BREAKING THE CHAIN OF NOROVIRUS - CLEAN HANDS AND CLEAN SURFACES

North Carolina Environmental Health Symposium

Clyde “Chip” Manuel, PhD – 2 August 2019

AGENDA

- GOJO Introduction
- Norovirus Science
- Cross-contamination – Best Practices for Reducing Risk of Norovirus contamination
- Hygiene Science Principles + Myths / Misinformation
- Conclusions

PERSONAL DISCLOSURES

- I work for Industry (employed by GOJO, formerly Diversey)
  - Industry is not necessarily bad / biased
- Motivation is good Science & improved Public Health
  - ✓ advance the science in meaningful ways to public health, that are aligned with GOJO commercial interests
  - ✓ I try to stay objective at all times
  - ✓ be evidence based in my communications
  - ✓ collaborate with external thought leaders (academic and public health)
  - ✓ publish in peer-reviewed literature & present at conferences
- Regulators have difficult challenges
- Collaboration is critical to advancement

PERSONAL DISCLOSURES

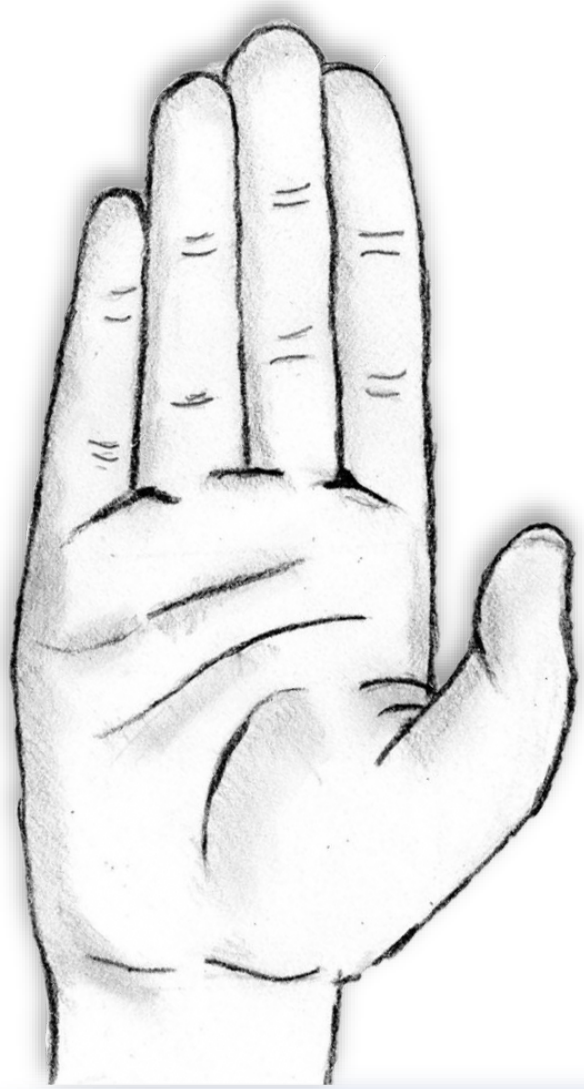
GO PACK! (Sorry UNC fans)

PATHOGENS SURVIVE ON SURFACES

Type of Pathogen	Duration of Persistence
Escherichia coli	1.5 hours - 16 months
Norovirus	4 - 6 weeks
Hepatitis A	3 weeks
Listeria spp.	1 day - months
Salmonella typhi	6 hours - 4 weeks
Staphylococus aureus, incl. MRSA	7 days - 7 months
Shigella	2 - 28 days
Campylobacter	1- 4 hours

Kramer A. BMC Infectious Diseases 2006;6:130

PATHOGENS SURVIVE ON SKIN



Pathogen	Duration of Persistence
Norovirus	Up to 2 hours
Hepatitis A	5.50 to 7.70 hours
Influenza A	*1/2 hour to 1 hour*
Escherichia coli	Up to 1 ½ hour
Klebsiella pneumoniae	Up to 1 ½ hour
Shigella	Up to 3 hours
Serratia marcescens	Up to 1 ½ hour
Staphylococcus aureus	Up to1 ½ hour

Kramer A. BMC Infectious Diseases 2006;6:130

CHAIN OF INFECTION

Next Sick Person

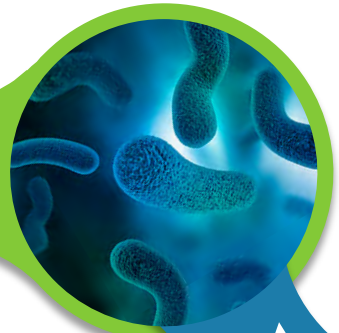
Susceptible Host

- Babies
- Children
- Elderly
- Weakened immune system
- Unimmunized people
- Anyone

Germs

Agent

- Bacteria
- Viruses
- Parasites



Where Germs Live

Reservoir

- People
- Animals: Pets
- Animals: Wild
- Food
- Soil
- Water

How Germs Get Out

Portal of Exit

- Mouth
- Cuts in skin
- Stool: During diapering and toileting

Germs Get Around

Mode of Transmission

- Contact: Hands, toys, sand
- Droplets: Speaking, sneezing, coughing

How Germs Get In

Portal of Entry

- Mouth
- Cuts in skin
- Eyes

A BIT ABOUT GOJO…

Ohio: Home of the Norovirus

“Norwalk virus” (NoV)

The first Norovirus identified as a cause of gastroenteritis following an outbreak of “winter vomiting disease” at an elementary school in Norwalk, Ohio in 1968.

Nor-OH-Virus

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OHIO IS ALSO HOME OF GOJO, A GLOBAL LEADER IN HYGIENE SOLUTIONS SINCE 1946

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GOJO Mission

To bring well-being to one billion people every day while embedding sustainability in every aspect of its business.

"Everything I know, I learned from someone else."

- Jerry Lippman on the importance of lifelong learning

THE GOJO PURPOSE

“Saving Lives and Making Life Better Through Well-Being Solutions”

Drives us every day to develop truly innovative, lifesaving products

DERMAPRO™
Isopropyl Alcohol Gel
Healthcare Formula

1946

1988
Invention of
PURELL® Hand Sanitizer

1997
Introduction of PURELL®
brand to Consumer

2002
CDC Changes Guideline for
Hand Hygiene in Healthcare
Settings

2010
Launch PURELL®
Advanced Hand Sanitizer

2016
Launch PURELL®
Surface Sanitizers

2017
Launch the
PURELL SOLUTION™

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GOJO Publication with Thought Leader Collaborators *(examples)*

Improved Inactivation of Nonenveloped Enteric Viruses and Th
Surrogates by a Novel Alcohol-Based Hand Sanitizer

Efficacy of Commonly Used Disinfectants for Inactivation of Human Noroviruses and Their Surrogates

Impact of an Alcohol-Based Hand Sanitizer Intervention on the Spread of Viruses in Homes

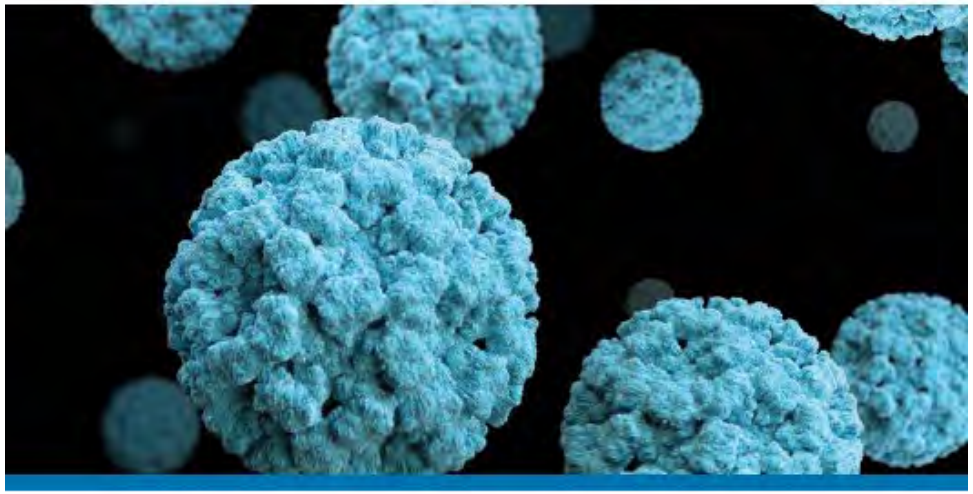
Laboratory Evidence of Norwalk Virus Contamination or of Infected Individuals

High Hand Contamination Rates During Norovirus Outbreaks in Long-Term Care Facilities

Comparison of the Activity of Alcohol-Based Handrubs Against Human Noroviruses Using the Fingerpad Method and Quantitative Real-Time PCR

THE IMPORTANCE OF NOROVIRUS

Why you should have a good food safety program to control its spread



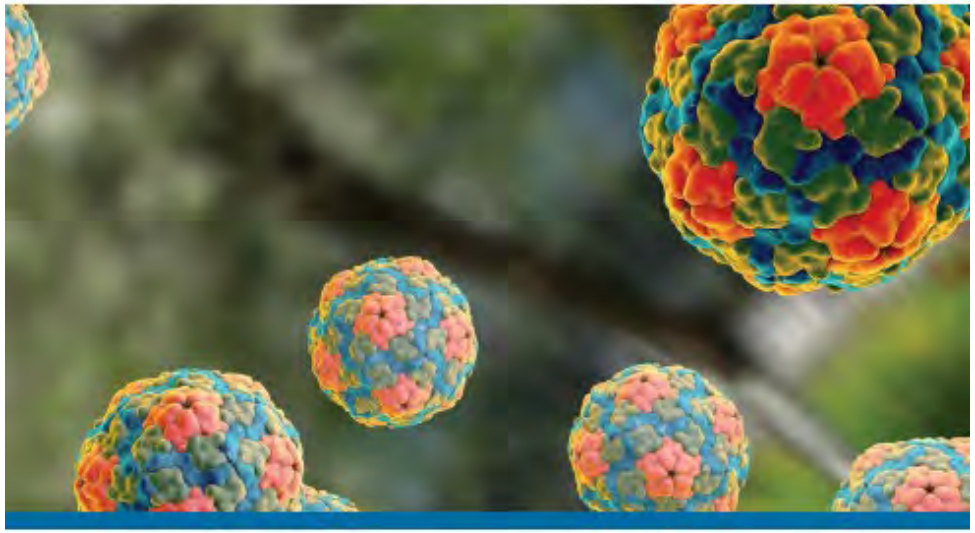
Elizabeth Bradshaw, DVM, Extension Associate, NoroCORE

Lee-Ann Jaykus, Ph.D., Scientific Director NoroCORE, William Neal Reynolds Distinguished Professor Food Science, North Carolina State University

Dave Shumaker, B.S., Microbiologist GOJO Industries, Inc., Akron, OH

HEPATITIS A VIRUS: A SIGNIFICANT FOODBORNE PATHOGEN

What you should know to protect your establishment, customers and staff from the virus.

