

Calming the Wrath of Food & Waterborne Diseases

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US Centers for Disease Control and Prevention



PIDSP @ 25: Forging Ahead in Pediatric Infectious Diseases
Manila, Philippines
February 21, 2018



Today's Discussion:

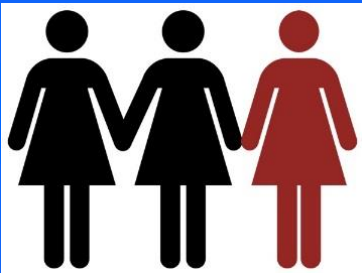
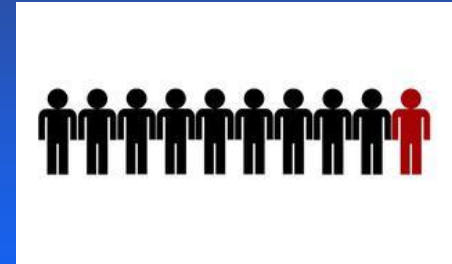


1. Half of the problem: Norovirus
2. Regional problem: Aflatoxin
3. CDC Enteric Disease Toolkit
4. Arising Issue: CIDT vs Culture tests



Burden of Foodborne Illness Worldwide

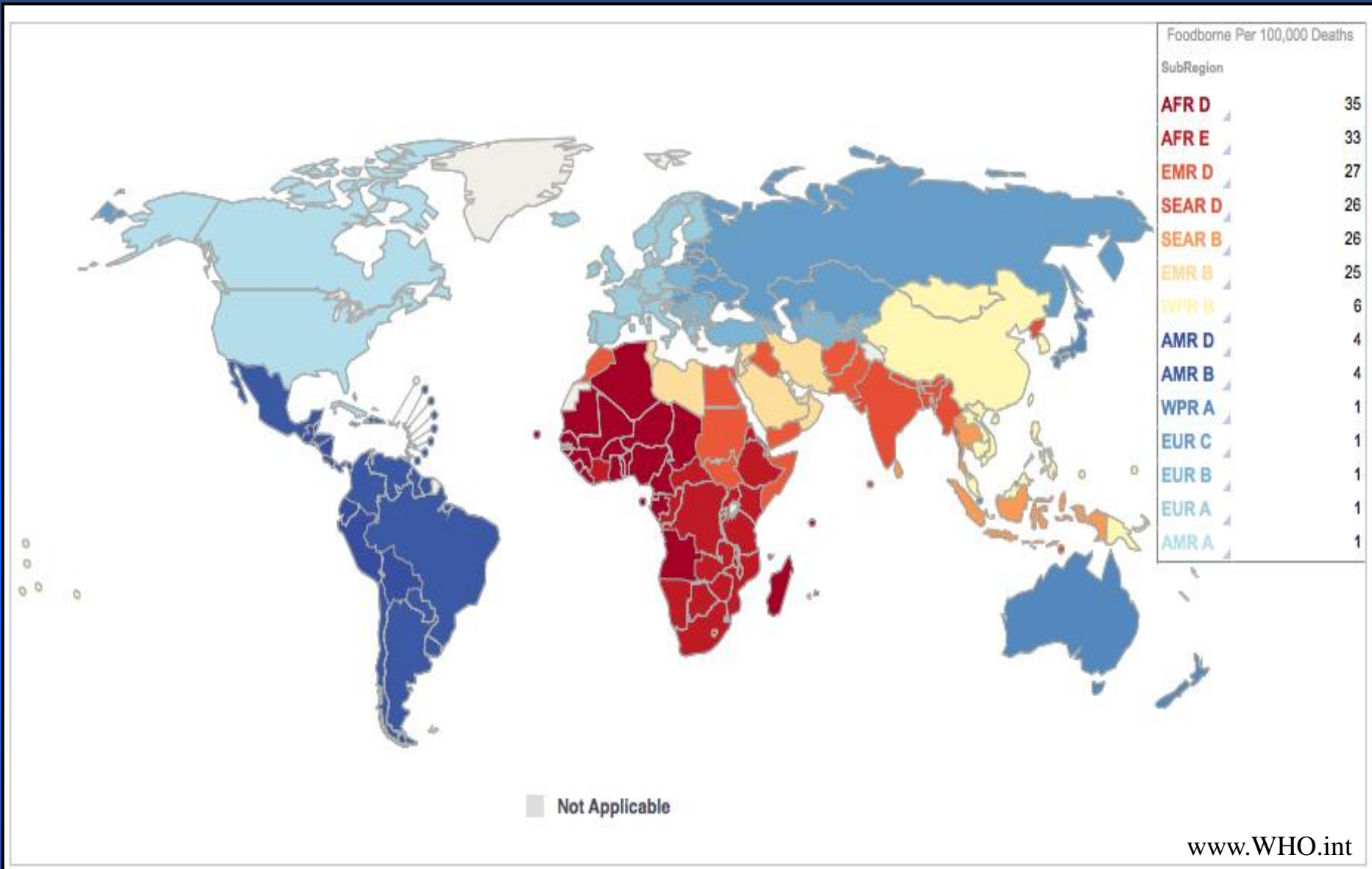
- 1 in 10 people worldwide are sickened after consuming contaminated food each year (550-600 million)



