

## ICU Design and Infection Prevention

*Annual Board Review and Update in Pulmonary and Critical Care Medicine*  
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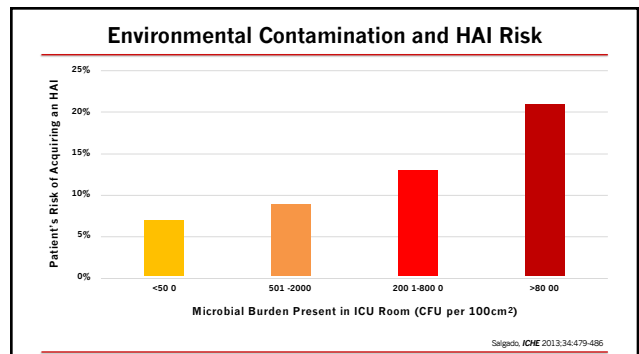
### Disclosures

- **Grant funding**
  - US Centers for Disease Control and Prevention (CDC)
  - Agency for Healthcare Research and Quality (AHRQ)
  - Massachusetts Department of Public Health
- **Royalties**
  - UpToDate, Inc.

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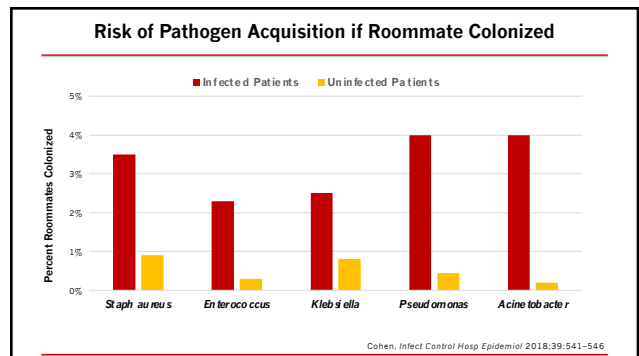
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### Odds of Pathogen Acquisition Based on Prior Room Occupant's Colonization Status

MRSA	VRE	C.difficile
<b>Risk 1.4 to 2.9 Times Higher</b>	<b>Risk 1.6 to 2.4 Times Higher</b>	<b>Risk 2.6 Times Higher</b>

