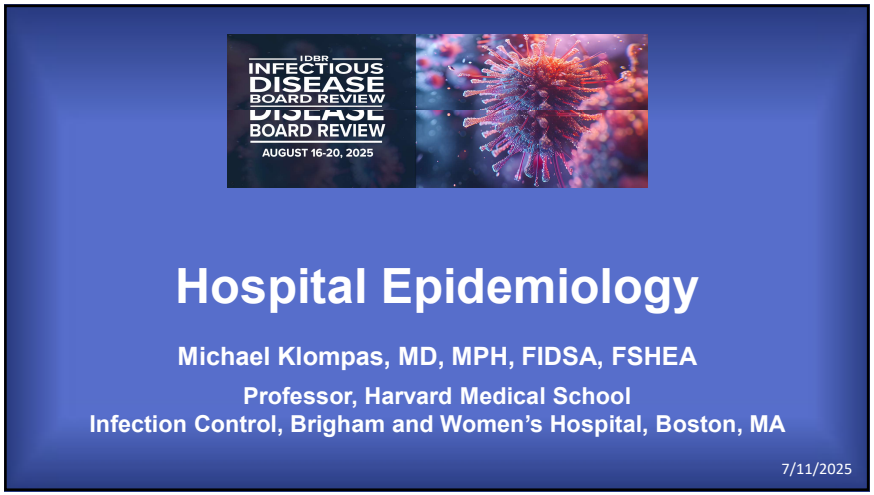
30 Hospital Epidemiology

Speaker: Michael Klompas, MD, MPH, FIDSA, FSHEA



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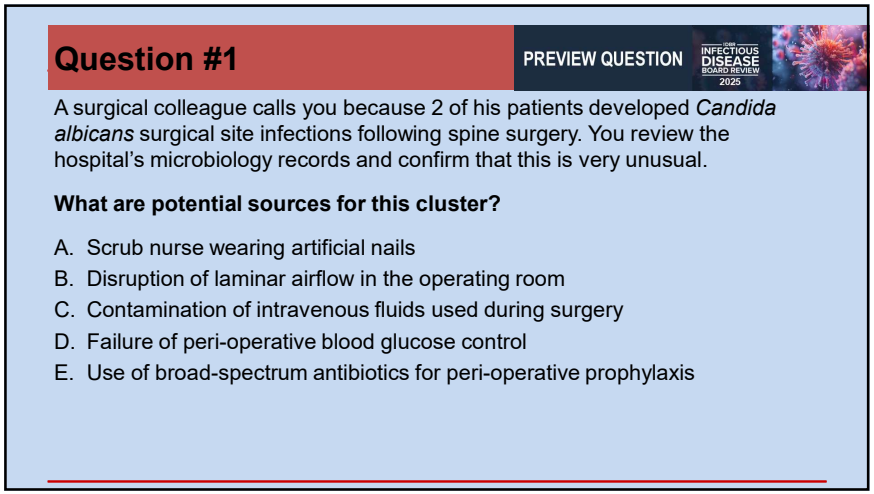

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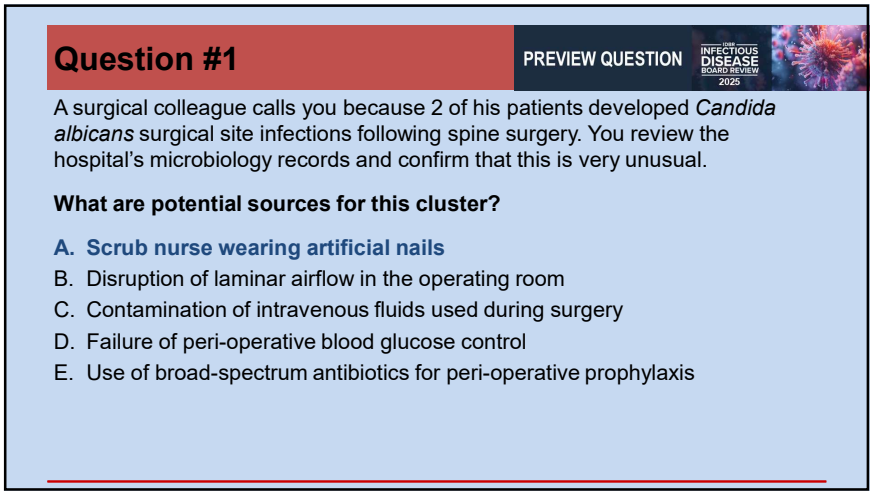

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Nail Add-Ons & Blemishes Can Harbor Pathogens

etsy.com/dk-en/listing/598625946/nurse-nail-art-decals

- **Nail add-ons can act as reservoirs for potentially pathogenic organisms; can persist despite cleaning with an antiseptic**
- **Multiple clusters linked to healthcare workers with artificial nails & infected nails**
  - NICU patients with ESBL *Klebs pneumo* infections
  - Serratia bloodstream infections in dialysis patients linked to RN opening heparin vials with fake nails
  - NICU patients with *Pseudomonas* infections linked to healthcare workers with artificial & infected nails
  - Laminectomy surgical site infections with *Candida albicans* traced to scrub tech with artificial nails
  - Sternal wound infections with *Pseudomonas* traced to OR nurse with onychomycosis
  - Sternal wound infections with *Pseudomonas* traced to cardiac surgeon with onychomycosis

Gupta, ICHE 2004;25:210-215
Gordon, *ICHE* 2007;28:743-744
Foca, *N Engl J Med* 2000;343:695-700
Parry, *Clin Infect Dis* 2001;32:352–7
McNeil, *Clin Infect Dis* 2001;33:317-323
Mermel, ICHE 2003;24:749-52

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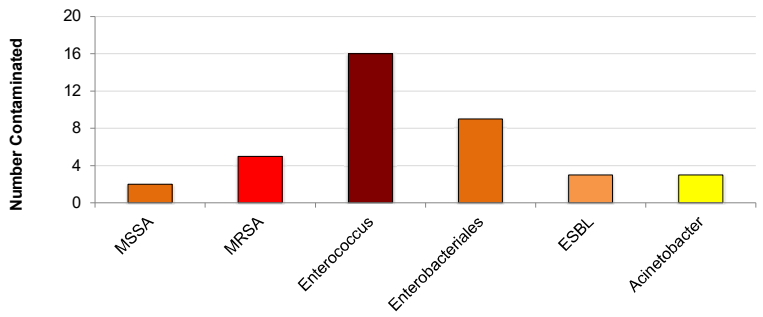
Organisms Recovered from Physicians' Hands Following a Single Physical Exam

Standardized exams of 56 patients, hand hygiene & sterile gloves prior to exam



Tschopp, *Infection Control & Hospital Epidemiol* 2016;37:673-679

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Essential Hand Hygiene Practices

SHEA The Society for Healthcare Epidemiology of America

Promote healthy hand skin & fingernails

- Fingernails should be short, healthy, and natural
- Perform hand hygiene per the WHO's Five Moments
  1. Before touching patient
  2. Before clean procedure
  3. After touching patient
  4. After touching body fluids
  5. After touching the patient's environment
- Alcohol-based hand rub typically preferred over soap & water
- Facilitate primary and secondary prevention of dermatitis

