

23 – Hospital Epidemiology

Speaker: Michael Klompas, MD

IDIR
INFECTIOUS
DISEASE
BOARD REVIEW

AUGUST 20-24
2022

Hospital Epidemiology

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7/18/2022

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INFECTIOUS
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Disclosures of Financial Relationships with Relevant Commercial Interests

- Grant funding:
 - Centers for Disease Control and Prevention
 - Agency for Healthcare Research and Quality
 - Mass Department of Public Health
- Royalties
 - UpToDate

Topics

- Fomites: do hand hygiene and contact precautions work?
- Air: respiratory pathogen transmission & prevention
- Water: the source of all evil
- Clostridioides difficile: you are your own enemy
- Devices: the other source of all evil
- Cluster investigation: find the missing link

Question #1

What is the most common healthcare-associated infection?

- A. Central line associated bloodstream infections
- B. Catheter-associated urinary tract infections
- C. Hospital-acquired pneumonia
- D. Surgical site infections
- E. 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 C. difficile	0.6
Bloodstream infections	0.4
Urinary tract infections	0.3
Any healthcare-associated infection	3.2

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

Question #2

What is the most common healthcare-associated pathogen?

- A. Pseudomonas aeruginosa
- B. Staphylococcus aureus
- C. Klebsiella pneumoniae
- D. Candida albicans
- E. Clostridioides difficile

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The Most Common Hospital Acquired Pathogens

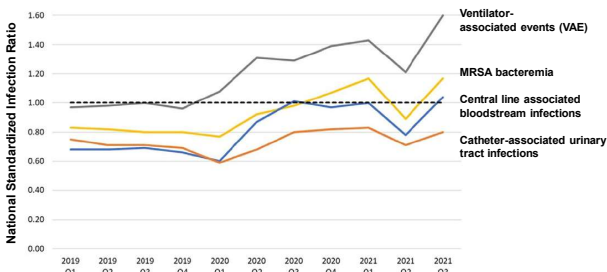
CDC point-prevalence survey of healthcare-associated infections in 2015, 199 hospitals, 10 states

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

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

Impact of the pandemic on U.S. HAI rates

Healthcare-associated infections reported to CDC's National Healthcare Safety Network, ~3000 hospitals



Question #3

Your hospital's Chief Quality Officer is exasperated that hand hygiene compliance rates in your hospital continue to hover around 60-70% despite years of trying to improve performance. What evidence-based strategies can you recommend to improve compliance?

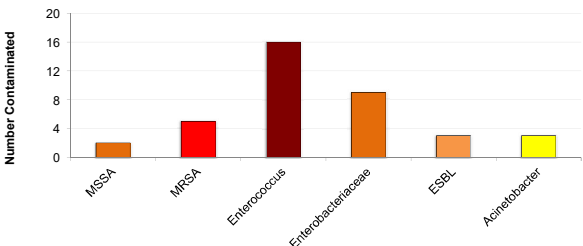
- A. Improve data collection by deploying more secret observers
- B. Do an educational blitz on the benefits of hand hygiene
- C. Give high performing staff gift cards
- D. Create an accountability model wherein failure to conduct hand hygiene will be managed like other serious performance lapses



How can we improve hand hygiene rates and will it make a difference?

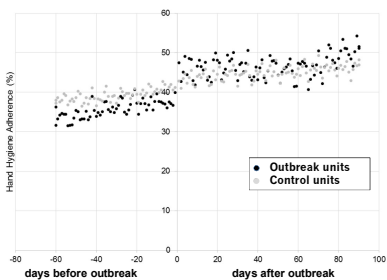
Organisms Recovered from Physicians' Hands Following a Single Physical Exam

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



Association between Hand Hygiene Rates and Outbreaks

Analysis of hand hygiene rates per electronic monitoring systems in the days before vs after outbreaks, 5 hospitals, 26 inpatient units



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How do we improve hand hygiene?



Comparative efficacy of interventions to promote hand hygiene in hospital: systematic review and network meta-analysis

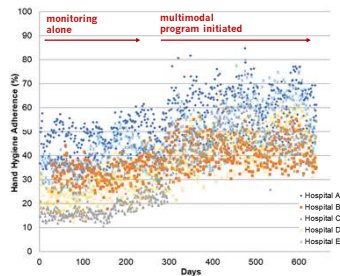
Nantakiat Luangasanatip,^{1,2} Mallawan Hongswan,¹ Direk Limmathuroksakul,^{1,3} Yoel Lubell,^{1,4} Andie S Lee,^{1,4} Stephan Harbarth,² Nicholas P J Day,^{1,4} Nicholas Graves,^{2,7} Ben S Cooper^{1,4}

Core Model	Provide infrastructure
	Education and training
	Feedback
	Reminders
	Institutional safety culture
Plus	Goal setting
	Reward incentives
	Accountability

Luangasanatip BMJ 2015;351:h3728

Hand Hygiene Rates per Electronic Monitoring Systems

Assessment of hand hygiene rates following installation electronic monitoring + multimodal QI program, 5 hospitals, Toronto



Electronic monitoring alone insufficient. Need a multimodal program for success.