1/3 of these are children <5 years old (200 million)

- DALYs due to foodborne illness = 33 million years of life





125,000 children <5 years old die of foodborne diseases each year



Burden of Foodborne Illness: Western Pacific Region

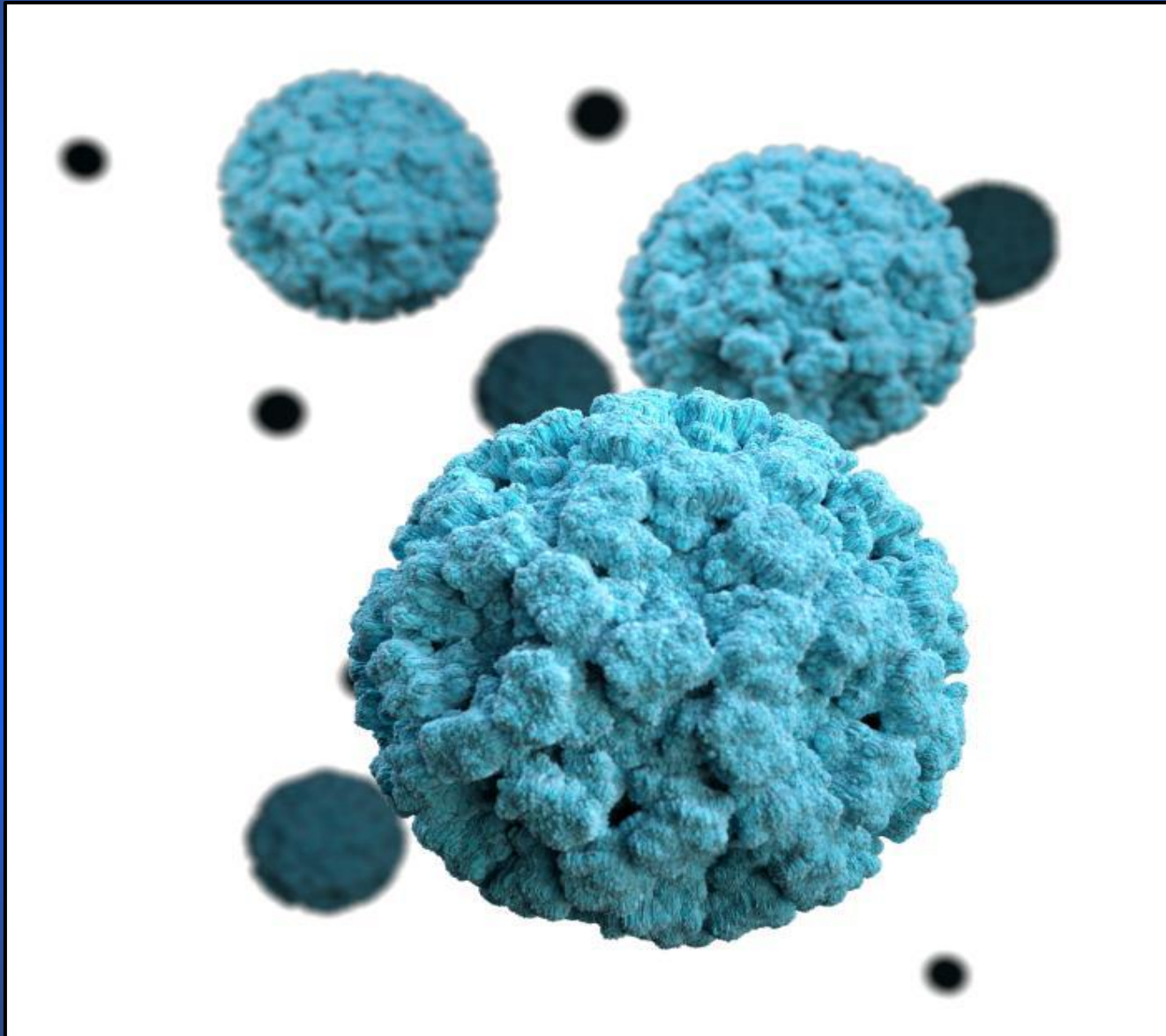


40,000,000 foodborne illnesses in children
<5 years old annually

7,000 foodborne deaths in children
<5 years old annually



Norovirus: Half of the Problem



Norovirus: Half of the Problem



Norovirus is the leading global cause of acute gastroenteritis
(all ages)

