

## Hotel Microbiology

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## Today's Topics

- Organisms associated with outbreaks in hotels
- Importance of fomites in spread of pathogens
- Norovirus outbreaks in hotels: case examples involving fomites
- Bacterial hotspots in hotels
- Movement of virus in a hotel
- Impact of interventions on virus spread

## Results

- Virus detected
  - Next four rooms cleaned by the maid
  - On surfaces (table tops) in the conference room
  - On 1/3 of the conference attendees hands
  - On the coffee pot handle of the breakfast area



## Why Hotels?

- Large number of persons in one place
- Number of persons change daily
- Persons come from different regions all over the world
- Exposure occurs over days/weeks
- Major cost to hotels (closure, clean-up, lost business)
- Challenging in terms of infection control

## Vehicles of Exposure (Hotel Outbreaks)

- Food
- Food Handlers
- Water (aerosols)
- Fomites
- Swimming pools
- Hot tubs
- Lobby Water Fountains
- Air conditioning systems

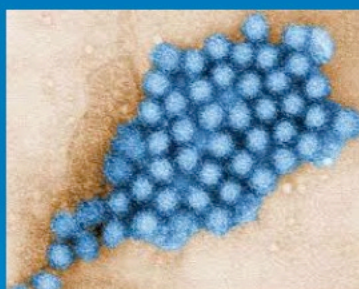
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## Organisms Most Commonly Associated with Documented Outbreaks in Hotels

Legionella



Norovirus



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## The Curse of the Cruise Ships



- Floating hotels (have to report outbreaks of norovirus)
- >50 outbreaks of norovirus
- One documented outbreak of influenza on a long cruise

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## The Gamblers Grunts



- **Channel 10 News, Ashville**
- **Jan. 20, 2010**
- Workers at Harrah's Casino in Cherokee are battling a virus that's sickened nearly 250 people.
- A cleaning crew is wiping down more than 3,000 slot machines with a bleach and water mix. Door knobs, escalator handrails and restrooms are also sanitized hourly.

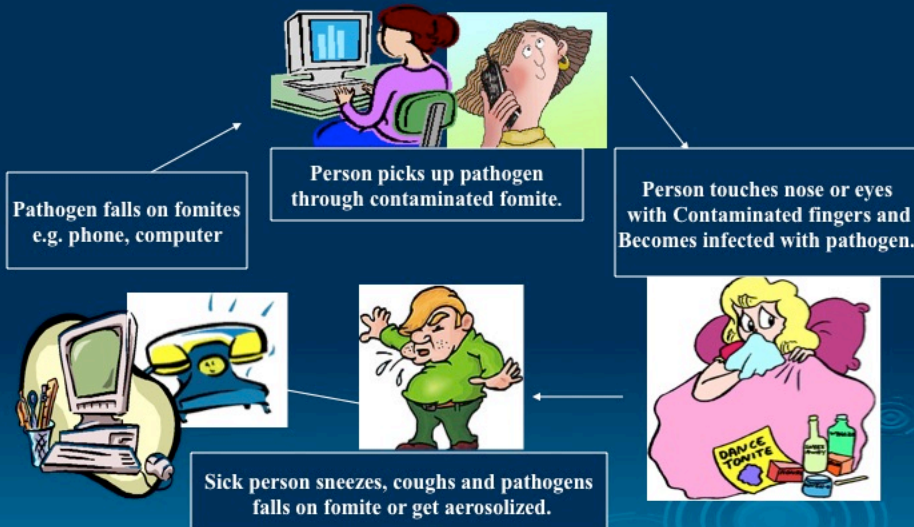
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## What are Fomites?