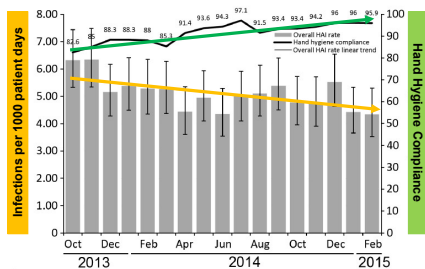
1. Engage HCPs to specify hand hygiene dispenser locations
2. Educate each unit about electronic monitoring and share baseline rates
3. Provide weekly reports to unit managers and staff on hand hygiene performance
4. Post visual reminders about the importance of hand hygiene
5. Create a safety climate

Leis, Clin Infect Dis 2020;71:e680-685

All Hands on Deck!



Better Hand Hygiene, Fewer Healthcare Associated Infections



Sickbert-Bennett, Emerg Infect Dis 2016;9:1628-1630

Question #4

You are sick and tired of having to put on gloves and gown every time you enter the room of a patient with a history of MRSA. You wonder: do contact precautions actually prevent infections?

- A. Contact precautions do little to prevent the spread of resistant bacteria
- B. Contact precautions prevent healthcare-associated infections
- C. The impact of contact precautions on infections with resistant bacteria remain unclear – need more longterm data
- D. Contact precautions will prevent infections but are associated with significant increased risk of psychological harm to patients
- E. Contact precautions prevent infections but only in surgical patients

VIEWPOINT

Contact Precautions for Endemic MRSA and VRE
Time to Retire Legal Mandates

POW!

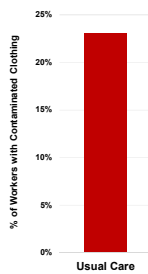
VIEWPOINT

The Importance of Contact Precautions for
Endemic Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant Enterococci

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Clothing Contamination



- Most common pathogens:
 - Staph aureus*
 - Enterococcus sp.*
 - Stenotrophomonas*
 - Pseudomonas*
 - Acinetobacter*
 - Enterobacter*
 - Klebsiella*

Williams, *Infection Control Hospital Epidemiol* 2015;36:431-437

Contact Precautions

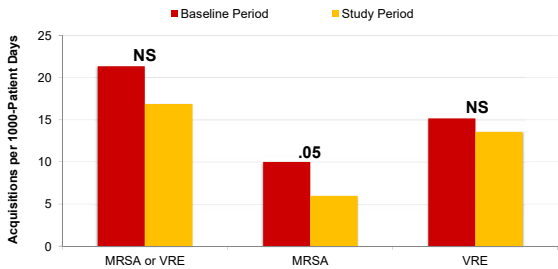


- Expensive
- Onerous
- Diminish patient contact
- More non-infectious adverse events
- More depression and anxiety
- Lower patient satisfaction

Am J Infection Control 2009;37:85-93

Universal vs Targeted Contact Precautions in ICUs

Cluster-randomized trial in 20 ICUs of gloves & gowns for all patients versus colonized patients alone



Harris, *JAMA* 2013;310:1571-80

Universal vs Targeted Contact Precautions

Cluster-randomized trial in 20 ICUs of gloves & gowns for all patient encounters versus usual care

- Universal gloves and gowns also associated with:
 - Less healthcare worker entries into patients' rooms
 - 4.3 vs 5.2 entries per hour, $P=.02$
 - No difference in adverse events
 - 59 vs 74 events per 1000 patient-days, $P=.24$
 - Equivocal effect on hand hygiene
 - No change in room entry compliance (56% vs 50%, $P=.42$)
 - Higher room exit compliance (78% vs 63%, $P=.02$)

JAMA 2013;310:1571-80

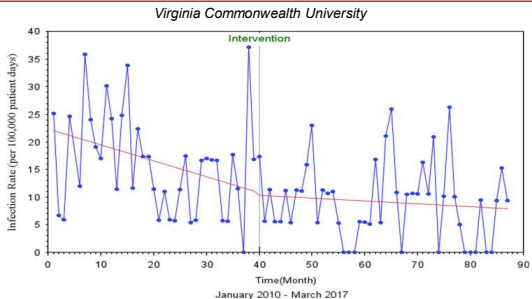
Elimination of Routine Contact Precautions for Endemic Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant *Enterococcus*: A Retrospective Quasi-Experimental Study

Evaluation of Vancomycin-Resistant Enterococci (VRE)–Associated Morbidity Following Relaxation of VRE Screening and Isolation Precautions in a Tertiary Care Hospital

Impact of Discontinuing Contact Precautions for Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant *Enterococcus*: An Interrupted Time Series Analysis

Evaluation of contact precautions for methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus*