Global economic impact >\$64 billion / year

58% of all foodborne outbreaks are caused by
norovirus

Ahmed, et al. *Lancet* 2014
Bartsch, et al. *PLoS One* 2016
Scallan, et al. *Emerg Infect Dis* 2011



Norovirus at Olympics has officials scrambling

POSTED 9:40 AM, FEBRUARY 7, 2018, BY [ASSOCIATED PRESS](#), UPDATED AT 09:43AM, FEBRUARY 7, 2018

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PYEONGCHANG, South Korea — Signs posted around the Olympic venues urge extreme caution. Nine hundred troops stream into the area to help. Worried organizers sequester 1,200 people in their rooms.



The Olympic rings is seen in Hoenggye town, near the venue for the Opening and Closing ceremony ahead of PyeongChang 2018 Winter Olympic Games on February 4, 2017 in Pyeongchang-gun, South Korea. (Chung Sung-Jun/Getty Images)

Officials are scrambling on the eve of the biggest planned event in South Korea in

HEALTH • INFECTIOUS DISEASE

A Norovirus Outbreak Hit the Winter Olympics in PyeongChang. Here's What You Need to Know



Infected Food Handlers



The common rule is to stay home 2 days following end of symptoms, but you are still likely shedding virus recovery



For Norovirus:

Do not assume alcohol hand sanitizers will kill norovirus

Scrub hands well with soap



Use dilute bleach or quarternary ammonia-based cleaners for disinfecting rugs, surfaces

Wear gloves when cleaning



Human Challenge Efficacy Trials of Norovirus Vaccines



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ORIGINAL ARTICLE

Norovirus Vaccine against Experimental Human Norwalk Virus Illness

Robert L. Atmar, M.D., David I. Bernstein, M.D., Clayton D. Harro, M.D., Mohamed S. Al-Ibrahim, M.B., Ch.B., Wilbur H. Chen, M.D., Jennifer Ferreira, Sc.M., Mary K. Estes, Ph.D., David Y. Graham, M.D., Antone R. Opekun, P.A.-C., Charles Richardson, Ph.D., and Paul M. Mendelman, M.D.

N Engl J Med 2011; 365:2178-2187 | December 8, 2011 | DOI: 10.1056/NEJMoa1101245

The Journal of
Infectious Diseases

Norovirus Vaccine Against Experimental Human GII.4 Virus Illness: A Challenge Study in Healthy Adults

David I. Bernstein¹, Robert L. Atmar², G. Marshall Lyon³, John J. Treanor⁴, Wilbur H. Chen⁵, Xi Jiang¹, Jan Vinjé⁶, Nicole Gregoricus⁶, Robert W. Frencik Jr¹, Christine L. Moe⁷, Mohamed S. Al-Ibrahim⁸, Jill Barrett⁹, Jennifer Ferreira⁹, Mary K. Estes², David Y. Graham², Robert Goodwin¹⁰, Astrid Borkowski¹¹, Ralf Clemens¹¹ and Paul M. Mendelman¹⁰

GI.1 intranasal

Current Status:
Met safety and immunogenicity endpoints

GI.1/GII.4 intramuscular

Current Status:
Phase II: Safety and Immunogenicity in Children

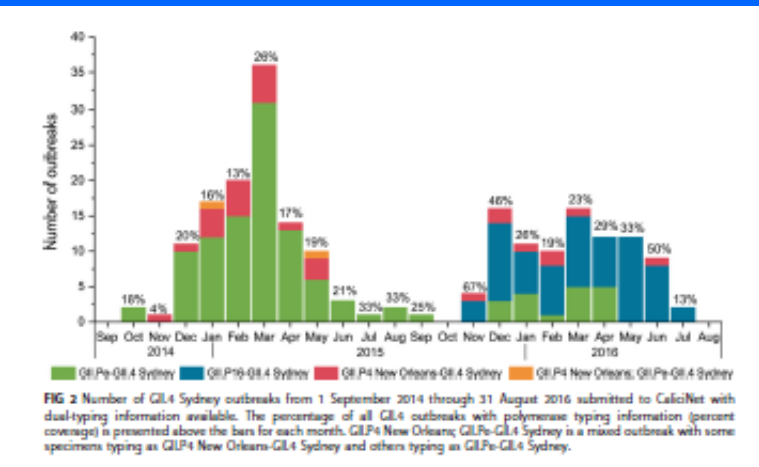
Current emergence of a novel, recombinant strain of norovirus (GII.4 – GII.P16)