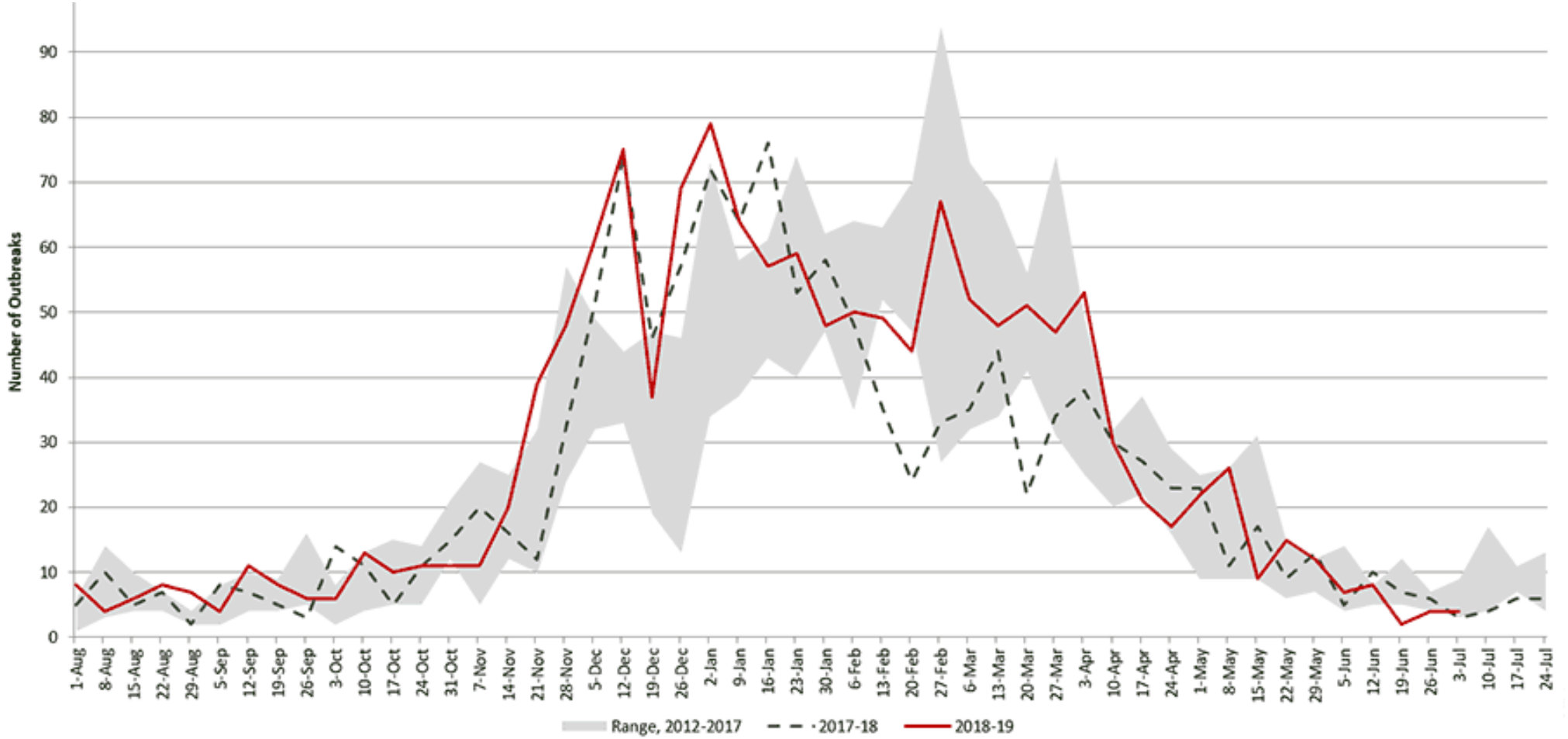


Syed A. Sattar, PhD
Professor Emeritus of Microbiology,
University of Ottawa, Ottawa, Ontario, Canada
Chief Scientific Officer, CREM Co Labs, Mississauga, Ontario, Canada

James Arbogast, PhD
GOJO Industries, Inc., Akron, OH

NOROVIRUS SCIENCE + CROSS CONTAMINATION

Number of Suspected or Confirmed Norovirus Outbreaks Reported by NoroSTAT-Participating States Per Week, 2012-2019



•August 1, 2018 – July 9, 2019: 1,418 norovirus outbreaks. This is slightly above the range reported during the same period over the previous 5 years.

Source: CDC, https://www.cdc.gov/norovirus/reporting/norostat/data.html

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Noroviruses: The Perfect Human Pathogens?

Aron J. Hall Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia

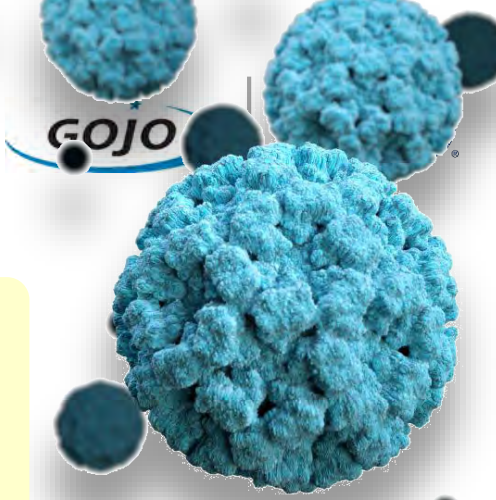
Aron J. Hall
J Infect Dis (2012) 205 (11): 1622-1624

WHAT MAKES NOROVIRUSES SO SUCCESSFUL AS A PATHOGEN?

Highly Contagious: extremely low infectious dose

- 18 –1,000 virus particles
  - Handling of contaminate
    hand-to-mouth contact
  - Via ingestion of aerosoli
    toilet flush (unique amon

WHAT MAKES NOROVIRUSES SO SUCCESSFUL AS A PATHOGEN?



High environmental stability

- Resists: **Gut environment – very low pH, freezing and heat temperatures up to 140° F, several disinfectants**
- Persists: **On human hands for at least two hours, on common surfaces for at least 3 to 6 weeks**
- Remains: **Infectious in water for at least 60 days, stable on foods for hours – weeks**

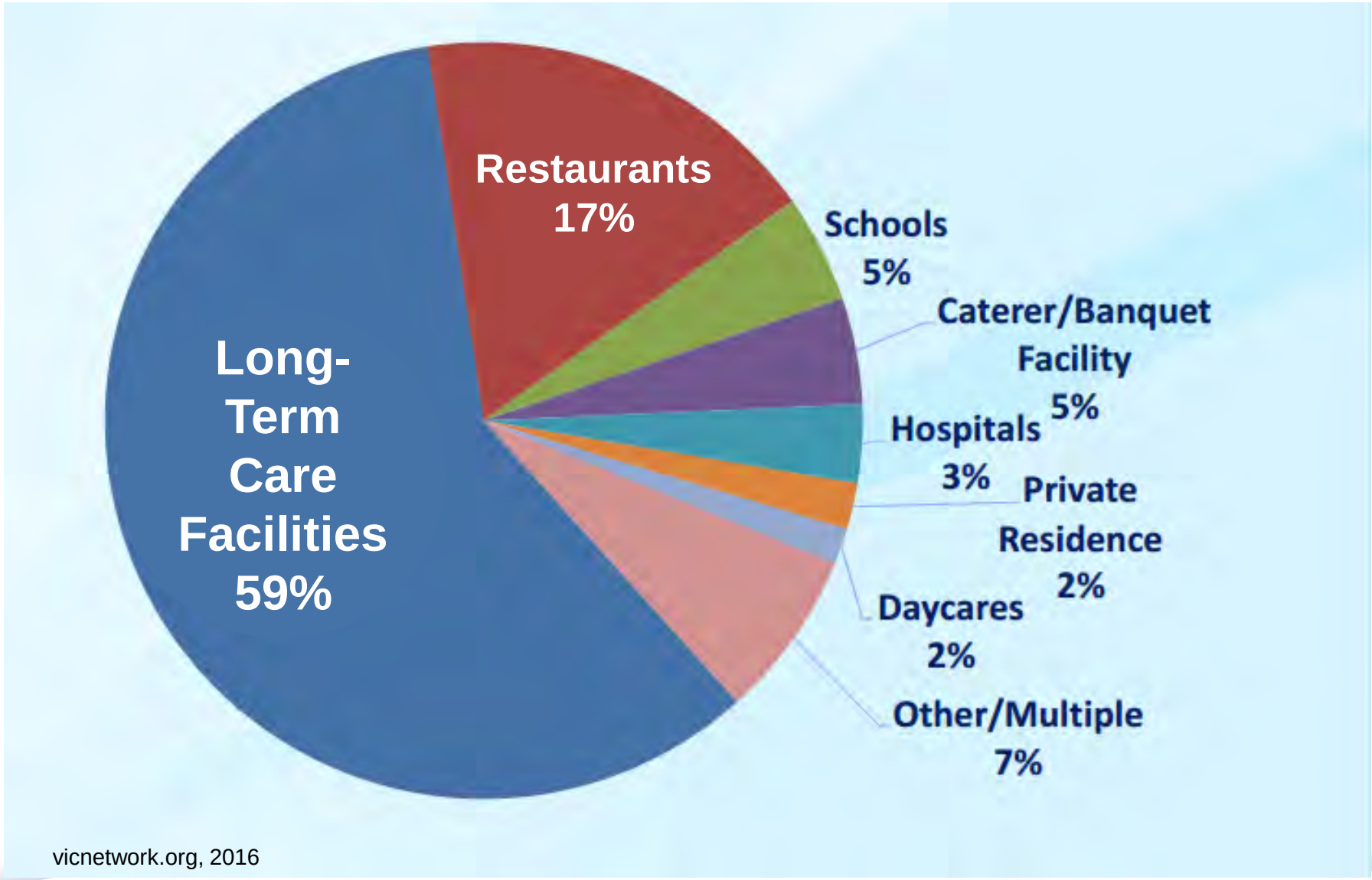
BURDEN OF FOODBORNE NOROVIRUS IN THE UNITED STATES