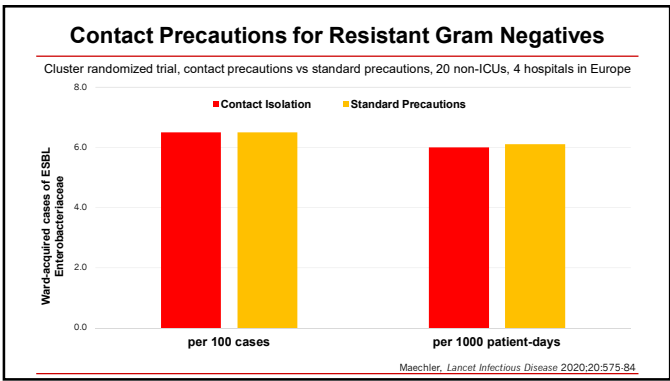
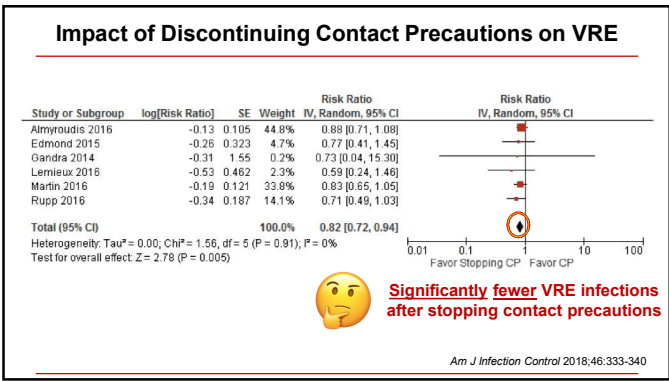
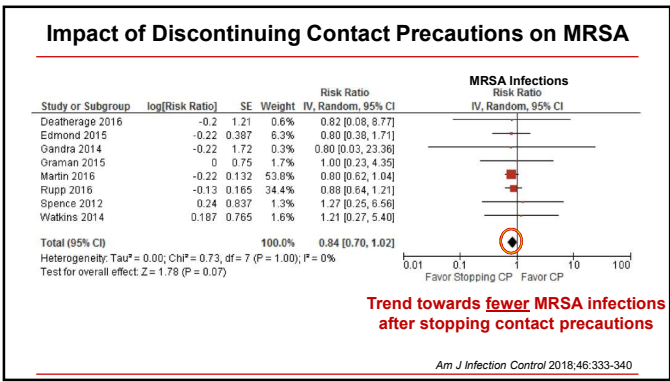
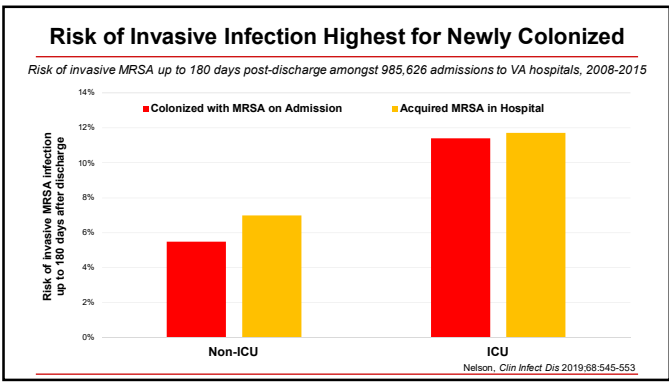
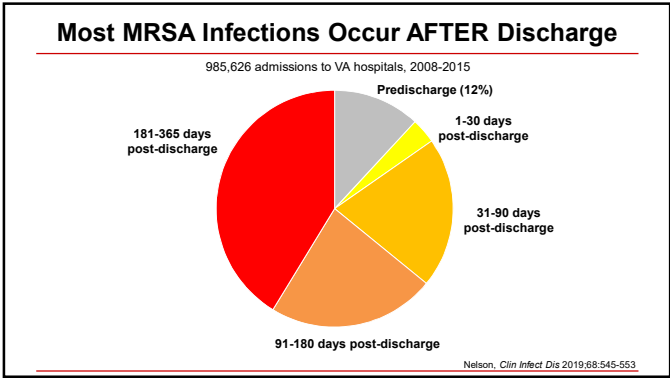
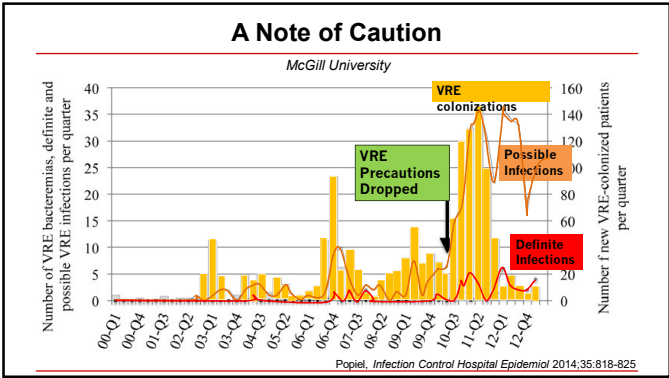
Discontinuing Contact Precautions for MRSA and VRE



Infection Control Hospital Epidemiol 2018;39:676-682

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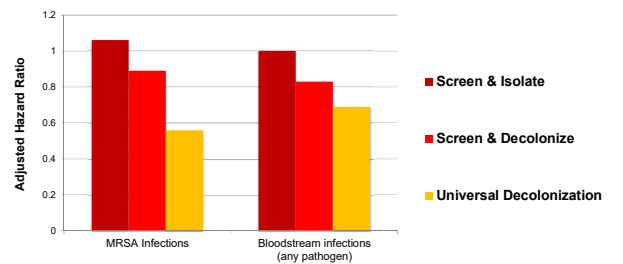
Speaker: Michael Klompas, MD

Limitations

- Most studies single center
- All studies observational
- Limited duration of follow up
- No active surveillance to detect silent transmission
 - Most studies track HAI rates rather than new colonization
- Low event rates and thus limited power
- Limited data on parallel interventions
 - Hand hygiene rates, chlorhexidine bathing, quality of environmental cleaning, etc.