Genetic and Epidemiologic Trends of Norovirus Outbreaks in the United States from 2013 to 2016 Demonstrated Emergence of Novel GII.4 Recombinant Viruses

Jennifer L. Cannon,^a Leslie Barclay,^b Nikail R. Collins,^c Mary E. Wilkswold,^b Christina J. Castro,^d Laura Cristal Magaña,^d Nicole Gregoricus,^b Rachel L. Marino,^b Preeti Chhabra,^e Jan Vinje^b

CDC Foundation, Atlanta, Georgia, USA^a; Division of Viral Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia, USA^b; Atlanta Research and Education Foundation, Decatur, Georgia, USA^c; Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee, USA^d; Synergy America, Inc., Atlanta, Georgia, USA^e



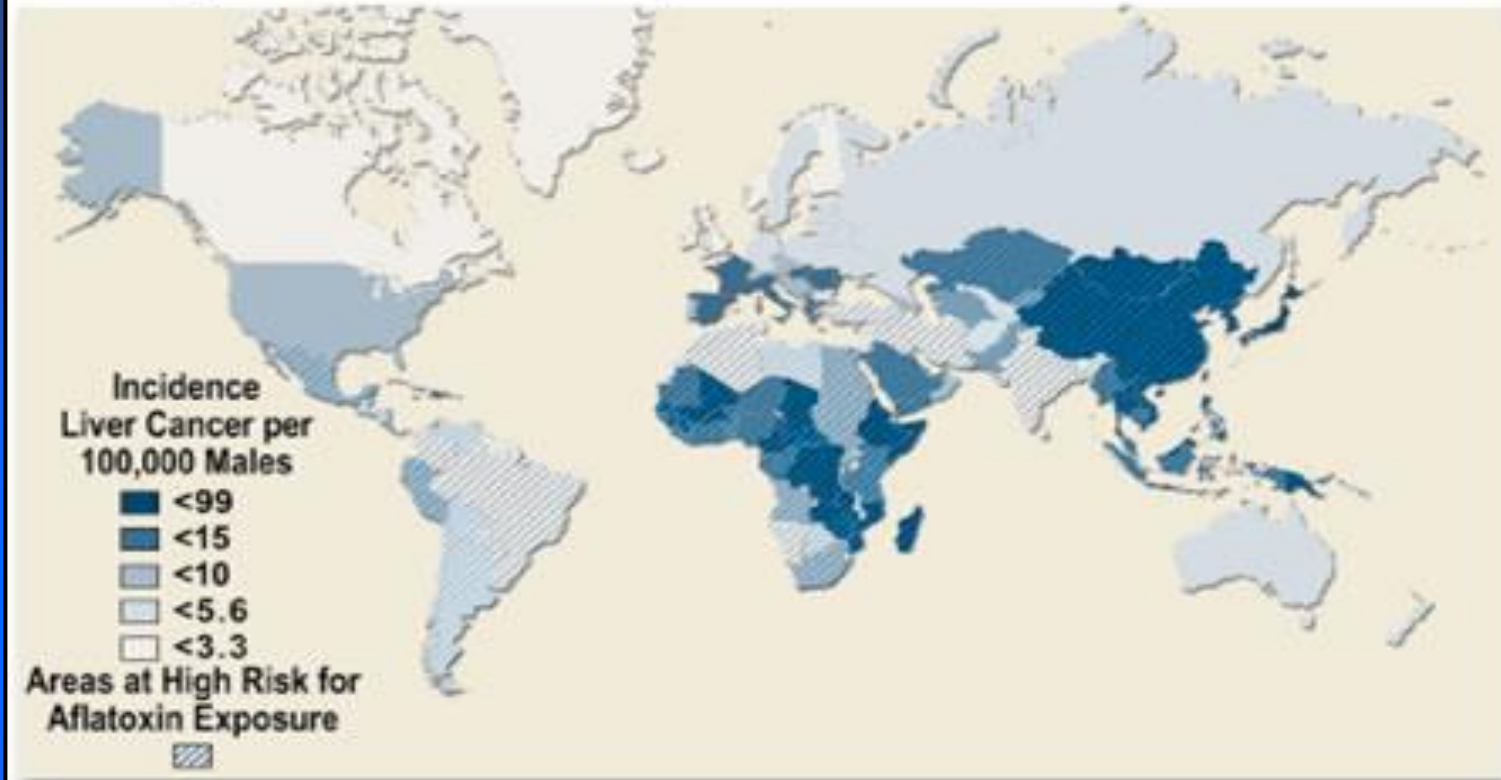
- Unique polymerase sequence with low fidelity combined with existing GII.4
- “...appears to have made these viruses evolve toward greater transmissibility.”
- Showing up disproportionately in foodborne outbreak surveillance (x 2 ½)



