

# 31 – Hospital Epidemiology

Speaker: Michael Klompas, MD



## Hospital Epidemiology

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### • Disclosures of Financial Relationships with Relevant Commercial Interests

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#### • Royalties:

- UpToDate

## Question #1



What is the most common healthcare-associated infection?

- Central line associated bloodstream infections
- Catheter-associated urinary tract infections
- Hospital-acquired pneumonia
- Surgical site infections
- Clostridioides difficile*

## The Most Common Hospital Acquired Infections

CDC point-prevalence survey of healthcare-associated infections in 2015, 199 hospitals, 10 states

	Frequency per 100 patients
Pneumonia	0.9
Surgical site infections	0.7
Gastrointestinal infections including <i>C. difficile</i>	0.6
Bloodstream infections	0.4
Urinary tract infections	0.3
<b>Any healthcare-associated infection</b>	<b>3.2</b>

Magill, *N Engl J Med* 2018;379:1732-1744

## The Most Common Hospital Acquired Pathogens

CDC point-prevalence survey of healthcare-associated infections in 2015, 199 hospitals, 10 states

	Frequency per 100 healthcare-associated infections
<i>C. difficile</i>	15%
<i>Staphylococcus aureus</i>	11%
<i>Escherichia coli</i>	10%
Candida species	6%
Enterococcus species	5%
Enterobacter species	5%
<i>Pseudomonas aeruginosa</i>	5%
<i>Klebsiella species</i>	5%

Magill, *N Engl J Med* 2018;379:1732-1744

## Question #2

A surgical colleague calls you because 2 of his patients developed *Candida albicans* surgical site infections following spine surgery. You review the hospital's microbiology records and confirm that this is very unusual. What are potential sources for this cluster?

- Scrub nurse wearing artificial nails
- Disruption of laminar airflow in the operating room
- Contamination of intravenous fluids used during surgery
- Failure of peri-operative blood glucose control
- Use of broad-spectrum antibiotics for peri-operative prophylaxis

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## Nail Add-Ons & Blemishes Can Harbor Pathogens



- 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 pneumoniae* 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

Smith, CMAJ 2004;171:110-115  
Gardner, Lancet 2007;369:160-164  
Fau, N Engl J Med 2009;361:696-700

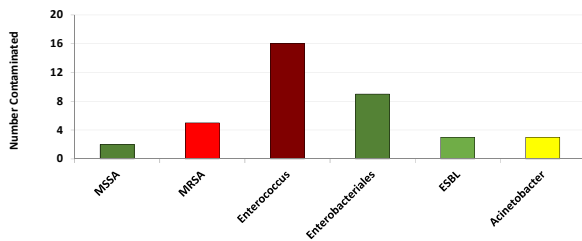
Perry, Clin Infect Dis 2009;32:321-7  
Mehra, Clin Infect Dis 2008;31:81-82  
Nawro, Clin 2002;34:749-52



MicrobeWorld.org/Tasha Sturm/Cabrillo College

## 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

## Essential Hand Hygiene Practices



### 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 patient environment

- Alcohol-based hand rub typically preferred over soap & water
- Facilitate primary and secondary prevention of dermatitis

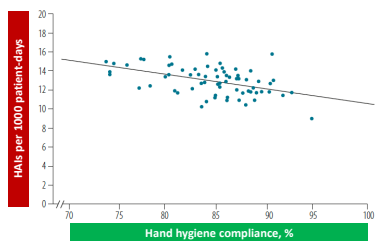
### Ensure hand hygiene supplies are always readily accessible

- Widespread, convenient alcohol-based hand rub dispensers

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

## Better Hand Hygiene, Fewer Healthcare Associated Infections

Monthly hand-hygiene compliance and HAI incidence, Oulu University Hospital, Finland 2013-2018



Ojanpera, Bull World Health Organ 2020;98:475-483

## Question #3

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?

