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

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Objectives

1) Environmental cleaning and C diff prevention
2) Monitoring methods for environmental cleaning
3) Isolation and hand hygiene
4) Impact on CDI rates with reduction in treatment of asymptomatic bacteriuria

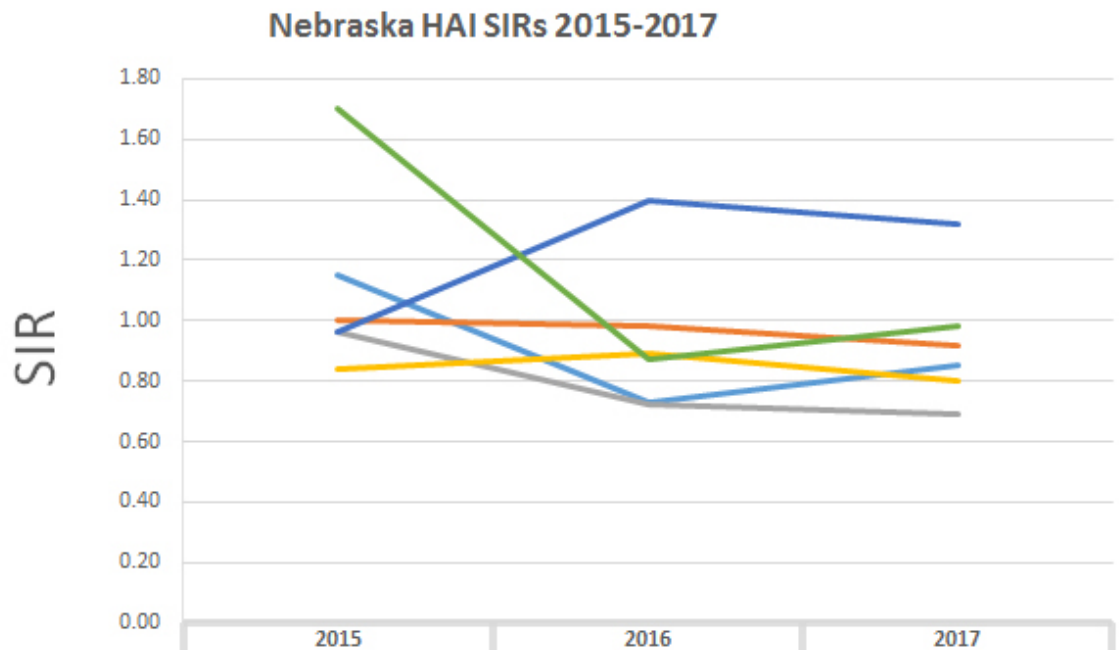
Clostridioides difficile

- 2015 CDC study found that CDI caused almost half a million infections among patients in the United States in a single year
- An estimated 15,000 deaths are directly attributable to CDI
- Making it a substantial cause of infectious disease death in the US States