Aflatoxin: A Regional Problem



Correlation Between Populations with High Liver Cancer Rates and High Risk of Chronic Exposure to Aflatoxin Contamination



Liver cancer data from the GLOBOCAN 2002 database
(http://www-dep.iarc.fr/GLOBOCAN_frame.htm)

Aflatoxin data from Williams et al., *Human Aflatoxicosis in Developing Countries*,
Am J Clin Nutr 80:1106–22, 2004.

Aflatoxin enables the shut-off of a gene (codon 249)
allowing uncontrolled cell proliferation which *can*
predispose infected subjects to liver cancer



Global Impact of Waterborne Diarrheal Diseases

Diarrheal Diseases from Contaminated Water:

- Globally, at least 2 billion people use a drinking-water source contaminated with feces
- Contaminated drinking water is estimated to cause 500,000 diarrheal deaths each year

Shigella
Cholera

Hepatitis A
Typhoid

Campylobacter
Giardia

Improvements in household sanitation are associated with lowered risk of bacterial/parasitic enteric infections (**but are not associated with viral causes**)

CDC's Enteric Diseases Toolkit

The Enteric Diseases Toolkit was developed to help facilitate capacity building in countries to prevent, detect, and respond to diseases from contaminated food, water, and environmental sources.

For more information, CDC contact:

Brion Edwards (yjv8@cdc.gov)

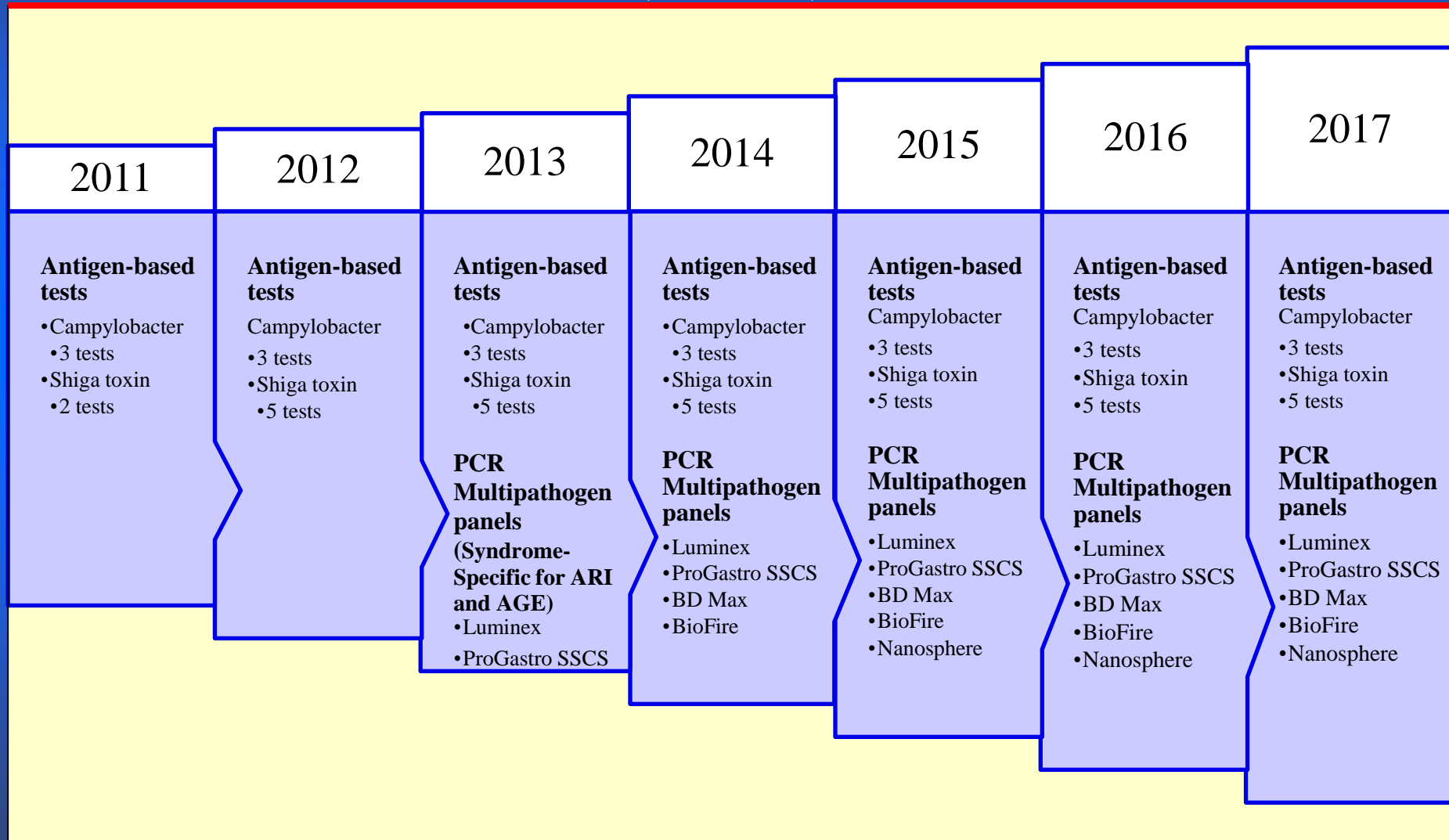
and/or Heena Mikoleit (glv8@cdc.gov)