Decolonizing patients may be better than isolating carriers

Cluster randomized trial of **MRSA screen & isolate** vs **screen & decolonize** vs **decolonize everyone**; 74 ICUs, 43 hospitals

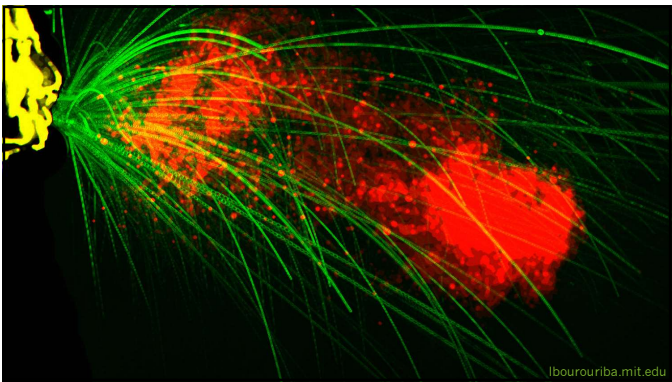


Huang et al. NEJM 2013;368:2255-65

Question #5

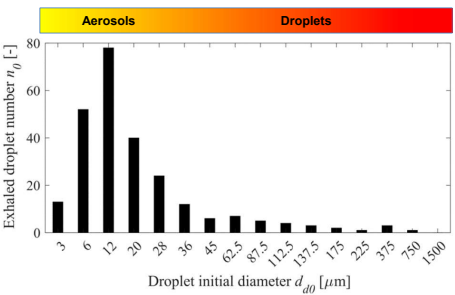
Your vaccinated co-worker is convinced she caught SARS-CoV-2 at work despite adhering to the hospital's policy requiring all healthcare workers to wear a surgical mask for all patient encounters. She did care for a patient who was diagnosed with SARS-CoV-2 infection on hospital day 4 following an elective admission for breast surgery. Your boss asks if it is possible your co-worker was infected by this patient despite wearing a surgical mask?

- A. No, surgical masks provide excellent protection against respiratory viruses
- B. No, breakthrough infections are very unusual in vaccinated people
- C. No, SARS-CoV-2 in HCWs is almost always acquired outside the hospital
- D. Yes, surgical masks provide partial protection against respiratory viruses
- E. Yes, surgical masks do not provide any protection against respiratory viruses



lbounouriba.mit.edu

People Produce Respiratory Particles in a Range of Sizes



Chen, Building and Environment 2020;176:106859

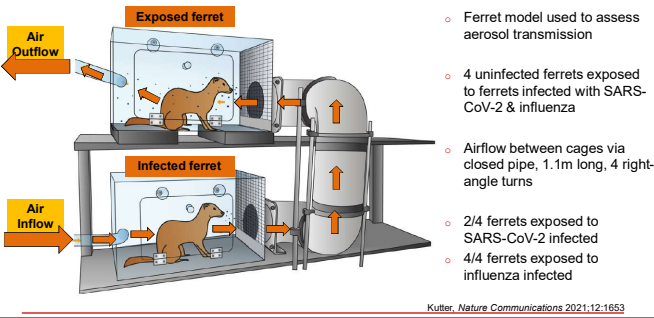
Respiratory Viruses Recovered from Air Samples in Clinics and Hospitals

SARS-CoV-2
Influenza
RSV
Rhinovirus
MERS...

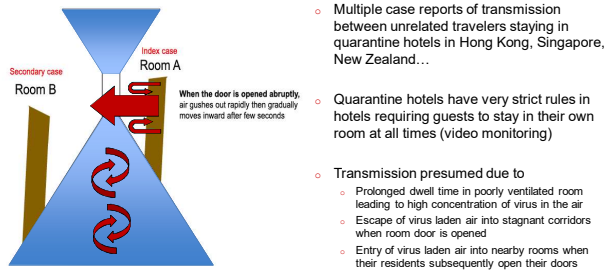
Wang, Infection Control Hospital Epidemiol 2022; PMID 35811422
Borghard, JAMA Network Open 2020;3:e2033232
Rhee, Infect Control Hospital Epidemiol 2020;41:239-268
Kim, Clin Infect Dis 2019;68:363-8

photo: phl.cdc.gov/phl/details.asp?id=11162

Transmission via Aerosols



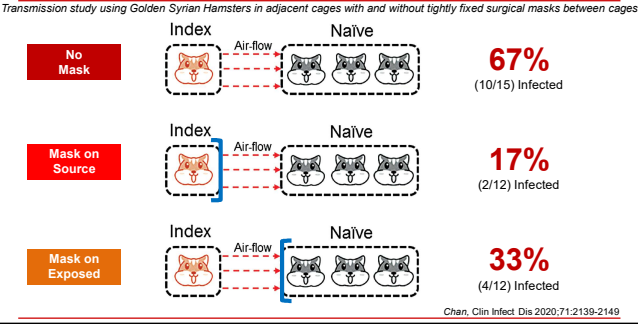
Aerosol Transmission in Humans: Quarantine Hotels



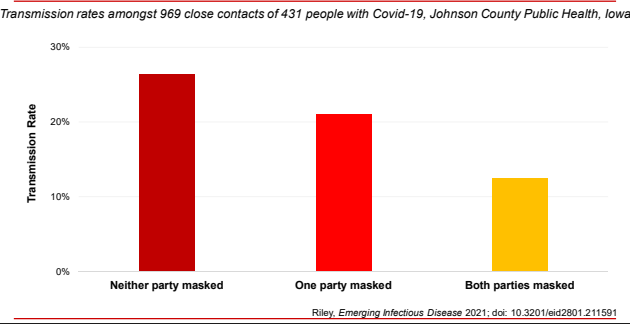
How good is your surgical mask?