Ensure hand hygiene supplies are always readily accessible

- Widespread, convenient alcohol-based hand rub dispensers

Infection Control & Hospital Epidemiology 2023;44:355-376

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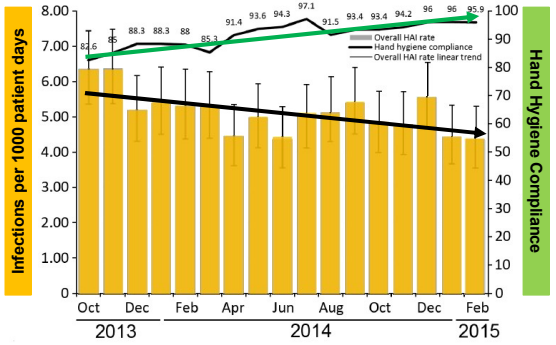
Better Hand Hygiene, Fewer Healthcare Associated Infections

University of North Carolina Hospitals, 2013-2015



Emerg Infect Dis 2016;9:1628-1630

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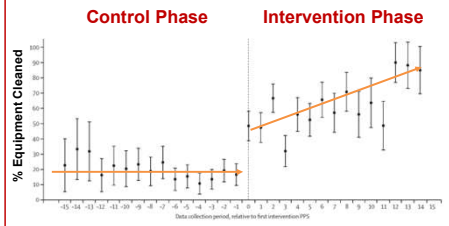
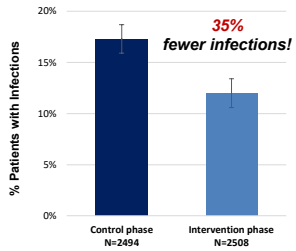
Cleaning Equipment Prevents Infections

Stepped-wedge cluster randomized trial of enhanced vs routine equipment cleaning, 10 units, 1 hospital, Australia
Enhanced cleaning included 3 extra hours/day of shared medical equipment cleaning + audit & feedback

Equipment Cleaning Audits



Healthcare Associated Infections



Browne, *Lancet Infect Dis* 2024;12:1347-1356

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Question #2

PREVIEW QUESTION

A 43-year-old man is brought to the hospital after being found unconscious. Vomitus and feces were on the patient. His airway was suctioned; he was intubated for airway protection and then transferred to the ICU. An LP was performed. Gram stain showed gram negative diplococci.

Which healthcare workers should be offered post-exposure prophylaxis?

A. The scribe who documented the patient's emergency care
B. The respiratory therapist that suctioned the patient's vomitus
C. The medicine intern that did an admission physical in the ICU
D. The radiology technician that did a portable chest x-ray in the ED
E. The nurse that placed his IV in the ED (difficult stick, 3 attempts)

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Neisseria transmission to healthcare workers

Comprehensive search for occupational Neisseria infections in healthcare workers in England and Wales 1982-1996

Case 1

Provider: Doctor

Full clinical exam of 9 yo with meningitis, including fundoscopy during which **patient coughed into doctor's face**

0.5-2h contact time

Incubation period: 4d

Case 2

Provider: EMS worker

Transported 16 yo with meningitis to hospital. Care included **airway insertion and delivery of oxygen while patient seizing** in the ambulance

0.5-2h contact time

Incubation period: 7d

Case 3

Provider: Nurse

Nursed a 7mo with sepsis while baby being prepared for transfer to referral hospital; **in close contact while child crying and coughing for at least 5h**

5-6h contact time

Incubation period: 5d

Estimated 0.8 infections per 100,000 healthcare worker contacts with meningococcal patients

Gilmore, Lancet 2000;356:1654-1655

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Antimicrobial Prophylaxis for *Neisseria meningitidis*

- **Indicated for close contacts of patients with invasive disease***
  - Household members (risk: 4 in 1000)
  - Childcare center contacts
  - Anyone directly exposed to patient's oral secretions
    - Kissing, mouth-to-mouth resuscitation
    - Endotracheal intubation, suctioning oral secretions without respiratory protection

*not indicated if Neisseria only isolated from sputum, nasopharynx, conjunctiva, etc.

- **Exposure window**
  - From 7 days before symptom onset through 24h after starting treatment
- **Prophylaxis options**
  - Rifampin 600mg PO q12h x 2d
  - Ciprofloxacin 500mg PO x 1
  - Ceftriaxone 250mg IM x 1

Cohn, MMWR Recomm Rep 2013;62(RR-2):1

14

Question #3

A 69-year-old man is admitted to hospital with fatigue, weight gain, and edema. He is found to have nephrotic syndrome and ultimately diagnosed with amyloidosis. On hospital day 7, a nurse notes a vesicular rash on his left flank and right chest. The patient is placed on Airborne precautions. PCR of fluid from a vesicle is positive for VZV.

Who of the following requires VariZIG?

A. Unvaccinated seronegative nurse looking after the patient in the next room
B. Unvaccinated seronegative respiratory therapist on rituximab for SLE
C. Patient's pregnant nurse, 2 doses varicella vaccine as child. She is VZV IgG-
D. Hospital roommate, 75 yo poorly controlled diabetes, unknown vax status
E. The dermatologist that unroofed a vesicle for testing. She is VZV IgG+

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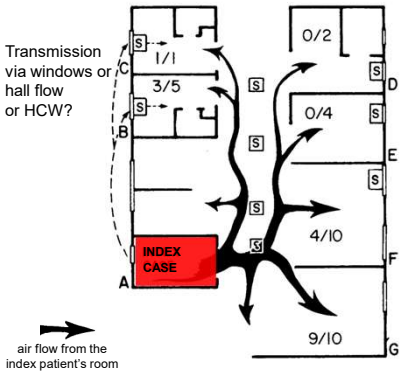
Varicella Outbreak!

Cluster of 15 varicella cases, attributed to child with varicella pneumonia, Boston Children's Hospital, 1970s



0% attack rate
Distance and fresh air leading to dilution

0% attack rate
Distance and fresh air leading to dilution

40% attack rate
HVAC unit operational

90% attack rate
HVAC unit not working, rendering the room negative pressure relative to the hall

Leclair, NEJM 1980;302:450-453

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Varicella Transmission

- **Person-to-person spread**
  - Direct contact with active lesions
  - Airborne spread from a person with respiratory involvement
  - Aerosolization from skin lesions or bedsheets (both rare but reported)
- **Incubation period:**
  - 8-21 days (usually 14-16 days)
- **Infectious period:**
  - From 24-48h before rash onset until all skin lesions crusted
- **Highly contagious if not immune:**
  - Varicella household transmission rate among susceptible individuals 85%
  - Herpes zoster household transmission rate ~25%
  - Breakthrough infections and transmissions relatively common but attenuated

Menkhaus, *Lancet* 1990;336:1315 (airborne spread)
Lopez, JID 2008;197:646-653 (skin lesions, linens)

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Management of Varicella Exposure

- **Definition of exposure**
  - >15-60mins in same room as person with primary varicella or disseminated zoster involving the respiratory tract, or skin-to-skin contact with exposed varicella lesions
  - No exposure if HCW immune and wearing a mask or respirator
- **Management of Exposures**

Immune Status	Vaccinate?	VariZIG?	Furlough d8-21?	Monitor d8-21?
Fully vaccinated, seropositive, or prior Dx	No	No	No	Yes
Partially vaccinated	Yes	No	Depends[2]	Yes
Unvaccinated & seronegative	Yes	No	Yes	Yes
Unvaccinated & unable to vaccinate[1]	No	Yes[3]	Yes[4]	Yes

[1] Vaccine contraindicated if pregnant or immunocompromised
[2] Furlough if vaccine was given >5d after first exposure
[3] Or valacyclovir d7-13 if VariZIG not available
[4] Furlough d8-28 if given VariZIG

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Question #4

A 64-year-old man with coronary disease is admitted with unstable angina. He is treated medically and referred for urgent catheterization. He's found to have a flow limiting lesion in the circumflex. A stent is placed. He initially improves but 3 days later develops fever, cough, and recurrent chest pain. His workup is positive for recurrent MI and influenza. The interventional cardiologist who did his procedure discloses that he had mild sniffles at the time, but no fever and he wore a procedure mask at all times.