	Illnesses	Hospitalization	Death
1st	**Norovirus (58%)**	Nontyphoidal Salmonella spp. (35%)	Nontyphoidal Salmonella spp. (28%)
2nd	Nontyphoidal Salmonella spp. (11%)	**Norovirus (26%)**	Toxoplasma gondii (24%)
3rd	Clostridium perfringens (10%)	Campylobacter spp. (15%)	Listeria monocytogenes (19%)
4th	Campylobacter spp. (9%)	Toxoplasma gondii (8%)	**Norovirus (11%)**

Costs $2 billion per year in medical care services and lost productivity

Scallan 2011 EID Hoffmann 2012 slide courtesy Dr. Wang –OSU-OARDC

MAIN SETTINGS FOR NOROVIRUS OUTBREAKS



vicnetwork.org, 2016

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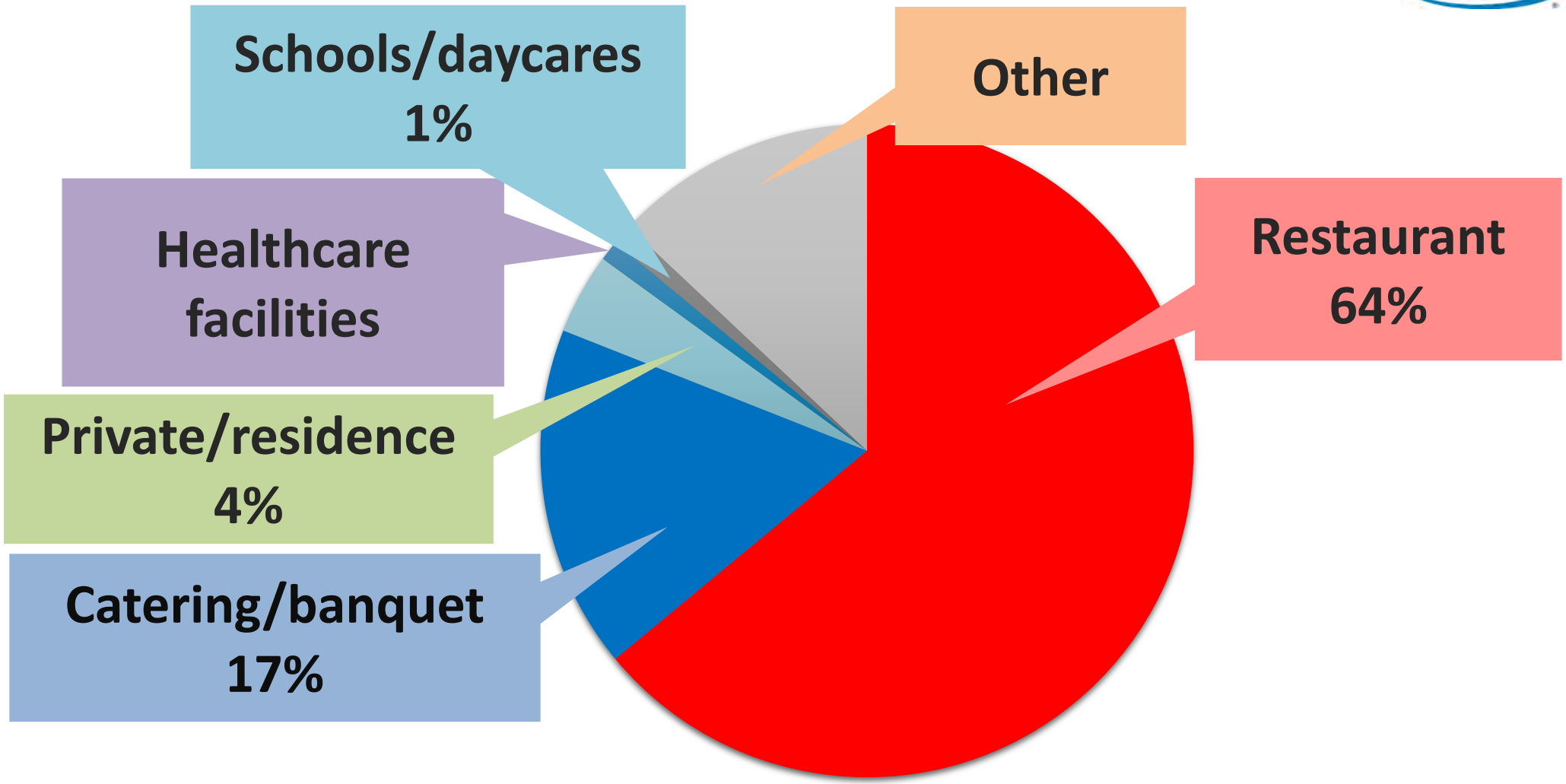
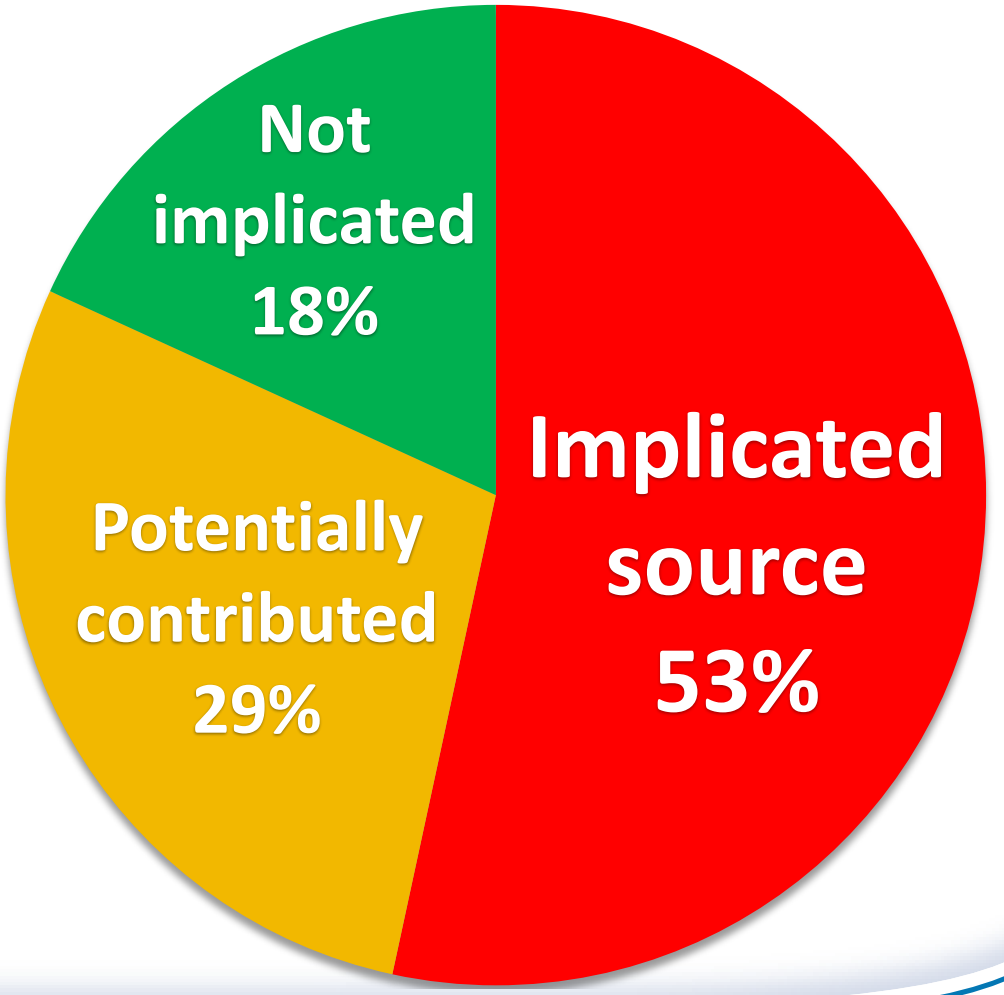
WHERE DO NOROVIRUS OUTBREAKS FROM FOOD CONTAMINATION HAPPEN?



SOURCE: CDC National Outbreak Reporting System, 2009-2012

THE ROLE OF FOOD WORKERS IN FOODBORNE NOROVIRUS OUTBREAKS = 80%!!



