2018 OutbreakNet/WASH Webinar Series

September 18, 2018 3-4PM EDT

Brittany Robinson, MPH
Brittany Isabell, MPH
Amy Kahler, MPH
Waterborne Disease Prevention Branch

2018 OutbreakNet/WASH Webinar Series

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Reminders:

- Please do not listen using both the phone line and computer speakers, as this affects audio quality for all participants.
  - Please mute your phone during the presentation.
  - If you are using your computer speakers and have problems with the audio quality, please turn off your speakers and try calling into the phone line.

- Use the Group Chat box on your screen to send questions/comments to CDC or to share them with other participants.

- The meeting will be recorded.

Agenda

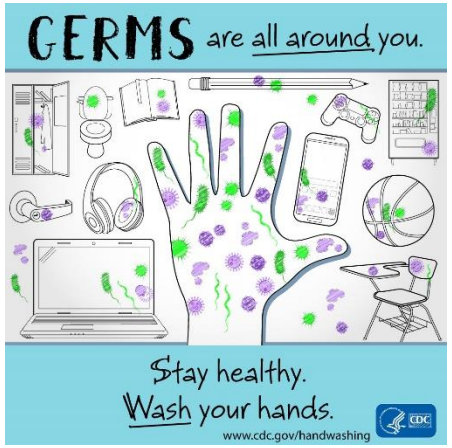
1. Welcome and participant polls
2. General updates
3. Featured presentations:
   - "Navigating the Course: Investigation of a Multi-Pathogen Outbreak at a Zipline Facility in Sevier County, Tennessee, 2018," Brittany Isabell, TN Department of Health
     - Environmental Microbiology Lab Perspective: Amy Kahler, CDC
4. Discussion and Q&A
5. Closing

Global Handwashing Day 2018
Clean Hands – A Recipe for Health

- **Observance Day**
  - October 15 (annually)
  - Designed to support a global and local culture of handwashing with soap
- **Community Outreach**
  - 30 Metro-Atlanta schools to receive handwashing demonstrations and hygiene kits

Promotional Activities

- **New Graphics & Posters**
- **Facebook Live Event**
- **MMWR article**
  - Visual Abstract
- **Partner Engagement**
  - Newsletters
  - OPHPR "Public Health Matters" Blog



Promotional Activities

- **Social Media Outreach**
  - Traditional social media
  - Twitter and Instagram story polls
  - #HandwashingHeroes campaign
- **Web Updates**
  - Show me the Science
  - Wash Your Hands CDC.gov Feature
  - Observance web page

TN Department of Health

Navigating the Course: Investigation of a Multi-Pathogen Outbreak at a Zipline Facility in Sevier County, Tennessee, 2018

CDC WASH Webinar,
September 18th, 2018

Brittany S. Isabell, MPH | Regional Epidemiologist | East Tennessee Regional Health Office

Sevier County, Tennessee

Sevier County Tourism

Sevier County Tourism

Sevier County Tourism

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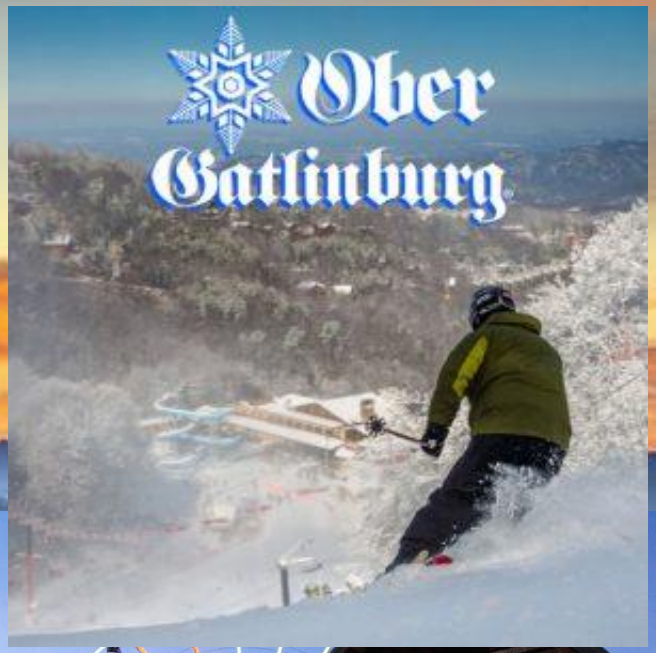
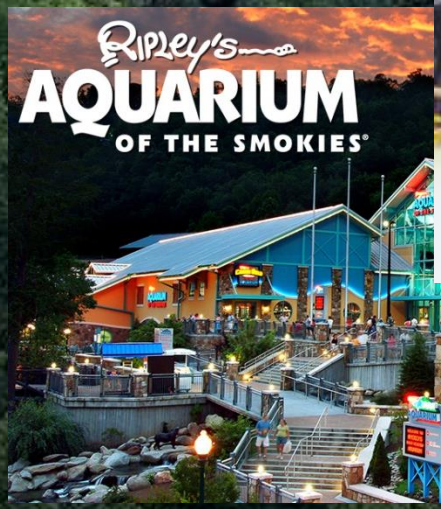