J Hospital Infection 2015;91:211-217

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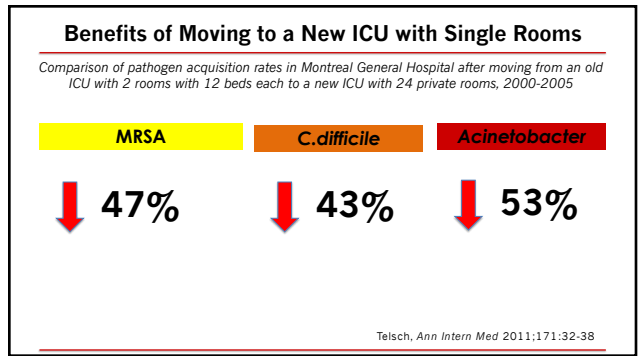
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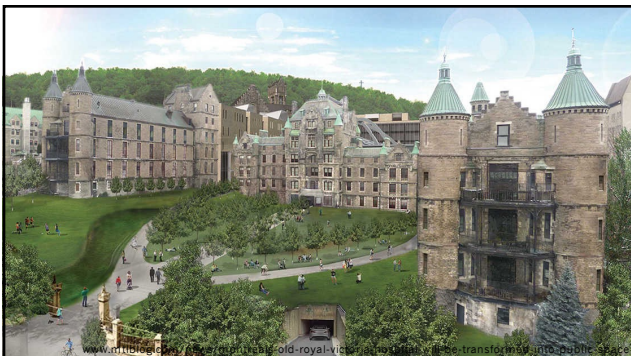
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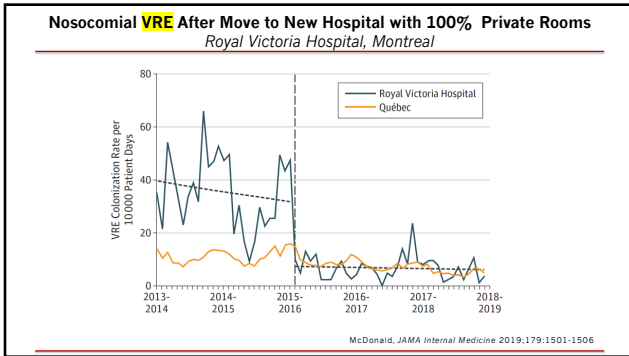
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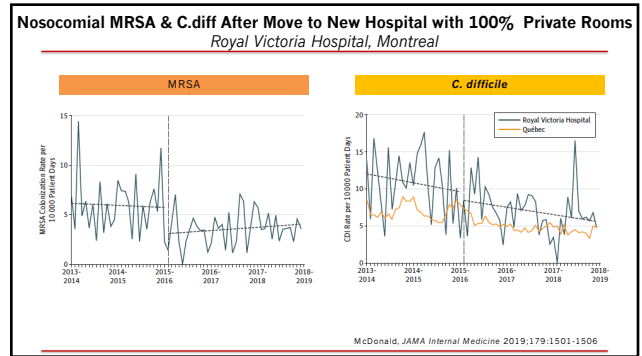
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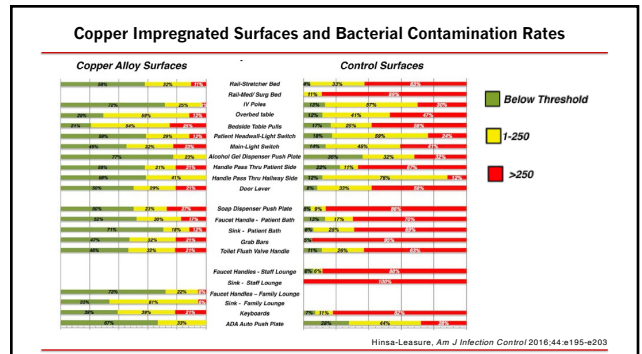
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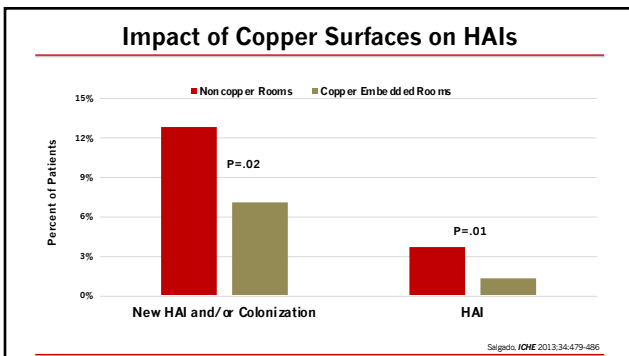
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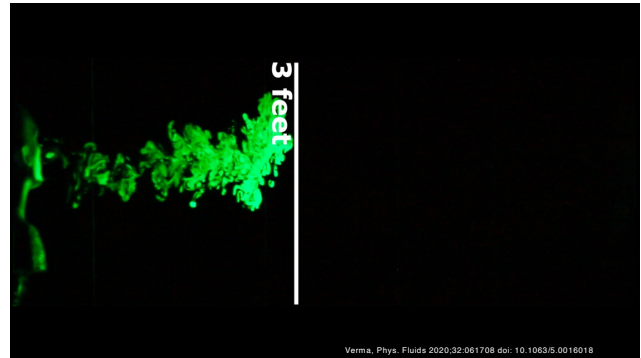
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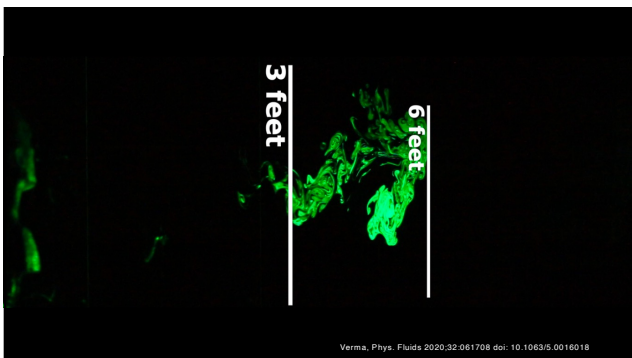
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### Transmission Risk in Shared Hospital Rooms