Did the cardiologist infect the patient?

A. No, surgical masks provide excellent protection/control for respiratory viruses
B. No, sniffles alone without fever cannot be influenza
C. No, procedure rooms have excellent ventilation
D. Yes, surgical masks only provide moderate protection/control for respiratory viruses
E. Yes, surgical masks do not provide any protection against respiratory viruses

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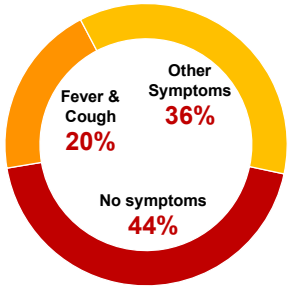
Influenza Transmission Possible with Few or No Symptoms

1,116 participants from 225 households in South Africa, tested for influenza 2x/week by PCR, 2017-2018

Source Individual Symptom Status



Influenza Transmission rate
- With 0 symptoms: 6%
- With ≥2 symptoms: 17%

27% of secondary flu infections were acquired from asymptomatic index cases

Cohen, *Lancet Glob Health* 2021; 9:e863-874

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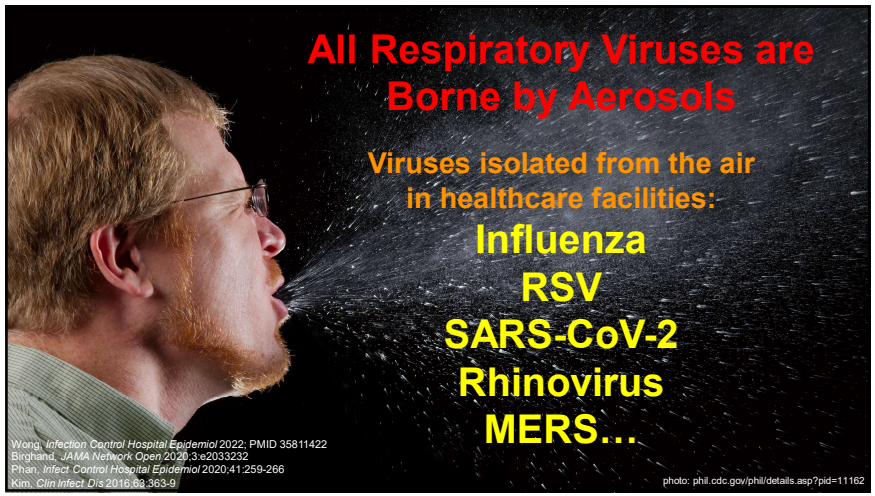

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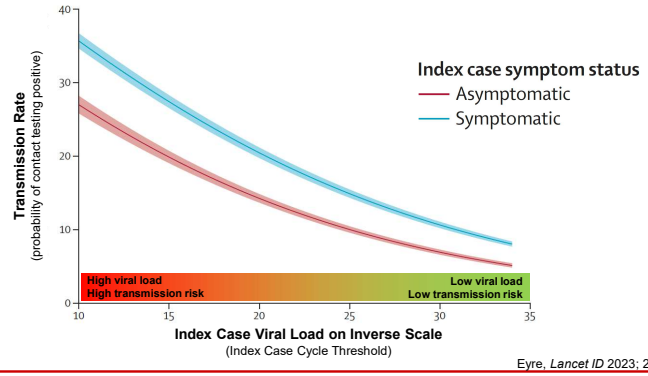
Viral Load Predicts Transmission Risk

Secondary attack rates amongst 1,173,643 contacts of 6,263,786 index cases, UK, Jan 2021-Jan 2022



Eyre, *Lancet ID* 2023; 23:922-932

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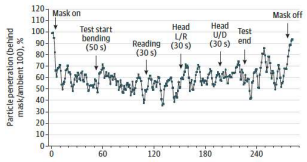
Filtration Efficiency: Surgical Mask vs N95 Respirator

Surgical Mask with Ear Loops

Particle Penetration Behind Mask

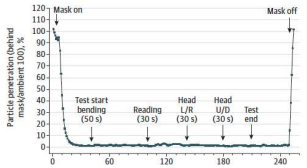


Filtration Efficiency

38.1%

N95 Respirator

Particle Penetration Behind Mask



98.5%

Sickbert-Bennett, *JAMA Internal Med* 2020; 180:1607-1612

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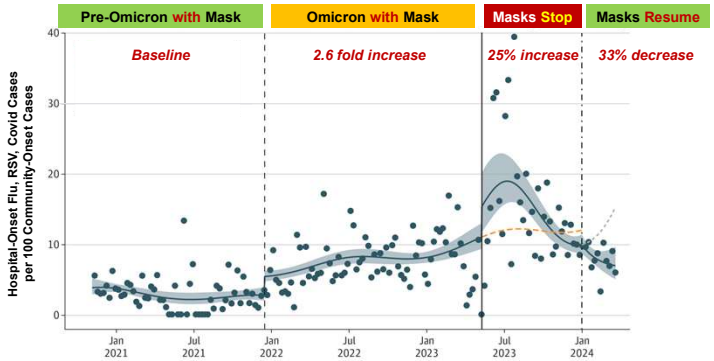
Masking and Hospital-Onset Respiratory Viral Infections

Associations between Masking Policies and Hospital-Onset Influenza, RSV, and Covid in 10 US Hospitals



Pak, *JAMA Network Open* 2024;7(11):e2448063

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Surgical Masks Decrease TB Transmission Risk Too!

17 patients with TB randomized to wear masks on alternate days. Ward air funneled to two groups of guinea pigs. One group only exposed on mask days. One group only exposed on non-mask days.