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

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### Neisseria transmission to healthcare workers

Comprehensive description of Neisseria meningitidis in healthcare workers in England and Wales 1992-1996

Case 1	Case 2	Case 3
<p>Provider: Doctor</p> <p>Full clinical exam of 9 yo with meningitis, including fundoscopy during which <b>patient coughed into doctor's face</b></p> <p>0.5-2h contact time</p> <p>Incubation period: 4d</p>	<p>Provider: EMS worker</p> <p>Transported 16 yo with meningitis to hospital. Care included airway insertion and delivery of oxygen while <b>patient seizing in ambulance</b></p> <p>0.5-2h contact time</p> <p>Incubation period: 7d</p>	<p>Provider: Nurse</p> <p>Nursed a 7mo with sepsis while baby being prepared for transfer to referral hospital; <b>in close contact while child crying and coughing for at least 5h</b></p> <p>5-6h contact time</p> <p>Incubation period: 5d</p>

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

Gilmore, Lancet 2000;356:1654-1655

### 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
- 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

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

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

### Question #4

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?

- Unvaccinated seronegative nurse looking after the patient in the next room
- Unvaccinated seronegative respiratory therapist on rituximab for SLE
- 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
- The dermatologist that unroofed a vesicle for testing. She is VZV IgG+.

### Varicella Outbreak!

Transmission of varicella pneumoniae, Boston Children's Hospital, 1970s

Transmission via windows or hall flow or HCW?

- Room A: INDEX CASE (9/10)
- Room B: 3/5
- Room C: 1/1
- Room D: 0/2
- Room E: 0/4
- Room F: 4/10
- Room G: 9/10

Attack rates and conditions:

- 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

Lectin; NEJM 1980;302:450-453

### 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, IJD 2008;197:646-653 (skin lesions, lesions)

### 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 <sup>2</sup>	Yes
Unvaccinated & seronegative	Yes	No	Yes	Yes
Unvaccinated & unable to vaccinate <sup>1</sup>	No	Yes <sup>4</sup>	Yes <sup>4</sup>	Yes

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

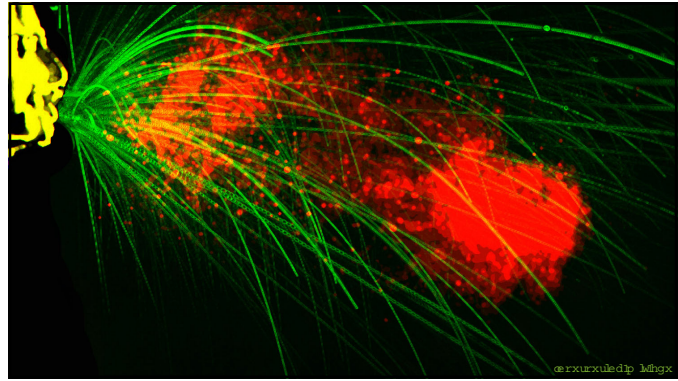
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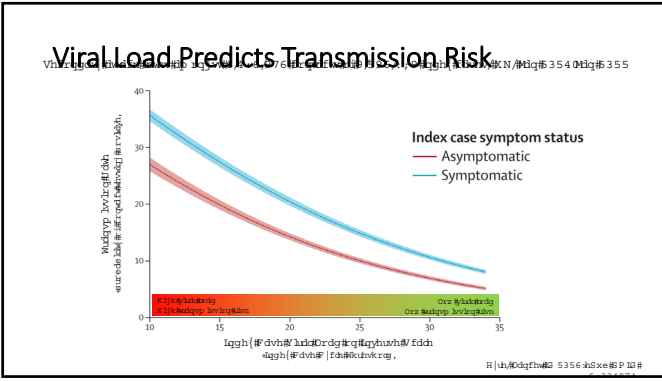
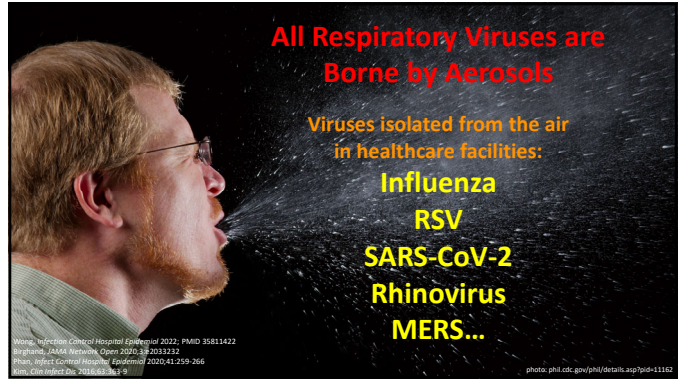
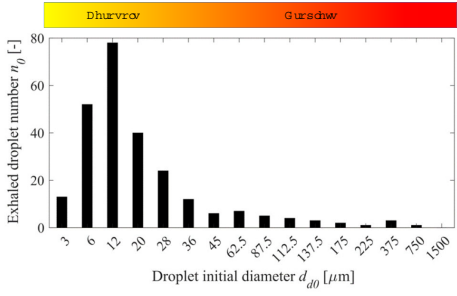
## Question #5