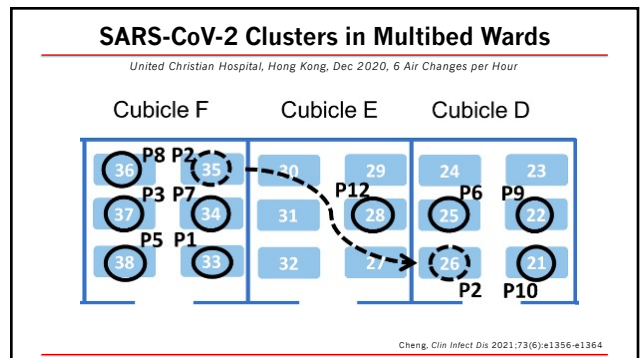


- Brigham & Women's Hospital, Sept 2020 - April 2021
- 25 patients diagnosed with SARS-CoV-2 after admission to a shared room
- 31 potentially exposed roommates
- Roommates ~7 feet apart and separated by a curtain
- ≥6 air changes per hour
- Median duration of exposure: 18 hours (IQR 12-47 hours)
- 12/31 (39%) roommates infected

**39% of exposed roommates were infected**

Karan, Clinical Infectious Diseases 2021; doi: 10.1093/cid/ciab564

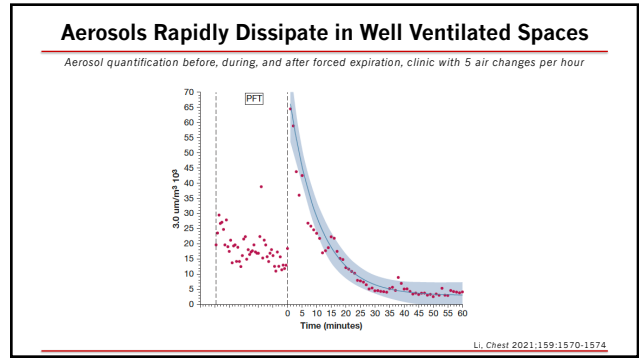
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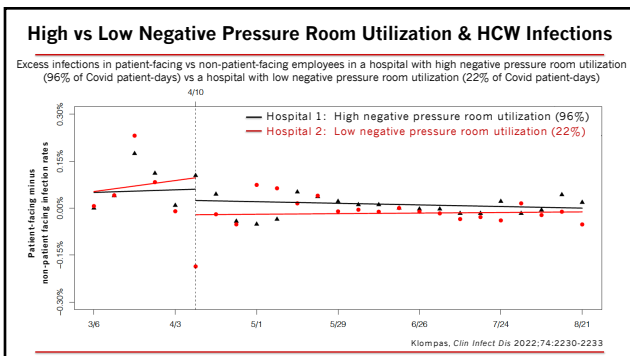
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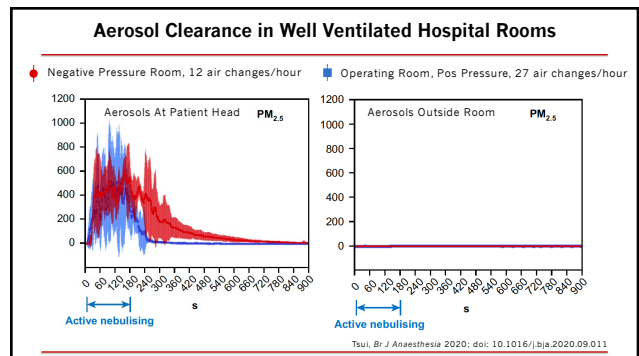
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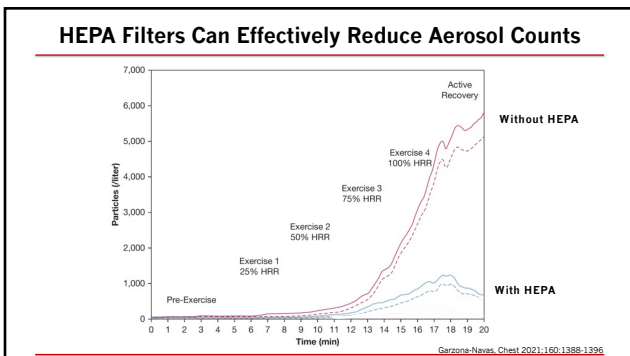
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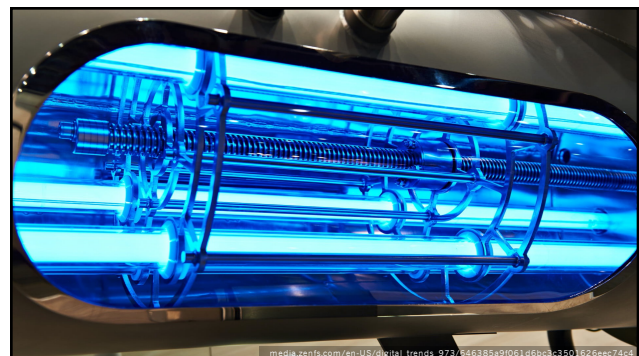
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### Upper Room Germicidal UV using Far-UVC (222nm)

