Prevention and Control of Highly Transmissible Viruses in Retail Foodservice Operations

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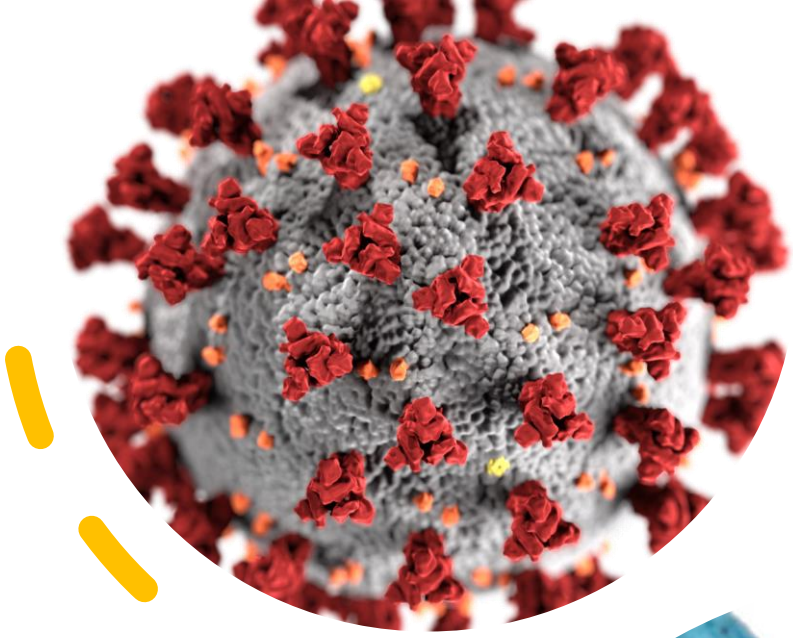
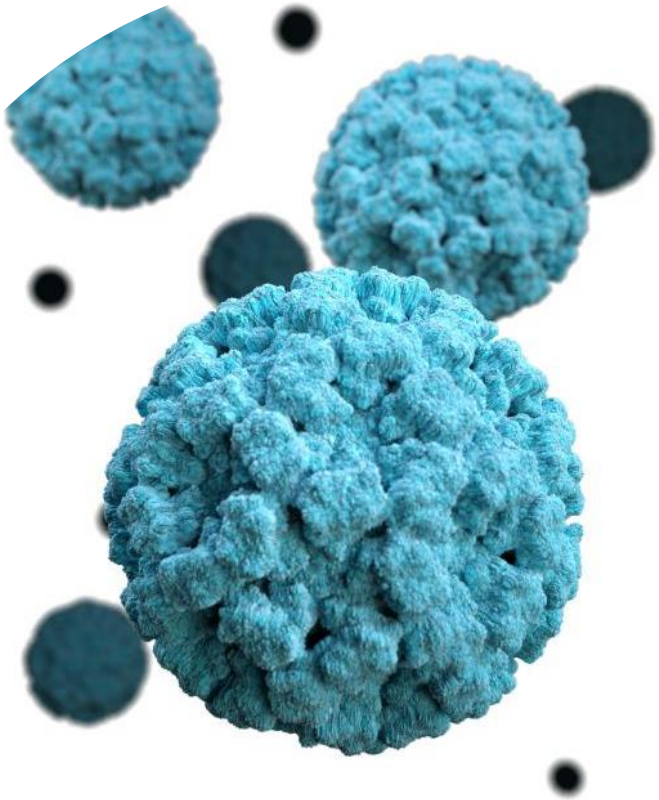
Division of Agriculture

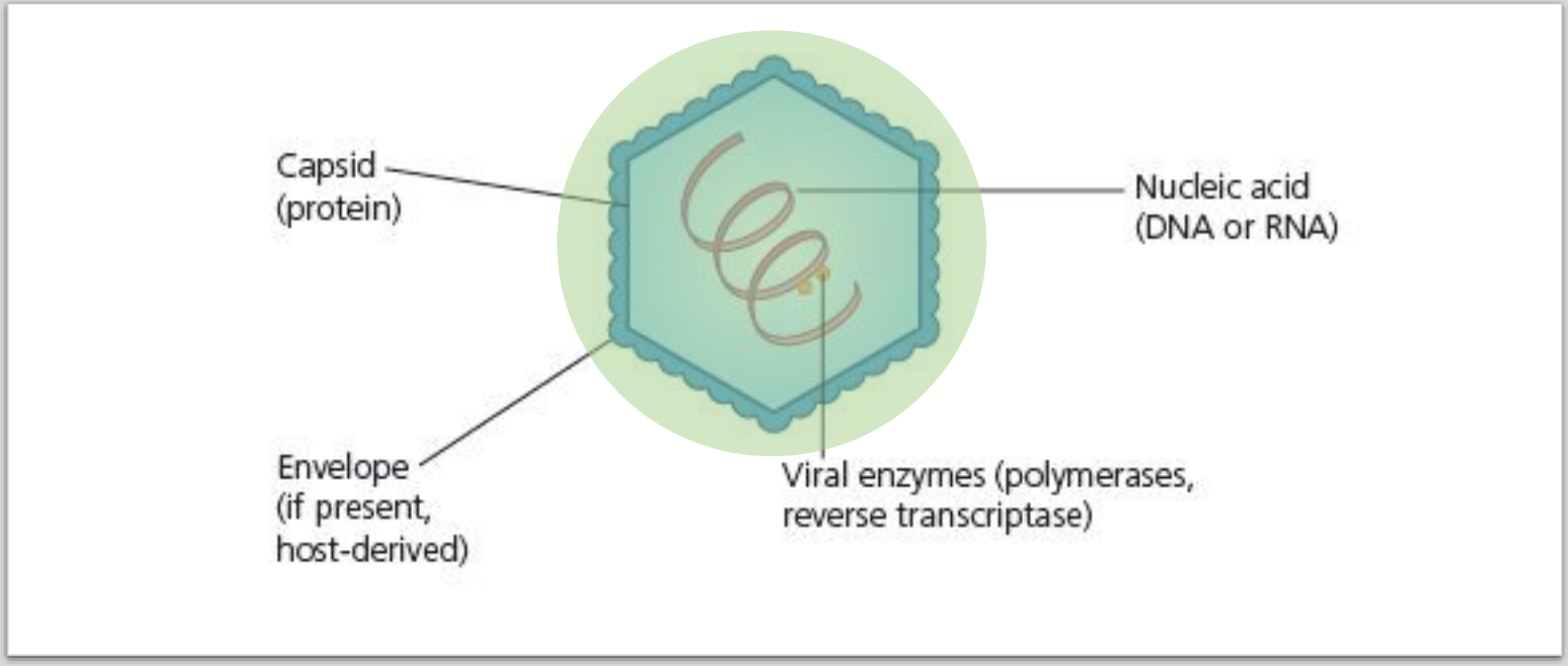
What do an enteric virus and a respiratory virus have in common?

Virus Structure and Function





- Viruses are small, intracellular parasites that cannot reproduce by themselves.
- An infectious virus particle is referred to as a *virion*.
- A virion consists of the nucleic acid and an outer shell of protein, referred to as a *capsid*.
- A virion may be *enveloped* or *non-enveloped*.
- **Most viral host ranges are narrow**.