https://www.cdc.gov/hai/organisms/cdiff/cdiff_infect.html

Nebraska HAI Rates

As of January 1, 2017

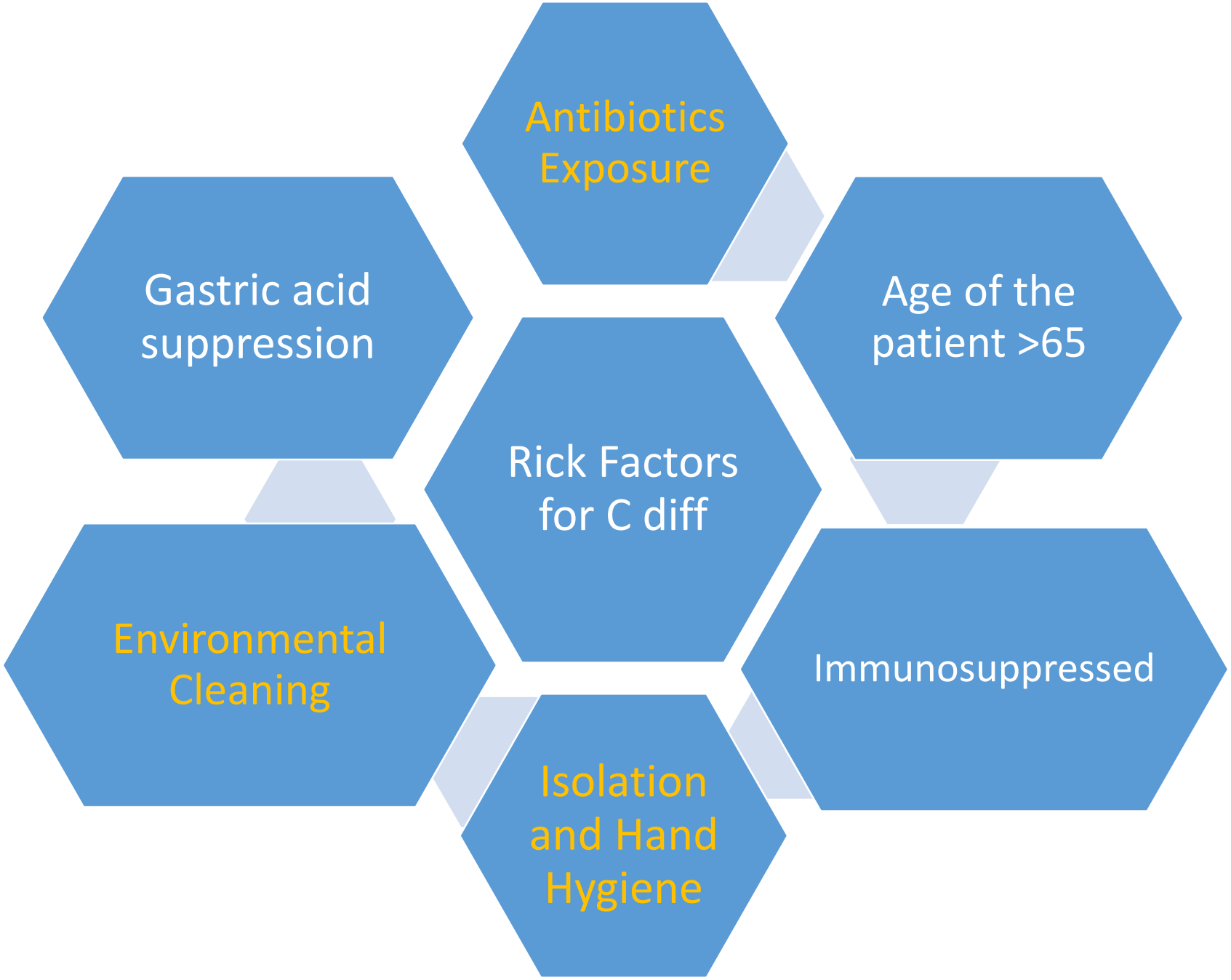


	2015	2016	2017
CLABSI SIR*	1.15	0.73	0.85
CAUTI SIR*	1.00	0.98	0.92
MRSA Bacteremia SIR*	0.96	0.72	0.69
CDI SIR*	0.84	0.89	0.80
Colon SSI SIR*	0.96	1.40	1.32
HYSTER SSI SIR*	1.70	0.87	0.98

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


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

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]

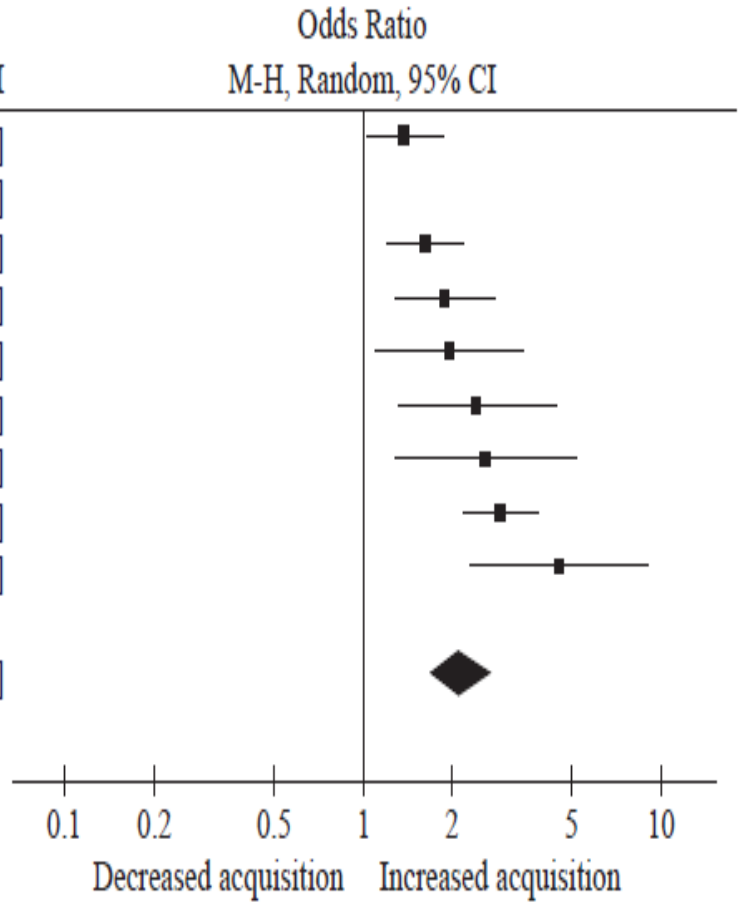
- Odds ratio for study pathogens was 2.14 [95% confidence interval (CI): 1.65-2.77]
  - Methicillin-resistant Staphylococcus aureus (MRSA)
  - Vancomycin-resistant enterococcus (VRE)
  - Clostridium difficile
  - Acinetobacter
  - Extended-spectrum b-lactamase-producing organism (ESBL)
  - Pseudomonas
- 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)