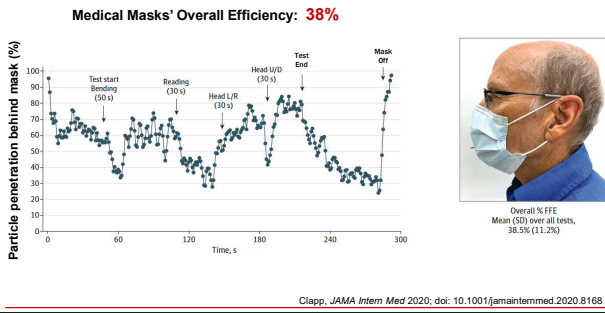
Medical Masks are Good! ... But Not Perfect

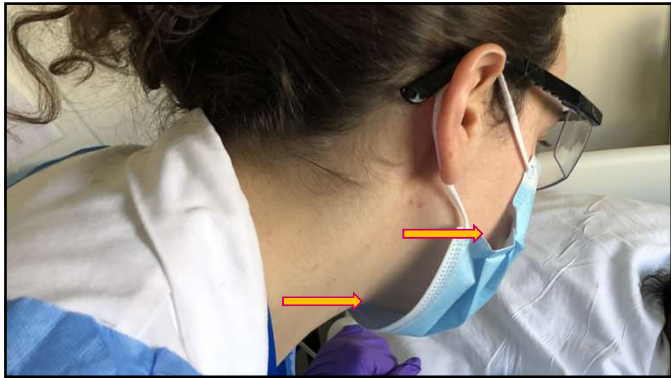


Masking Effectiveness in Practice



Mask Filtration Efficiency in Practice





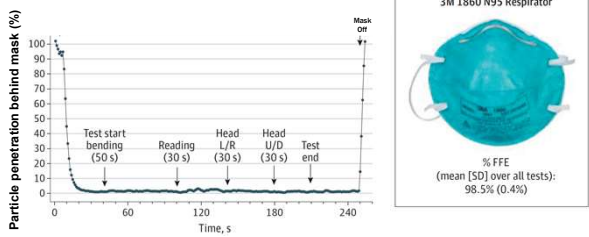
Transmission To and From HCWs Despite Masks

- We have documented multiple instances of transmission to healthcare workers despite masks & eye protection
- All transmissions confirmed by whole genome sequencing (0 SNP differences)
 - Patient to CT tech (10 min interaction)
 - Patient to video swallow technician (45 mins)
 - Asymptomatic inpatient to two patient care assistants (4-8 hours)
 - Presymptomatic nurse to patient (2 shifts)
 - Presymptomatic outpatient to physician (45 mins, both parties masked)

Klompas, Ann Intern Med 2021; doi.org/10.7326/M20-7567
Klompas, Clin Infect Dis 2021; doi.org/10.1093/cid/ciab218

We Have the Solution!

N95 Respirators' Overall Efficiency: 98%

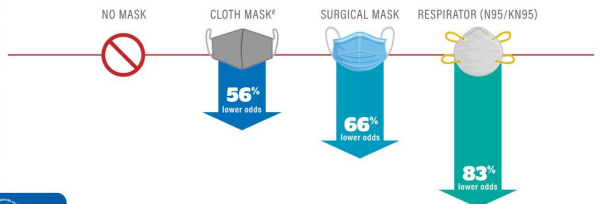


Sickbert-Bennett, JAMA Intern Med 2020; doi: 10.1001/jamainternmed.2020.4221

People who reported always wearing a mask in indoor public settings were less likely to test positive for COVID-19 than people who didn't*

WEARING A MASK LOWERED THE ODDS OF TESTING POSITIVE

Among 534 participants reporting mask type^a



bit.ly/MMWR7106

* Matched case-control study, 1,839 people, Feb 15–Dec 1, 2020
† Compared people with similar characteristics (e.g., vaccination)
‡ Not statistically significant

MMWR

Question #6

Which of the following healthcare workers is at greatest risk of getting infected with SARS-CoV-2 by a patient?

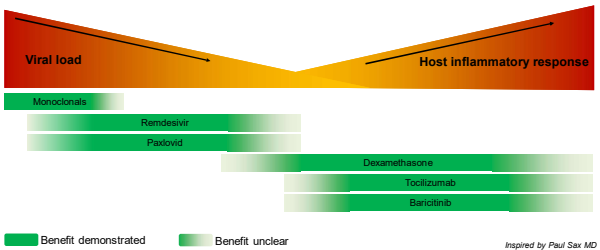
- A. Anesthesiologist performing intubations for elective surgeries (patients tested within 72h of procedure, PPE = surgical mask)
- B. Nurse working in a COVID ICU looking after patients on high flow O2 (PPE = N95, eye protection, gown, gloves)
- C. Psychiatrist counselling healthy outpatients in person in her office (PPE = surgical mask)
- D. Food services worker dropping off food trays for patients in Covid and non-Covid rooms. (PPE = surgical mask)