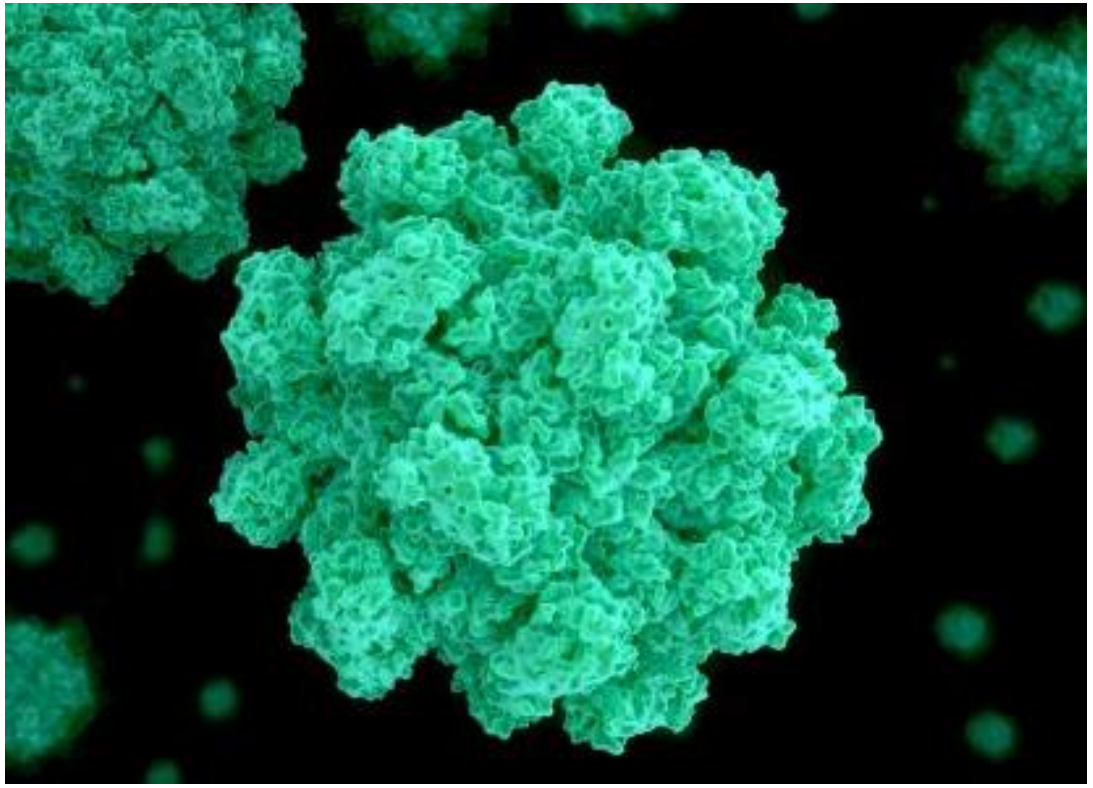


Virus Structure and Function

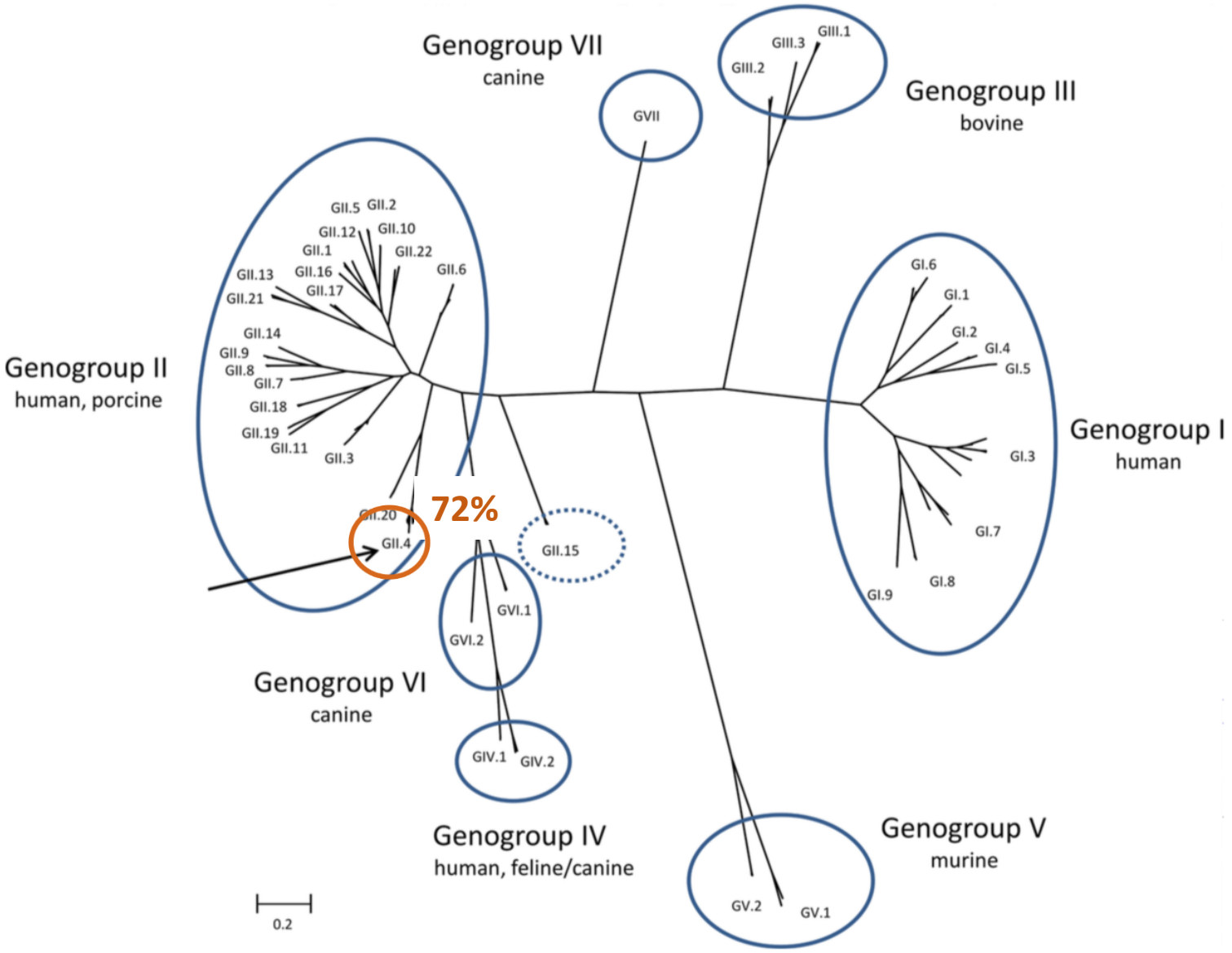
Human Norovirus (hNoV)

- Public Health Impact
  - Most common cause of acute AGE worldwide
  - 19 to 21 million illnesses each year in the U.S.
    - 78% of all cases with a known cause (2009-2010)
    - Account for over **50% of foodborne illnesses**
  - Majority of morbidity and mortality in very young and elderly
  - Numerous modes of transmission

hNoV – The Basics



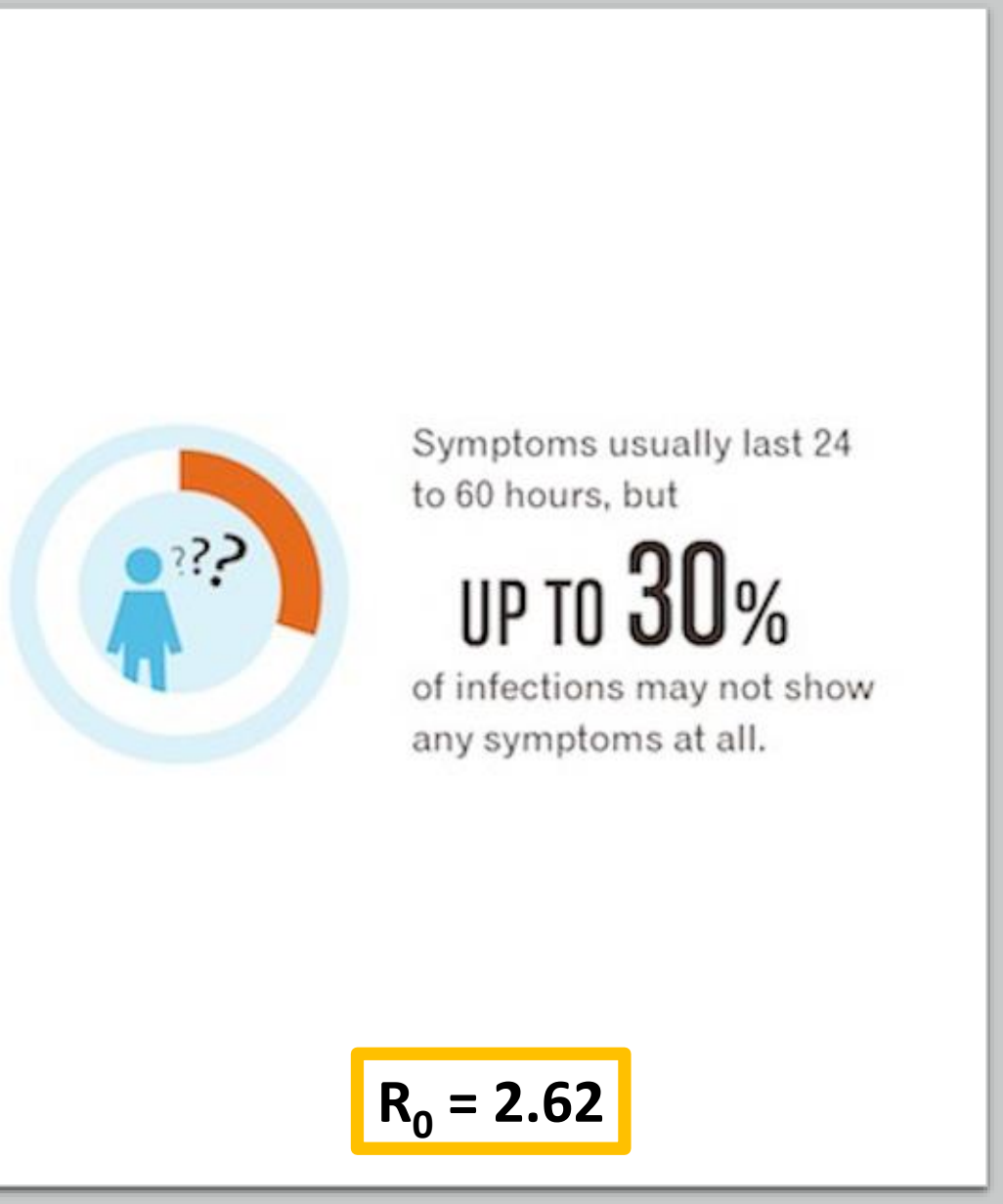
- Structure
  - ssRNA, non-enveloped
  - 7 genogroups and 41 genotypes
  - Human = GI, GII, GIV