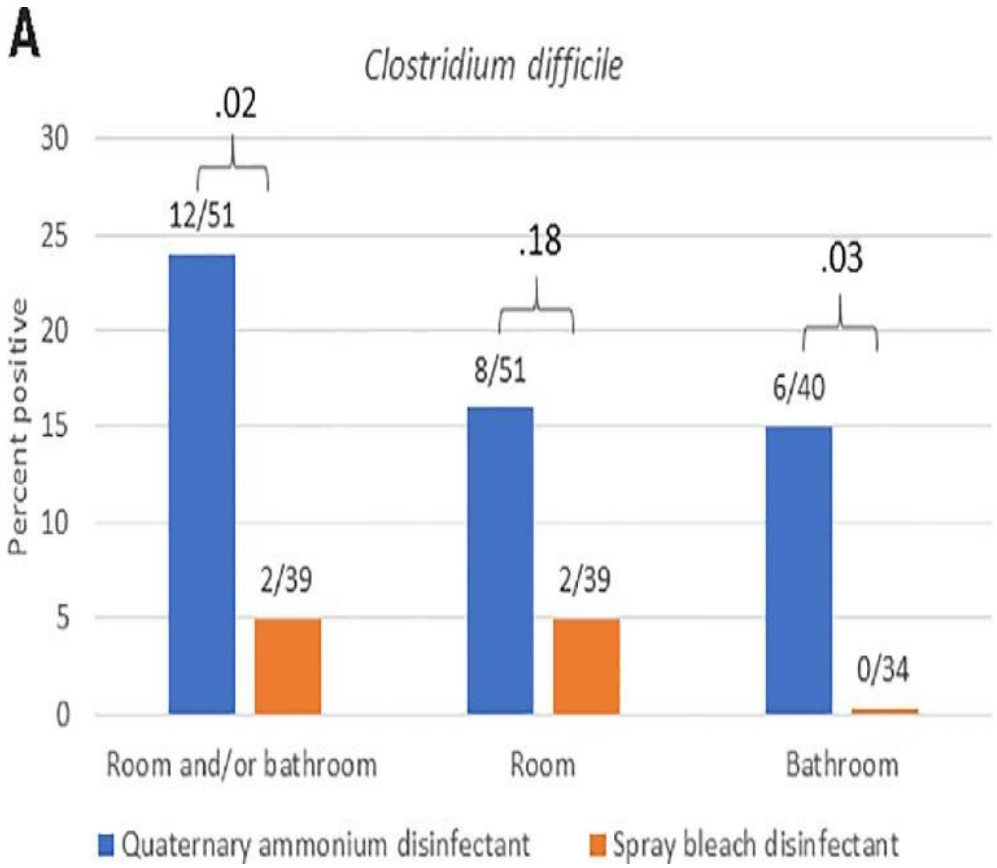
J Hosp Infect. 2015 Nov;91(3):211-7. doi: 10.1016/j.jhin.2015.08.005. Epub 2015 Aug 22

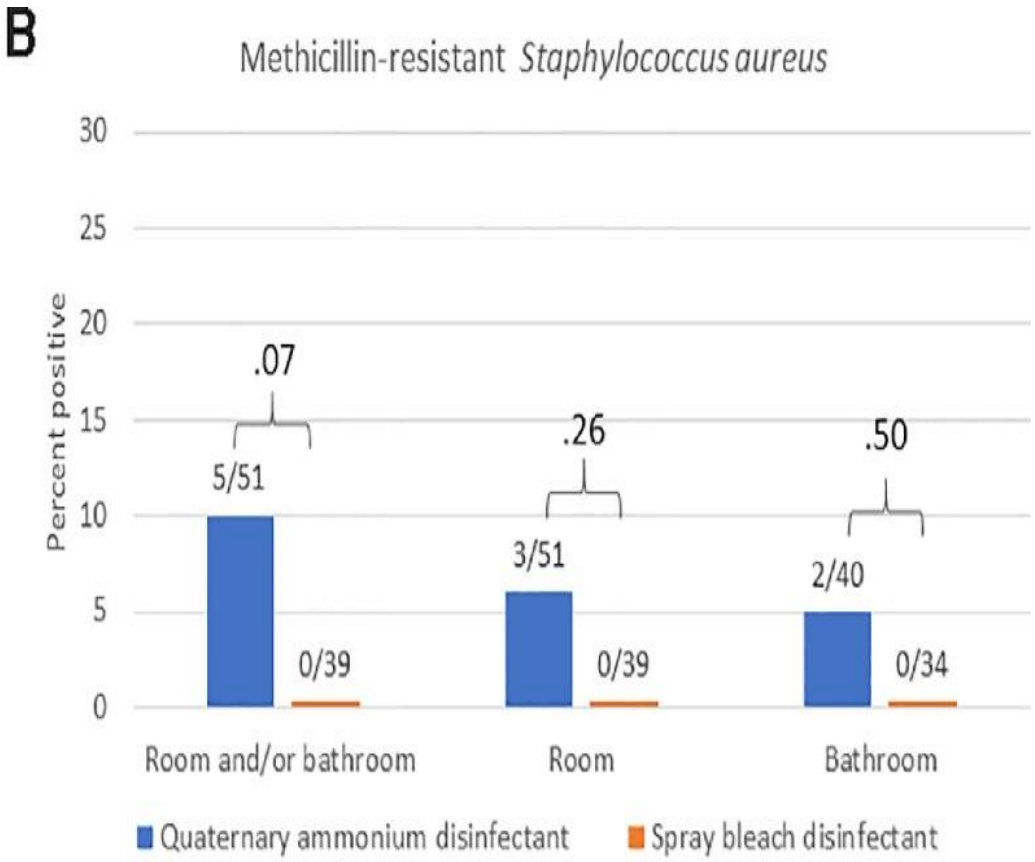
Impact of routine use of a spray formulation of bleach on *Clostridium difficile* spore contamination in non-*C difficile* infection rooms