MMWR *website (http://www.cdc.gov/mmwr), Hall et al, 2012 .*

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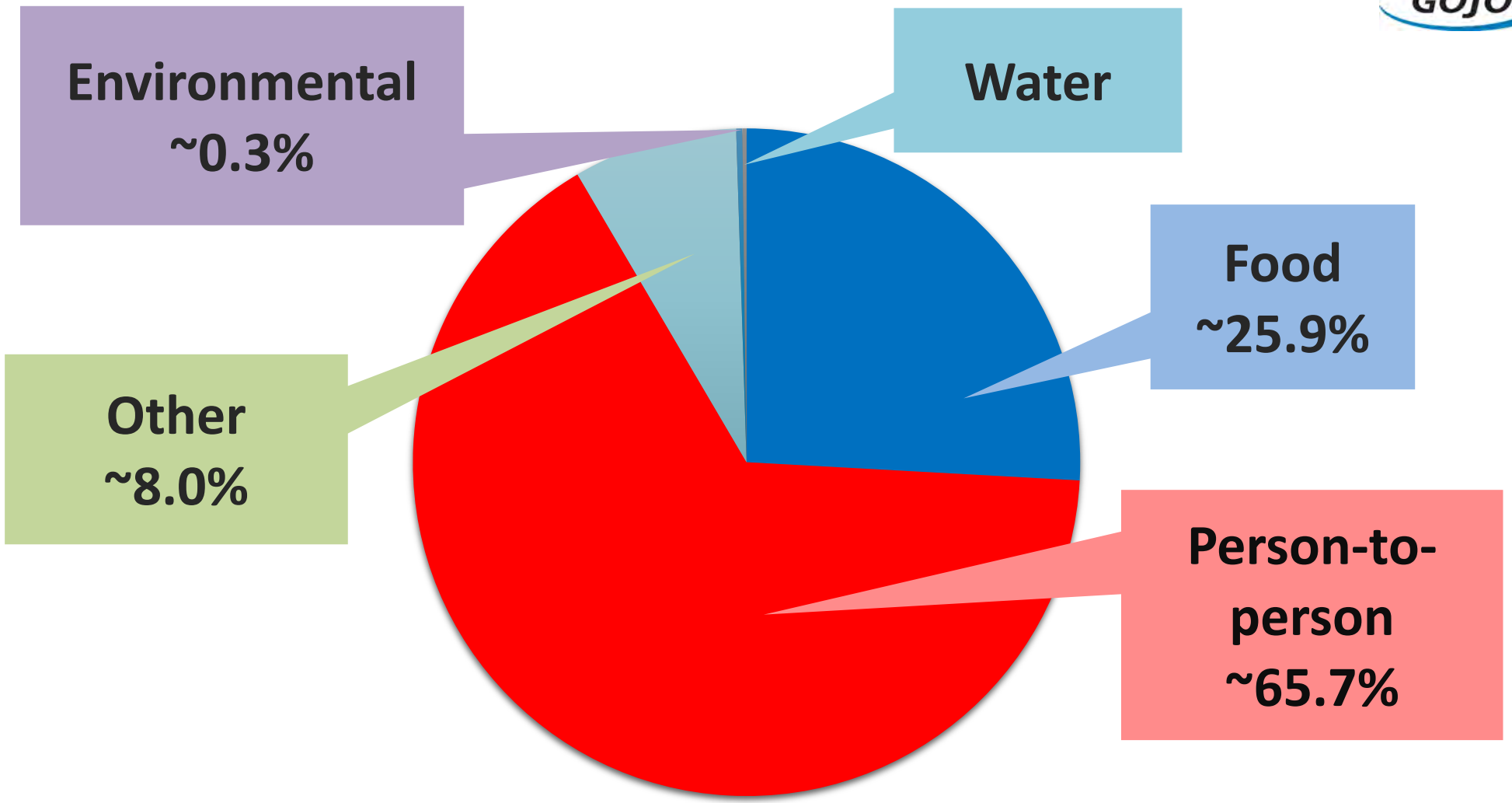
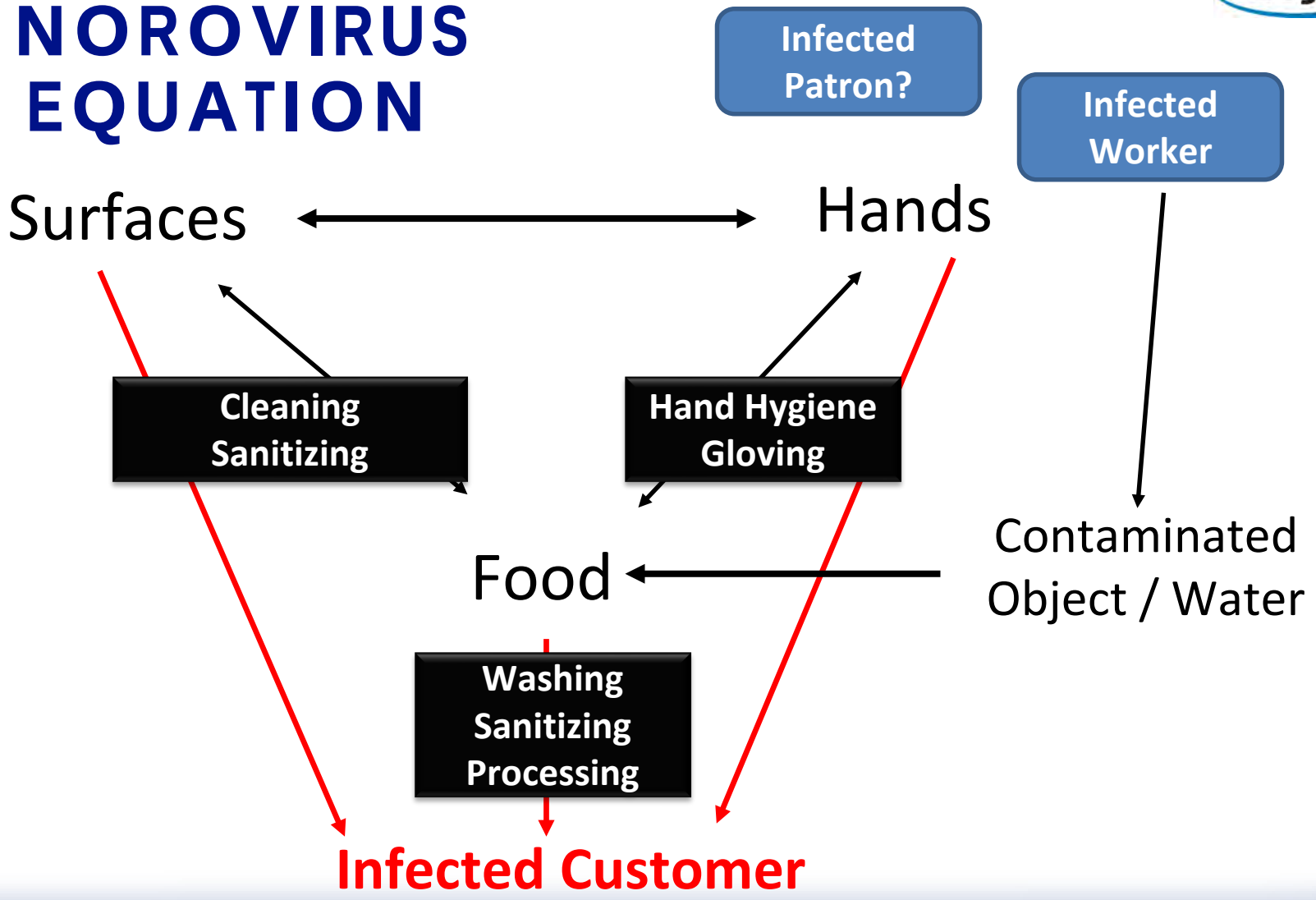
HOW NOROVIRUS IS TRANSMITTED



Wikswo et al. Surveillance Summaries, December 11, 2015 / 64(SS12);1-16

HANDS & SURFACES ARE PART OF A NOROVIRUS TRANSFER EQUATION



Risk Analysis DOI: 10.1111/risa.12758

Quantitative Risk Assessment of Norovirus Transmission in Food Establishments: Evaluating the Impact of Intervention Strategies and Food Employee Behavior on the Risk Associated with Norovirus in Foods

Steven Duret, Régis Pouillot, Wendy Fanaselle,* Efstathia Papafragkou, Girvin Liggans, Laurie Williams, and Jane M. Van Doren

1 MAR 2017 DOI: 10.1111/risa.12758 http://onlinelibrary.wiley.com/doi/10.1111/risa.12758/full#risa12758-fig-0001

NOROVIRUS RISK FACTORS & PREVENTION SCENARIOS IN RETAIL FOOD ESTABLISHMENTS

Approach:

Create a mathematical model to predict number of NoV illnesses on a daily basis from a typical retail food establishment

BASELINE

Using scientific evidence, determine impact of various factors (e.g., handwashing, touch points, disinfectants, etc.) on reduction of NoV as compared to baseline

SCENARIOS

Determine which factors have highest contribution to NoV illness. Make recommendations on best practices

OUTPUT

Risk Analysis. 2017 Nov;37(11):2080-2106

THE IMPACT OF DIFFERENT INTERVENTIONS ON THE REDUCTION OF NOROVIRUS OUTBREAKS

Exclusion from work of symptomatic food employee

- **Full Compliance: 75% of baseline illnesses**
- **No Exclusion: 226% of baseline illnesses**