Vinjé (2015) J Clin Microbiol

hNoV – The Basics

- Clinical symptoms
  - 12 to 48 h incubation
  - Vomiting, watery diarrhea, stomach cramps, nausea, and general malaise
  - Self-limiting (24-60 h)
  - No known chronic sequelae
  - Complications include volume depletion and dehydration
  - Potential for chronic infections in immunocompromised and physically stressed individuals

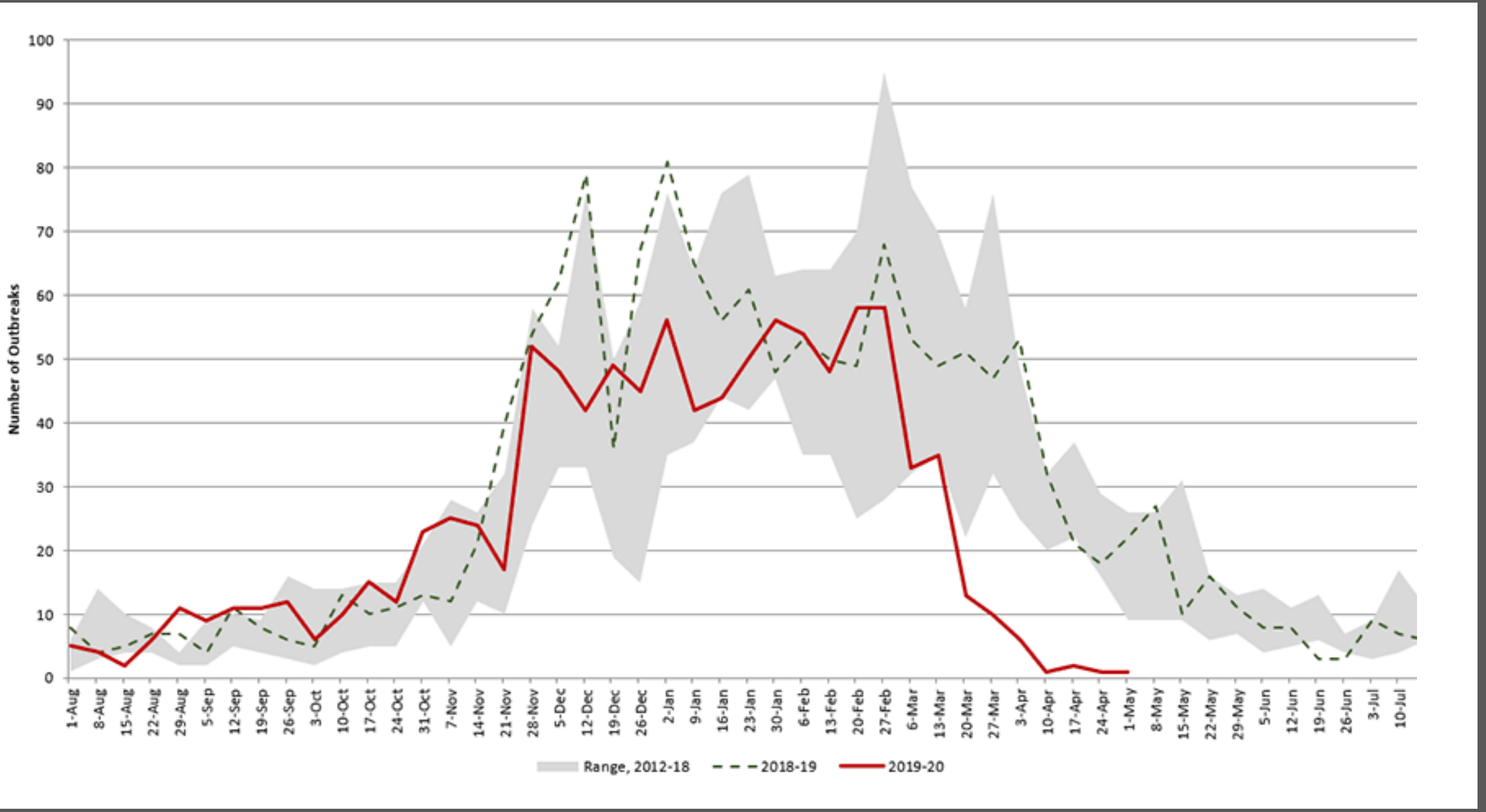


Common Misnomers for hNoV

- Stomach Flu
- “24-hour” Flu
- Winter Vomiting Disease
- Cruise Ship Virus

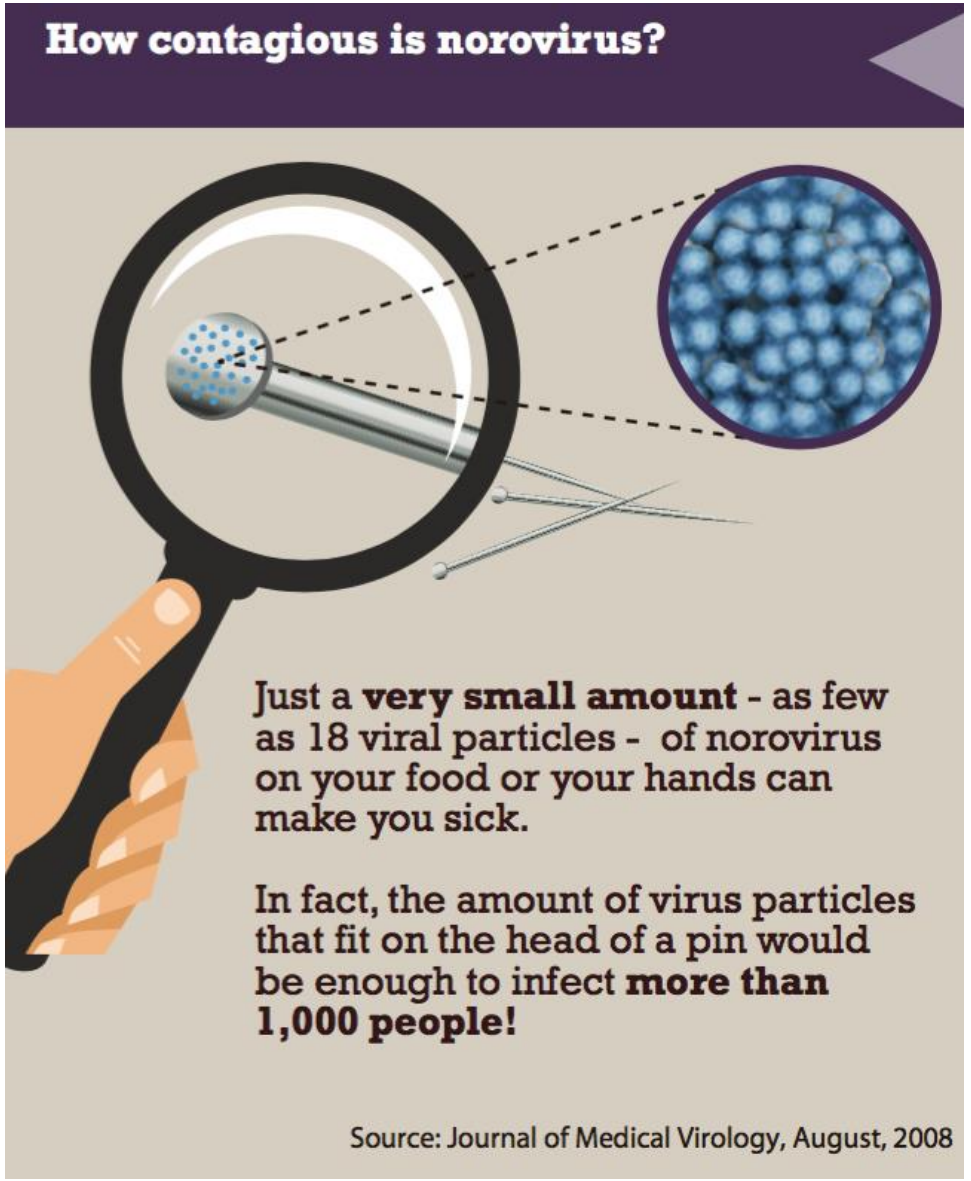
Norovirus is commonly referred to as the “flu”:

- seasonal component
- rapid onset

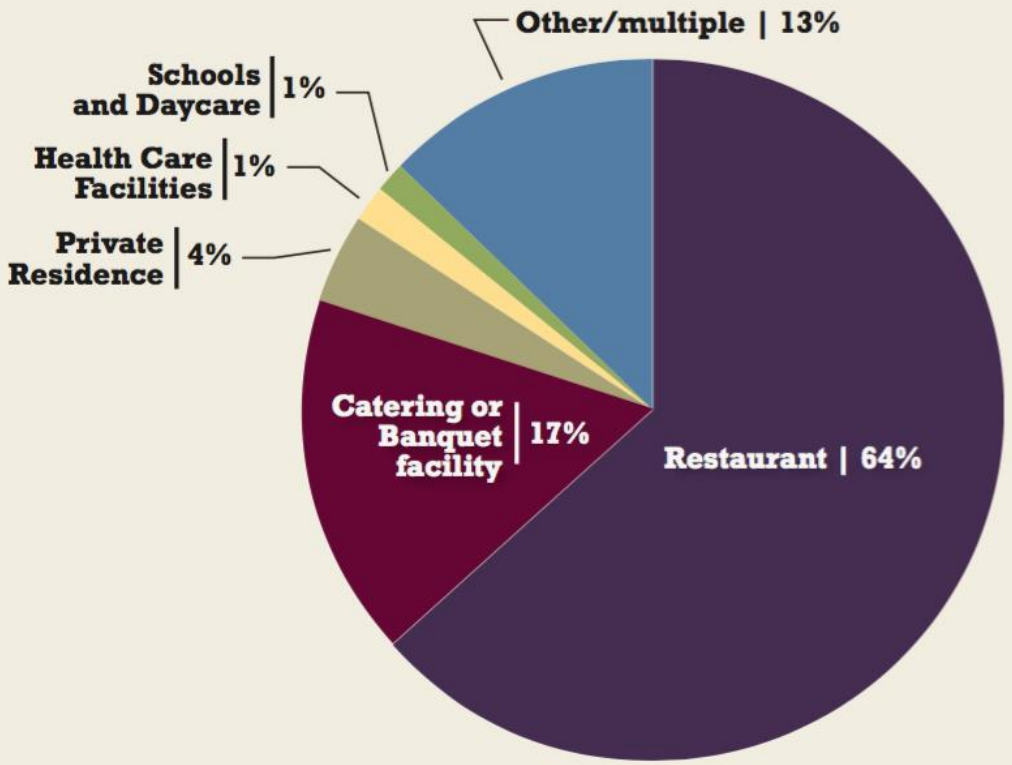

Number of Outbreaks
100
90
80
70
60
50
40
30
20
10
0
1-Aug
8-Aug
15-Aug
22-Aug
29-Aug
5-Sep
12-Sep
19-Sep
26-Sep
3-Oct
10-Oct
17-Oct
24-Oct
31-Oct
7-Nov
14-Nov
21-Nov
28-Nov
5-Dec
12-Dec
19-Dec
26-Dec
2-Jan
9-Jan
16-Jan
23-Jan
30-Jan
6-Feb
13-Feb
20-Feb
27-Feb
6-Mar
13-Mar
20-Mar
27-Mar
3-Apr
10-Apr
17-Apr
24-Apr
1-May
8-May
15-May
22-May
29-May
5-Jun
12-Jun
19-Jun
26-Jun
3-Jul
10-Jul
Range, 2012-18
2018-19
2019-20

Norovirus Transmission

- Key Characteristics
  - Low infectious dose
  - High shedding concentrations
  - Prolonged shedding
  - Genetic Diversity
  - Environmental Stability
  - Resistant to common disinfectants
  - Shedding through vomiting – aerosolization and particle distribution
  - Multiple routes of transmission

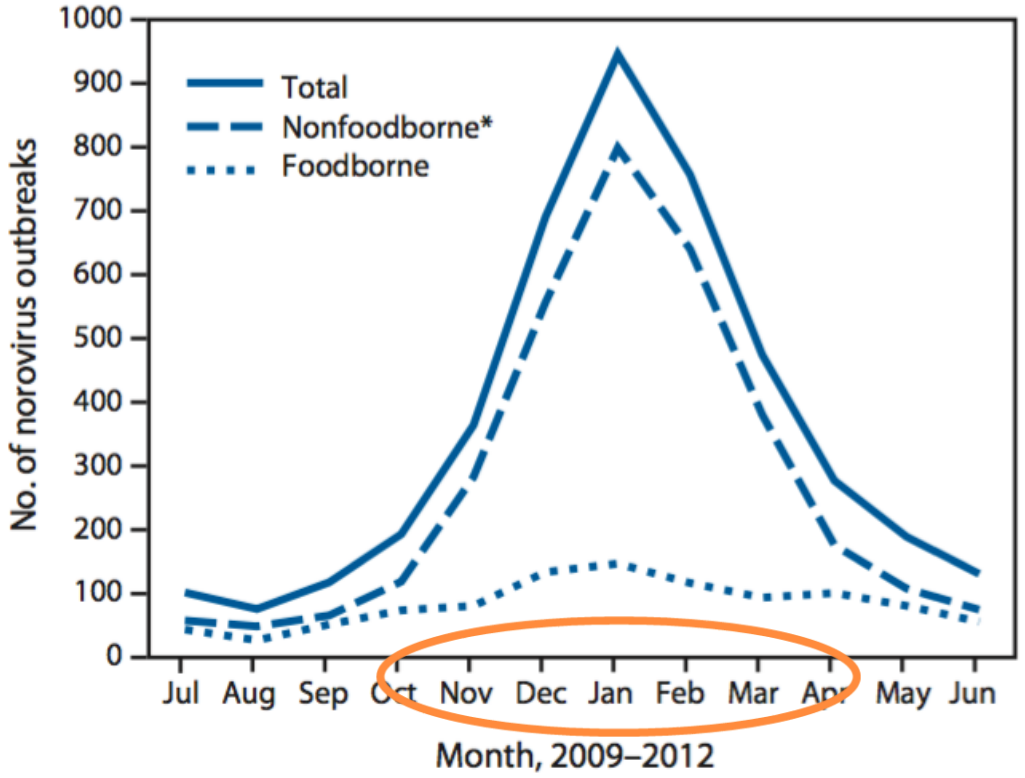


Where do norovirus outbreaks from food contamination happen?



SOURCE: CDC National Outbreak Reporting System, 2009-2012

FIGURE 1. Number of reported norovirus outbreaks, by primary transmission mode and month of onset — National Outbreak Reporting System, United States, 2009–2012



* Includes person-to-person, waterborne, environmental contamination, and other or unknown transmission modes.

Common Norovirus Breeding Grounds

While norovirus is a foodborne illness, it's highly contagious and easily spread in crowded areas like:

- hospitals

- nursing homes

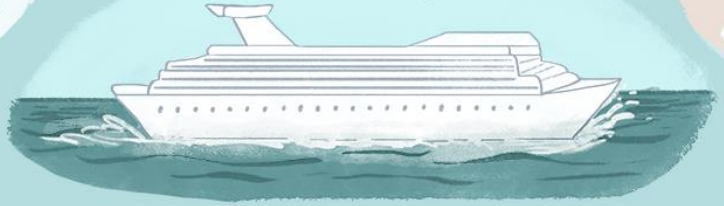
- daycare centers

- military training centers

- schools

- resorts

- cruise ships



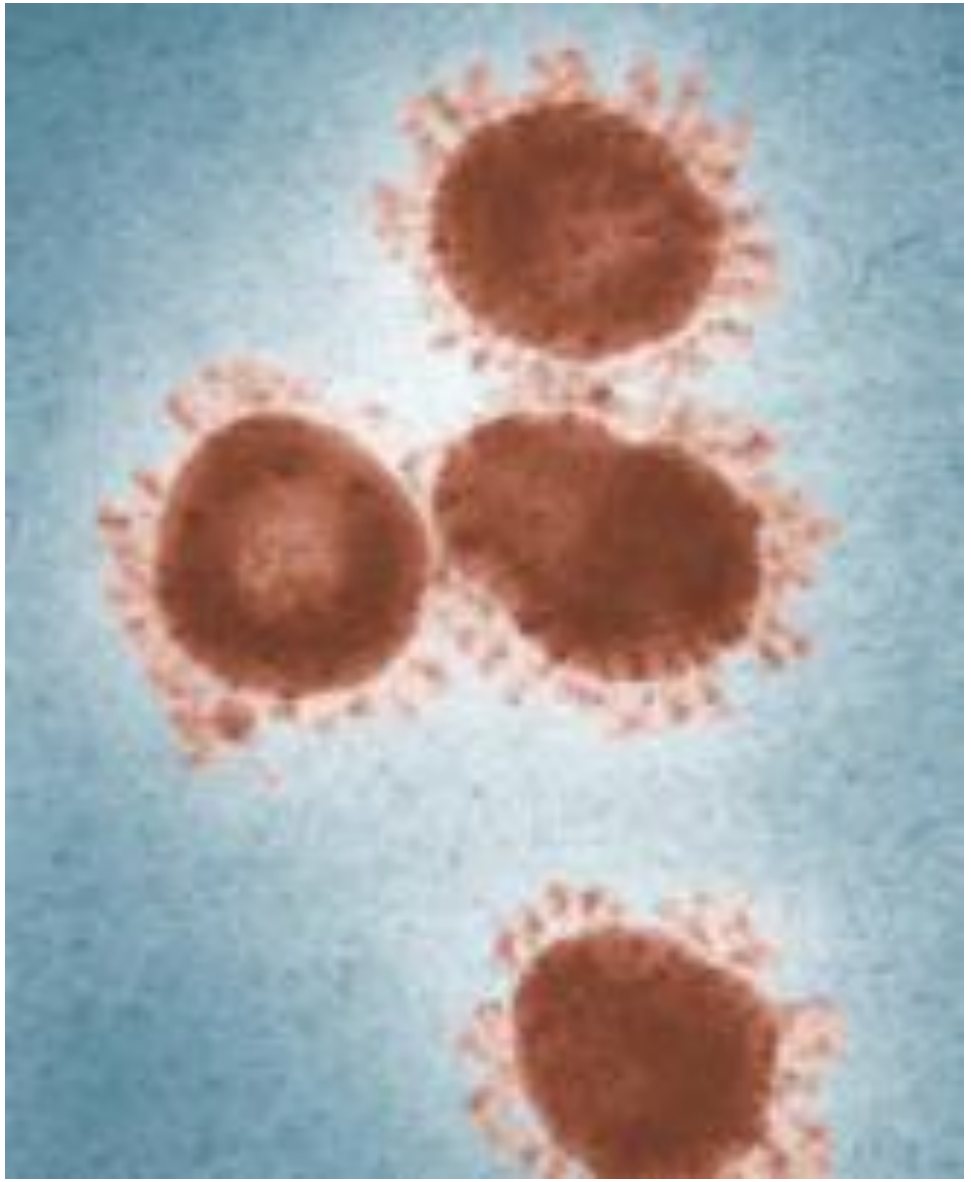
verywell

Severe acute respiratory syndrome (SARS) coronavirus (CoV) type 2

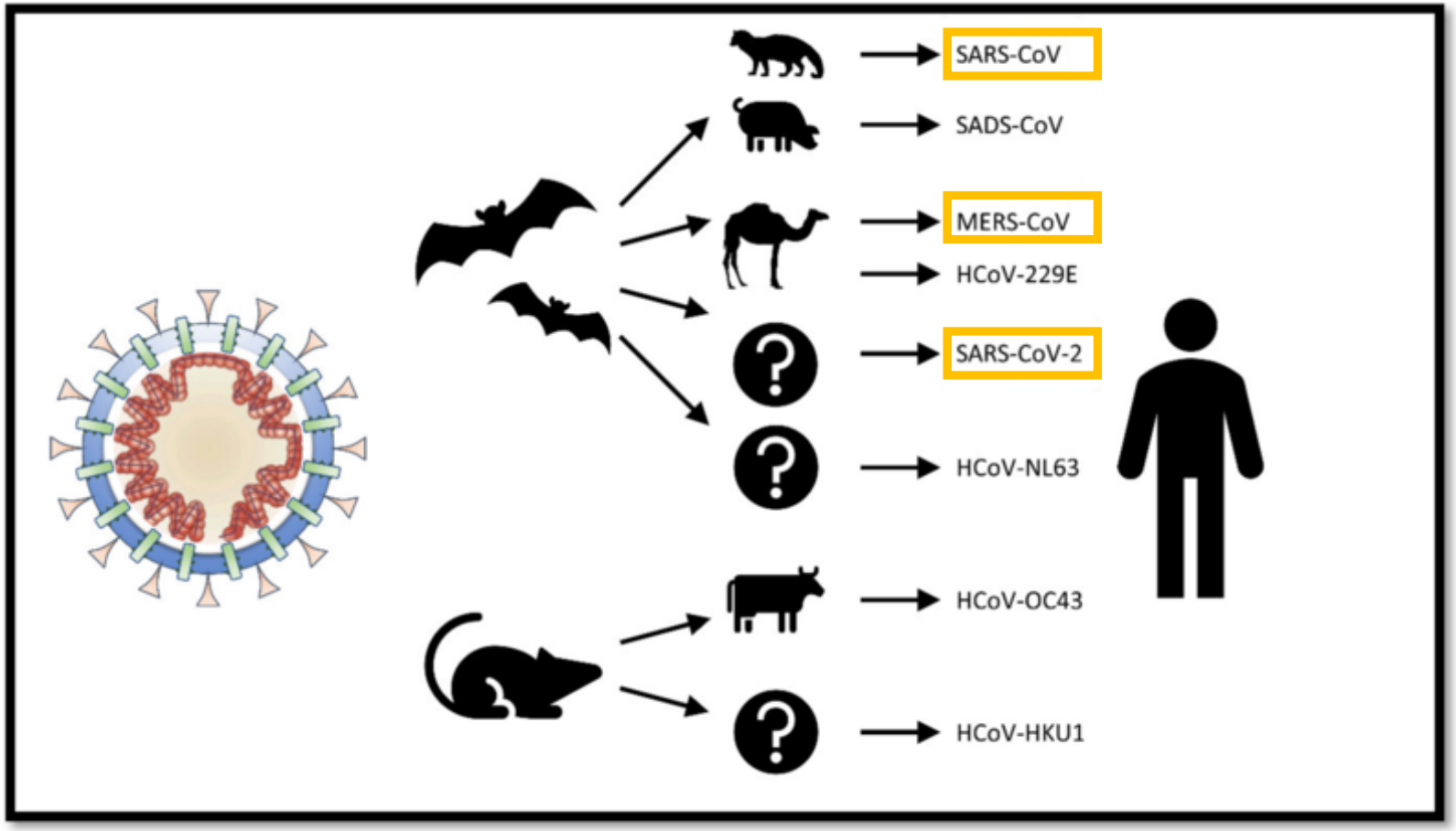
- Public Health Impact
  - Causative agent of COVID-19
  - The 3rd coronavirus to jump from animal to human
  - 1.55 million confirmed cases in U.S. (5/20/2020)
    - 93,439 deaths
  - Majority of mortality in older population and those with comorbidities

SARS-CoV-2 – The Basics

- Structure
  - ssRNA, **enveloped**
  - Genus *betacoranavirus*
    - Highly pathogenic CoVs