Sevier County Tourism

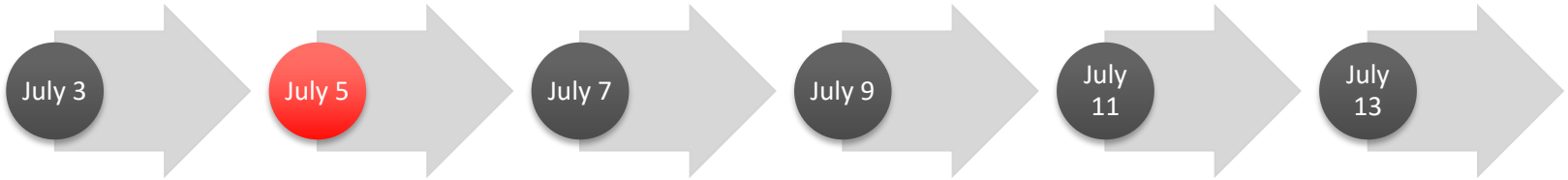


Timeline - Initial Notification

- Complaint from Sevier County visitor
- 5 individuals with Noro-like symptoms
- Unremarkable activities and locations listed

Timeline - Initial Notification

- 2nd complaint from Sevier County visitor (unrelated to first complainant)
- Notable activity in common with 1st complaint: zipline tour at Facility C



Prior Illness Reports

- After complaints on 7/3 and 7/5 regarding Facility C, an old complaint from June related to Sevier County was revisited

- Facility C was found to be listed among complainant activities prior to illness onset

Prior Illness Reports

- June complaint involved a Missouri Boy Scout Troop that traveled throughout NC and TN for a week participating in various adventure activities

- Several possible sources of exposure during trip

- Stayed at campsite in Sevier County that was the focus for connection to illness at time of complaint
  - Campsite inspected by TDH Environmental Health
  - No issues and no further complaints of illness related to campsite

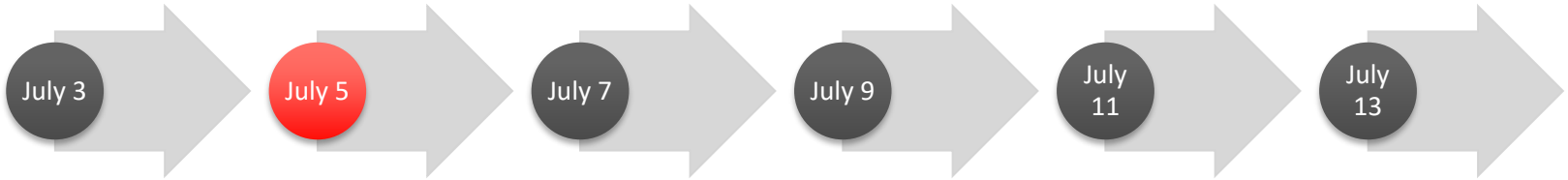
Outbreak Investigation Initiated

Objectives

1. Confirm the diagnosis of gastroenteritis among patrons of Facility C
2. Conduct an epidemiologic study to assess exposures and outcomes
3. Determine the etiology of the outbreak
4. Recommend public health measures to halt and prevent the spread of illness

