shaken for 10–15 s. Step 3: the reaction tube is placed in a luminometer and a result is reported as relative light units (RLUs). The higher the RLU value, the greater the amount of ATP detected on the surface

High Touch Surface Monitoring with ATP

- Measurement of organic ATP on surfaces using a luciferase assay and luminometer
  - been used to evaluate cleanliness of food preparation surfaces for >30 years
- Total amount of ATP, both microbial and non-microbial
  - quantified and expressed as relative light units
- Although readout scales vary more than 10 fold and sensitivity varies between commercially available systems
  - very low readings are typically associated with low aerobic colony counts (ACCs)
  - very high readings may represent either a viable bioburden, organic debris including dead bacteria or a combination of both
- ATP system shown
  - significant improvement in daily cleaning
  - quantitative measurement to indicate the level of cleanliness of high touch surfaces

https://www.cdc.gov/hai/toolkits/appendices-evaluating-environ-cleaning.html

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Your Touch Can Make a Difference

722K
healthcare-associated infections acquired in 2011 the U.S.[2]

HAIs

HAIs are one of the **top ten** leading causes of death in the U.S.[1]

About **1 in 25** patients will acquire a healthcare-associated infection during their hospital stay[2]

BACTERIA IN THE PATIENT ROOM

See some of the key areas where bacteria live in the patient room.

HAIs cost hospitals up to **$33 billion** each year[3]

~~75,000~~
deaths per year occur as a result of HAIs[2]

approx. **40%**
Handwashing compliance rates fall below 40% in a healthcare setting[4]

1. http://www.ahrq.gov/research/findings/factsheets/errors-safety/haify10/haify10.pdf, Retrieved April 24, 2014
2. http://www.cdc.gov/HAI/surveillance/index.html. Retrieved April 14, 2014.
3. http://www.cdc.gov/HAI/pdfs/hai/Scott_CostPaper.pdf. Retrieved April 24, 2014
4. Centers for Disease Control and Prevention. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. MMWR 2002;51(No. RR-16):[22]. Retrieved April 4, 2014.

GP Georgia-Pacific

Persistence of Skin Contamination & Environmental Shedding of C diff During and after Treatment

Ajay Sethi, Wafa Al-Nassir, Michelle Nerandzic, Greg Bobulsky and Curtis Donskey

- Skin contamination and environmental shedding remained high at the time of resolution of diarrhea (60% and 37%)
- Lower at the end of treatment C diff treatment (32% and 14%)

Process For Hospitalized Patient When CDI Resolves

1) Move patient with CDI to new room once symptoms resolve

2) Educate patient & family about need to move out of contaminated environment to clean one

3) Bathe or shower patient before moving to clean room

4) Unit staff will request a room transfer within 24hrs

5) Leave isolation caddy on door until Hospitality has completed Discharge cleaning

6) If patient cannot be transferred to a new room

- patient continues on contact precautions in existing room until room change or discharge
- existing room is cleaned with bleach-based cleaner

https://infectioncontrol.ucsfmedicalcenter.org

Impact on CDI rates with Reduction in Treatment of Asymptomatic Bacteriuria

WHAT DO WE KNOW ABOUT ANTIBIOTIC USE IN NURSING HOMES?

- 11% of nursing home residents were on antibiotics on any single day
- 1 in 3 of these antibiotic prescriptions was for the treatment of urinary tract infections
  - At least ½ of these prescriptions were for either the wrong drug, dose, or duration

https://www.cdc.gov/antibiotic-use/stewardship-report/pdf/stewardship-report.pdf

Massachusetts Department of Public Health: Reducing C diff

- Educational Interventions in Nursing Homes
- 16 nursing homes implemented multi-faceted educational interventions to reduce unnecessary antibiotic use for asymptomatic bacteriuria
- Conducted in-person trainings on antibiotic use for UTI
- 1 year later
  - 28 % decrease in unnecessary urine cultures for patients
  - 37 % reduction in antibiotics given to patients experiencing asymptomatic bacteriuria
  - 47% percent reduction in healthcare-acquired CDI

Reducing unnecessary urine culturing and antibiotic overprescribing in long-term care: a before-and-after analysis