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 control against respiratory viruses



## People Produce Respiratory Particles in a Range of Sizes







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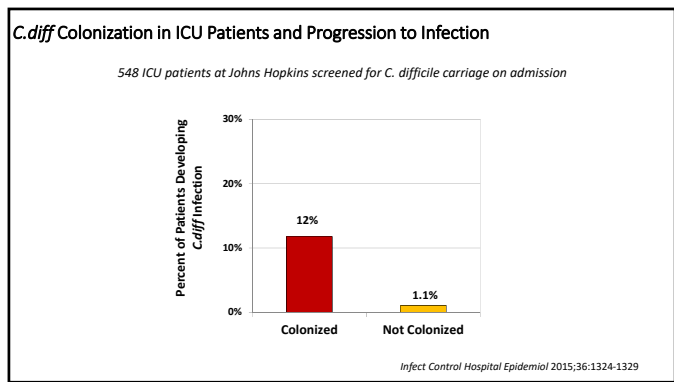
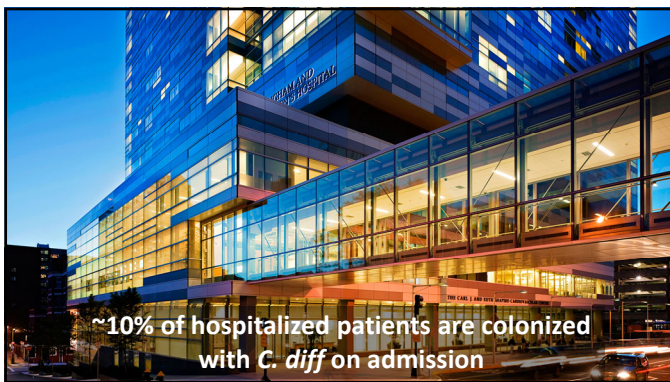
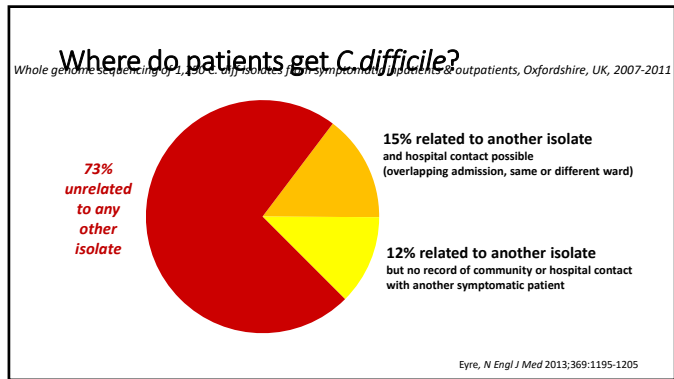
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PREVIEW QUESTION

## Question #6

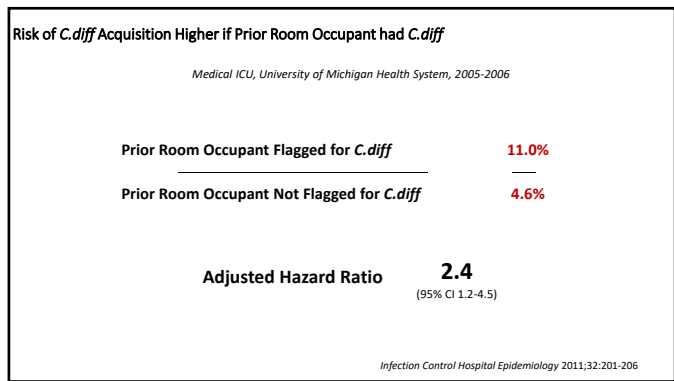
A 63-year-old man with lymphoma is admitted for chemotherapy. His course is complicated by new atrial fibrillation and hospital acquired pneumonia (treated with vancomycin, cefepime, levofloxacin). On hospital day 12 he develops severe diarrhea and is diagnosed with *C. difficile* infection. Where did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