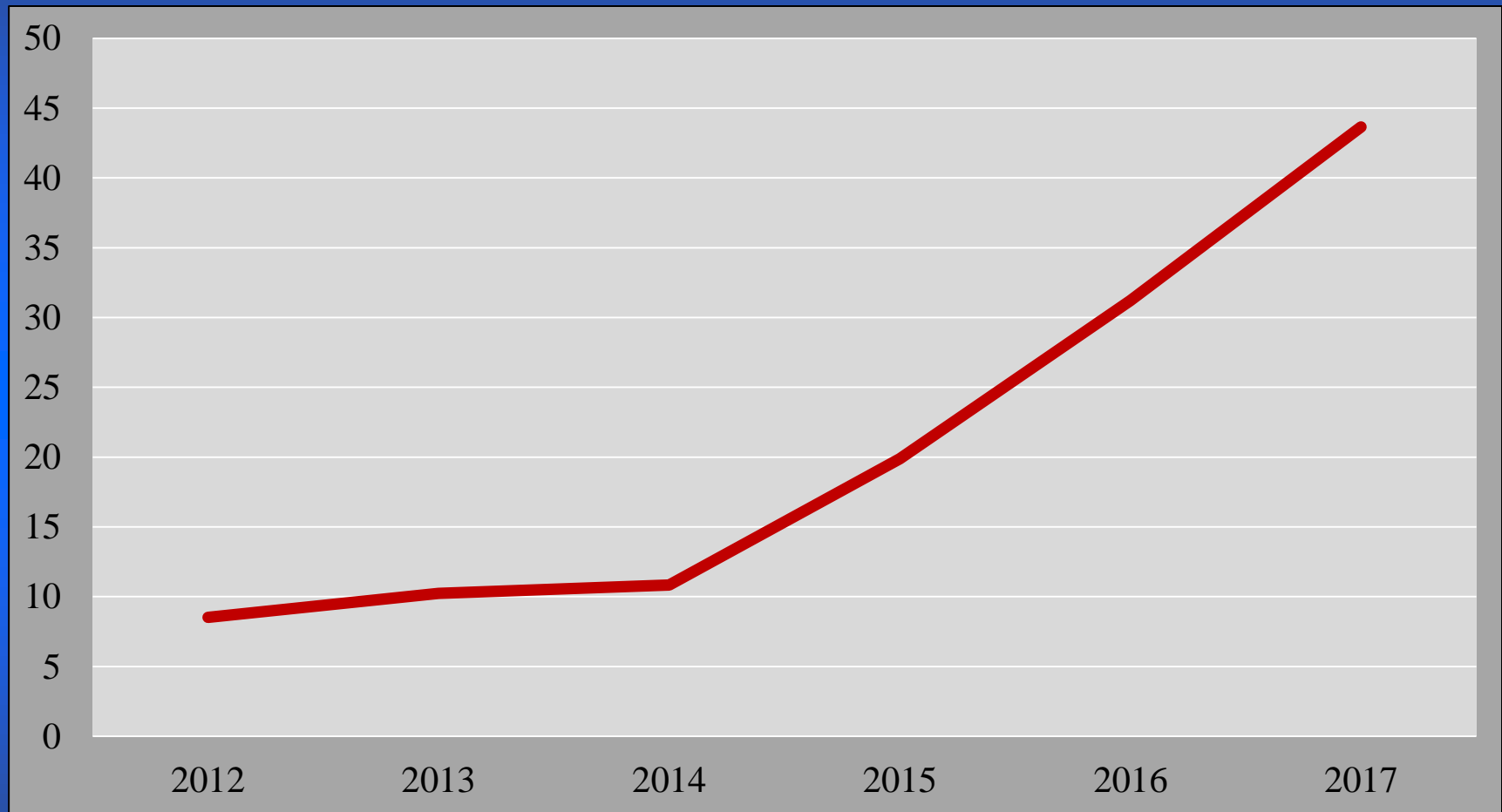
Toolkit Training Module Content

Leadership	Frontline	Train the Trainer
<p>Outbreak Preparedness & Response Frontline Express Module Outbreak Prevention, Detection, and Response Concepts for Leadership Purchasing and Resource Management</p> <p>Effective Communication & Policy Crisis and Emergency Risk Communication Public Health Policy</p> <p>Outbreak Management Efficient Outbreak Management Monitoring and Evaluation Employee Satisfaction and Retention Capacity Building and Staff Development</p>	<p>Introductory Level Enteric disease overview Environmental health, Epidemiology and laboratory considerations Steps of an outbreak investigation</p> <p>Intermediate Level Data collection tools and techniques Outbreak response tool development Control and prevention measures</p> <p>Advanced Level Treatment and control Crisis and emergency risk communication Data analysis and reporting Monitoring and evaluation</p>	<p>Adult Learning Concepts</p> <p>Tier 1 Course Content (introductory through advanced)</p> <p>Performance Evaluation</p> <p>Curriculum Development</p> <p>Continuing Education Requirements and Tracking</p> <p>Online Training Management</p>

Changes in US Clinical Lab testing practices towards Culture-Independent Diagnostic Tests (CIDTs)



Percentage of US bacterial foodborne surveillance cases detected by CIDT+ test (excluding STEC), 2012-2017



How does the use of CIDTs impact Foodborne/Waterborne disease surveillance?

- Widely used in viral diagnostics (EIA, PCR, multipathogen panels), but still lagging in use for some bacterial/parasitic diagnostics which have depended on culture testing