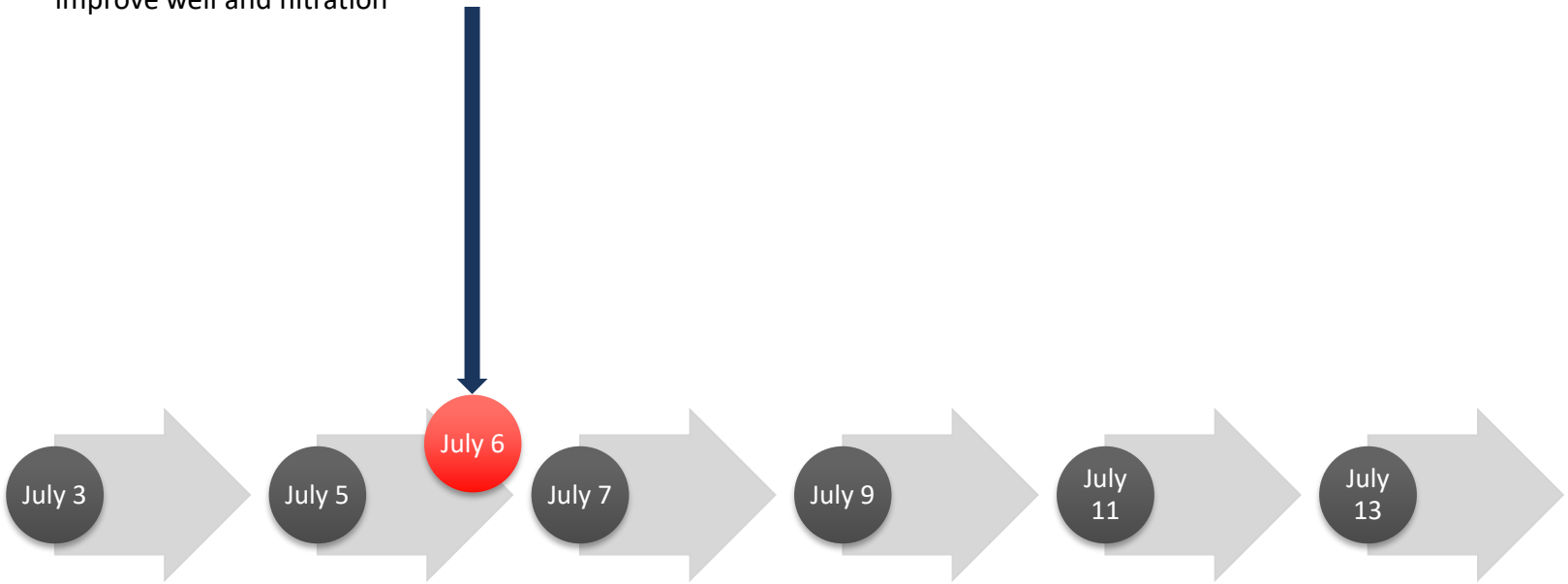
Timeline -Facility Assessment

- TDEC collected water samples
- Reviewed well location
- Assessed volume of patrons being served



Timeline - Facility Assessment

- TDEC samples **positive for *E. coli* and total coliforms**
- Recommendations made to improve well and filtration



Timeline - Facility Assessment

TN Department of Environment & Conservation

- TDEC samples **positive for *E. coli* and total coliforms**
- Recommendations made to improve well and filtration

TN Department of Health | East Regional Office

- EH field manager visited Facility C to perform an assessment and investigate water procedures
- Advised Facility to switch to bottled water based on TDEC sample results

July 3 → July 5 → July 6 → July 7 → July 9 → July 11 → July 13

Facility C

- 350-400 visitors per day, 6 days a week
- Two zipline courses and one mountain bike course
- No food service (pre-packaged only)
- Self-serve drinking water from the onsite well was provided in coolers throughout the facility
  - Coolers filled by staff throughout the day and cleaned weekly
- Septic tank onsite
- Zipline equipment (harnesses, helmets, etc.) cleaned after use by spraying with Lysol
- Reports of "GI bug running through staff" for a several of weeks