- > Inanimate objects involved in the spread of disease



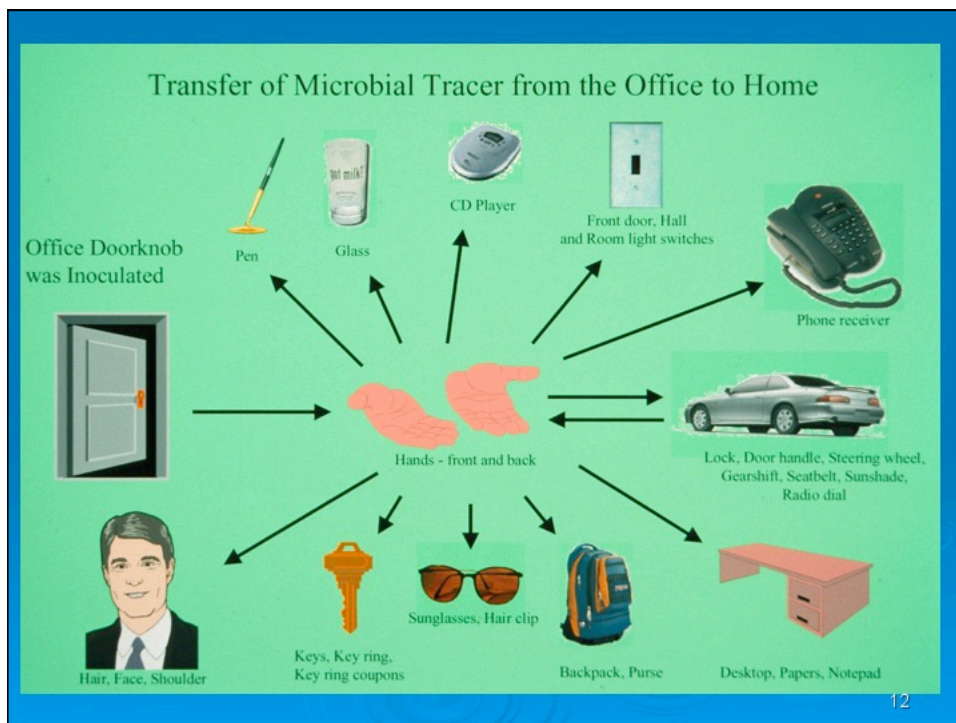
## Role of fomites in transmission of a disease



## Hand Contact in Adults

➤ Adults touch their face 15.5 times per hour

- 2.5 eyes
- 5 nose
- 8 lip



## How Efficient is Transfer?

(Lopez et al, 2009)

- Type of suspending media
  - Greater transfer when suspended in feces than phosphate buffered saline
- Hand/object contact
  - Type of interaction with object (i.e. doorknob vs. push button)
  - Finger vs. hand



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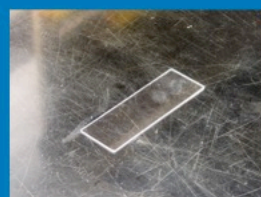
## Fomites – not all the same