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



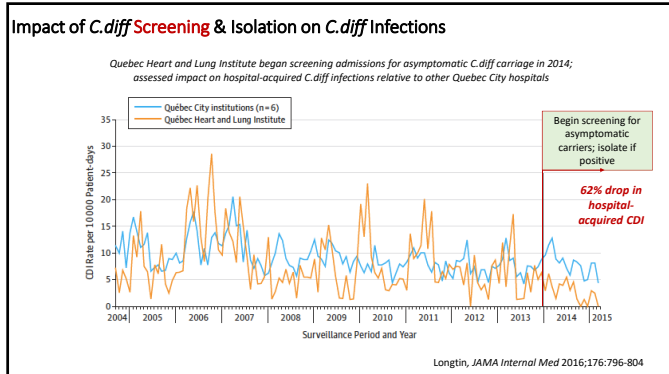
## So Where Do Inpatients Get *C. diff* From?


- Present on admission**
  - Patient colonized prior to arrival, disease activates in the setting of exposure to antibiotics, antacids, immunosuppressants, and frailty
- Transmission from symptomatic patients**
  - Spores carried patient to patient via staff hands & clothing, equipment, the environment
- Transmission from asymptomatic patients**
  - Spores carried patient to patient via staff hands & clothing, equipment, the environment



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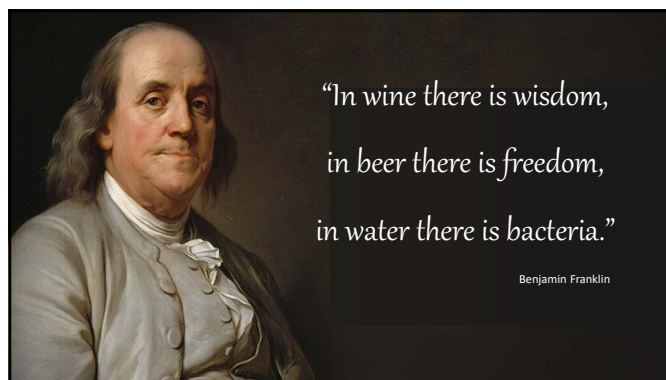


- ### Essential Practices to Prevent *C.difficile* in Hospitals
- 
- Minimize use of antimicrobials through implementation of an antibiotic stewardship program
  - Implement diagnostic stewardship to assure appropriate use and interpretation of *C.difficile* testing
    - Guide or limit use of PCR, aid 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
- Source: Infection Control & Hospital Epidemiology 2023;44:527-549

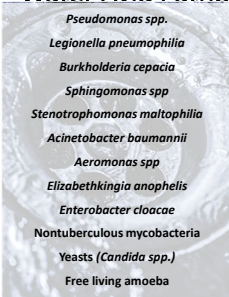
### Question #7

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?

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



### Water Avid Pathogens



- 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.

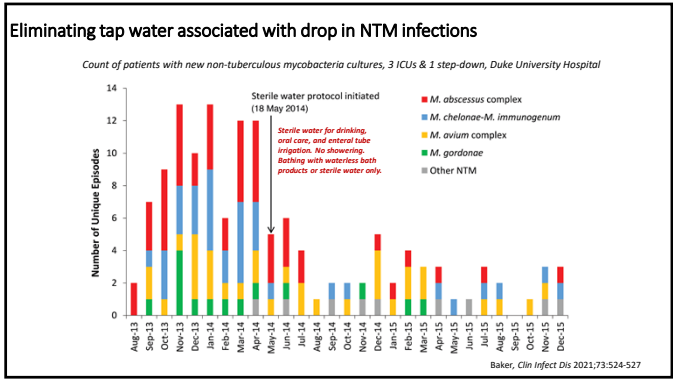
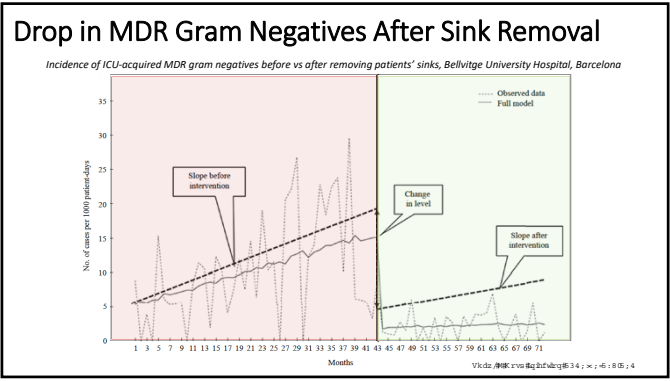
Pathogens listed:

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



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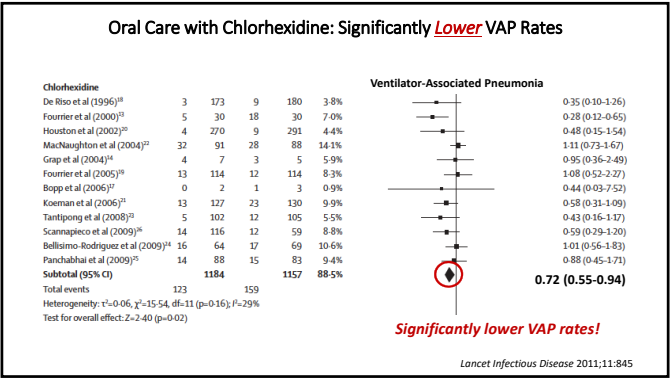
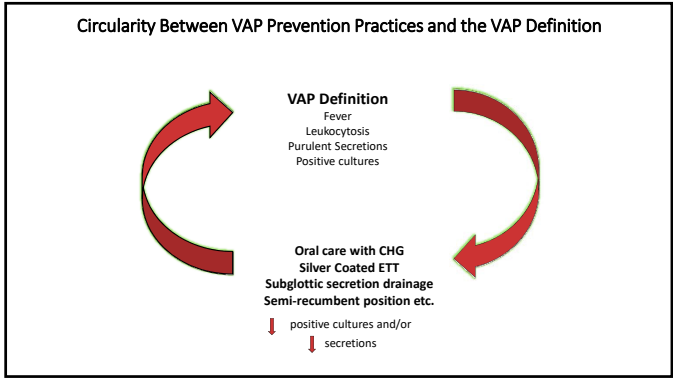
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### Question #8

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?

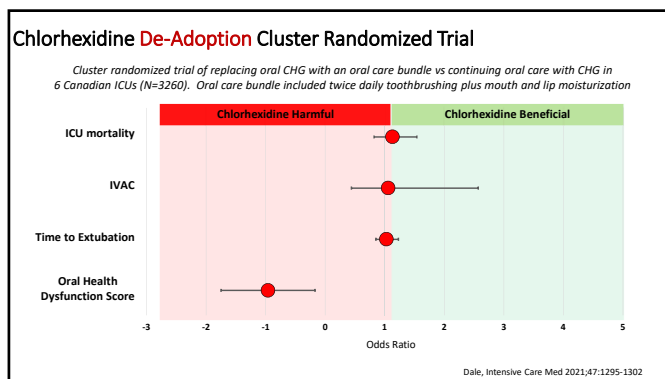
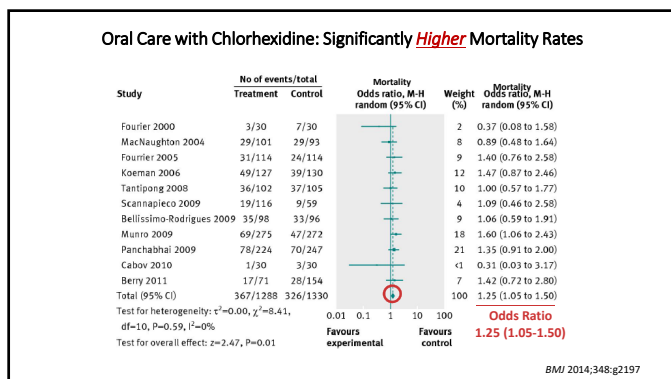
- A. Silver coated endotracheal tubes
- B. Oral care with chlorhexidine
- C. Daily toothbrushing
- D. Placing patients in the lateral Trendelenburg position
- E. Probiotics





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### Toothbrushing: lower mortality, shorter LOS

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

Outcome	Studies	Patients	Meta-Analysis	Effect
Hospital-acquired pneumonia*	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!