- Do not require isolation of living organisms
- Advantages of CIDTs versus Culture testing:
 - Cheaper and easier to use
 - Faster and more sensitive
 - Detects multiple pathogens and wider range of pathogens
- Disadvantages of CIDTs versus Culture testing:
 - Loss of pathogen subtype information needed for outbreak detection
 - Variation in test performance from one another and from culture
 - New strains may not be picked up by CIDT
 - Loss of ability to test for antimicrobial susceptibility
 - Detection of multiple pathogens in a single specimen can make interpretation difficult



In Summary:

Controlling norovirus would reap great decreases in
foodborne illnesses

Aflatoxin is specific to WPRO, but may be causing a large
chronic disease burden

Enteric Disease Toolkit available for training on foodborne
disease prevention

CIDT test usage for foodborne diagnostics is rapidly
growing, but brings challenges in interpretation



Thank you!



Daniel Payne, PhD, MSPH

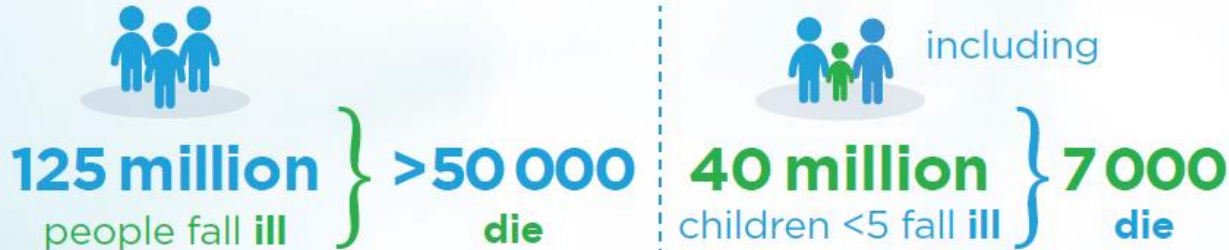
DVP6@CDC.GOV





Foodborne diseases in the WHO Western Pacific Region

Every year



Aflatoxin (caused by mould on grain) is main cause of foodborne disease deaths with **70% of all cases worldwide in this Region**



Region has highest death rate from foodborne **parasites**



As a result **>10 000** people develop liver cancer each year

**FOODBORNE DISEASES ARE PREVENTABLE.
EVERYONE HAS A ROLE TO PLAY.**

For more information: www.who.int/foodsafety
#SafeFood

Source: WHO Estimates of the Global Burden of Foodborne Diseases. 2015.