Acrylic



Ceramic tile



Glass

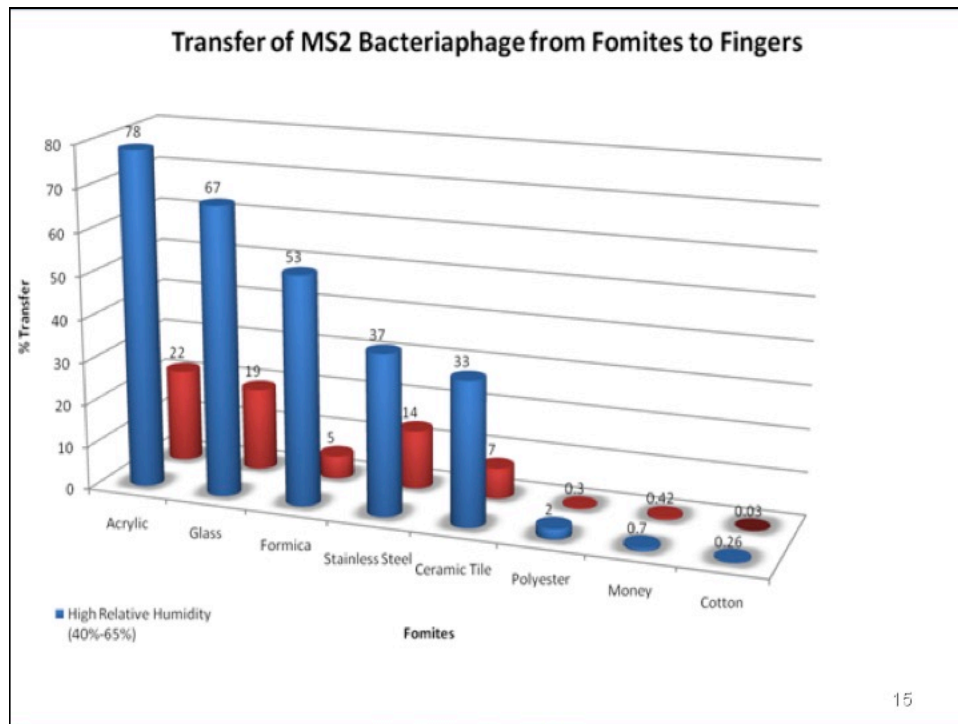


Stainless steel



Formica

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## Hotel Outbreaks – Case Examples

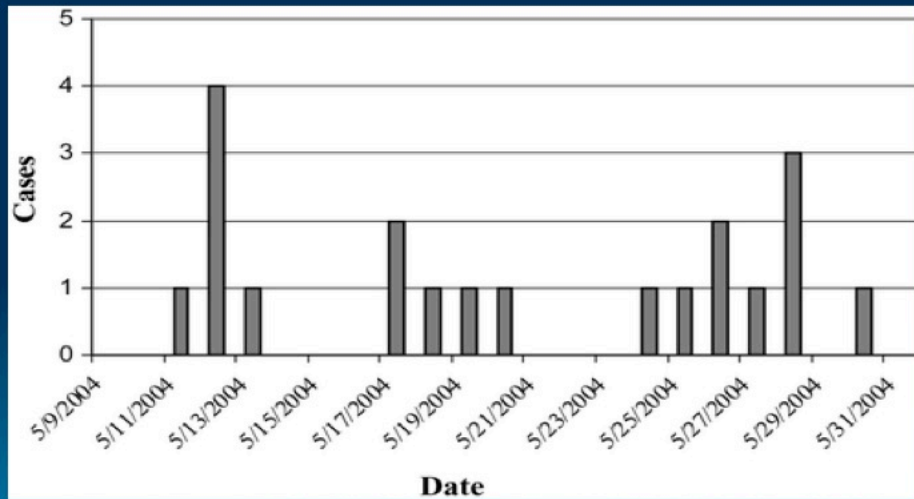
### Houseboats



- Jones, et al. 2007. The role of fomite contamination during an outbreak of norovirus on houseboats. *Intl. J. Environ. Hlth.* 17: 1-9.
- Same houseboats rented to elder hostel group
- Rented to three different groups over a month
- Groups had no contact
- Norovirus outbreaks occurred on all groups



## Norovirus – House boat Outbreak



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## Detection of Norovirus on Houseboat Fomites

norovirus RT-PCR  
swab sample results  
(n = 20) by surface  
type and boat number.

|                               | Bathroom surfaces                        | Kitchen surfaces                         | Door handles                             |
|-------------------------------|--|--|--|
| Boat number                   | Total no. of samples/<br>no. of positive | Total no. of samples/<br>no. of positive | Total no. of samples/<br>no. of positive |
| 1                             | 2/1                                      | 1/1                                      | 1/1                                      |
| 2                             | ns                                       | ns                                       | 1/1                                      |
| 3                             | 4/4                                      | 2/0                                      | 1/1                                      |
| 4                             | ns                                       | 2/1                                      | Ns                                       |
| 5                             | ns                                       | ns                                       | Ns                                       |
| 6                             | ns                                       | ns                                       | Ns                                       |
| <b>Total percent Positive</b> | <b>83%</b>                               | <b>40%</b>                               | <b>100%</b>                              |

ns, not sampled.

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## Prolonged Outbreak of Norovirus in a Hotel

- Cheeseburgh et al 2000. epidemiol. Infect. 125:93-98
- Outbreak of norovirus over a six month period
- Fomites positive for norovirus
  - Carpet (recent vomit) -62%
  - Carpet (no vomit) -75%
  - Toilet hands ,taps, basins – 39%
  - Phones, door handles , -24%
  - Cushions, curtains – 20%

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## Outbreak of Norovirus Associated with Environmental Contamination in a Hotel

- Kimura et al 2011. Epidemiol. Infection . 139:317-325.
- Outbreak began on two widely spread floors after vomiting incidences
- The infection among guests spread widely on the two floors after cleaning by staff.