\*12 of the 14 studies in ventilated patients

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

- ### 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

### Question #9

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?


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

- ### 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*

### 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*

### Question #10

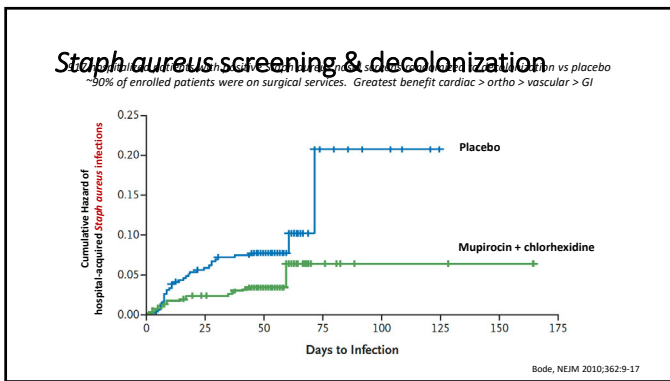
A 66 yo gent with poorly controlled diabetes is admitted with fever and a swollen left knee. He underwent elective knee replacement 3 weeks ago. Knee aspirate gram stain shows gram positive cocci in clusters. Culture is positive for *Staph aureus* (methicillin-susceptible). The patient is taken to the 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?

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

### Where do *Staph aureus* infections come from?

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

Staph Bacteremia	Surgical Site Infections
Nasal isolates compared to blood isolates in 219 patients with <i>Staph aureus</i> bacteremia. 82% matched	Nasal isolates compared to wound isolates in 39 patients with <i>Staph aureus</i> SSIs. 85% matched
von Eiff, NEJM 2001;344:11-16	Perl, NEJM 2002;346:1871-77



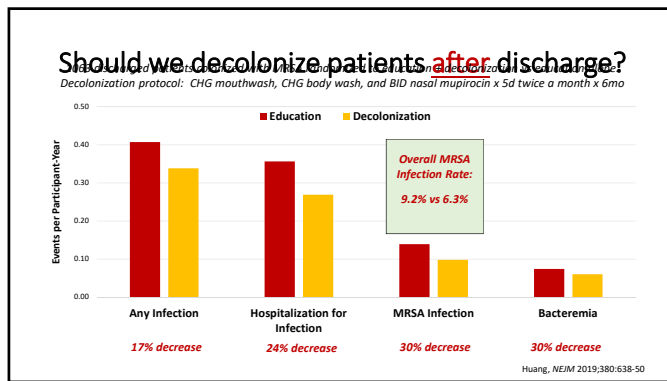
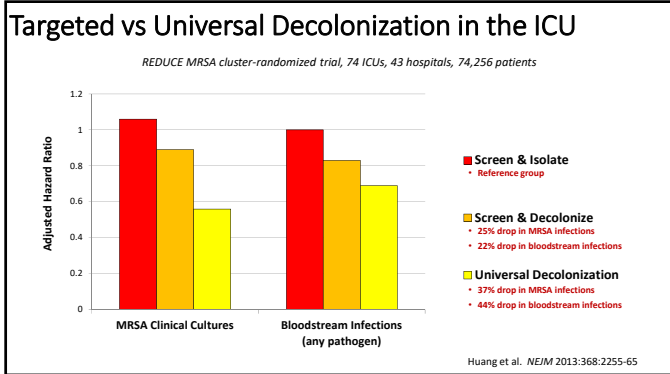
### Targeted vs Universal Decolonization in the ICU

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

Screen and Isolate	Screen and Decolonize	Universal Decolonization
Nasal MRSA screen If positive, isolate	Nasal MRSA screen If positive, isolate & decolonize with CHG baths x 5 days + mupirocin x 5 days	No screening Decolonize <b>all</b> patients with CHG baths throughout ICU stay + mupirocin x 5 days
Huang et al. NEJM 2013;368:2255-65		