Efficient Hand Washing

58% of baseline illnesses

Handwashing frequency associated with gloving compliance

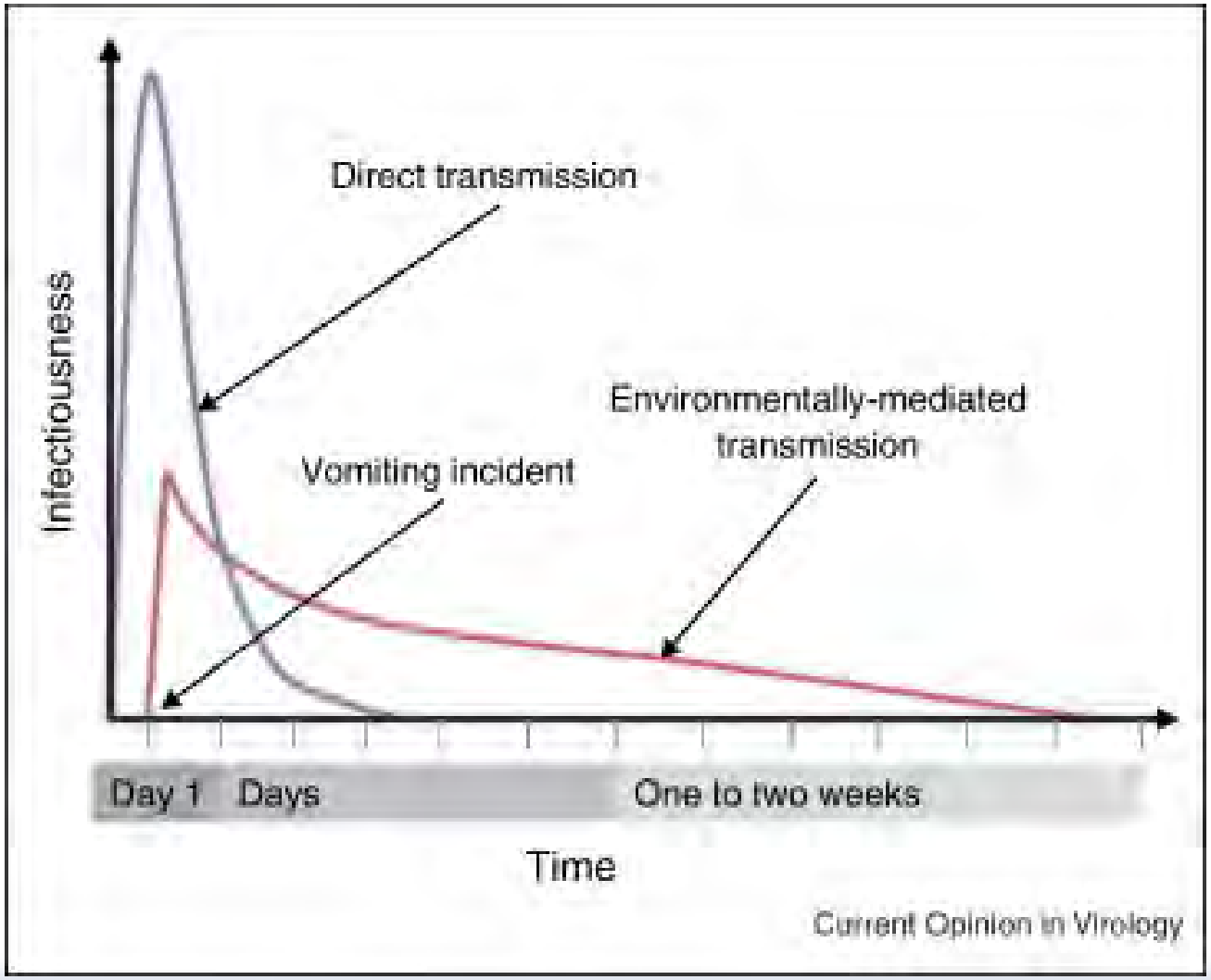
62% of baseline illnesses

Elimination of contact between hands, faucets, doors handles

75% of baseline illnesses

Risk Analysis. 2017 Nov;37(11):2080-2106

WHAT HAPPENS IF YOU DON'T DISINFECT SURFACES?



Curr Opin Virol. 2012 Feb;2(1):96-102.

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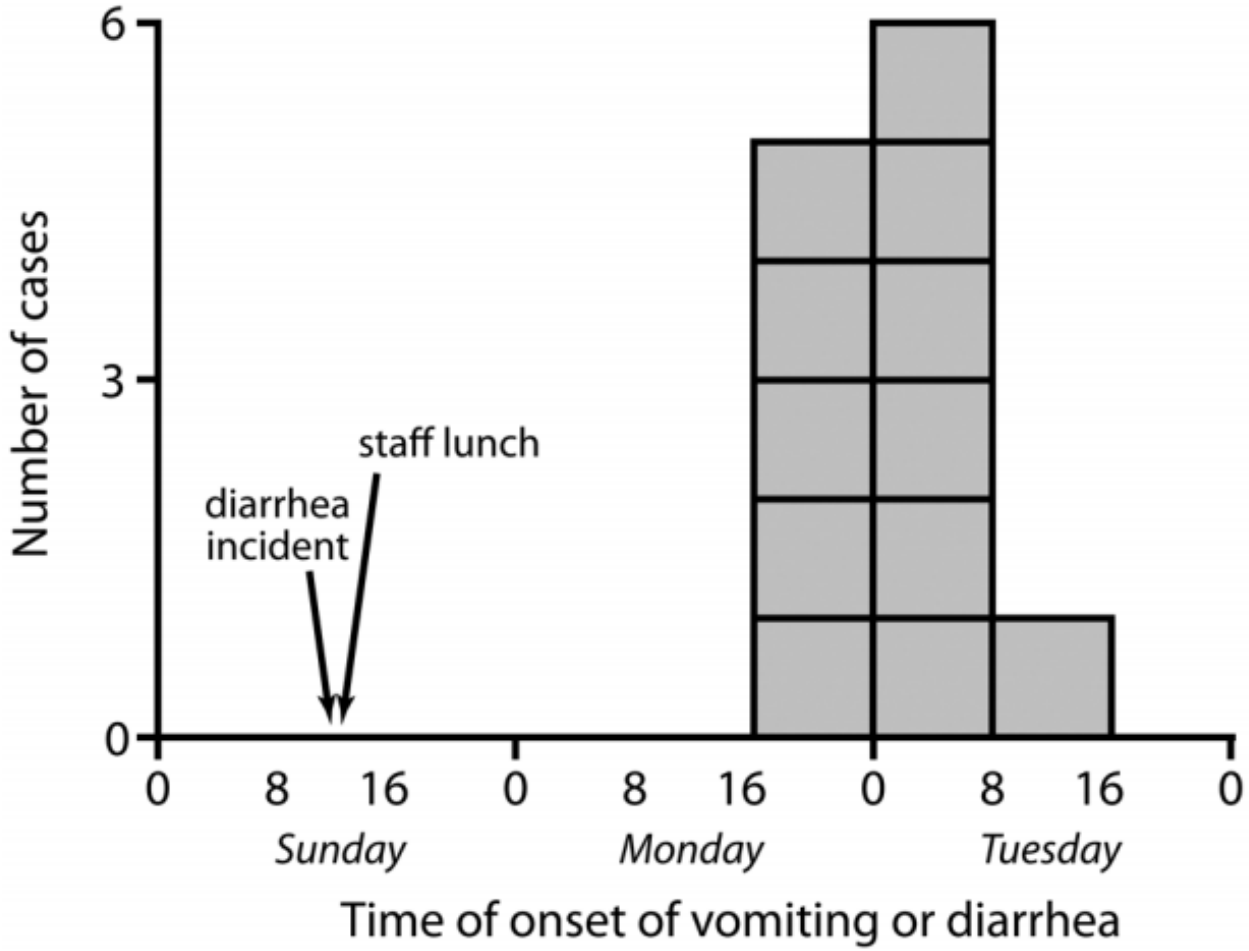
A Norovirus Outbreak Related to Contaminated Surfaces

Kimberly K. Repp,[1] Trevor P. Hostetler,[1] and William E. Keene[2]

[1]Washington County Department Health and Human Services, Hillsboro; and
[2]Oregon Public Health Division, Portland, Oregon



ADDITIONAL LISTENING

10:39

+ PLAYLIST

DOWNLOAD

EMBED

TRANSCRIPT

HEALTH

Tracking The Spread Of A Nasty Virus

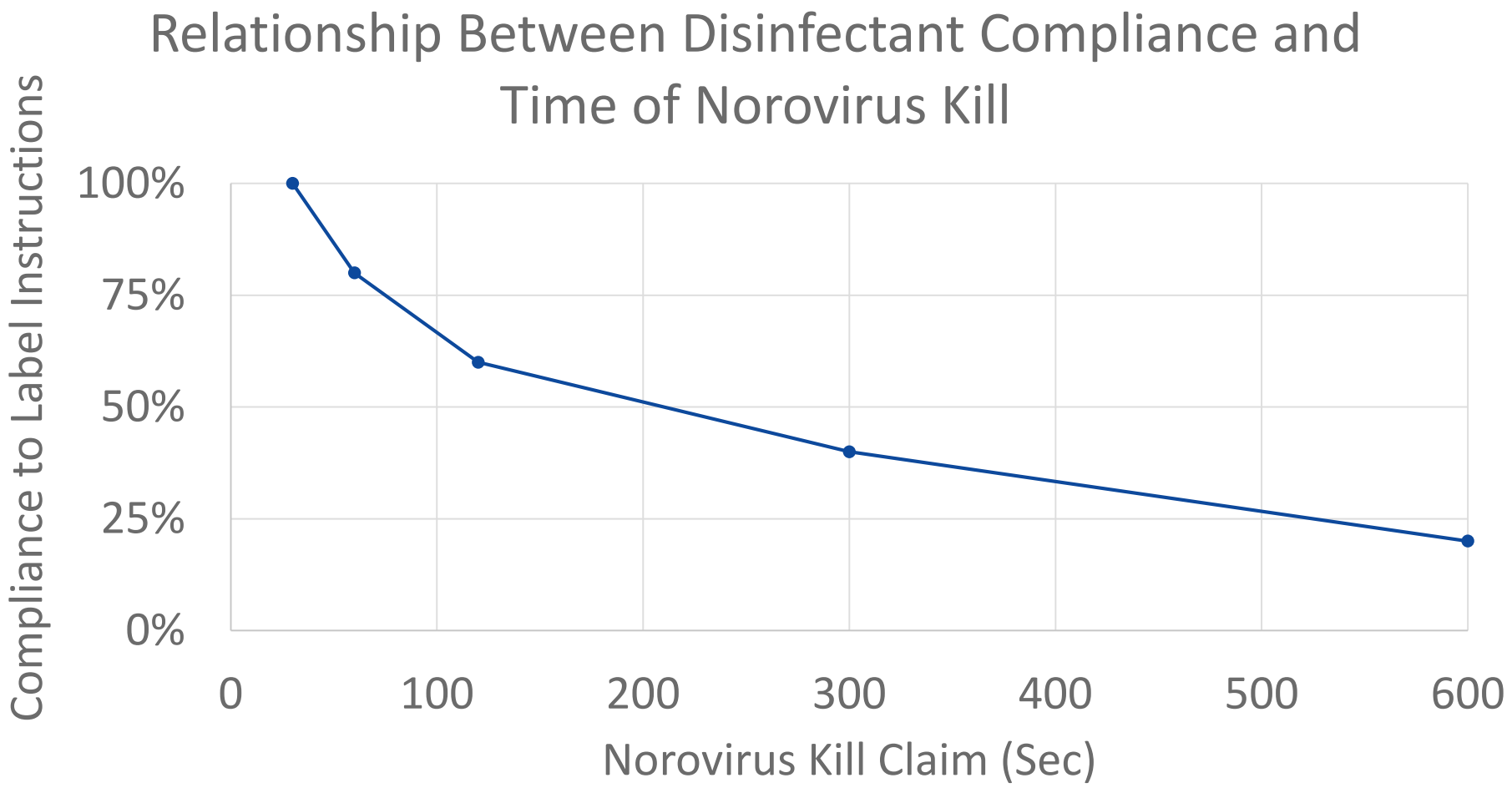
May 11, 2012 · 1:00 PM ET

Heard on Talk of the Nation

When members of a travel soccer team in Oregon fell ill last year, the details of how the disease spread through the team were mysterious. Kimberly Repp, an epidemiologist in Washington County, Oregon, describes the medical detective work that led epidemiologists through the chain of transmission of the norovirus.