- Far UVC light may be a feasible option to decrease airborne virus
- Active against airborne respiratory viruses including coronavirus
- Cannot penetrate the stratum corneum or the ocular tear layer so may be safe for prolonged human exposure

Beta HCoV-OC43 in normal human lung WI-38 fibroblasts  
Green = Anti-human coronavirus spike glycoprotein; Blue= DAPI

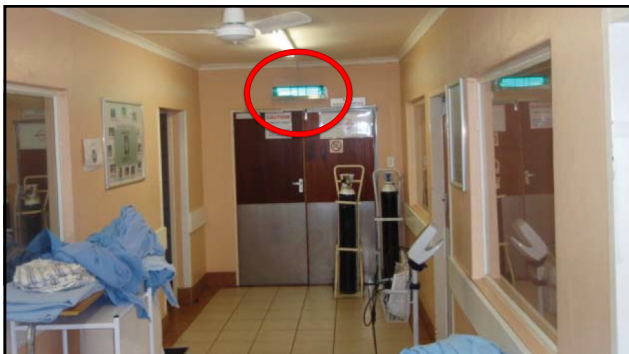
a) 0 mJ/cm²      b) 0.5 mJ/cm²  
c) 1 mJ/cm²      d) 2 mJ/cm²

Buonanno, Scientific Reports 2020; doi: 10.1038/s41598-020-67211-2

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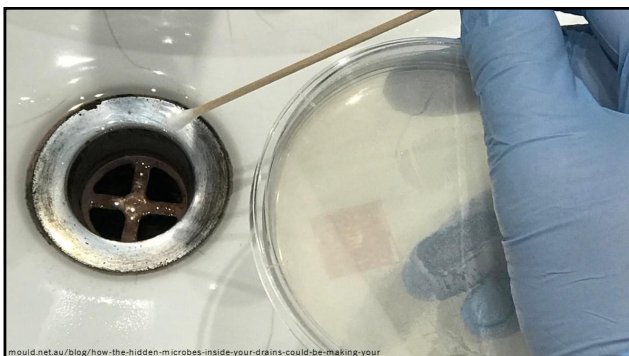
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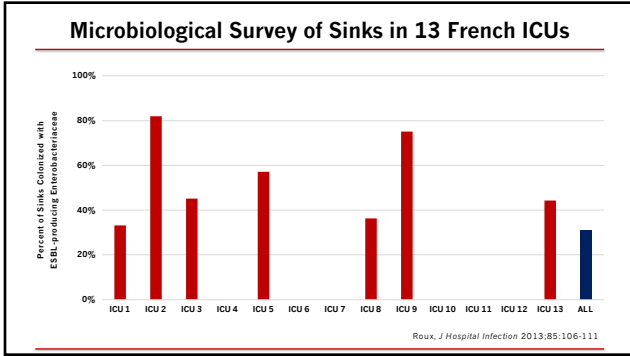
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### Sink Drains

- Sink and drains in ICUs are frequently colonized with multidrug resistant bacteria
  - Pseudomonas
  - Acinetobacter
  - Carbapenem resistant Enterobacteriaceae
  - Serratia...
  - Non-tuberculous mycobacteria
  - Mold

Kirby Gordon, Clin Infect Dis 2017;64:1435-44

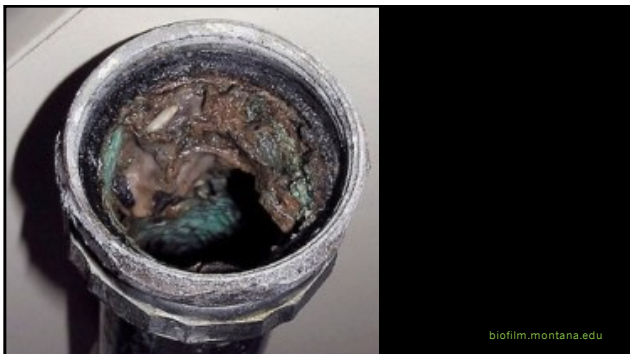
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**c.**