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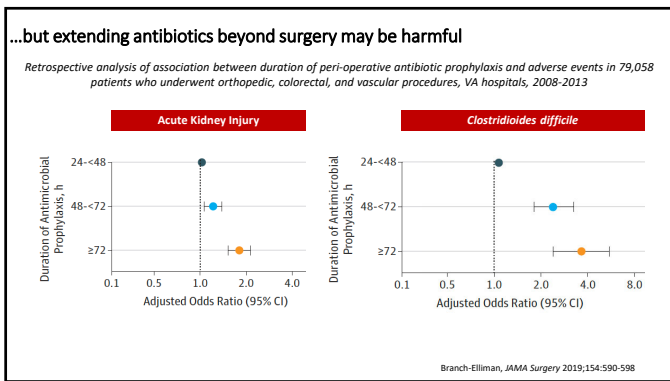
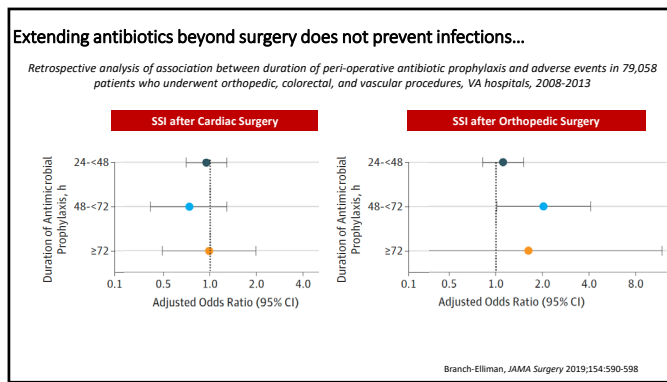
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### Question #11

An obese 62 yo 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 placed on the left side. After surgery she is admitted to the ICU for recovery. How long should cefazolin be continued post-operatively?

- 0-hours – prophylaxis should be stopped after surgery
- 12-hours
- 24-hours
- Until the chest tube is removed
- Until the patient is extubated



- ### 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

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## 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



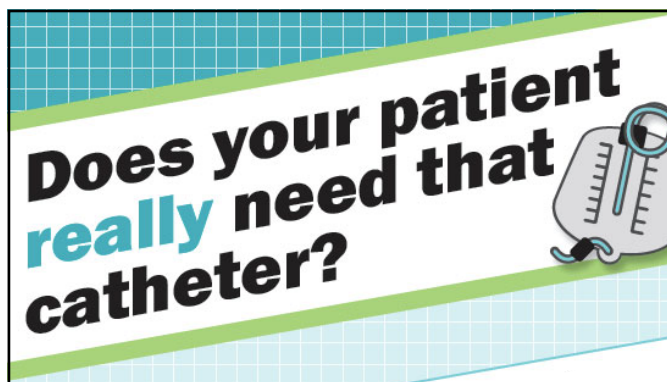
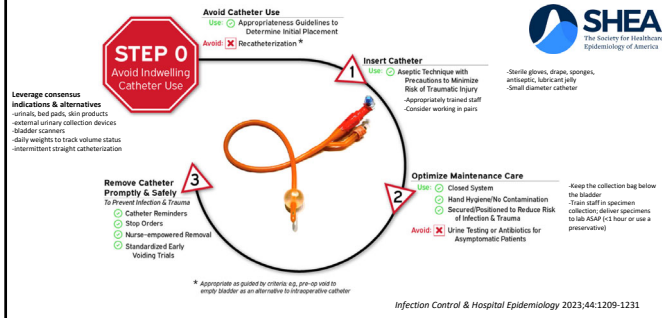
Infection Control & Hospital Epidemiology 2023;44:695-720

## Question #12

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?

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

## Essential Practices to Prevent Catheter-Associated UTIs



**Accepted Indications:**

- Perioperative use in selected surgeries
- Acute urinary retention or obstruction
- Accurate measurement of urinary output in critically ill patients
- Strict immobilization for trauma or surgery
- Severe perineal and sacral wounds in incontinent patients
- Hospice/comfort care/palliative care

## Question #13

A 52 yo woman is admitted to hospital with intermittent epigastric pain. Labwork is notable for elevated ALK, Tbilii, 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?

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

# 31 – Hospital Epidemiology

Speaker: Michael Klompas, MD

## Duodenoscopes

- o Notoriously difficult to sterilize
- o 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

- o Many clusters reported



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

## 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

## 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.

Thank You!

For all the lives we touch

Clean hands protect our patients. Always perform hand hygiene and help others do the same.

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BRIGHAM AND WOMEN'S HOSPITAL

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