https://www.npr.org/2012/05/11/152508362/tracking-the-spread-of-a-nasty-virus

EFFICACY AND TIME OF KILL IS CRUCIAL



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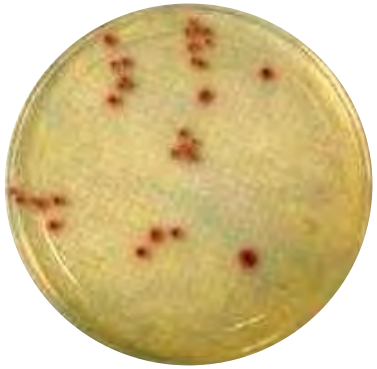
RECENT NOROVIRUS SPILL KIT ADVANCEMENTS

- It helps to have a written procedure + proper steps to clean up body fluid spills
- Use a disinfectant effective at killing Norovirus rapidly (30 seconds) and is safe to use on hard and soft surfaces

Norovirus is a serious issue for food safety managers. Reports of norovirus outbreaks in restaurants, schools and cruise ships drive national headlines and serve as warnings for the foodservice industry. Outbreaks can happen anywhere. The best defense is a good response plan for vomit and diarrhea events. Body fluid spill kits are a key part of risk management programs and include surface disinfectants that kill and prevent the spread of norovirus. Investing in **PURELL™ Body Fluid Spill Kits** can be a cost saving decision.

HYGIENE SCIENCE PRINCIPLES + MYTHS / MISINFORMATION

HANDS: MOST COMMON MEANS OF MICROBIAL SPREAD



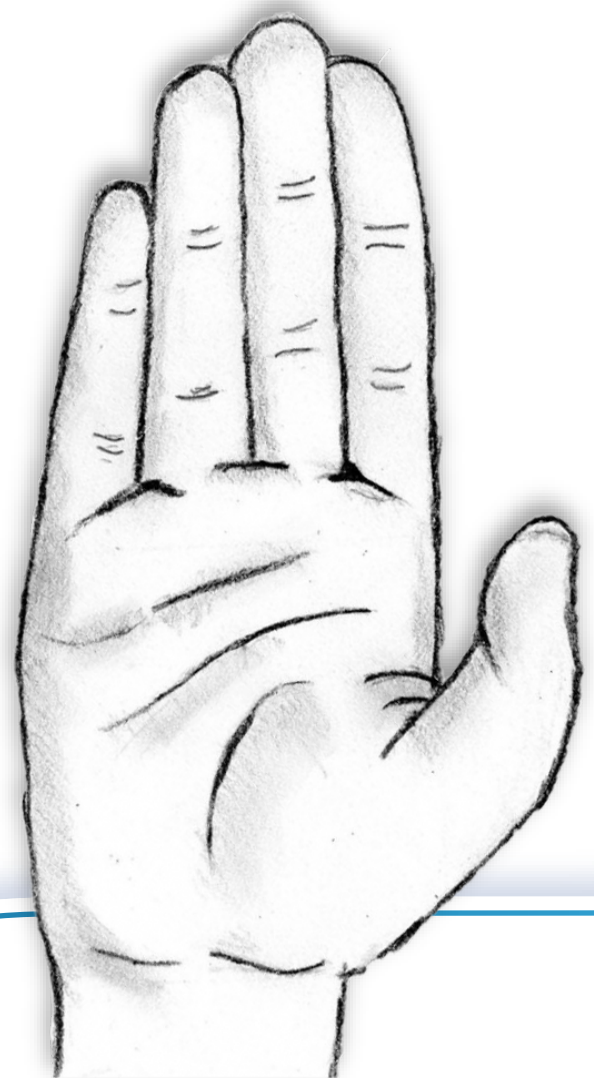
Acquisition of MRSA on hands after touching the bedrail of a colonized patient[1]

Acquisition of MRSA on hands after examination of a colonized patient[1]

~80% of infectious diseases are transmitted by hands[2]

[1]Donskey and Eckstein. *N Engl J Med* 2009; 360.
[2]CDC Guideline (2002) & WHO Guideline (2009) on Hand Hygiene in Healthcare.

THE NEED FOR HAND HYGIENE
PATHOGENS CAN SURVIVE ON HANDS / FINGERS FOR HOURS



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Shigella	Up to 3 hours
Serratia marcescens	Up to 1 ½ hour
Staphylococcus aureus	Up to1 ½ hour

Kramer A. BMC Infectious Diseases 2006;6:130

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Targeted Hygiene at Key Moments is Critical

According to the CDC, “Keeping hands clean is one of the most important steps we can take to avoid getting sick and spreading germs to others.” The agency recommends these important times to wash or sanitize your hands:

1. Before, during and after preparing food
2. Before eating food
3. Before and after caring for someone who is sick
4. After using the bathroom
5. After sneezing and coughing

CDC RESOURCES

- CDC Foundation partnership led to the launch of the CDC Clean Hands Count Campaign (May, 2016), a national educational campaign with the following objectives:
  - Improve hand hygiene knowledge and compliance
  - Address the myths and misperceptions surrounding hand hygiene
  - Empower patients, their families and visitors to act as patient advocates and to work together with their healthcare providers
- Updated materials released May 2019 (including Spanish translation) and under development for community settings (targeted for October 2019)

Resources are available to you and the public at https://www.cdc.gov/handhygiene/campaign/index.html

Have you heard these myths?

General Categories:

- Formulation
- Delivery Systems
- Microbial
- Monitoring / Compliance
- Technique
- Human Health

PURELL Hand Sanitizer causes antibiotic resistance.

Hand sanitizers create supergerms.

All germs are the same.

Using hand sanitizer kills all the germs, even the good ones.

All hand sanitizers, soaps, surface products are the same.

Hand sanitizers contain Triclosan.

Frequent use of hand sanitizer dries out my hands.

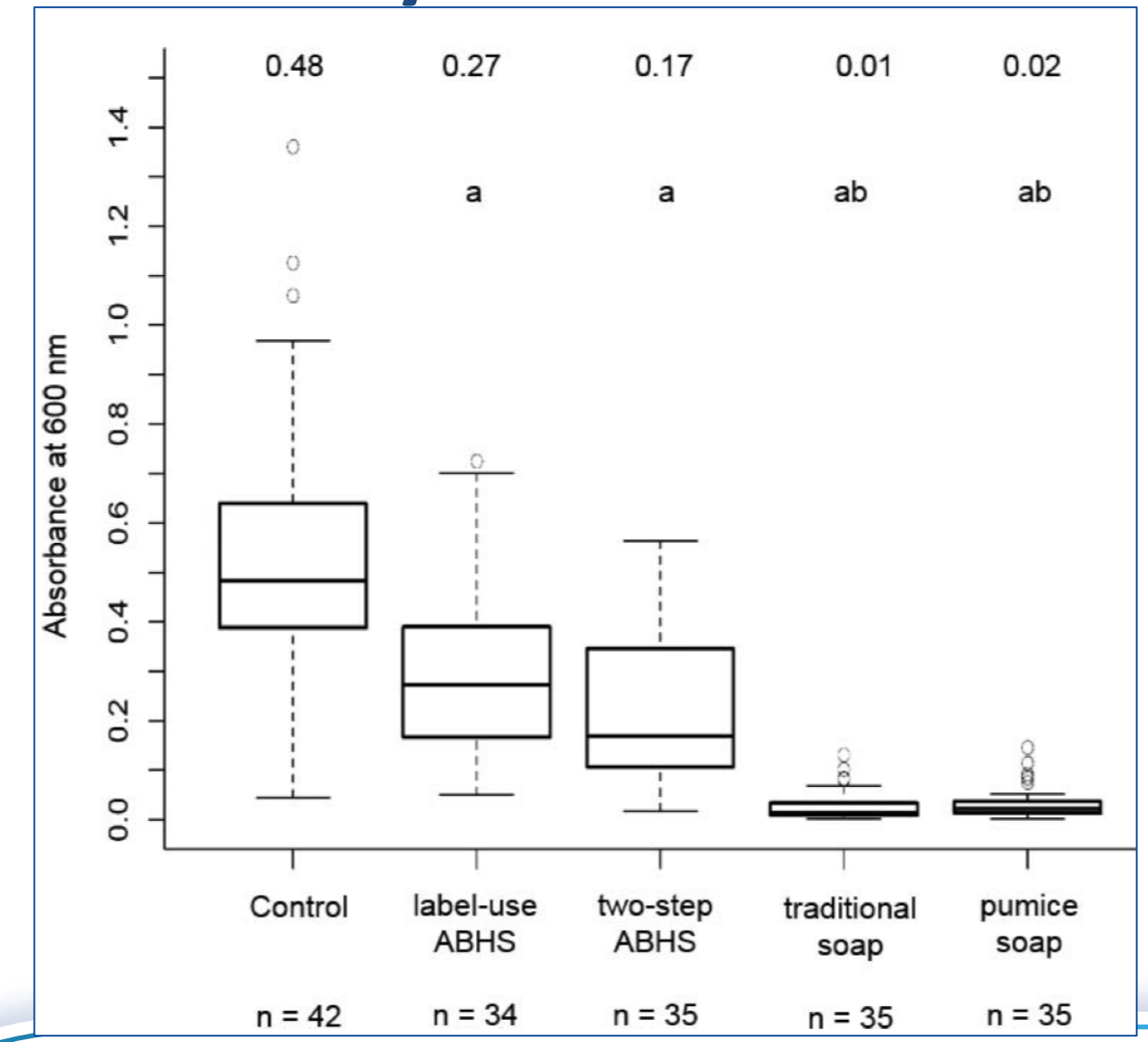
Are we too clean?

Have you heard these myths?