- 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

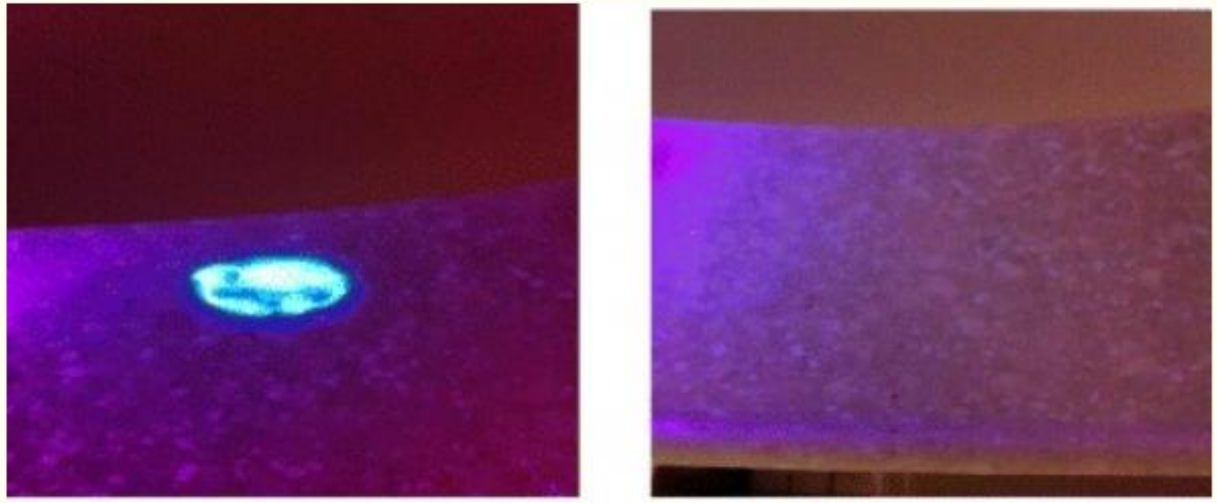
- Suggest that use of sporicidal disinfectants for all post discharge room disinfection might be helpful in reducing the risk for *C. difficile* transmission from contaminated surfaces.
- Future studies are needed to determine if routine use of sporicidal disinfectants in non-CDI rooms will result in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