The Sickest are Sometimes the Least Contagious

Early Infection
Fever, myalgia, fatigue

Pulmonary Phase
Shortness of breath, cough, hypoxia

Hyperinflammatory Phase
ARDS, myocarditis, renal failure, neuro syndromes



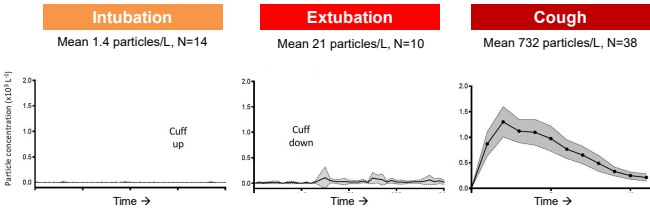
Inspired by Paul Sax MD

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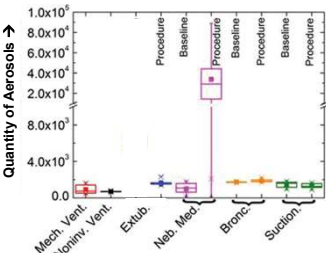
How many aerosols does intubation generate?

Continuous aerosol monitoring using an optical particle sizer in an operating room



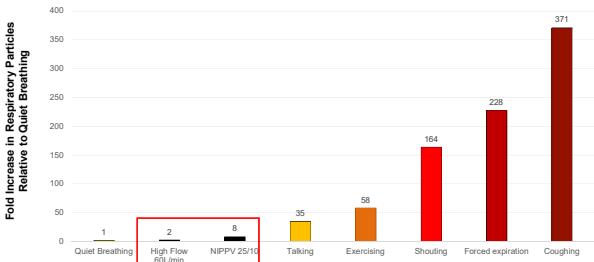
Brown, *Anesthesia* 2021;76:174-181

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

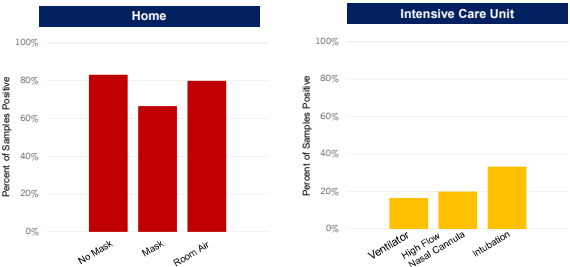
Impact of High Flow O2 on Respiratory Emissions



Wilson 2021, medRxiv, doi: 10.1101/2021.02.07.21251309

SARS-CoV-2 Air Sampling: ICU vs Home

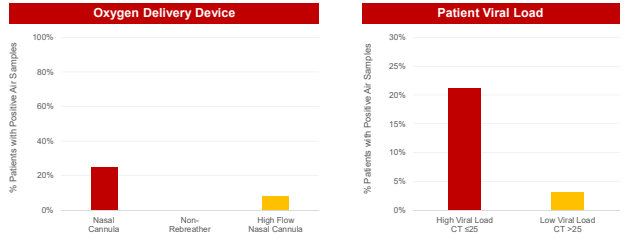
Air sampling for SARS-CoV-2 RNA in rooms of Covid positive patients in ICU vs home



de Man, *J Hospital Infection* 2021; doi: 10.1016/j.jhin.2021.10.018

Air Sampling for SARS-CoV-2

Room air samples obtained from 75 patients hospitalized with Covid-19; tested for SARS-CoV-2 RNA

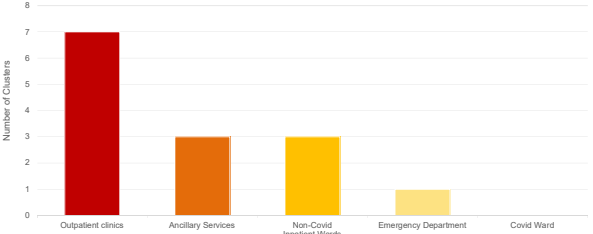


Air positivity for SARS-CoV-2 correlates with patient viral load, not with oxygen delivery device!

Janssen, *J Hosp Infection* 2022;123:87-91

Where do nosocomial clusters occur?

Whole genome sequencing analysis of 14 clusters, 117 infections (112 HCWs, 5 patients), VA Northeast Ohio Cluster defined as ≥3 potentially-related infections



Jinadatha, *Open Forum Infect Dis* 2021; doi.org/10.1093/ofid/ofab328

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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

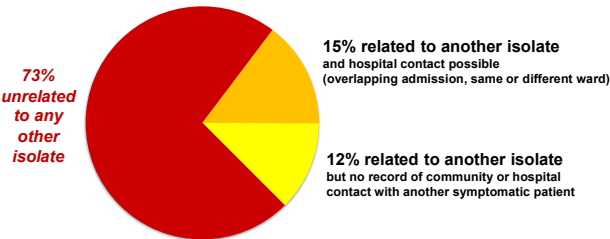
Question #7

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 toilet seat of the shared bathroom in his room
- C. From the food provided by the hospital
- D. From the community (already colonized on admission)

Where do patients get *C.difficile*?