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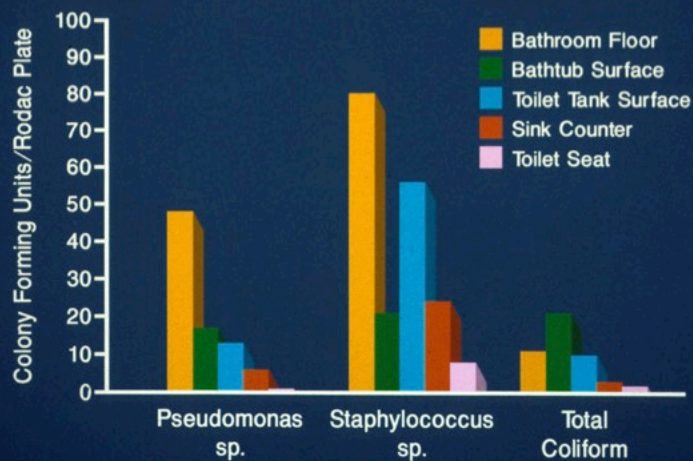
## Bacterial Hotel Hot Spots



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## Hotel Study - Tucson, AZ

### Numbers of Different Bacteria Found on Hotel Bathroom Surfaces



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## Hotel Study - Tucson, AZ

### Total Bacterial Numbers Found in Bathrooms of Different Hotel Groups



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### TV Remote Controls\*

| Total Bacteria                        | Coliforms | <i>E. coli</i> | Semen |
|---------------------------------------|-----------|----------------|-------|
| 2,500 to 430,000 Colony forming units | 37.5 %    | 12.5%          | 18.2% |

16 tested for bacteria and 11 for semen

MRSA detected on one remote

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Typical Remote – difficult to clean and disinfect

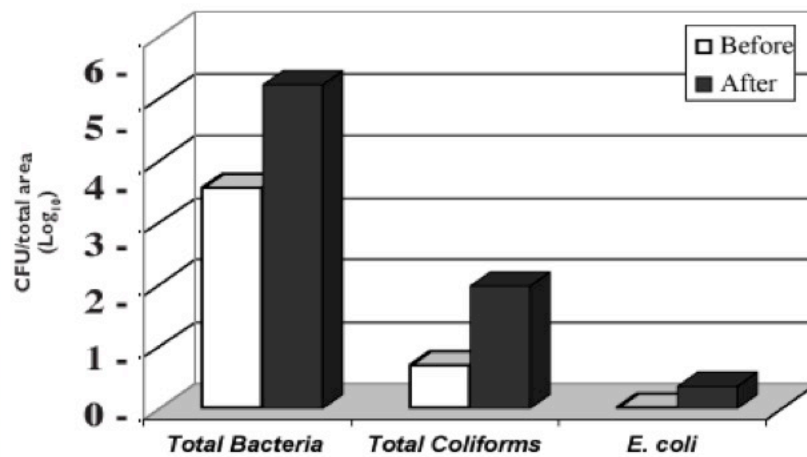


Flat faced remote – easy to disinfect and clean

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### Impact of Wiping Table Top in Restaurants with Cleaning Cloths in Hotels

FIGURE 3. Bacteria found on tabletops before and after cleaning in restaurants



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## What's on Your Coffee Cup Lid?

|        | Total Bacteria/<br>lid | Coliform<br>Identifications |        | Total Bacteria/<br>lid | Coliform<br>Identifications |
|--------|------------------------|-----------------------------|--------|------------------------|-----------------------------|
| Sample |                        |                             | Sample |                        |                             |
| 1      | 820                    |                             | 16     | 810                    |                             |
| 2      | 550                    | Enterobacter cloacae        | 17     | 1.90E+03               |                             |
| 3      | <10                    |                             | 18     | 20                     |                             |
| 4      | 430                    |                             | 19     | 10                     |                             |
| 5      | 10                     |                             | 20     | 140                    |                             |
| 6      | <10                    |                             | 21     | 10                     |                             |
| 7      | 20                     |                             | 22     | 30                     |                             |
| 8      | 330                    |                             | 23     | 50                     |                             |
| 9      | 6.70E+05               | Serratia spp                | 24     | 60                     |                             |
| 10     | <10                    |                             | 25     | 1.20E+04               |                             |
| 11     | 650                    |                             | 26     | 210                    | Enterobacter sakazakii      |
| 12     | 2.60E+03               | Serratia spp                | 27     | 3.10E+04               | Serratia spp                |
| 13     | 2.50E+03               | E. coli                     | 28     | 110                    |                             |
| 14     | <10                    |                             | 29     | 2.60E+03               |                             |
| 15     | 1.80E+03               |                             | 30     | 450                    |                             |