Hand sanitizers aren't as good as soap and water at removing germs

If hands are soiled, they must be contaminated with germs

Have you heard these myths?



Hand sanitizers aren't as good as soap and water at removing germs

J Food Prot. 2015 Nov;78(11):2024-32

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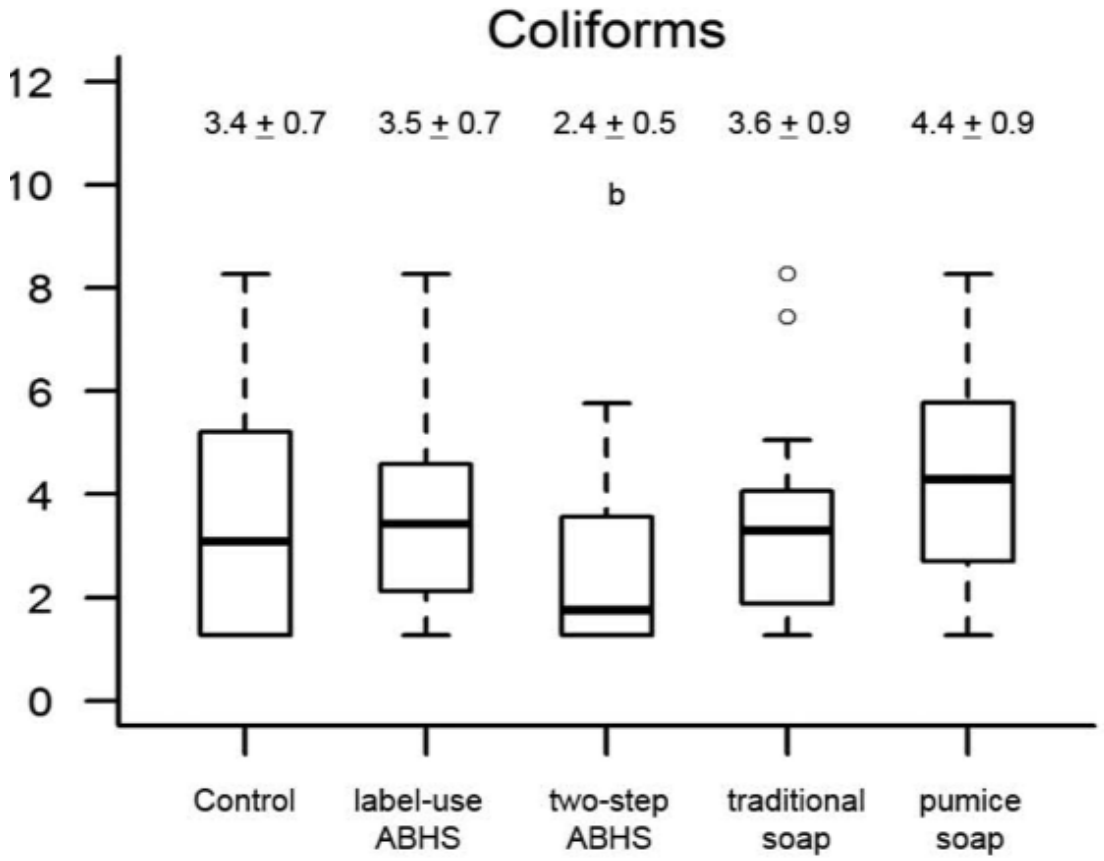
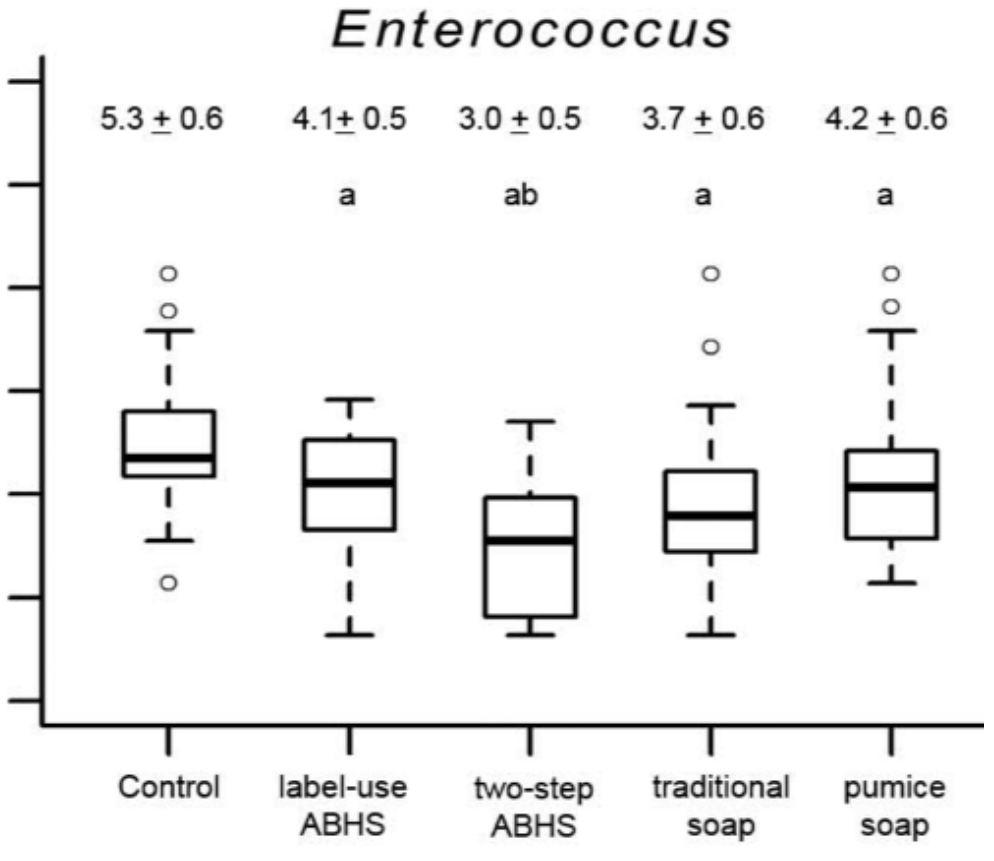
Intervention	label-use ABHS	two-step ABHS	traditional soap	pumice soap
Absorbance After Intervention	0.264	0.045	0.012	0.020

Have you heard these myths?





J Food Prot. 2015 Nov;78(11):2024-32

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Have you heard these myths?

HANDWASHING & NOROVIRUS REMOVAL – NOT A LOT OF EVIDENCE EXISTS!

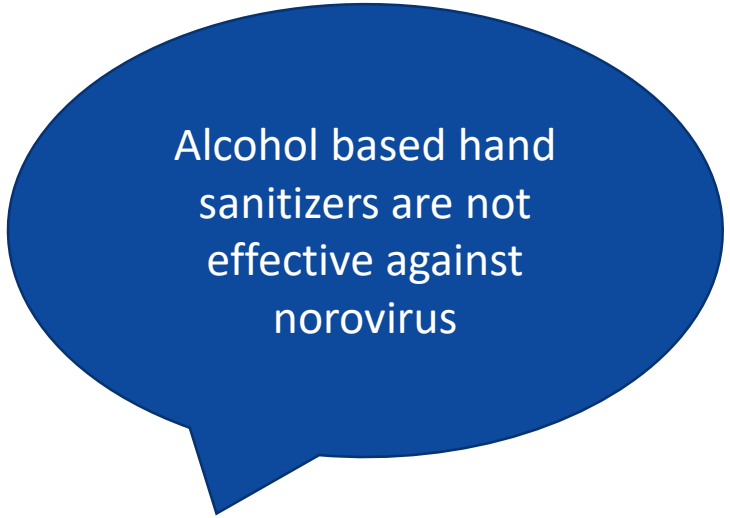
Antimicrobial handwash actives are not virucidal

Nov Surrogates Tested	Log_{10} Reduction by Soap	Log_{10} Reduction by Water only

- ✓ **Do not assume handwashing gives complete removal**
- ✓ **Do not assume some "actives" are better than others**
- ✓ **More research needed on handwashing**

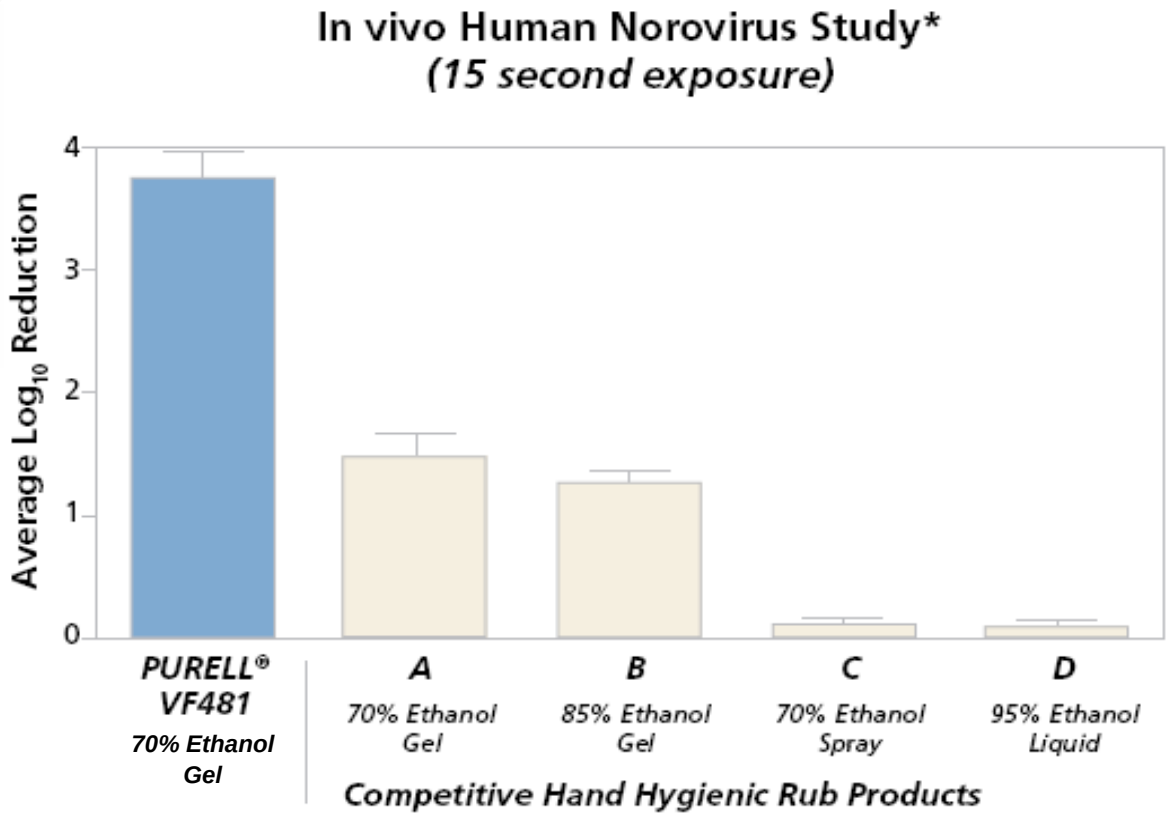
1. Lages, 2008, *J Hosp. Infect.* 68:159.
2. Liu et. al., 2010 *Appl. Environ. Microbiol*. vol. 76 2 394-399
3. Conover & Gibson, 2016 Food Control 69: 141-146

Have you heard these myths?