Before marked surface was wiped After marked surface was wiped

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

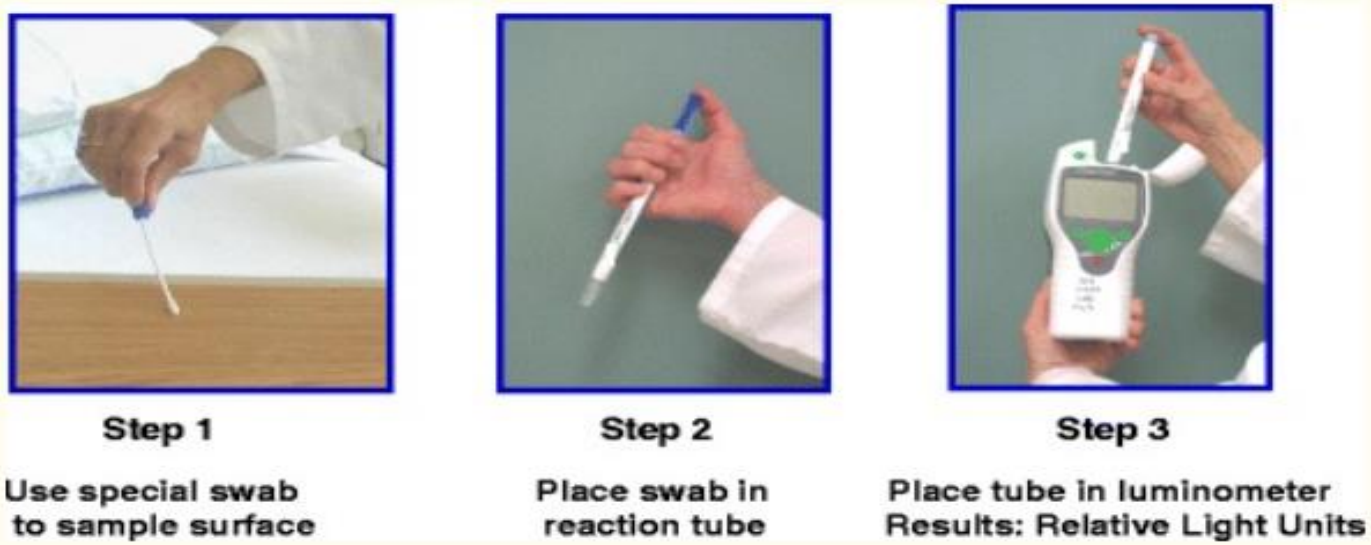


Fig. 3

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

Your Touch Can Make a Difference

722K

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

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]

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

Major Article

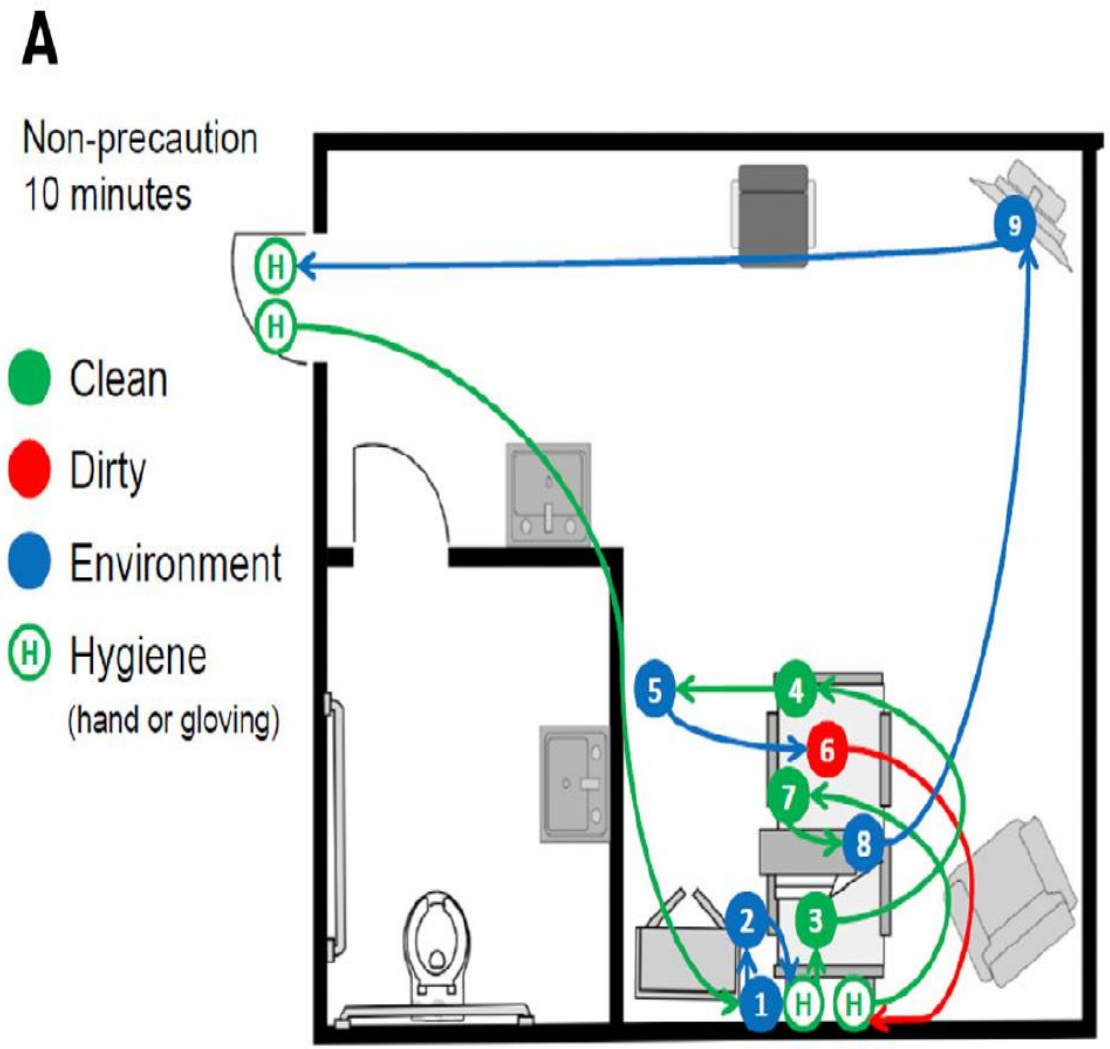
Understanding nurses' workflow: Batching care and potential opportunities for transmission of infectious organisms, a pilot study