Odd days
Patients masked
Ward air ported to guinea pig group 1

Even days
Patients unmasked
Ward air ported to guinea pig group 2

36/90 (40%) Infected

69/90 (77%) Infected

Masking patients associated with 56% decrease in TB transmission to guinea pigs

Dharmadhikari, *AJRCCM* 2012;185:1104-1109

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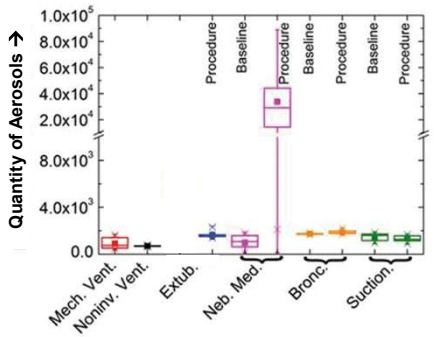
Most "Aerosol Generating Procedures" Do Not Generate Aerosols



Doggett, *Chest* 2020; 158:2467-2473
O'Neil, *Clin Infect Dis* 2017;65:1342-1348
Li, *Open Forum Infect Dis* 2017;4(Suppl 1):S34

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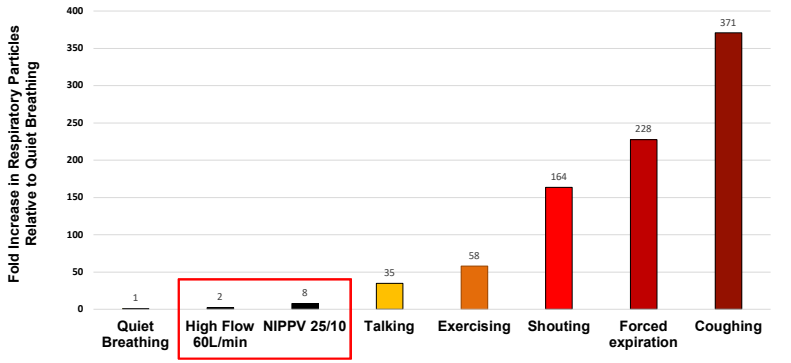
Impact of High Flow O2 on Respiratory Emissions



Wilson, *Anaesthesia* 2021;76(11):1465-1474

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Risk & Protection Exists on a Continuum

Factors That Increase Risk

- High community incidence
- Higher viral load
- Symptoms
- Proximity
- Longer exposure
- Poor ventilation
- Lack of masking
- Lack of vaccination

Factors That Decrease Risk

- Low community incidence
- Lower viral load
- Lack of symptoms
- Distance
- Brevity
- Good ventilation
- Mask on patient
- Mask on provider
  - N95 > KN95 > facemask
- Vaccination

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Question #5

A 63-year-old man with lymphoma is admitted for chemotherapy. His course is complicated by new atrial fibrillation and hospital acquired pneumonia (treated with vancomycin, cefepime, levofloxacin). On hospital day 12 he develops severe diarrhea and is diagnosed with *C. difficile* infection.

Where did the patient most likely acquire this pathogen?

A. From another patient on his ward (carried by healthcare workers' hands)
B. From the previous occupant of his bed
C. From the toilet seat of the shared bathroom in his room
D. From the food provided by the hospital
E. From the community (already colonized on admission)

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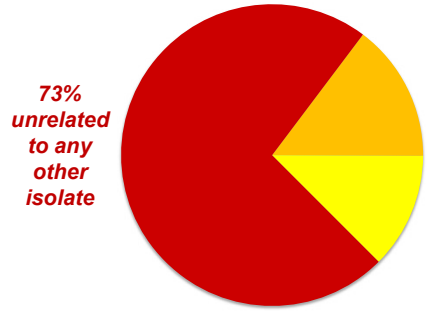
Where do patients get *C. difficile*?

Whole genome sequencing of 1,250 C. diff isolates from symptomatic inpatients & outpatients, Oxfordshire, UK, 2007-2011



73% unrelated to any other isolate

15% related to another isolate
and hospital contact possible
(overlapping admission, same or different ward)

12% related to another isolate
but no record of community or hospital contact with another symptomatic patient

Eyre, *N Engl J Med* 2013;369:1195-1205

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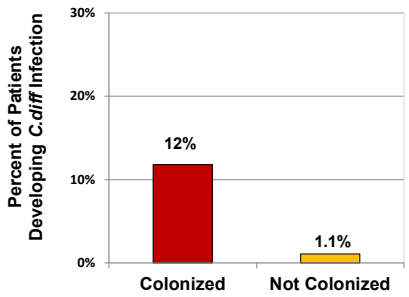
C. diff Colonization in ICU Patients and Progression to Infection

548 ICU patients at Johns Hopkins screened for C. difficile carriage on admission



Infect Control Hospital Epidemiol 2015;36:1324-1329

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So Where Do Inpatients Get *C. diff* From?

1. Present on admission
- Patient colonized prior to arrival, disease activates in the setting of exposure to antibiotics, antacids, immunosuppressants, and frailty

2. Transmission from symptomatic patients
- Spores carried from patient to patient via staff hands & clothing, equipment, the environment

3. Transmission from asymptomatic patients
- Spores carried from patient to patient via staff hands & clothing, equipment, the environment

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Risk of *C. diff* Acquisition Higher if Prior Room Occupant had *C. diff*

Medical ICU, University of Michigan Health System, 2005-2006

Prior Room Occupant Flagged for *C.diff*	**11.0%**
Prior Room Occupant Not Flagged for *C.diff*	**4.6%**

Adjusted Hazard Ratio **2.4** (95% CI 1.2-4.5)

Infection Control Hospital Epidemiology 2011;32:201-206

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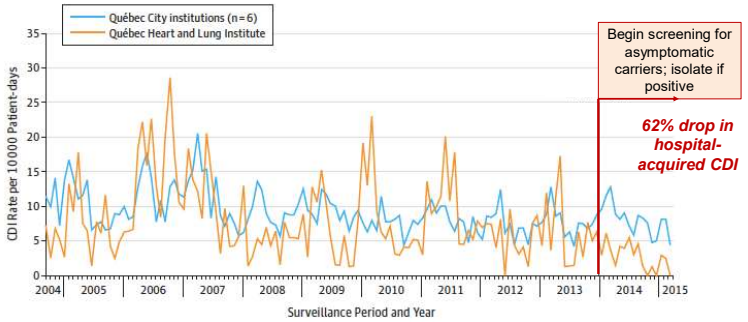
Impact of *C. diff* Screening & Isolation on *C. diff* Infections

Quebec Heart and Lung Institute began screening admissions for asymptomatic C.diff carriage in 2014; assessed impact on hospital-acquired C.diff infections relative to other Quebec City hospitals



Longtin, *JAMA Internal Med* 2016;176:796-804

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Essential Practices to Prevent *C. difficile* in Hospitals

- Encourage appropriate use of antimicrobials through implementation of an antibiotic stewardship program
- Implement diagnostic stewardship to assure appropriate use and interpretation of *C. difficile* testing
  - Guide or limit use of PCR, aid in interpretation
  - Avoid testing patients if no significant diarrhea, recent positive test, or age <1 year
- Use contact precautions, single room preferred
- Adequately clean and disinfect equipment and the environment
  - Use dedicated equipment when possible (e.g., stethoscope, BP cuff, thermometer…)
- Assess the adequacy of room cleaning
  - Consider using sporicidal agents if cleaning adequate but ongoing *C. diff* transmission
- Create lab-based alerts for clinicians and infection control re new cases
- Conduct surveillance for *C. diff* infections and report to stakeholders
- Educate clinicians, enviro services, administrators, & patients about *C. difficile*
- Measure compliance with contact precautions and hand hygiene

SHEA The Society for Healthcare Epidemiology of America

Infection Control & Hospital Epidemiology 2023;44:527-549

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Question #6

The MICU attending calls you because she's noticed 4 patients with new *Burkholderia cepacia* complex infections in her unit over the last 6 months. The patients were hospitalized during different periods. All Burkholderia isolates were first detected >7 days after admission.