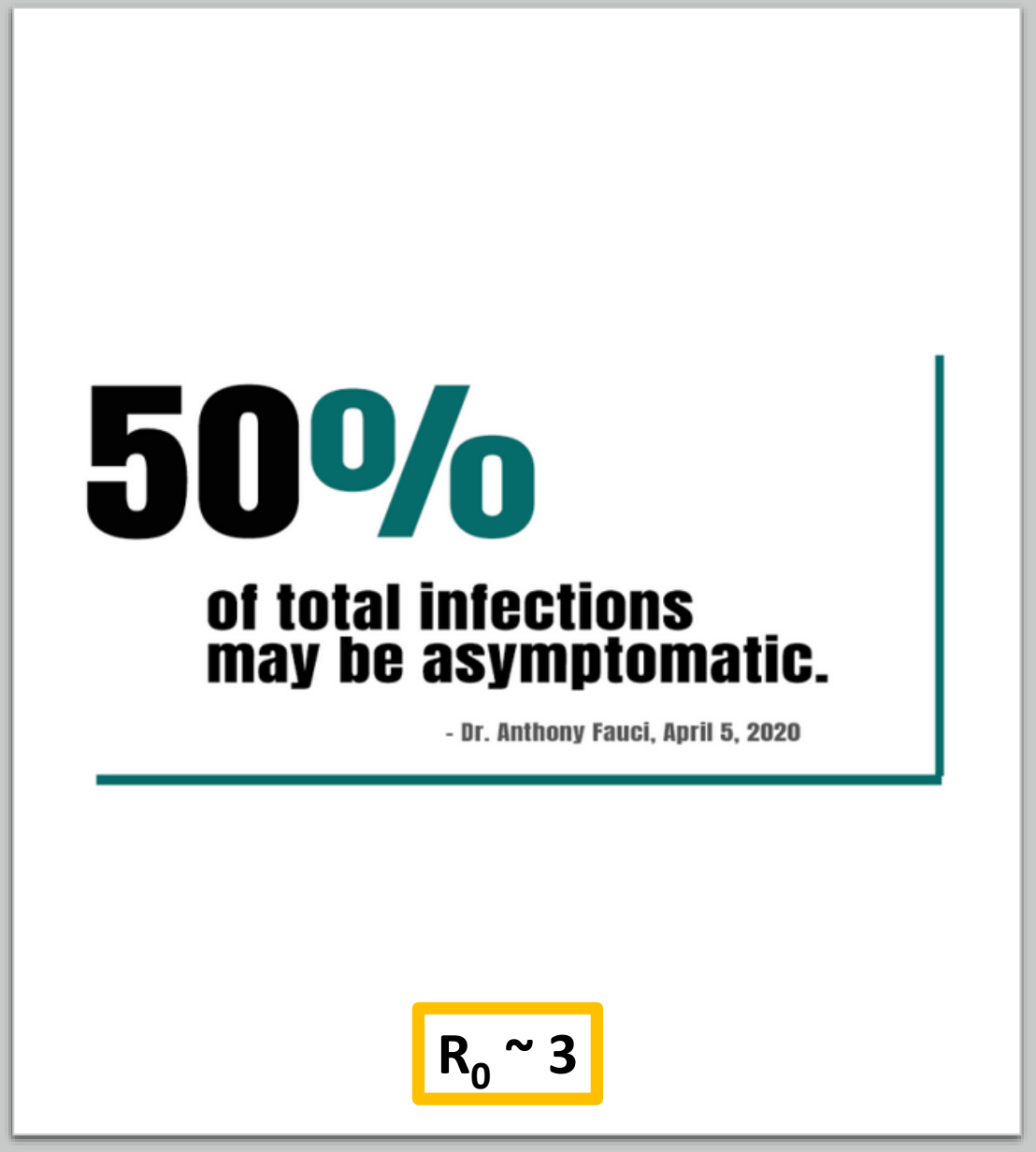


Animal Origins of Human CoVs



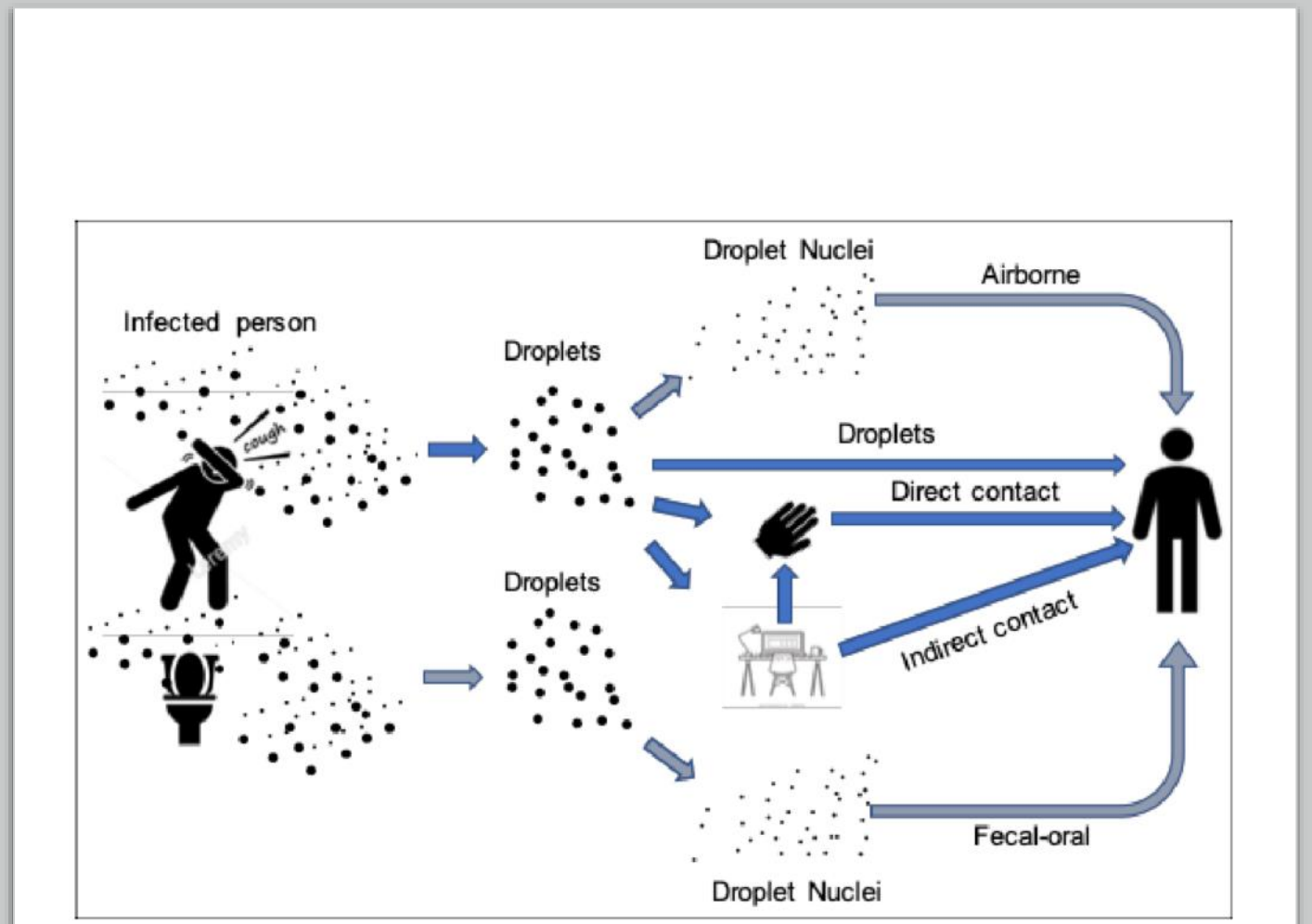
SARS-CoV-2 – The Basics

- Clinical symptoms
  - 2 to 14-day incubation period
  - Cough
  - Shortness of breath or difficulty breathing
  - Fever
  - Chills
  - Muscle pain
  - Sore throat
  - New loss of taste or smell
  - **Less common = GI symptoms**

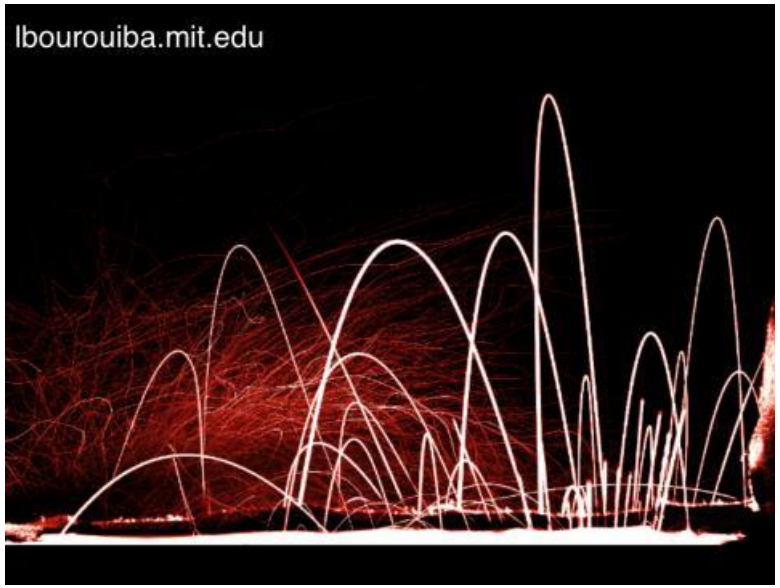


SARS-CoV-2 Transmission

- Key Characteristics
  - Low infectious dose
  - High shedding concentrations
  - Prolonged shedding
  - ***Environmental Stability***
  - Shedding through respiratory droplets
    - ***Feces?***
  - Multiple routes of transmission