Epidemiologic Investigation

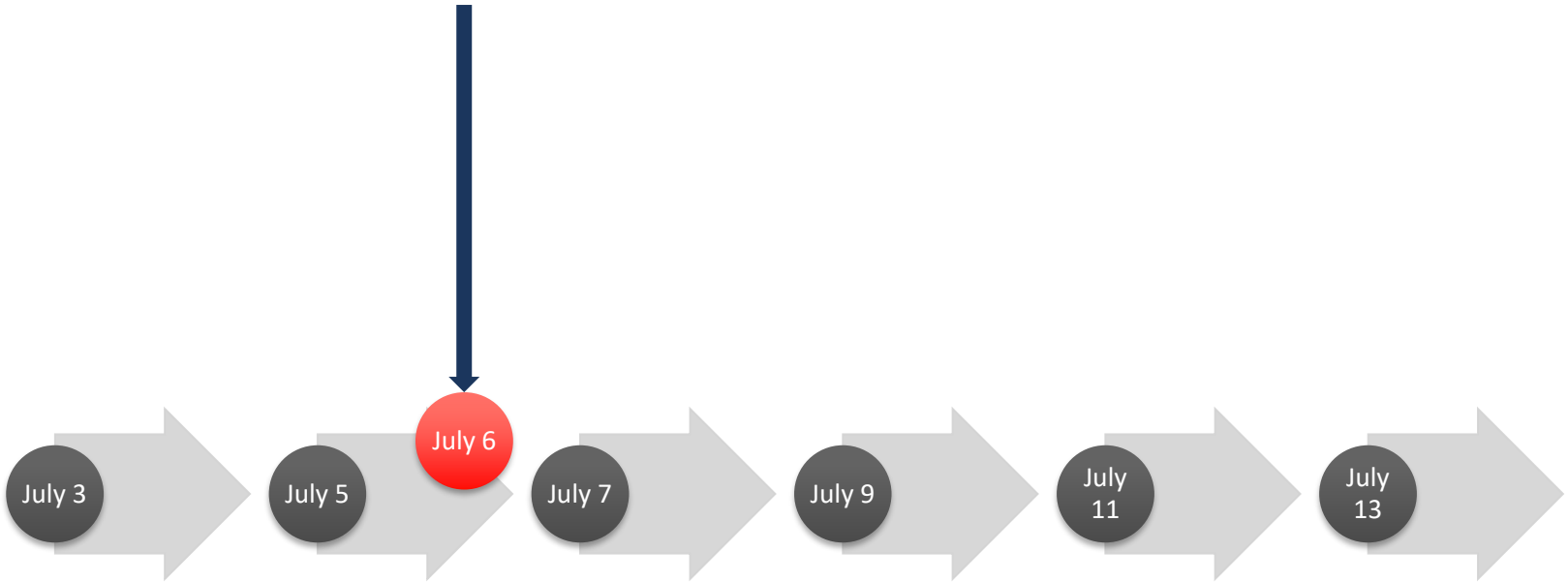
- Survey developed in REDCap by Epidemiologist
- Goal: Collect illness and exposure information to perform case control study
- Worked with Facility C to get online purchase records for 3 week period from 6/15 – 7/6
- Nearly 3,000 email addresses provided

REDCap
Research Electronic Data Capture

Timeline - Epidemiologic Investigation

REDCap
Research Electronic Data Capture

- Survey sent at 3:20pm ET to 2,901 valid email addresses
- >500 responses within 8hrs of survey deployment indicating ~300 reports of illness



Timeline - Facility Remediation

- EH field office manager returned to Facility C and implemented temporary closure
- Ensured bottled water in use
- Restrooms and high touch surfaces disinfected with 200ppm bleach solution
- Hand sanitizer placed in each restroom
- Non-potable water signage posted in restrooms

CLOSED

July 3 → July 5 → July 7 → July 9 → July 11 → July 13

Timeline - Facility Remediation

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- Ensured bottled water in use
- Restrooms and high touch surfaces disinfected with 200ppm bleach solution
- Hand sanitizer placed in each restroom
- Non-potable water signage posted in restrooms

CLOSED

EH manager also collected additional water samples:

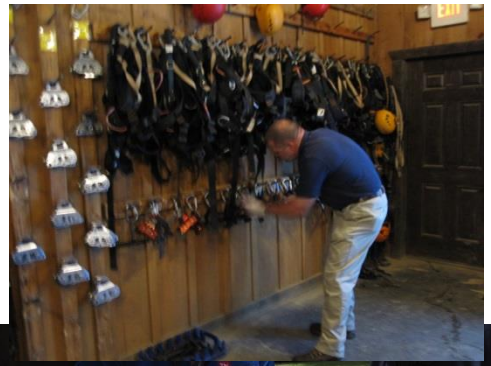
- Point of use water filter
- Non-filtered water from bathroom faucet
- Water from tubing used to dispense into water coolers