Lynn Gregory MSN, FNP-BC [a], Lauren E. Weston MPH [b], Molly Harrod PhD [b], Jennifer Meddings MD, MSc [a,b], Sarah L. Krein PhD, RN [a,b,*]

[a] *Division of General Medicine, Department of Internal Medicine, University of Michigan Medical School, Ann Arbor, MI*
[b] *Center for Clinical Management Research, Veterans Affairs Ann Arbor Healthcare System, Ann Arbor, MI*

Movement Patterns of Nurse #2

Providing Care in a Non-precaution Room During a 10-minute Room Entry

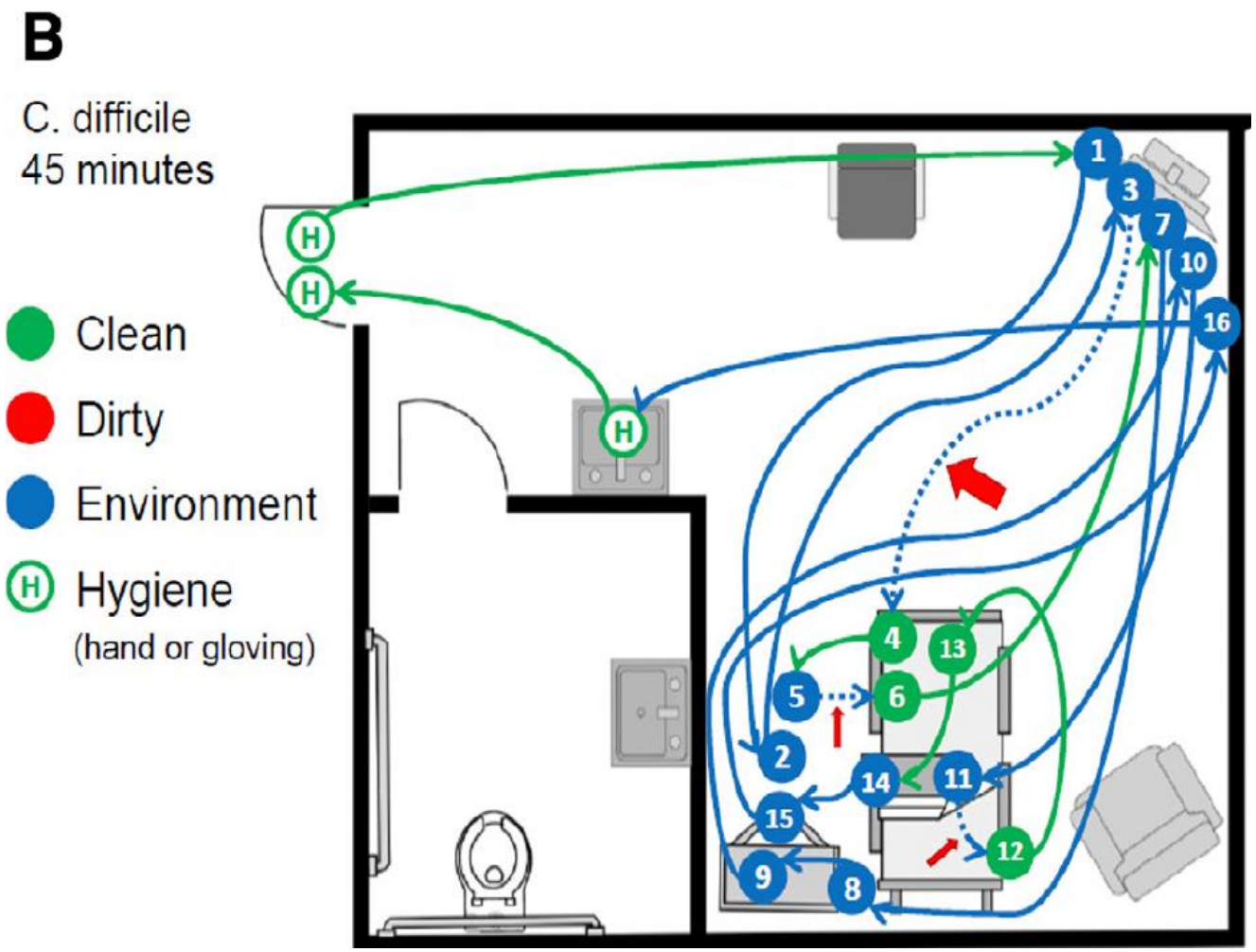


- Hand hygiene on entry
  - then environmental contacts at points 1 and 2 (turn off call light, check IV pump)
- Gloves are donned before clean contacts
  - points 3 and 4 (patient examination) followed by an environmental contact to adjust the room temperature at point 5
- Dirty contact at point 6 (assess urinary catheter then colostomy bag)
  - gloves were changed with hand hygiene prior to completing the examination at point 7, a clean contact
- The nurse then moved
  - to environmental contacts (tray table, patient phone) at points 8 and 9 before exiting with hand hygiene