What potential sources will you investigate?

A. Are providers consistently washing their hands between patients?
B. Are providers wiping down stethoscopes & phones between patients?
C. Did all the patients receive care from a common healthcare worker?
D. Were there any common devices amongst patients (e.g. ventilators, ECMO, bronchoscopes, ultrasound probes, etc.)?
E. Did all the patients visit the same operating room?

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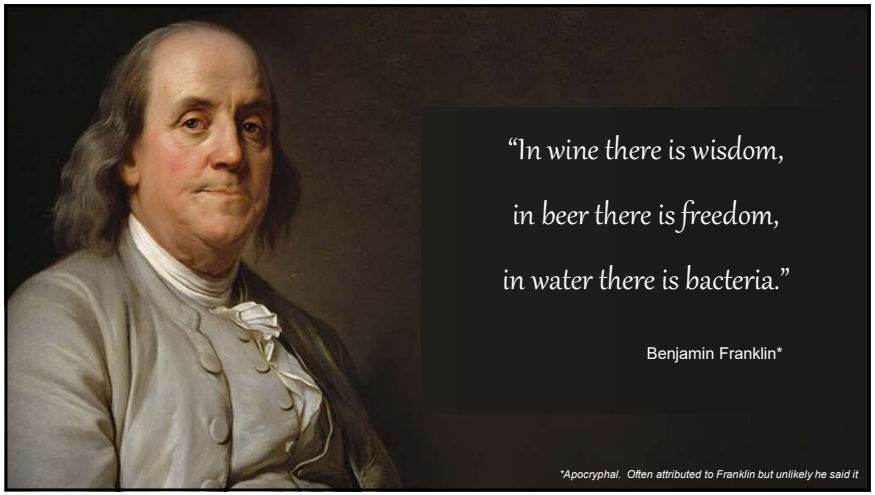

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Water Avid Pathogens

Pseudomonas spp.
Legionella pneumophilia
Burkholderia cepacia
Sphingomonas spp
Stenotrophomonas maltophilia
Acinetobacter baumannii
Aeromonas spp
Elizabethkingia anophelis
Enterobacter cloacae
Nontuberculous mycobacteria
Yeasts *(Candida spp.)*
Free living amoeba

- Normal inhabitants of water systems
- Promoters of persistence:
  - Biofilm forming
  - Relative resistance to disinfectants
- When clusters occur think:
  - Respiratory care equipment
  - Heating & cooling devices
  - Contaminated IV solutions & meds
  - Decorative water displays
  - Contaminated sink drains
  - etc.

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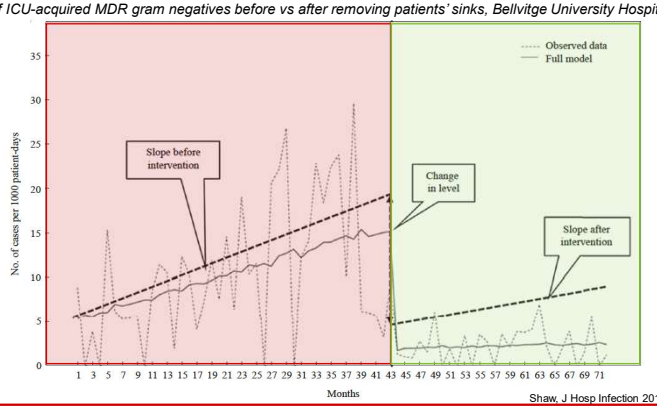
Drop in MDR Gram Negatives After Sink Removal

Incidence of ICU-acquired MDR gram negatives before vs after removing patients' sinks, Bellvitge University Hospital, Barcelona



Shaw, J Hosp Infection 2018;98:275-281

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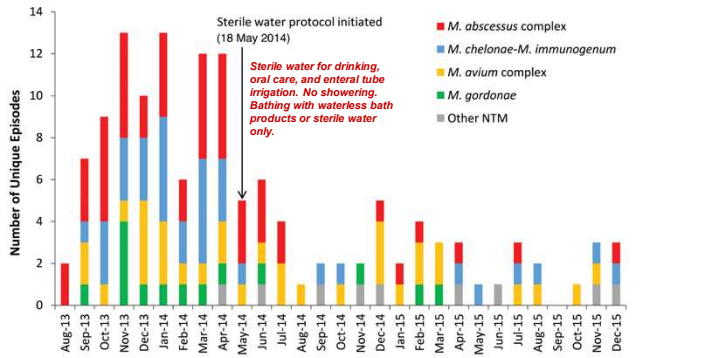
Eliminating tap water associated with drop in NTM infections

Count of patients with new non-tuberculous mycobacteria cultures, 3 ICUs & 1 step-down, Duke University Hospital



Baker, *Clin Infect Dis* 2021;73:524-527

47

Question #7

The CEO calls you to express her concern that ventilator-associated pneumonia rates in your hospital are double those of a competing hospital.

Which of the following measures are advised to reduce ventilator-associated pneumonia rates and improve patient outcomes?

A. Silver coated endotracheal tubes
B. Oral care with chlorhexidine
C. Daily toothbrushing
D. Placing patients in the lateral Trendelenburg position
E. Probiotics

48

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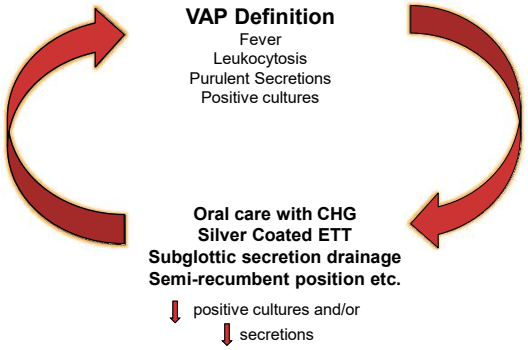
Circularity Between VAP Prevention Practices and the VAP Definition



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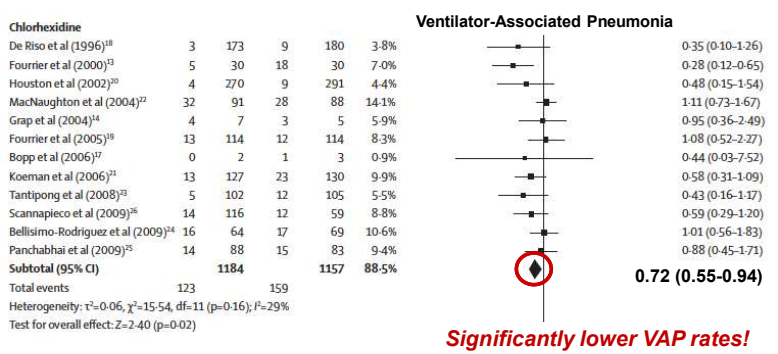
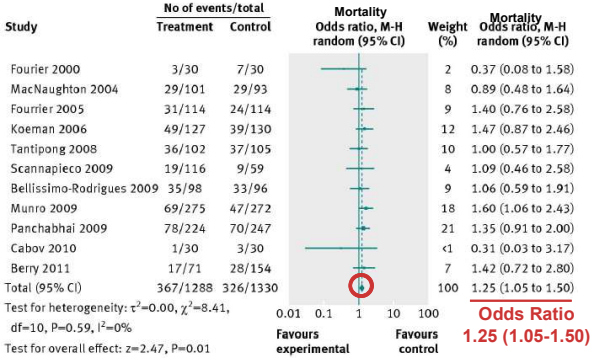
Oral Care with Chlorhexidine: Significantly *Lower* VAP Rates