**University of Virginia**

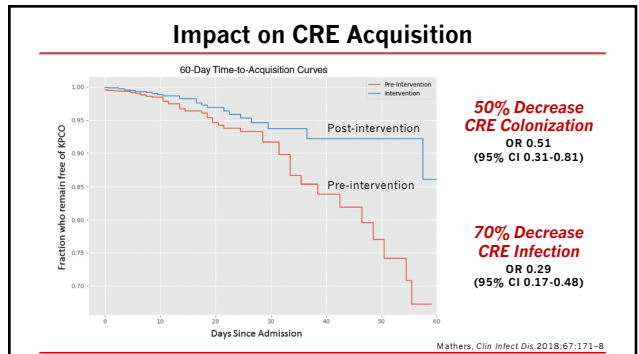
- Initiative to combat nosocomial acquisition of Carbapenem-resistant Enterobacteriaceae
- Installed sink trap heating & vibration devices in their ICUs
- Heats the sink trap to 75-85°C
- Added covers to disposal hoppers

Mathers, Clin Infect Dis 2018;67:171-8

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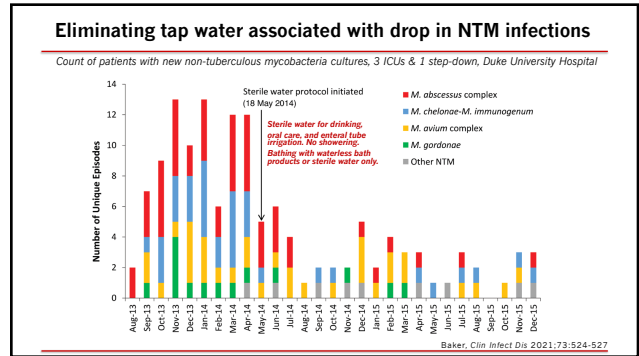
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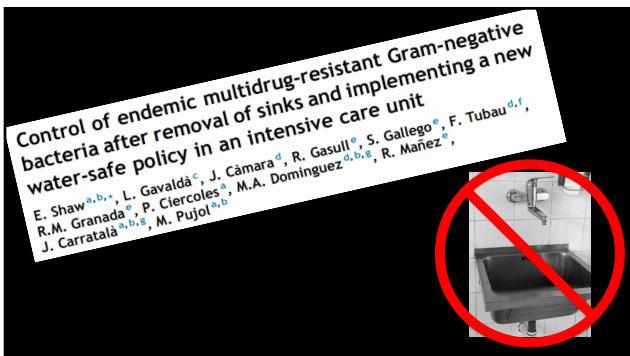
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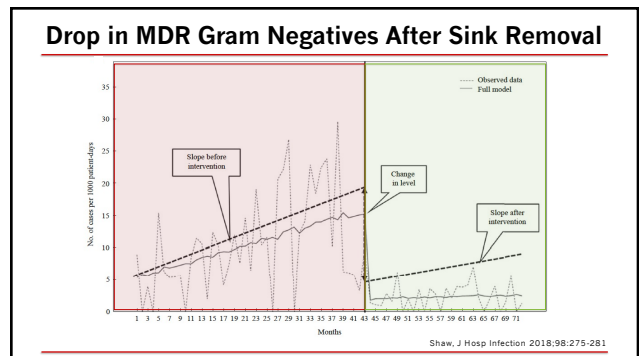
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### Summary: Design Considerations Affect Infection Risk

- Surface contamination**
  - Single rooms strongly preferred
  - Consider microbe-resistant surfaces
- Airborne contamination**
  - Single rooms +/- Airborne Infection Isolation Rooms
  - Protected Environments
  - Upper room germicidal UV?
- Water contamination**
  - Careful sink design
  - Waterless ICU

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### Thank You!

**For all the lives we touch**

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

BRIGAM HEALTH  
BRIGHAM AND WOMEN'S HOSPITAL

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LIVES TOUCH

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