July 3 → July 5 → July 7 → July 9 → July 11 → July 13

Meanwhile…

- Medical Director visited Facility to communicate health risk
- Communicable Disease Director met complainants that were able to provide stool specimens
- Epidemiologist continued monitoring survey responses and responding to e-mails from concerned patrons

Timeline - Environmental Health Investigation



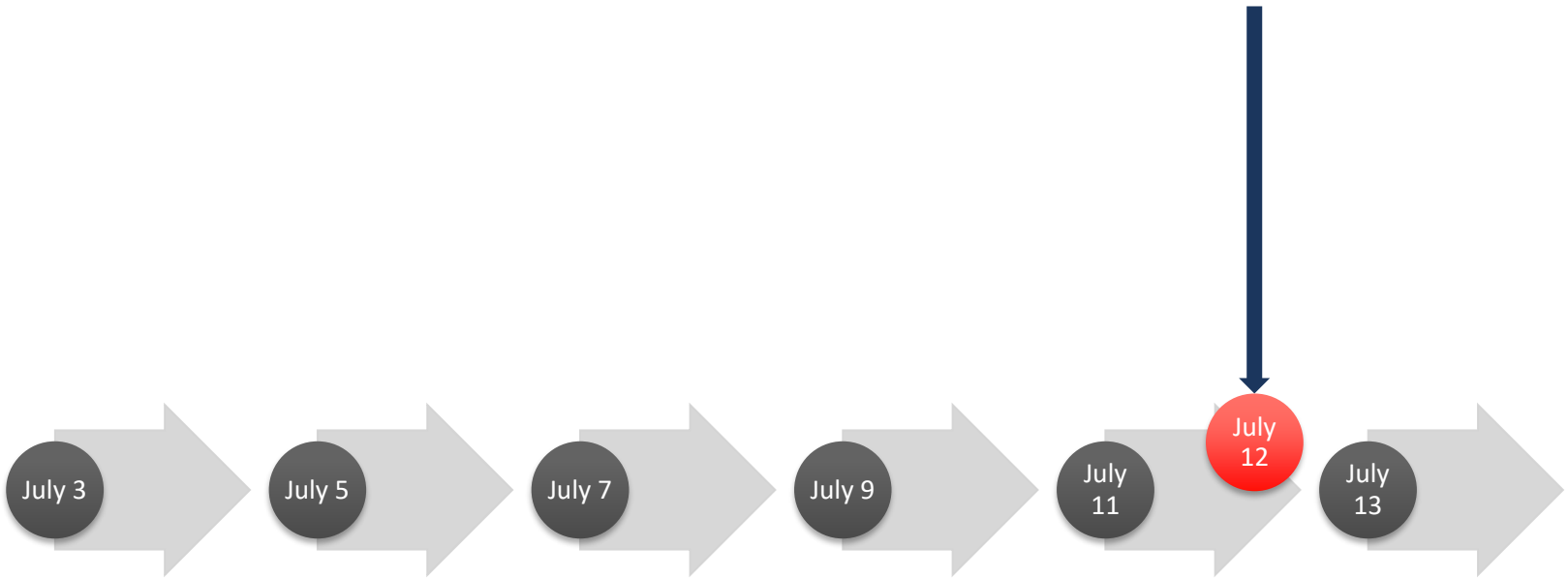
- Follow up visit to Facility C by ETR Team
- Ill worker policy shared
- Environmental swabs collected throughout property
  - Staff and patron gear
  - Staff and patron areas of main building
  - Bike and zipline courses
  - Transport ATVs
  - New and old coolers