Lancet Infectious Disease 2011;11:845

51

Oral Care with Chlorhexidine: Significantly *Higher* Mortality Rates

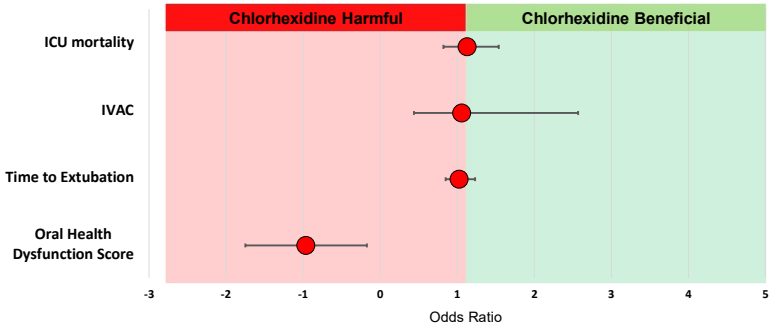


BMJ 2014;348:g2197

52

Chlorhexidine De-Adoption Cluster Randomized Trial

Cluster randomized trial of replacing oral CHG with an oral care bundle vs continuing oral care with CHG in 6 Canadian ICUs (N=3260). Oral care bundle included twice daily toothbrushing plus mouth and lip moisturization



Dale, Intensive Care Med 2021;47:1295-1302

53

Toothbrushing: Lower Mortality, Shorter LOS

Meta-analysis of 15 randomized trials of oral care with vs without toothbrushing

	Studies	Patients	Meta-Analysis	
Hospital-acquired pneumonia* (*12 of the 14 studies in ventilated patients)	14	2557	Risk Ratio 0.68 (95% CI 0.57-0.82)	*Lower!*
Ventilator Days	7	1285	-1.2 days (95% CI -2.4 to -0.1)	*Lower!*
ICU Length of Stay	6	1284	-1.8 days (95% CI -2.9 to -0.7)	*Lower!*
ICU Mortality	6	1331	Risk Ratio 0.81 (95% CI 0.69-0.95)	*Lower!*

Ehrenzeller, *JAMA Internal Med* 2024;184(2):131-142

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Essential Practices to Prevent VAP in Adults

- Avoid intubation and prevent reintubation
  - Use high flow nasal oxygen or non-invasive positive pressure ventilation whenever safe and feasible
- Minimize sedation
  - Avoid benzodiazepines
  - Use a protocol to minimize sedation
  - Implement a ventilator liberation protocol
- Maintain and improve physical conditioning
- Elevate the head of the bed to 30-45 degrees
- Provide oral care *with* toothbrushing but *without* chlorhexidine
- Provide early enteral nutrition
- Change the ventilator circuit only if visibly soiled or malfunctioning

Infection Control & Hospital Epidemiology 2022;43:687-713

55

Question #8

You are part of a multidisciplinary team working to prevent central line associated bloodstream infections in your hospital. Interventions to date include education, daily patient bathing with chlorhexidine, line insertion checklists, insertion kits, and maximal sterile barrier precautions during insertion.

What additional steps should you consider implementing?

A. Create a standing order for vancomycin for all patients with central lines
B. Replace all central lines every 7 days
C. Preferentially site all lines in the internal jugular vein whenever possible
D. Require “double antiseptic” skin preparation with povidone-iodine-chlorhexidine before all insertions
E. Require “double antiseptic” skin preparation with alcohol-chlorhexidine before all insertions

56

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Essential Practices to Prevent Line Infections

Before insertion

- Disseminate indications for evidence-based central line use to minimize unnecessary use
- Provide education and perform competency assessments
- Daily bathing with chlorhexidine

Infection Control & Hospital Epidemiology 2022;43:553-569

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Essential Practices to Prevent Line Infections

At insertion

- Use a checklist to assure all steps followed
- Perform hand hygiene
- Subclavian site preferred
- Use a catheter-placement kit with all necessary supplies
- Use ultrasound guidance to place the catheter
- Use maximal sterile barrier precautions
- Use an alcohol-chlorhexidine antiseptic for skin prep

Infection Control & Hospital Epidemiology 2022;43:553-569

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Essential Practices to Prevent Line Infections

After insertion

- Ensure appropriate nurse:patient ratio and limit use of float nurses in ICUs
- Use chlorhexidine-containing dressings for central lines
- Change transparent dressings and perform site care with a chlorhexidine-based antiseptic q7d (or immediately if soiled)
- Disinfect catheter hubs, connectors, ports before each use
- Remove non-essential catheters promptly
- Replace administration sets q7d or less
- Routinely measure line infection rates and report back to unit staff & hospital leaders

Infection Control & Hospital Epidemiology 2022;43:553-569

60

Question #9

A 66-year-old gentleman with poorly controlled diabetes is admitted with fever and a swollen left knee. He underwent elective knee replacement 3 weeks ago. Knee aspirate gram stain shows gram positive cocci in clusters. Culture is positive for Staph aureus (methicillin-susceptible). The patient is taken to the OR, the prosthesis is removed, and an antibiotic spacer is placed. The patient is devastated by the setback to his recovery and the need for more surgery.

He asks what more could have been done to prevent this infection?

A. Obtain a urine culture before surgery to rule out occult bacteriuria
B. Screen all patients before arthroplasty to identify *Staph aureus* carriers and decolonize them with chlorhexidine washes + nasal mupirocin
C. Prescribe 4 weeks of antibiotic prophylaxis for all arthroplasty patients
D. Only provide arthroplasty to patients with hemoglobin A1C's <7
E. Ensure all knee surgeries are performed with therapeutic hypothermia

61

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62

Where do *Staph aureus* infections come from?

80% of hospital acquired *Staph aureus* infections are attributable to patients' own flora (endogenous)

Staph Bacteremia

Nasal isolates compared to blood isolates in 219 patients with *Staph aureus* bacteremia. 82% matched

von Eiff, NEJM 2001;344:11-16

Surgical Site Infections

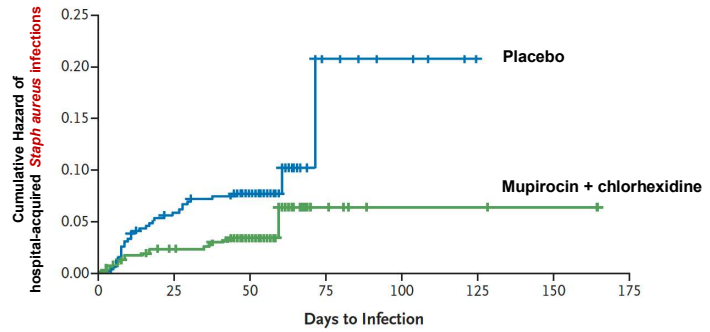
Nasal isolates compared to wound isolates in 39 patients with *Staph aureus* SSIs. 85% matched