L. Gregory et al. / American Journal of Infection Control 00 (2019) 1−6

Movement Patterns Nurse #2

Providing Care Over 45 minutes in a CDI contact Precaution Room



- Movement between the environment
  - (computer) at point 3, presumed contaminated, and the clean task of changing IV fluid (point 4)
  - should have prompted a glove change or hand hygiene
- Movement from environmental to clean contacts
  - included computer use for scanning medications at point 5 before checking a blood sugar at point 6
  - points 11-12 with an IV site assessment after contact with the computer, wall objects, tray table, and the in-room supply cabinet

L. Gregory et al. / American Journal of Infection Control 00 (2019) 1−6

Conclusion

- Movement patterns illustrate both the volume of activity associated with batching care
- General lack of attention to hand hygiene moments while providing care in contact precaution rooms
- Differences in how nurses structure their work in contact precaution rooms may contribute to risk of infectious disease transmission
- Understanding and addressing the challenges specific to how nurses work is a critical part of infection prevention in today's hospital environment

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. difficile

- 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

Method:

- 10 long-term care homes in Ontario, Canada
- December 2015 and May 2017
- Assessed the implementation of the program's 9 strategies
  - semistructured interviews with key informants
  - using a before-and-after study design, and on the basis of monthly facility-level records
  - measured changes in the rates of urine specimens sent for culture and susceptibility testing, prescriptions for antibiotics commonly used to treat urinary tract infections and total antibiotic prescriptions

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

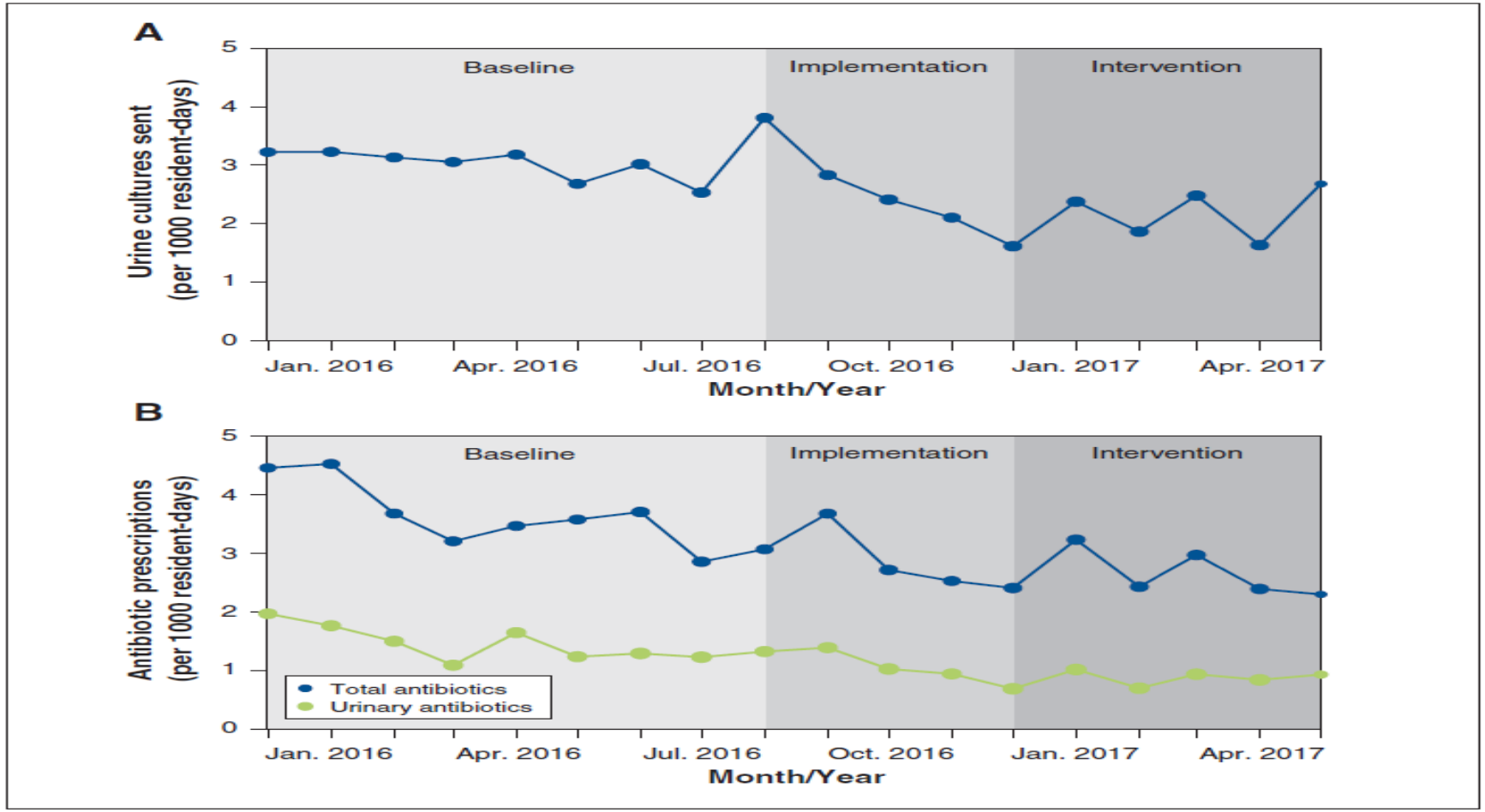


Figure 2: Variation in monthly rates (per 1000 resident-days) of (A) urine cultures sent and (B) antibiotic prescriptions in 10 long-term care homes.