July 3 → July 5 → July 7 → July 9 → **July 10** → July 11 → July 13

Timeline - Environmental Health Investigation

TN Department of Environment & Conservation

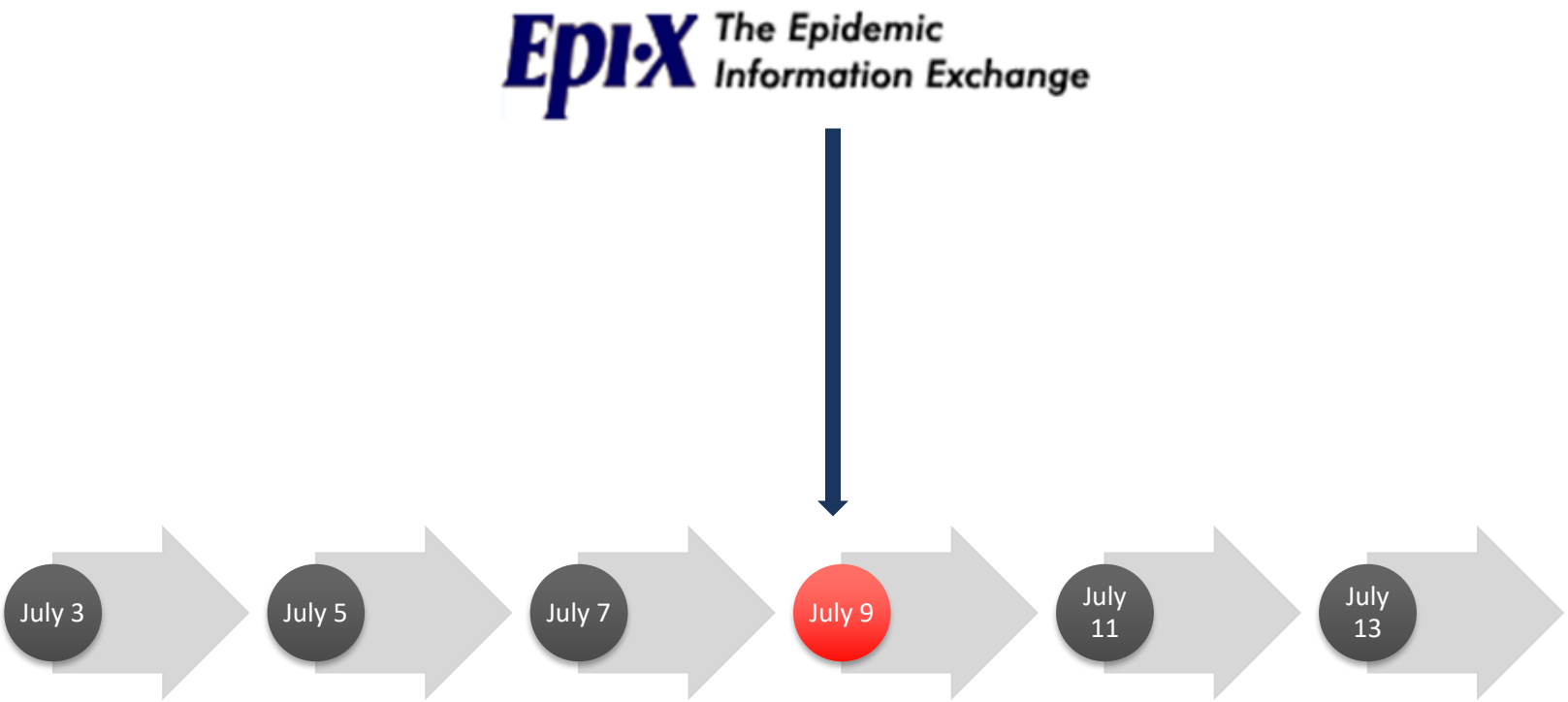
- Collection of additional raw water samples
- TDEC issued permit to Facility C to operate as a public water system



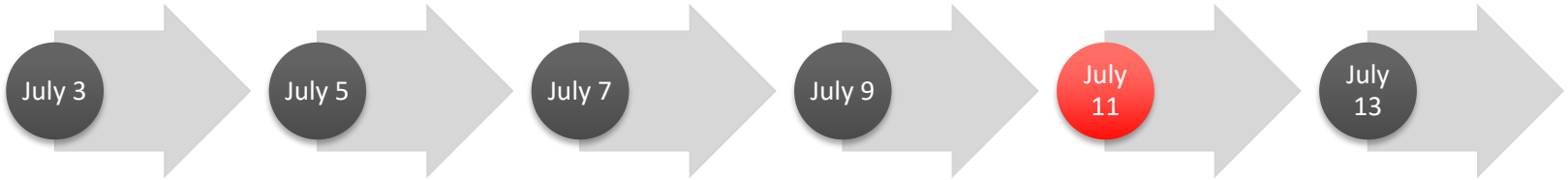
Communication

- Lab
  - Specimen collection, packaging, and shipping
- Interstate coordination
  - Additional specimen collection
- Media
  - Press releases and interviews
- TDEC
  - Remediation and permitting recommendations