Perl, NEJM 2002;346:1871-77

63

Staph aureus screening & decolonization

917 hospitalized patients with positive Staph aureus nasal screens randomized to decolonization vs placebo
~90% of enrolled patients were on surgical services. Greatest benefit cardiac > ortho > vascular > GI



Bode, NEJM 2010;362:9-17

64

Targeted vs Universal Decolonization in the ICU

REDUCE MRSA cluster-randomized trial, 74 ICUs, 43 hospitals, 74,256 patients

Screen and Isolate

Nasal MRSA screen

If positive, isolate

Screen and Decolonize

Nasal MRSA screen

If positive, isolate & decolonize with CHG baths x 5 days
+ mupirocin x 5 days

Universal Decolonization

No screening

Decolonize **all** patients with CHG baths throughout ICU stay
+ mupirocin x 5 days

Huang et al. NEJM 2013:368:2255-65

65

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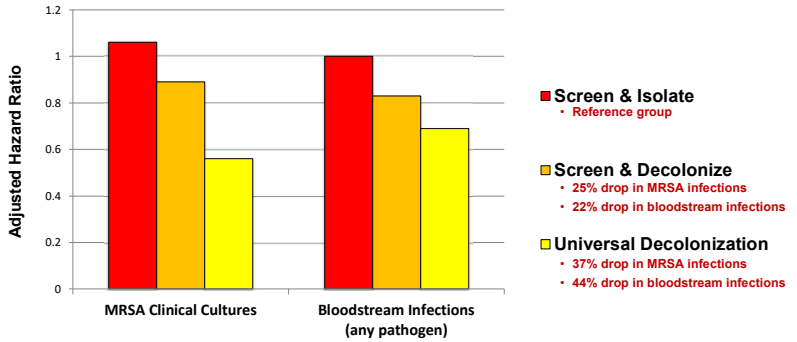
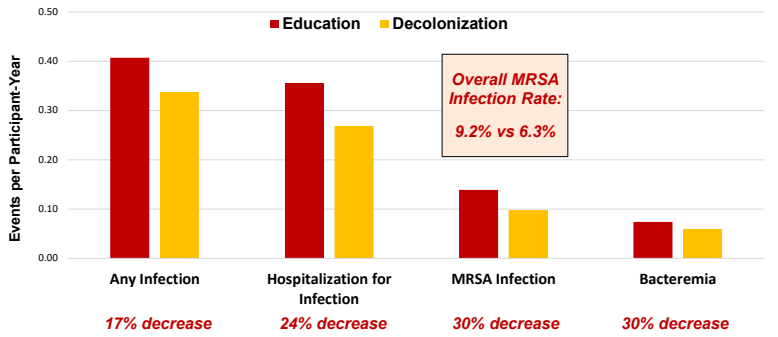


Huang et al. *NEJM* 2013:368:2255-65

66

Should We Decolonize Patients After Discharge?

1063 discharged patients colonized with MRSA randomized to education + decolonization vs education alone.
Decolonization protocol: CHG mouthwash, CHG body wash, and BID nasal mupirocin x 5d twice a month x 6mo



Huang, *NEJM* 2019;380:638-50

67

Question #10

An obese 62-year-old female smoker with COPD is admitted for elective resection of adenocarcinoma of the left upper lobe. She weighs 132kg. She is intubated and undergoes left upper lobe lobectomy. Cefazolin 3g IV is administered 30mins before incision and every 4 hours during surgery. A chest tube is place on the left side. After surgery she is admitted to the ICU for recovery.

How long should cefazolin be continued post-operatively?

A. 0-hours – prophylaxis should be stopped after surgery
B. 12-hours
C. 24-hours
D. Until the chest tube is removed
E. Until the patient is extubated

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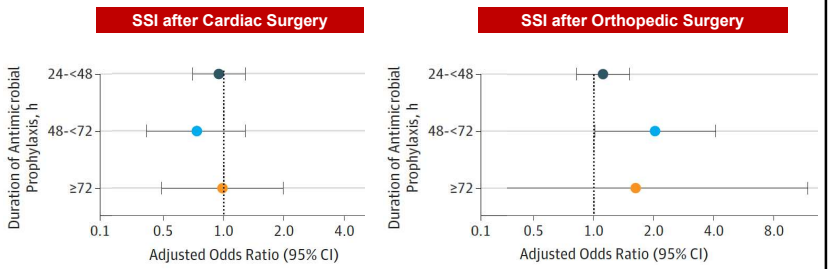
69

Extending antibiotics beyond surgery does not prevent infections…

Retrospective analysis of association between duration of peri-operative antibiotic prophylaxis and adverse events in 79,058 patients who underwent orthopedic, colorectal, and vascular procedures, VA hospitals, 2008-2013

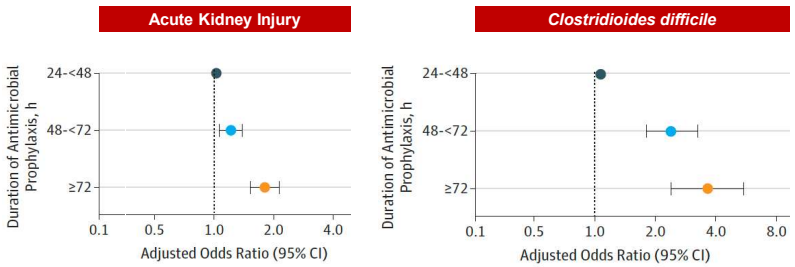


Branch-Elliman, *JAMA Surgery* 2019;154:590-598

70

…but extending antibiotics beyond surgery may be harmful

Retrospective analysis of association between duration of peri-operative antibiotic prophylaxis and adverse events in 79,058 patients who underwent orthopedic, colorectal, and vascular procedures, VA hospitals, 2008-2013



Branch-Elliman, *JAMA Surgery* 2019;154:590-598

71

Essential Practices to Prevent Surgical Site Infections – Part I

- Administer antimicrobial prophylaxis according to evidence-based practices and standards
- Use parenteral and oral abx prophylaxis before colorectal surgery
- Decolonize patients with an anti-Staphylococcal agent before cardiac and orthopedic procedures (+/- those with prosthetic implants)
- Use an anti-septic vaginal prep for cesareans & hysterectomy
- Do not remove hair at the operative site (unless it interferes with surgery)
- Use skin prep containing a combination of alcohol + an antiseptic
- Maintain normothermia during perioperative period
- Use impervious plastic wound protectors for GI and biliary tract surgery
- Perform intraoperative antiseptic wound lavage
- Control blood-glucose level in the post-operative period

Infection Control & Hospital Epidemiology 2023;44:695-720

72

Essential Practices to Prevent Surgical Site Infections – Part II

- Perform surveillance for surgical site infections (SSIs)
- Use a checklist and/or bundle to encourage best practices
- Increase the efficiency of surveillance by utilizing automated data
- Provide ongoing SSI rate feedback to surgical and periop personnel
- Measure & provide feedback on compliance with process measures
- Educate surgeons and periop personnel about SSI prevention measures
- Educate patients and their families about SSI prevention as appropriate
- Align SSI prevention practices with evidence-based standards, rules & regulation, and manufacturers' instructions for use
- Observe and review operating room personnel and the environment of care in the operating room and central sterile reprocessing

Infection Control & Hospital Epidemiology 2023;44:695-720

73

Question #11

A 55-year-old woman is emergently transferred to your hospital after falling and sustaining a spinal cord injury complicated by paraplegia. She is admitted to the intensive care unit following neurosurgery.