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## Hotel Intervention Study



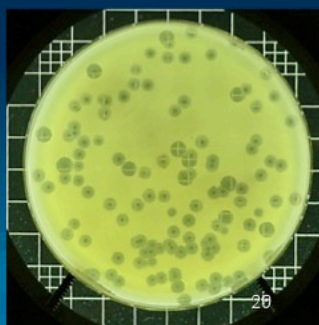
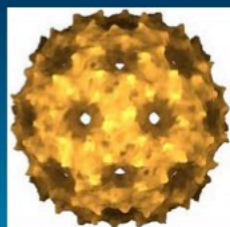
- How does a virus spread in a hotel
- what is the role of cleaning in the spread of viruses
- Do disinfectants and hand hygiene make a difference in the spread of virus?

Sifuentes et al. 2014. Use of hygiene protocols to control the spread of viruses in a hotel

## The Virus

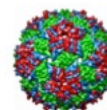
### Bacteriophage MS-2

- ~23 nm in diameter
- single stranded RNA
- no lipid layer
- inactivated by 99.99% by hand sanitizer
- similar in shape and size to the cold virus (rhinovirus)
- commonly used as a model for disinfectant testing



## Methods

- **Contamination Sites**
  - Guest Room
    - outside door handle, one bedroom, and bathroom faucet
    - Morning while participants were attending a meeting in the conference center



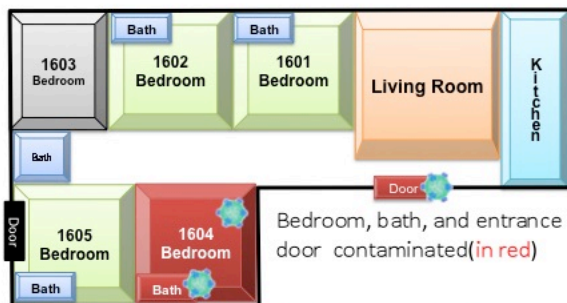
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## Methods

- Conference Center
  - MS-2 was used to contaminate outside door handle and the kitchen faucet handle
    - Before the start of the morning meetings.
- 8 Guests participated in study per overnight stay
- All evaluations run on three separate overnight stays

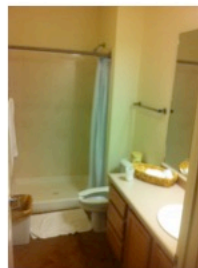
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## Hotel



### Hotel Suite

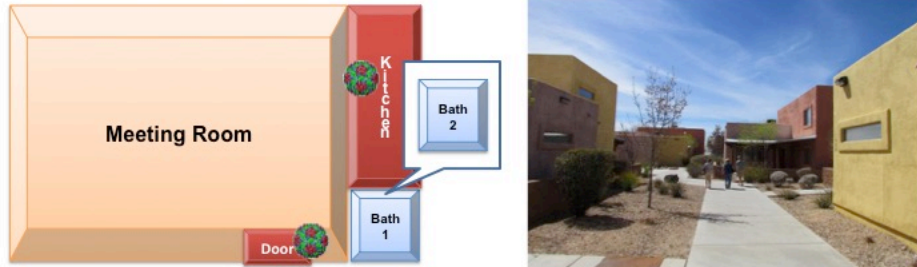
4 Bedrooms with Bath  
 Shared Bathroom  
 Shared Living Room  
 Shared Kitchen  
 2 Guests per Room



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## Conference Center



**Conference Center**

- Meeting Room
- Downstairs Bathroom
- Upstairs Bathroom
- Shared Kitchen
- 8 Hotel Guests plus Additional Attendees