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



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

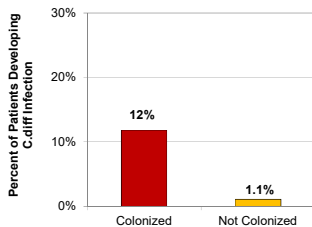


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C.diff Colonization in ICU Patients and Progression to Infection

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



Infect Control Hospital Epidemiol 2015;36:1324-1329

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

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

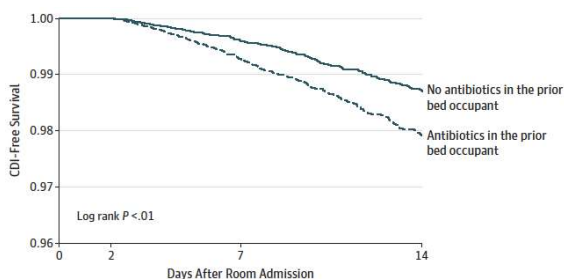
Prior Room Occupant Flagged for *C.diff* 11.0%

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

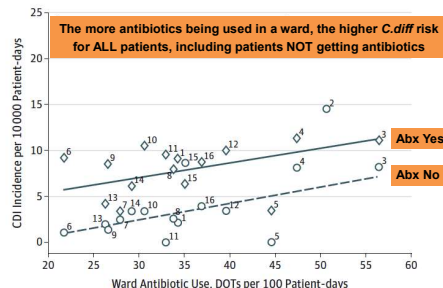
Impact of Prior Bed Occupant's Antibiotic History and Current Bed Occupant's C.diff Risk



JAMA IM 2016;176:1801-1808

Ward Level Antibiotic Use and C.diff Risk

The more antibiotics being used in a ward, the higher *C.diff* risk for ALL patients, including patients NOT getting antibiotics



JAMA IM 2015;175:626-633

Question #8

2022 PREVIEW QUESTION

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 and all 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

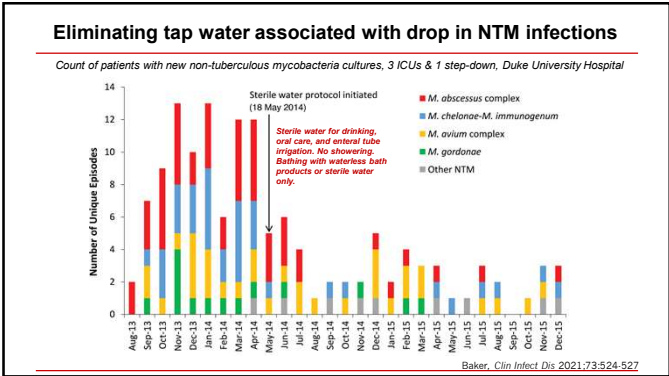
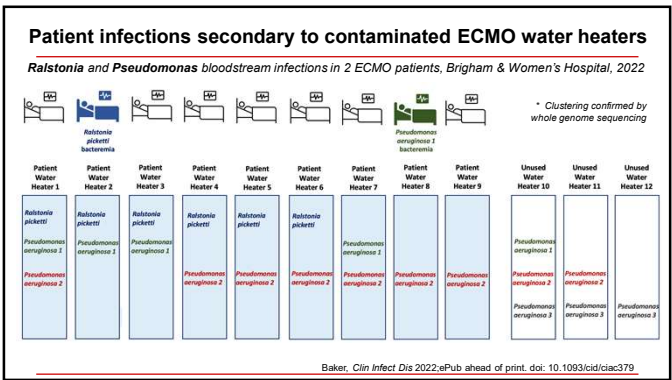
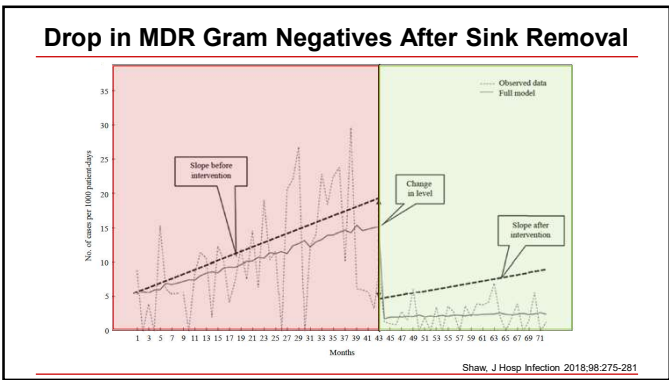
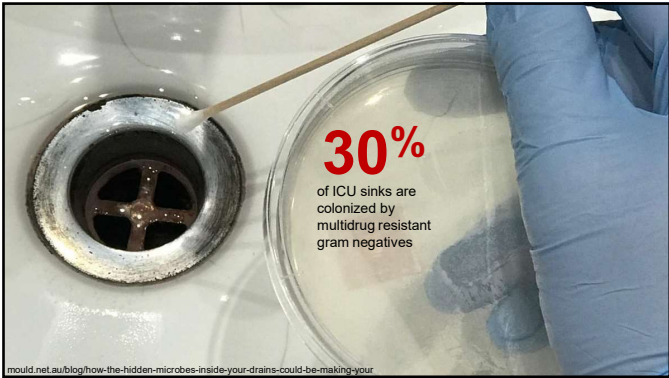
- Burkholderia cepacia*
- Pseudomonas aeruginosa*
- Stenotrophomonas maltophilia*
- Legionella pneumophila*
- Serratia marcescens*
- Non-tuberculous mycobacteria*
- +/- *Acinetobacter baumannii*
- Enterobacterales species

Think:

Respiratory care equipment
Contaminated sink drains
Contaminated medications
Heating & cooling devices
Decorative water displays
etc.