Which of the following steps is most likely to reduce her risk of developing a catheter-associated urinary tract infection?

A. Start prophylactic fosfomycin
B. Screen for colonization to inform targeted antibiotic prophylaxis
C. Change the urinary catheter every 7 days
D. Empty the catheter drainage bag before transporting her off the unit
E. Check a urinalysis daily and start pre-emptive antibiotics if she develops pyuria

74

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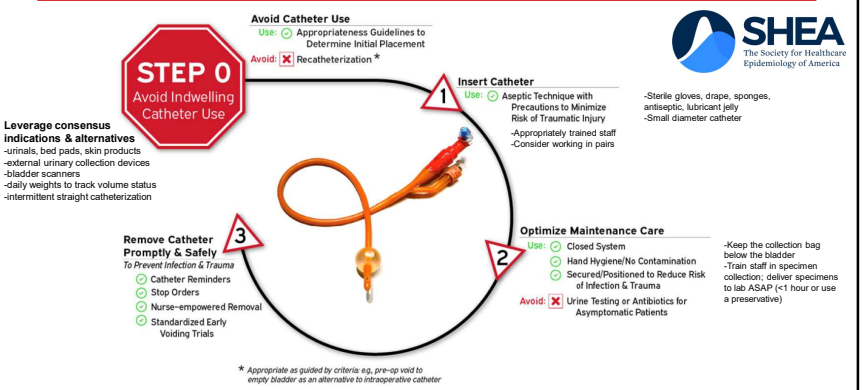
Essential Practices to Prevent Catheter-Associated UTIs



Infection Control & Hospital Epidemiology 2023;44:1209-1231

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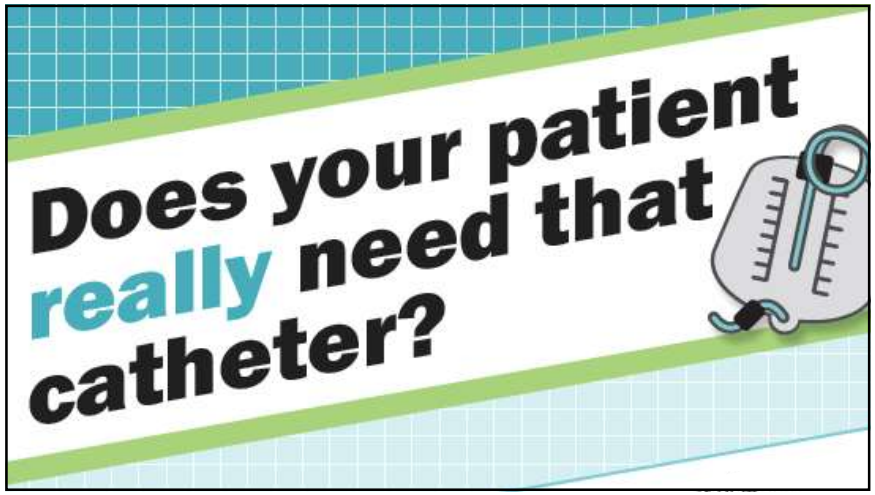

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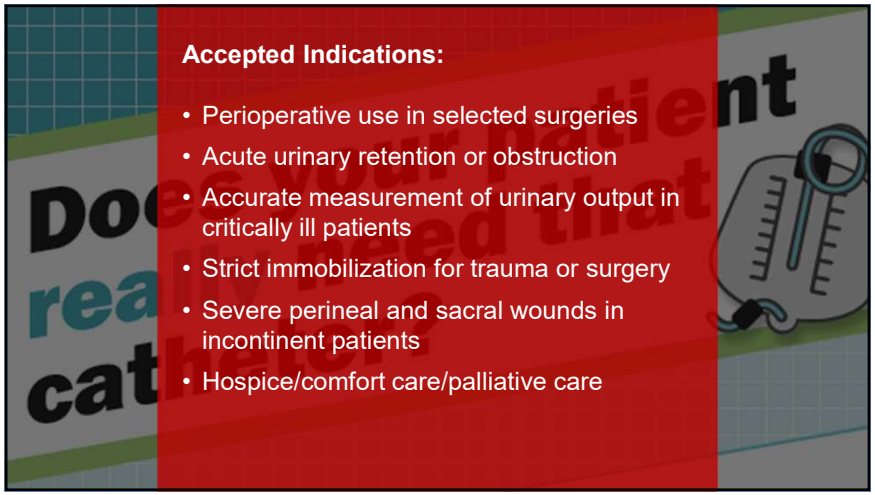

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Question #12

A 52-year-old woman is admitted to hospital with intermittent epigastric pain. Labwork is notable for elevated ALK, Tbili, and lipase. CT with contrast shows a thickened and dilated gall bladder with stones in the common bile duct. A foley is placed. The patient goes to ERCP for sphincterotomy and gallstone retrieval. Two days later she develops fever and delirium. Blood cultures are positive for carbapenem-resistant Enterobacterales.

What sources will you consider for this infection?

A. Healthcare workers with poor hand hygiene
B. The hospital's decorative water fountain
C. A contaminated duodenoscope
D. Contaminated intravenous contrast
E. Failure to remove a foley catheter in a timely fashion

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80

Duodenoscopes

- Notoriously difficult to sterilize
- Meta-analysis of 15 studies sampling duodenoscopes after reprocessing (925 scopes):
  - **16%** still **culture positive** after high level disinfection performed per manufacturers' instructions
  - **9%** still culture positive after **double reprocessing** or gas sterilization
- Many clusters reported

Larsen, *EClinicalMedicine* 2020;25:100451
Forbes, *JAMA Internal Med* 2023;183:191-200

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Outbreak Word Associations

Pathogen	Potential Sources
Legionella	Decorative water fountains, cooling units
Pseudomonas	Respiratory care equipment, drains & sinks
Burkholderia	Water heaters & coolers (e.g. ECMO)
Carbapenem-resistant Enterobacterales	Duodenoscopes
Candida auris	Temperature probes
Mycobacterium abscessus	Ice & water machines, other water sources
Mycobacterium chimaera	Cardiac bypass heater-cooler devices
Aspergillus sp.	Construction, plants & flowers

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Summary

- Pneumonia is the most common HAI; *C. difficile* the most common pathogen
- Equipment, hands, and clothing are commonly contaminated by bacteria
- Hand hygiene rates are inversely associated with HAI rates
- All respiratory viruses are spread by aerosols. Risk highest with high viral load, proximity, sustained exposure, poor ventilation. Surgical masks decrease risk by ~50%. N95 respirators decrease risk by ~95%
- Most aerosol generating procedures do not generate aerosols
- Most *C. difficile* is endogenous; activated during medical care in setting of antibiotics, immunosuppressants, frailty. Some hospital transmission too.
- Decolonize *Staph aureus* carriers with lines, before surgery, in the ICU
- Give antibiotic prophylaxis within 60mins before incision; stop after surgery
- Contaminated water, drains, respiratory equipment, and meds can spread water-based pathogens. Leading ICUs working on decreasing water-based care.

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