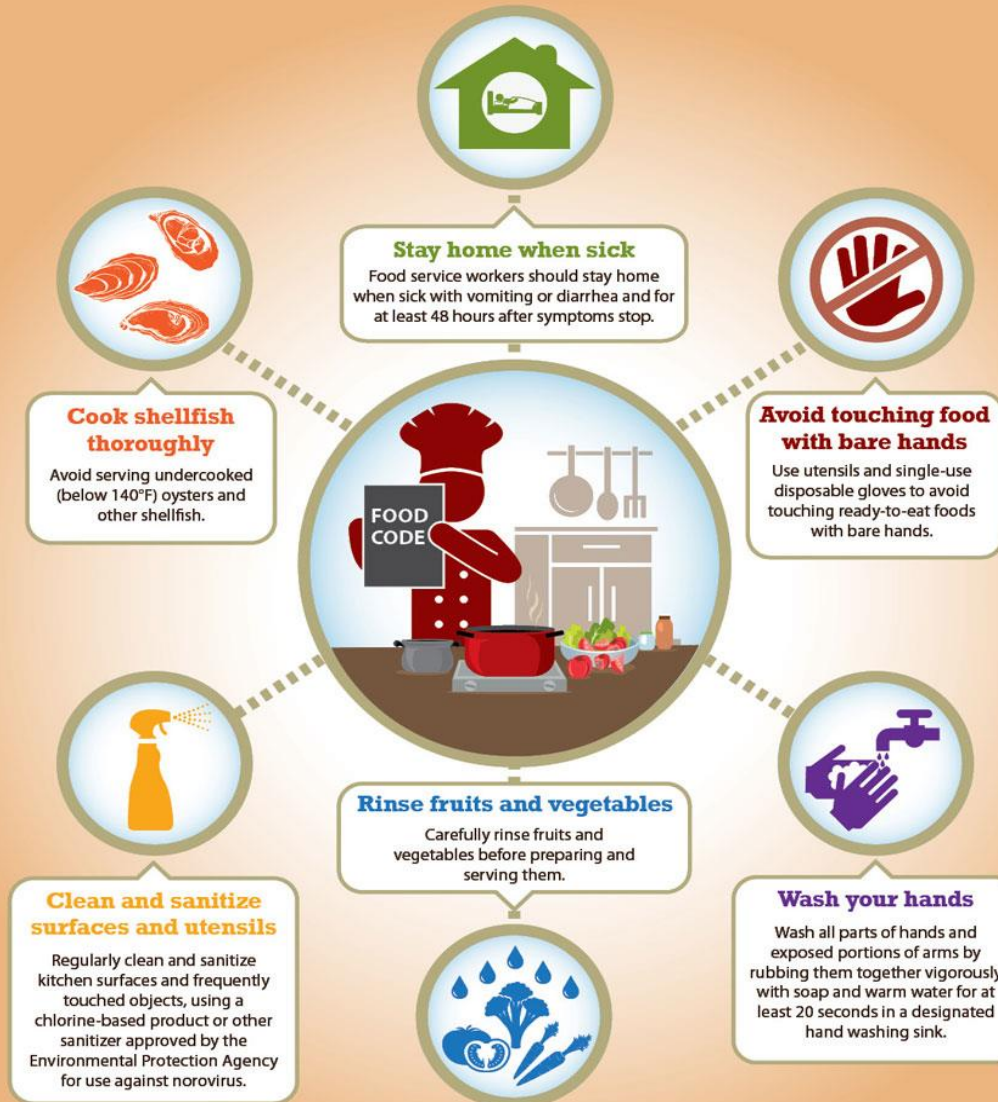


World Health Organization



Ways to prevent norovirus outbreaks from food contamination

Kitchen managers should be trained and certified in food safety and ensure that **all food service workers follow food safety practices** outlined in the **FDA model Food Code and CDC guidelines**.



SOURCES: US Food and Drug Administration, Food code, 2013, <http://www.fda.gov/foodcode>, MMWR, March 4, 2011.



HEALTH AND HUMAN SERVICES