- Kevin Antoine Brown, Andrea Chambers, Sam MacFarlane, Bradley Langford, Valeri Leung, Jacquelyn Quirk, Kevin L. Schwartz, Gary Garber

CMAJ Open. 2019 Jan-Mar; 7(1): E174–E181

5 Main Intervention with Coaching and Champions

1. Urine cultures only when residents have the indicated clinical signs and symptoms of a urinary tract infection
2. Urine specimens according to a midstream procedure or an “in-and-out” catheterization
3. Prescribe antibiotics- only specified clinical criteria have been met
4. Cease the use of dipsticks for the diagnosis of urinary tract infection
5. Cease urine culture screening (i.e., on admission or annually)

CMAJ Open. 2019 Jan-Mar; 7(1): E174–E181

Over the study period there was a decrease in the rates of urine culturing & antibiotic prescribing

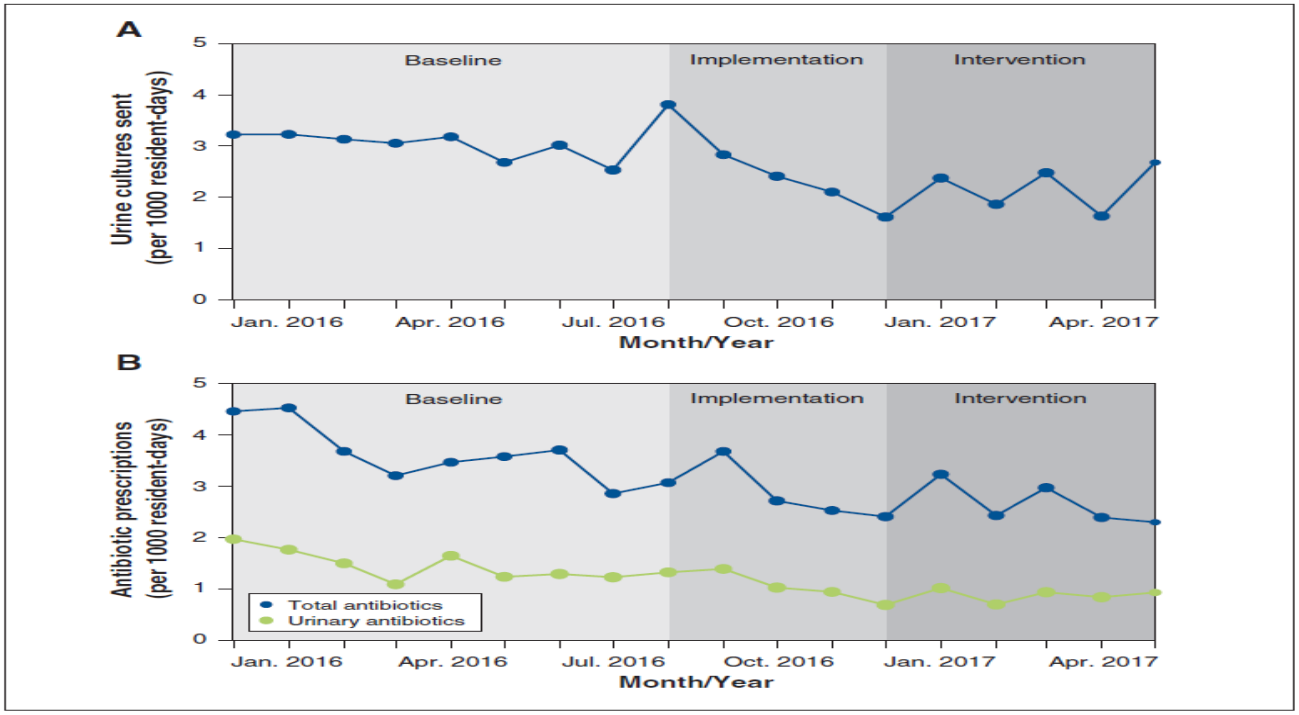

Figure 2: Variation in monthly rates (per 1000 resident-days) of (A) urine cultures sent and (B) antibiotic prescriptions in 10 long-term care homes.

CMAJ Open. 2019 Jan-Mar; 7(1): E174–E181

Q + A

@RVivekanandanMD
Renuga.Vivekanandan@Alegent.org