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Question #9

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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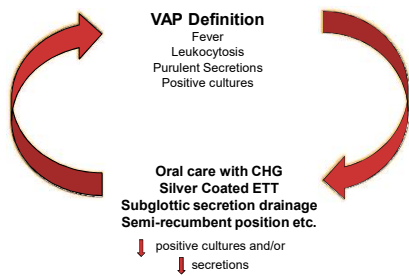
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The VAP Prevention Paradox

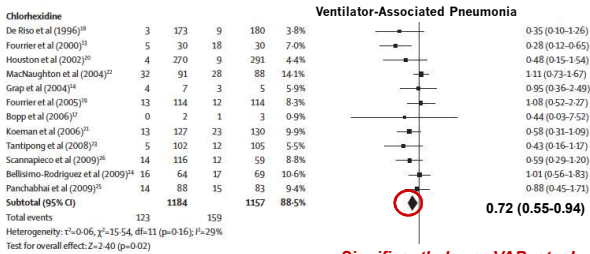
	VAP Rates	Vent Days	ICU Days	Hospital Days	Death
Oral care with chlorhexidine	↓	—	—	—	—
Silver-coated endotracheal tubes	↓	—	—	—	—
Subglottic secretion drainage	↓	—	—	—	—
Head-of-bed elevation	↓	—	—	—	—

Klompas, Critical Care 2009;13:315

Circularity Between VAP Prevention Practices and the VAP Definition



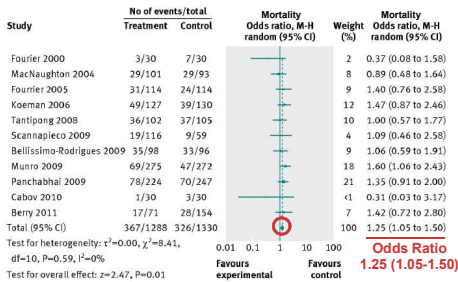
Oral Care with Chlorhexidine: Significantly **Lower** VAP Rates



Significantly lower VAP rates!

Lancet Infectious Disease 2011;11:845

Oral Care with Chlorhexidine: Significantly **Higher** Mortality Rates



BMJ 2014;348:g2197

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 #10

You are part of a multidisciplinary team that has been working diligently to implement processes and practices to lower 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

23 – Hospital Epidemiology

Speaker: Michael Klompas, MD

Essential Practices to Prevent Line Infections

Before insertion

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



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

Essential Practices to Prevent Line Infections

At insertion

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



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

Essential Practices to Prevent Line Infections

After insertion

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



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

Question #11

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 + 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

Best Practices to Prevent Surgical Site Infections

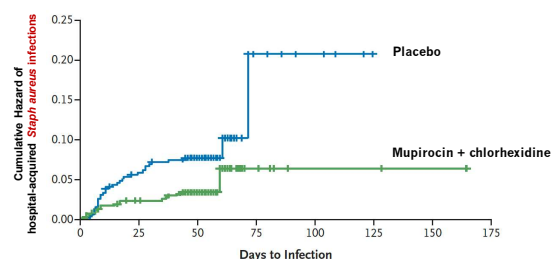
- o Shower or bathe with soap or antiseptic before surgery
- o Use antimicrobial prophylaxis before surgery only
- o Use an alcohol-based agent for skin preparation
- o Do not apply topical antimicrobials to the surgical incision
- o Maintain blood glucose <200 mg/dL during surgery
- o Warm patients to maintain normothermia during surgery
- o Increase the fraction of inspired oxygen during surgery and after extubation in patients with normal pulmonary function



Berrios-Torres, JAMA 2017;152:784-791

Staph aureus screening & decolonization

917 hospitalized patients with positive *Staph aureus* nasal screens randomized to decolonization vs placebo



Bode, NEJM 2010;362:9-17

23 – Hospital Epidemiology

Speaker: Michael Klompas, MD

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. You are driven to do all you can to protect her from hospital complications. 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. Start prophylactic cranberry extract
- 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

Recommendations to Prevent CAUTI

- Conduct daily assessment of the presence and need for indwelling urinary catheters
- Avoid using indwelling urinary catheters by using alternative urine-collection / measurements strategies
 - external suction catheters
 - condom catheters
 - daily weights for volume changes
 - bladder scanners
 - intermittent straight catheterization
- Aseptic technique for insertions
- Careful catheter maintenance
 - Use a closed system.
 - Replace if breaks in the closed system
 - Keep drainage bag below bladder
 - Empty bags q.shift and before transport
 - Do not pre-emptively change catheters to prevent infection
- Regular surveillance and feedback of infection rates

**Does your patient
really need that
catheter?**

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

Summary

- Pneumonia is the most common hospital-acquired infection
- *C. difficile* is the most common hospital-acquired pathogen
- Hand hygiene rates are inversely associated with HAI rates
- Improving hand hygiene requires multimodal methods & "all hands on deck"
- Hands, clothing, and equipment commonly contaminated by bacteria
- Contact precautions are most effective against skin-based organisms
- Stopping contact precautions doesn't clearly increase infections but most studies to date have not looked at long term outcomes
- 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.
- 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.

BRIGHAM HEALTH
FIRST BRIGHAM AND
WOMEN'S HOSPITAL

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