HUMAN NOROVIRUS EFFICACY OF HAND SANITIZERS

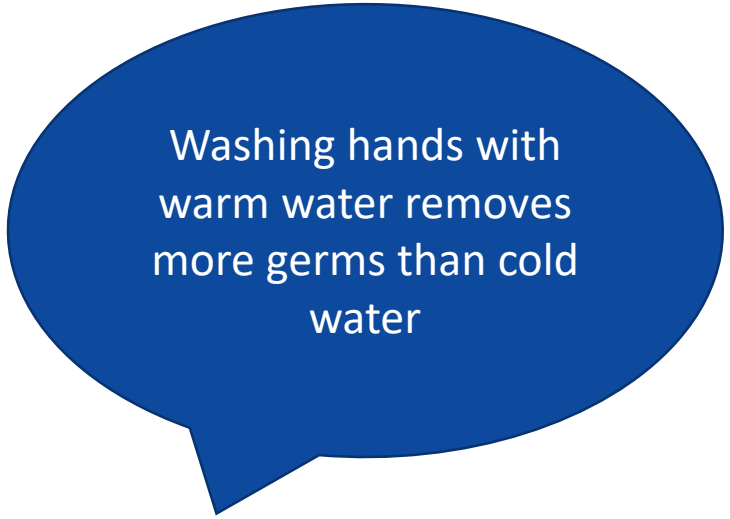
Lab: Dr. Moe (Emory University)
Method: Fingerpad, Quantitative real-time PCR to measure viral RNA
Soil Load: Human Feces



- ✓ VF481 is Statistically Superior to other test articles *(p<0.001)*
- ✓ Alcohol content does not dictate the efficacy: more alcohol does not always mean better efficacy.
- ✓ **Again, Formulation Matters!**

Ref: Liu *et.al.* "Comparison of the Activity of Alcohol-Based Handrubs against Human Noroviruses Using the Fingerpad Method and Quantitative Real-Time PCR." Food and Environmental Virology, 2010.

Have you heard these myths?



Have you heard these myths?

Research Paper

Quantifying the Effects of Water Temperature, Soap Volume, Lather Time, and Antimicrobial Soap as Variables in the Removal of *Escherichia coli* ATCC 11229 from Hands

DANE A. JENSEN,[1] DAVID R. MACINGA,[2] DAVID J. SHUMAKER,[2] ROBERTO BELLINO,[2] JAMES W. ARBOGAST,[2] AND DONALD W. SCHAFFNER[1]*

[1]*Department of Food Science, Rutgers University, 65 Dudley Road, New Brunswick, New Jersey 08901-8520; and* [2]*GOJO Industries, Inc., 1 GOJO Plaza #500, Akron, Ohio 44311, USA*

- Water temperature had no impact on bacteria removal
- Time (10 vs 20 sec) had a small bit statistically significant impact on bacteria removal

J Food Prot. 2017 Jun;80(6):1022-1031

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SURFACE SANITIZING IN RESTAURANTS EXAMPLE - THE RAG & BUCKET PARADIGM

SITUATION ANALYSIS

Customers using ready-to-use surface cleaners and sanitizers have asked how to store cleaning cloths between uses while maintaining compliance (no citations / violations during inspections).

Requirements in the current Food Code:

3-304.14 Wiping Cloths, Use Limitation.

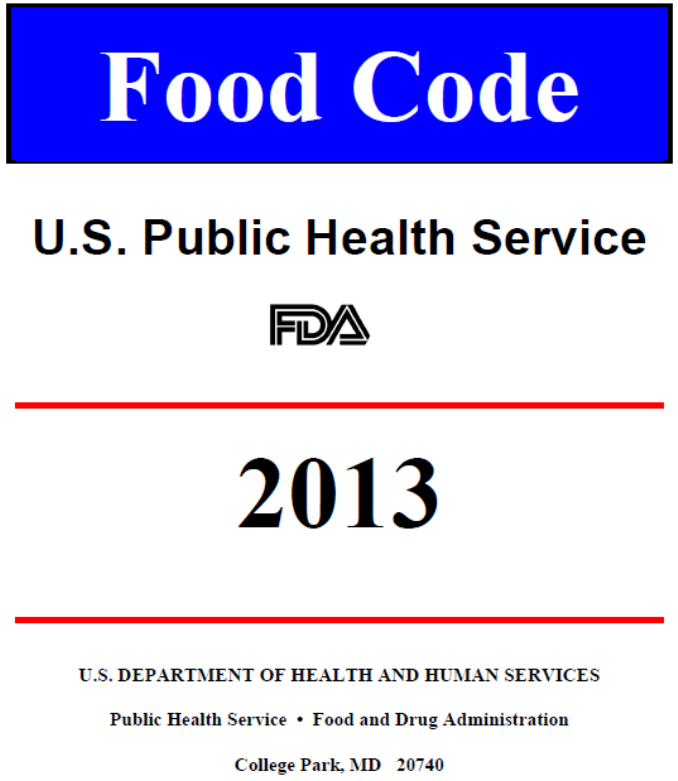
(A) Cloths in-use for wiping FOOD spills from TABLEWARE and carry-out containers that occur as FOOD is being served shall be:

(1) Maintained dry; and

(2) Used for no other purpose.

(B) Cloths in-use for wiping counters and other EQUIPMENT surfaces shall be:

(1) Held between uses in a chemical sanitizer solution at a concentration specified under § 4-501.114; and



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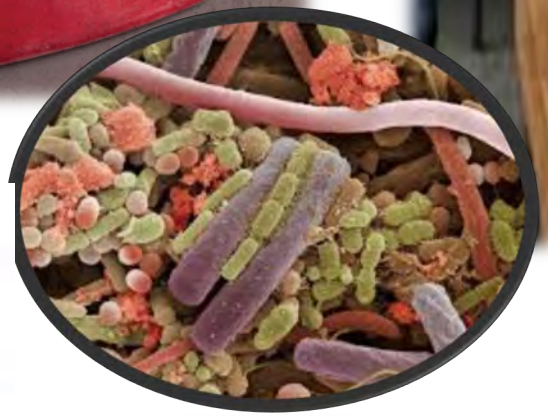
CURRENT CLEANING AND SANITATION

Dirty, reusable cloth towels can be a source of cross-contamination…

and create a poor guest experience



From **table** to **table**

From **"?"** to **table**

--- Reproduced with permission from Dr. Hal King

CURRENT CLEANING AND SANITATION

- From Bucket to Ready-to-eat food prep surfaces
- Sanitizer strength impossible to maintain in the presence of food soils (e.g., oils, fats, grease on reusable towels)

--- Reproduced with permission from Dr. Hal King

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KEY CONSIDERATIONS FOR SELECTING SANITIZERS AND DISINFECTANTS FOR SURFACES

1-Kill Claims

Does it kill the most prevalent pathogens for your market?

2- How quickly does it kill prevalent pathogens?

Kill Times

4-Other Factors

- Safe, nontoxic
- Compatible with surfaces and equipment
- Acceptable aesthetics
- Good cleaner
- Easy to use
- Environmentally sustainable
- Economical, Etc…

3- Does the product remain wet long enough to kill the pathogen?

- Is reapplication necessary?

Wet Times / Dwell Times

BREAKING THE CHAIN OF INFECTION

Next Sick Person

BREAK THE CHAIN!

- ✓ Immunizations
- ✓ Education
- ✓ Treatments

Germs

BREAK THE CHAIN!

- ✓ Diagnose and treatment

How Germs Get In

BREAK THE CHAIN!

- ✓ **Hand Hygiene and Cleaning/ Disinfection**
- ✓ PPE
- ✓ Personal hygiene
- ✓ First aid

Where Germs Live

BREAK THE CHAIN!

- ✓ **Hand Hygiene and Cleaning/ Disinfection**
- ✓ **Personal Hygiene**
- ✓ Infection prevention policies
- ✓ Food safety
- ✓ Pest control

Germs Get Around

BREAK THE CHAIN!

- ✓ **Hand Hygiene and Cleaning/ Disinfection**
- ✓ **PPE**
- ✓ **Food safety**
- ✓ Isolation

How Germs Get Out

BREAK THE CHAIN!

- ✓ **Hand Hygiene and Cleaning/ Disinfection**
- ✓ **Personal Hygiene**
- ✓ PPE
- ✓ Respiratory etiquette
- ✓ Waste disposal

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CONCLUSIONS

TAKE HOME MESSAGES

- Hands and contaminated surfaces play a significant role in the chain of infection of several diseases
- Hand hygiene and surface sanitization / disinfection are important preventive measures to break the chain of infection
- Not all hand antiseptics and surface disinfectants are equal: formulation matters for efficacy and outcome performance
- Learning how to wisely select Hand Hygiene and Surface Sanitizers/ Disinfectants is an important step in reducing infectious disease
- Newly developed interventions have shown improved virucidal efficacy against several hard to kill viruses (including Norovirus)
- Solutions Exist – Seek the Evidence and Experts for Recommendations

THANK YOU

QUESTIONS AND SUGGESTIONS

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