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

Total Antibiotics & Urinary Antibiotics Prescription

Before and After Trend Study

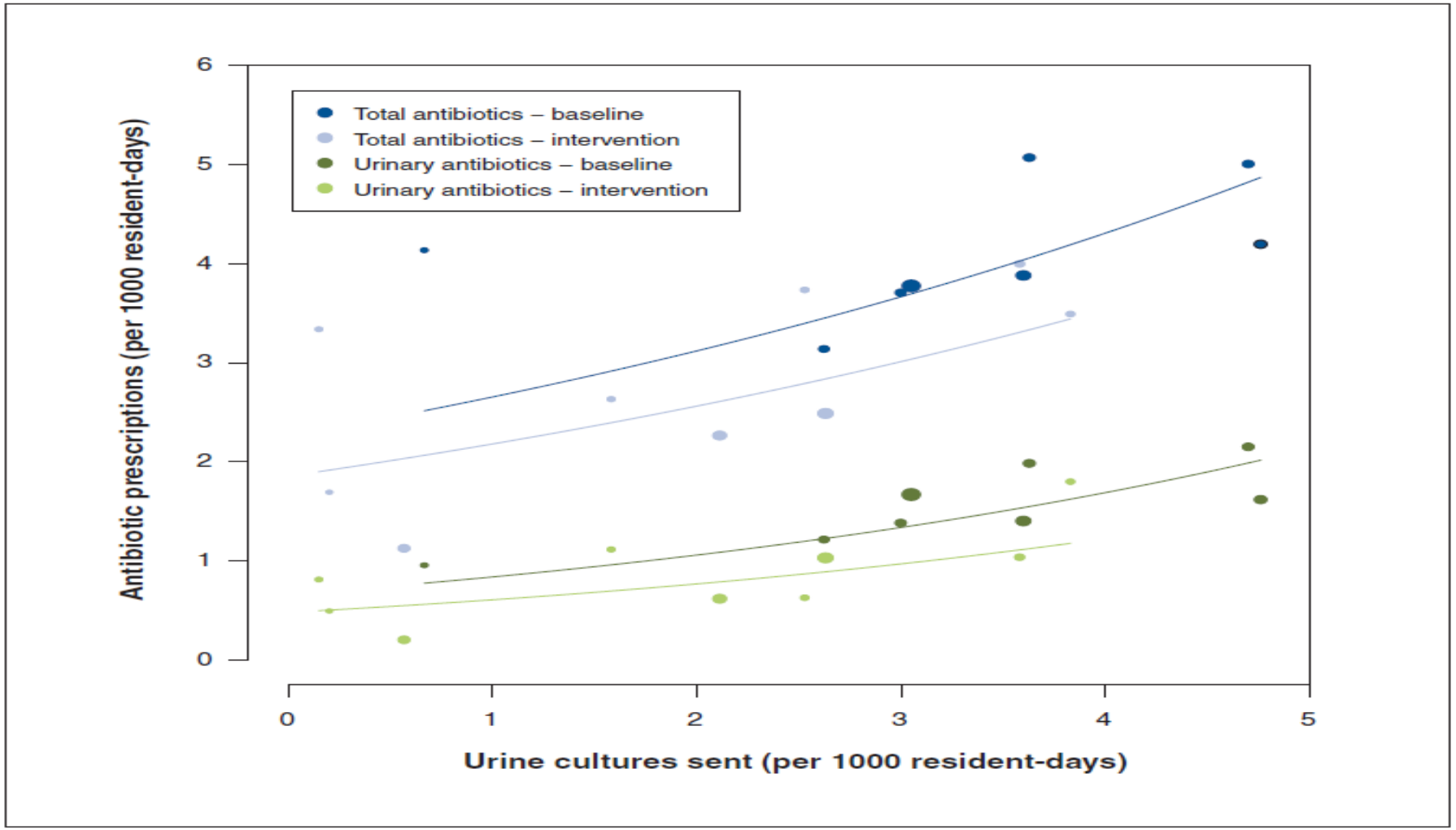


Figure 3: Association between urine culturing rates and antibiotic prescribing at the level of the long-term care home in the baseline and intervention periods, for 10 long-term care homes. Regression-based estimates are superposed.

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

Q + A

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