Timeline - Communication



Timeline - Communication



Timeline - Communication

TN Department of Health

FOR IMMEDIATE RELEASE
July 12, 2018

CONTACT: Elizabeth Hart
615-741-3446
Elizabeth.Hart@tn.gov

TDH INVESTIGATION ONGOING INTO ILLNESSES ASSOCIATED WITH ZIPLINE TOUR IN GATLINBURG

GATLINBURG, Tenn. – The Tennessee Department of Health continues to investigate an outbreak of illness after receiving more than 500 reports of gastrointestinal illness among visitors to the [redacted] Gatlinburg.

Testing is underway to try to identify the causes of the illnesses. Multiple patients who visited the facility since June 15, 2018 have tested positive for norovirus. One patient has tested positive for both norovirus and enteropathogenic *E. coli*.

"At this time we cannot point to one simple cause of this outbreak," said TDH Deputy State Epidemiologist John Dunn, DVM, PhD. "Preliminary testing and environmental health assessments indicate the water system at the zipline facility may have contributed to the outbreak; however, there are likely other sources involved in the spread of the illnesses, including contaminated surfaces and person-to-person transmission.

"Water testing has indicated fecal contamination of the facility's water system," Dunn continued. "Additional preliminary testing has identified enteropathogenic *E. coli*. Testing of clinical and environmental samples is still underway to look for bacterial, viral and parasitic organisms. It's important to note that while norovirus is reliably identified in stool samples during outbreak investigations, identifying it in food, water and the environment is more challenging."

Norovirus causes acute gastrointestinal illness and is often characterized by sudden onset of nausea, vomiting and diarrhea; symptoms typically last one to two days. Enteropathogenic *E. coli* causes watery diarrhea; symptoms may last several days.

[redacted]s is cooperating fully with the public health investigation and recommendations as well as regulatory actions. TDH continues to investigate the outbreak to confirm the causes of the illnesses, identify additional cases of illness and provide prevention recommendations.

The mission of the Tennessee Department of Health is to protect, promote and improve the health and prosperity of people in Tennessee. TDH has facilities in all 95 counties and provides direct services for more than one in five Tennesseans annually as well as indirect services for everyone in the state, including emergency response to health threats, licensure of health professionals, regulation of health care facilities and inspection of food service establishments. Learn more about TDH services and programs at www.tn.gov/health.

###

This news release can be accessed online at www.tn.gov/health/news.
Connect with TDH on Facebook and Twitter @TNDeptofHealth!

710 James Robertson Parkway • Andrew Johnson Tower, 5th Floor
Nashville, TN 37243 • Tel: 615-741-3111 • tn.gov/health

TN Department of Health

Press release

July 3 → July 5 → July 7 → July 9 → July 11 → July 12 → July 13

National Media Attention

CNN Health » Food | Fitness | Wellness | Parenting | Vital Signs Live TV U.S. Edition +

More than 500 Tennessee zipline visitors sick in stomach illness outbreak

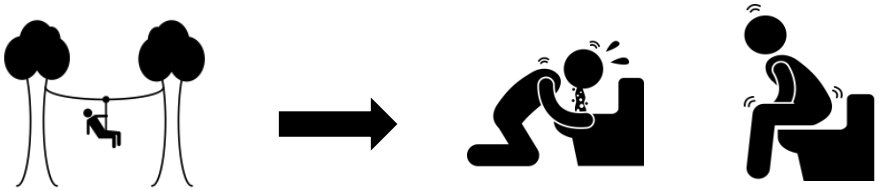
More than 500 ill after E. coli outbreak at zip line facility

By Lucia Suarez Sang, Fox News July 15, 2018 | 6:38pm

Epidemiologic Investigation Results

- Case Control Study

- **Case Definition:** A person who visited Facility C between 6/15 and 7/6 **AND**
  - **Case:** Experienced diarrhea and/or vomiting after visiting the facility