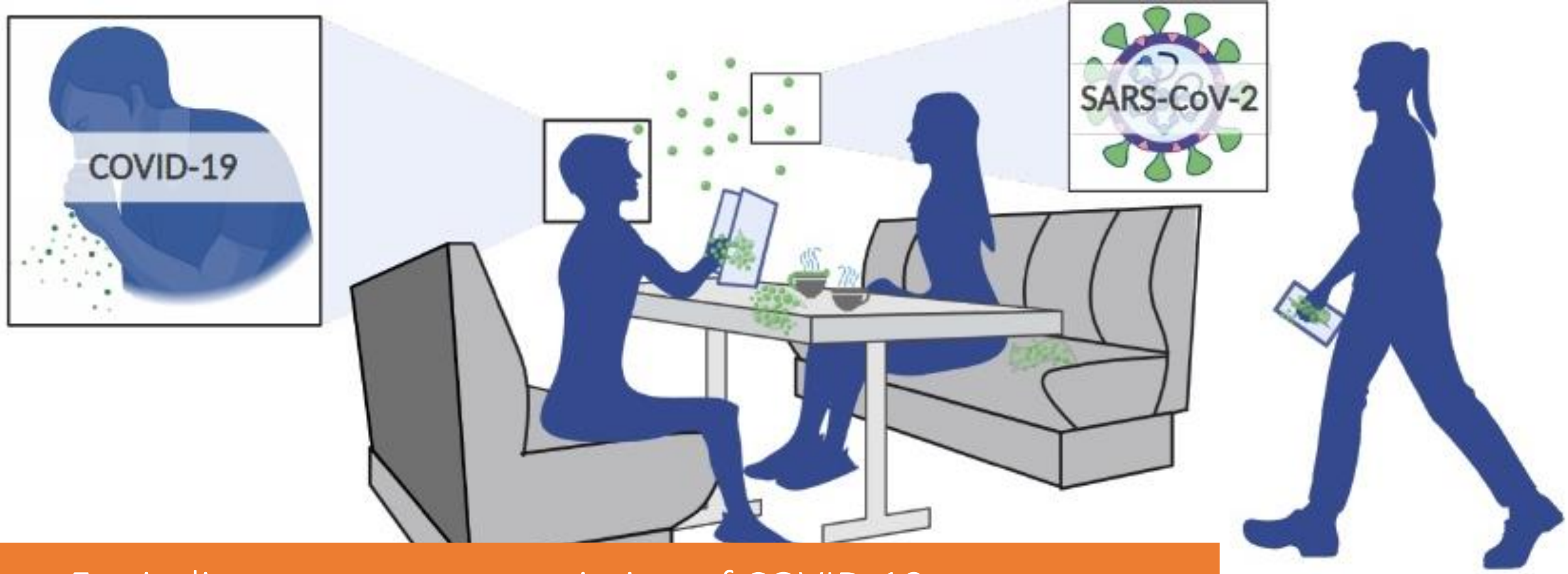
COVID-19 Breeding Grounds



Highly Transmissible Viruses – Common Ground

- Low infectious dose
- High shedding concentrations
- Prolonged shedding
- ***Environmental Stability?***
- Exposure through aerosolization
- Multiple routes of transmission
  - ***Fecal – oral, fecal – respiratory?***

What does all of this mean for retail foodservice operations?



For indirect contact transmission of COVID-19

Virus must:

1. Be introduced into the environment
2. Be able to survive on surfaces
3. Transfer from surface to hands a greater concentration than the infectious dose
4. Initiate infection via self-inoculation with eyes, nose, or mouth

Environmental Cleaning and Hygiene – Critical to Control of Viruses

- hNoV prevention and control measures are essentially being applied for COVID-19
- COVID-19 guidance and recommendations also released by FDA, CDC, and USEPA
  - Each agency refers to the other
- Information ABOUNDS!

hNoV – Infection Control

- Hand hygiene
  - Alcohol-based hand anti-septics (**NOT** a replacement for…)
  - Hand washing
  - PPE
- Cleaning and Disinfecting
  - Appropriate sanitizers and disinfectants
    - Concentration
    - Contact time
  - Tools for application and cleaning
    - Spray, foam, impregnated wipes
    - Reusable or disposable cloths

Proper Hand Hygiene

A common theme in virus prevention and control…

Food Control 73 (2017) 878–882

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

Impact of soap type—foaming vs. gel-based—on handwashing time

Danielle M. Conover, Kristen E. Gibson*

University of Arkansas, Department of Food Science, Center for Food Safety, 2650 N Young Ave, Fayetteville, AR 72704, USA

- Approximately 5 s difference in time spent HW

Food Control 69 (2016) 141–146

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

Comparison of two plain soap types for removal of bacteria and viruses from hands with specific focus on food service environments

Danielle M. Conover, Kristen E. Gibson*

University of Arkansas, Department of Food Science, Center for Food Safety, 2650 North Young Avenue, Fayetteville, AR 72704, United States

Table: Comparison of log reduction of *E. coli* and MS2 by treatment.

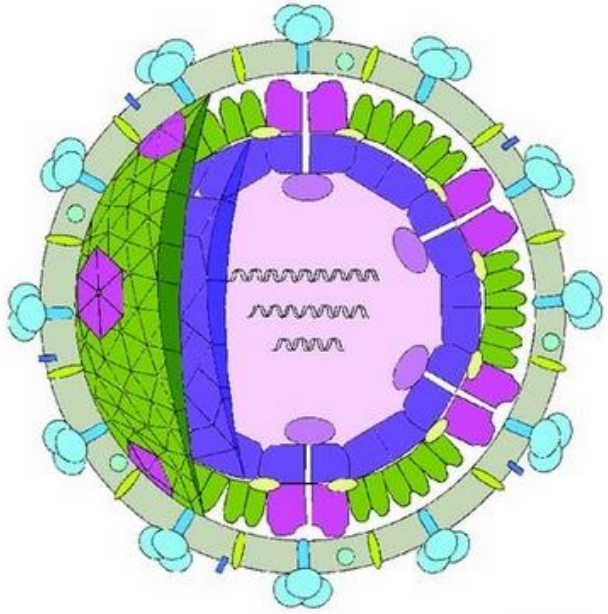
Treatment	Total Log_{10} CFU or PFU Reduction (± SD)		
	Microorganism		
	E. coli	MS2	p-value
Foaming	2.76 (0.70)	2.10 (0.57)	0.0008
Liquid	2.52 (0.58)	2.23 (0.51)	0.079
Water	2.45 (0.93)	1.20 (0.49)	<0.0001

RESEARCH ARTICLE

Handwashing and Ebola virus disease outbreaks: A randomized comparison of soap, hand sanitizer, and 0.05% chlorine solutions on the inactivation and removal of model organisms Phi6 and *E. coli* from hands and persistence in rinse water

Marlene K. Wolfe[1]*, Karin Gallandat[1], Kyle Daniels[1], Anne Marie Desmarais[1], Pamela Scheinman[2], Daniele Lantagne[1]

1 Department of Civil and Environmental Engineering, Tufts University, Medford, Massachusetts, United States of America, 2 Department of Dermatology, Brigham and Women's Hospital, Boston, Massachusetts, United States of America



What about enveloped viruses?

Cleaning and Disinfecting

- How do you clean and disinfect upholstery and carpet?
- What about multi-user touchscreen devices?
- Are the tools you use to clean with adding to the spread?