MS-2 was used to contaminate entrance door handle and kitchen faucet handle (in red)



## Sampling Sites

| Hotel Room                                     | Shared Kitchen in Room         | Conference Center                              |
|--|--------------------------------|--|
| Desk 1 (Wood)                                  | Kitchen Faucet (Chrome)        | Chair 1 (Wood)                                 |
| Chair 1 (Wood)                                 | Kitchen Counter (Laminate)     | Conference Table (Wood)                        |
| Desk 2 (Wood)                                  | Refrigerator Handle (Plastic)  | Top of Coffee Pot (Plastic)                    |
| Chair 2 (Wood)                                 | Kitchen Light Switch (Plastic) | Light Switch (Plastic)                         |
| Outside Bedroom Door Handle (Stainless Steel)  |                                | Downstairs Bathroom Light Switch (Plastic)     |
| Outside Bathroom Door Handle (Stainless Steel) |                                | Downstairs Bathroom Faucet and handle (Chrome) |
| Bathroom Faucet and Handle (Chrome)            |                                | Faucet Handle (Kitchenette) (Chrome)           |
| Bathroom Counter (Laminate)                    |                                | Refrigerator Handle (Plastic)                  |
| Toilet Handle (Chrome)                         |                                | Upstairs Bathroom Counter (Laminate)           |
| Shower Handle (Chrome)                         |                                | Upstairs Bathroom Faucet (Chrome)              |
| Bathroom Light Switch (Plastic)                |                                | Bathroom Light Switch (Plastic)                |

## Virus Spread between Hotel Rooms

- Add MS-2 virus added to one persons hand or bathroom counter top
- Sample next series of rooms after maids clean and conference room at end of day tested for virus.
- Conference attendees hands



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## Results

- Virus detected
  - Next four rooms cleaned by the maid
  - On surfaces (table tops) in the conference room
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## Intervention

### Intervention

- Provide maids with antimicrobial products and disinfectant wipes for key surfaces
- Provide attendees with hand sanitizers

- Hand sanitizer



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## Intervention



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## Effectiveness of Intervention Products Against MS-2 Virus

- Hand Sanitizer = 74.5% reduction of virus on the hands
- Disinfecting wipe = 50% reduction of virus on fomites

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## Interventions

- **Sanitizer Stands (alcohol gel hand sanitizer)**
  - Placed in the Conference Room, Common Area of Rooms, Café, Lobby.
- **Inhale Trays**
  - Contained Kleenex Cool Touch tissue, Kleenex Hand and Face moist wipes, and Kleenex sanitizer packets. Two trays were placed in the conference room, 1 in each room, 1 on lobby/check-in desk.

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## Interventions

- **Kleenex Disposable Hand Towels**
  - Bathrooms used reusable washcloths to dry hands, replaced with Kleenex Disposable hand towels.
- **Disinfecting wipes**
  - Disinfecting wipes provided to cleaning crew and disinfectant spray

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## Results

- Reduced virus detected on fomites in guest rooms by 90%
- Reduced virus on hands of guests by 50%



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## Findings Summary

### Intervention reduced

- the occurrence of viruses in a hotel
- the occurrence of viruses in common areas of hotel
- the occurrence of viruses in guest rooms
- the amount of viruses on fomites
- the movement (spread) of viruses throughout a hotel
- the movement (spread) of viruses from rooms to common areas
- the movement (spread) of viruses from common areas to rooms
- the probability of infection from viruses which cause respiratory infection (Rhinovirus and Influenza) and diarrhea (Norovirus)

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## Findings Summary

- Viruses can spread in a hotel
- Housekeeping practices can spread viruses between guest rooms
- Hotel guests can spread viruses from their room to common areas (conference center, shared kitchen) of the hotel
- Hotel guests can spread viruses from common areas (conference center, shared kitchen) to guest rooms

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## Summary

- Hotels are ideal environments for the rapid spread of certain infectious agents
- Fomites and cleaning/disinfecting procedures play a role in the transmission of enteric and respiratory viruses
- Better defined cleaning tools and cleaning/disinfecting protocols are needed

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A red brushstroke graphic with the text "Coming Soon" written in white, sans-serif font across it.

Coming Soon

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