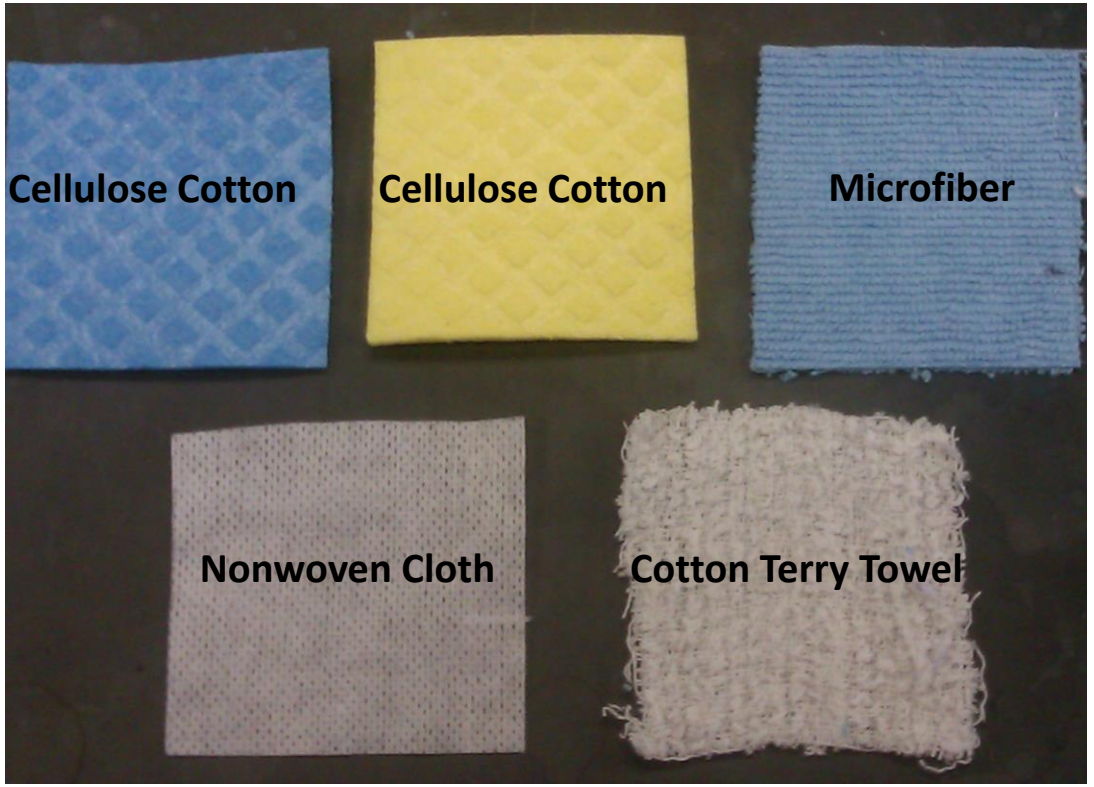
Applied and Environmental Microbiology

Removal and Transfer of Viruses on Food Contact Surfaces by Cleaning Cloths

Kristen E. Gibson, Philip G. Crandall and Steven C. Ricke
Appl. Environ. Microbiol. 2012, 78(9):3037. DOI: 10.1128/AEM.00027-12.
Published Ahead of Print 10 February 2012.

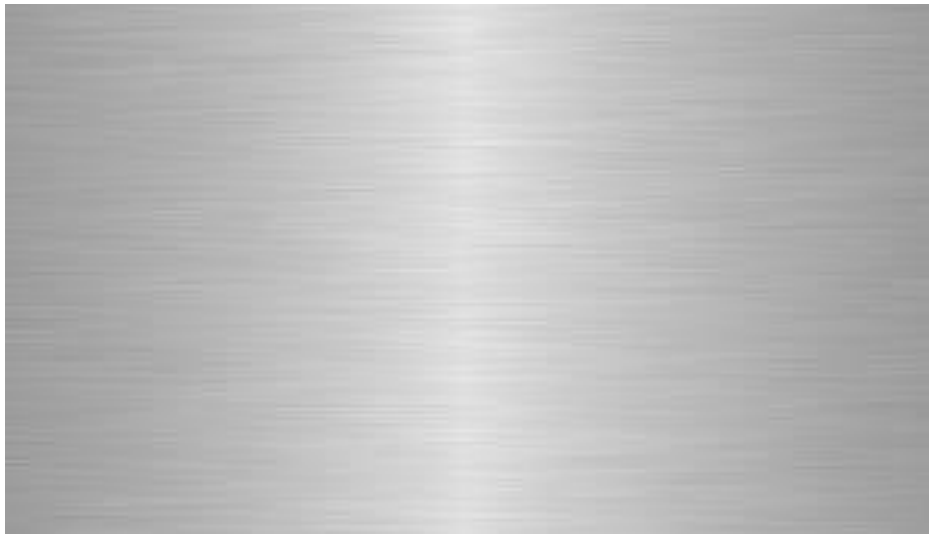
Cleaning Cloths

- What is the virus removal efficiency of each cloth?
- Do the cloths transfer virus back to the surface?
  - If so, what level of virus is transferred?

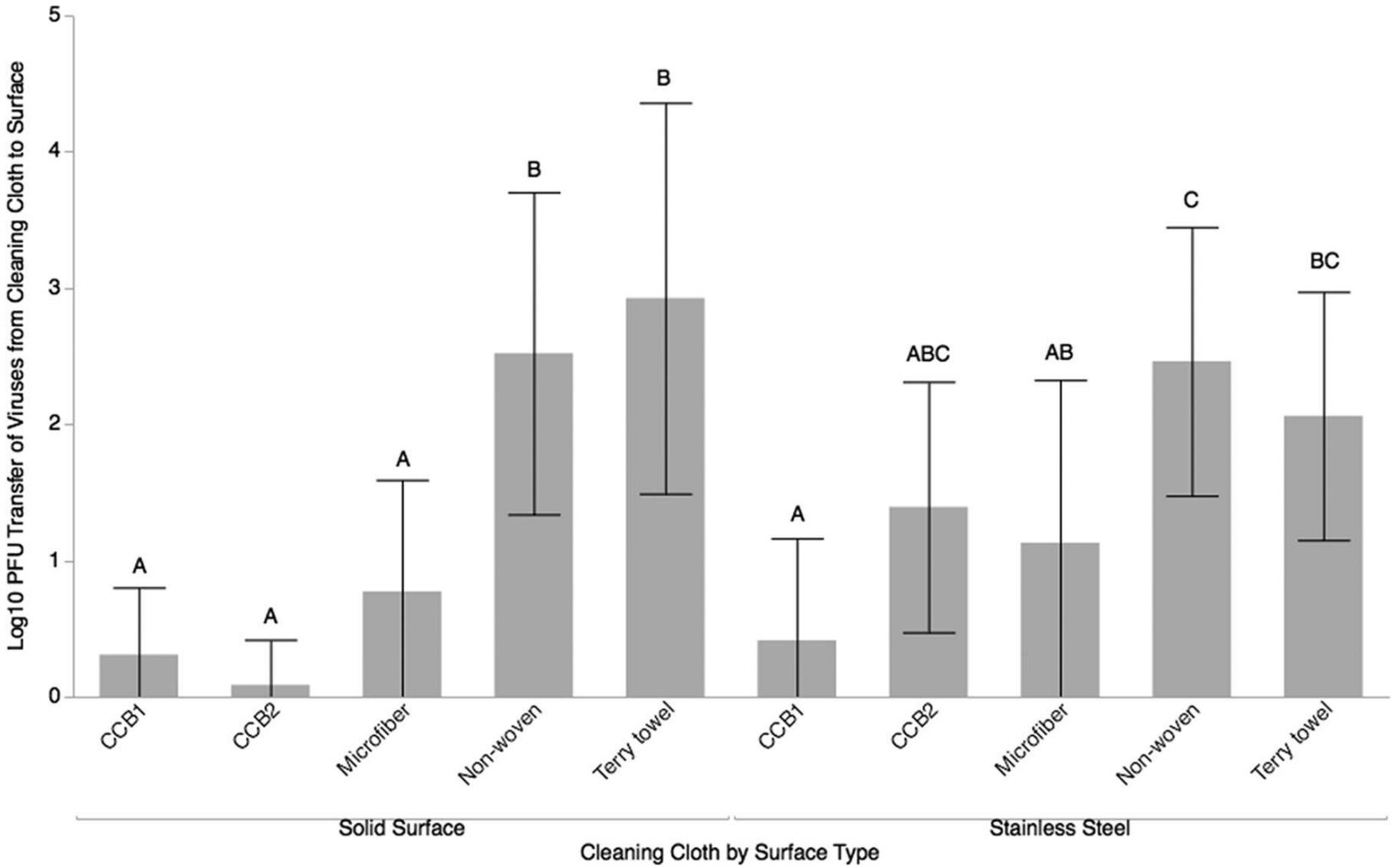


Cleaning Cloths

- Virus Removal
  - 100,000 to 1,000,000 viruses on surface
    - 700 viruses from solid surface across all cloths
    - 1,400 viruses from stainless steel across all cloths



Total virus (FCV, MS2, PRD1) transfer to solid surface and stainless steel by cleaning cloths.



Two log difference in virus transfer between cellulose/cotton and terry towel cloths.

Kristen E. Gibson et al. Appl. Environ. Microbiol. 2017; doi:10.1128/AEM.03373-16

Key Gaps Remain

- Fecal transmission route…
- Surface to Hands…and back again…
  - The transmissibility of SARS-CoV-2 from contaminated surfaces to hands
  - The frequency hands become contaminated with SARS-CoV-2
  - The viral load on hands after touching a contaminated surface
- FDA Food Code and Respiratory Viruses
  - Focus on ”back of the house”
  - Designed to prevent foodborne illnesses
  - Only requires food-contact surfaces to be cleaned **and** sanitized; non-food contact surfaces only need to be cleaned
- Confirmation of efficacy of USEPA N-List against SARS-CoV-2
  - Disinfecting wipes top this list
- How often is “frequent” cleaning and disinfecting?
  - Validation of environmental cleaning effectiveness

WASH YOUR HANDS

ANY QUESTIONS?