  - **Not a Case:** Did not experience diarrhea and/or vomiting after visiting the facility

Epidemiologic Investigation Results

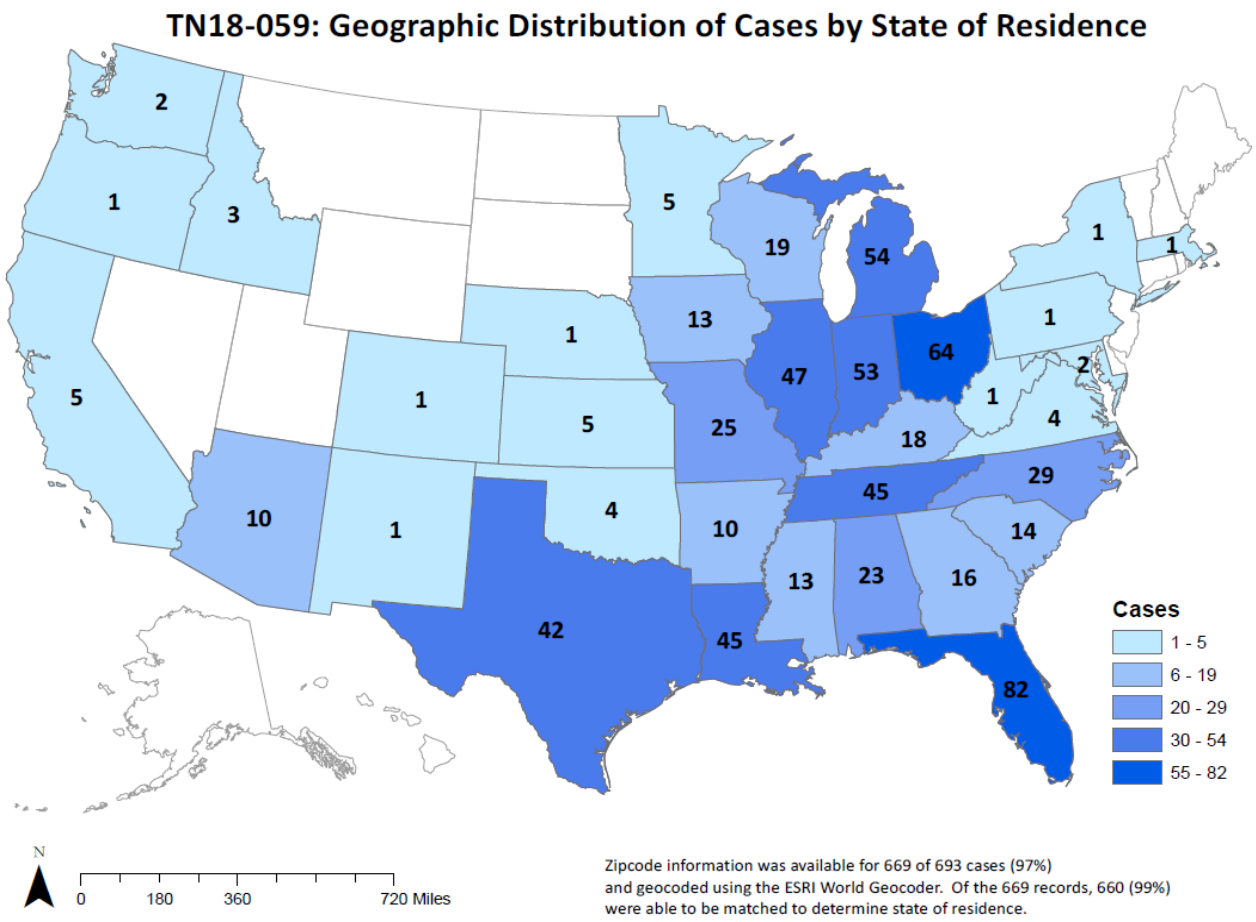
- Survey open 7/6 – 7/20 with a reminder email on 7/13
- 1167 partial or completed surveys
  - 40% response rate
- 1031 respondents had visited between 6/15 and 7/6
- Of the 1031, identified:
  - **693 cases** (67%)
  - **338 controls** (33%)

Epidemiologic Investigation Results

Demographic Data, Cases (N = 693)

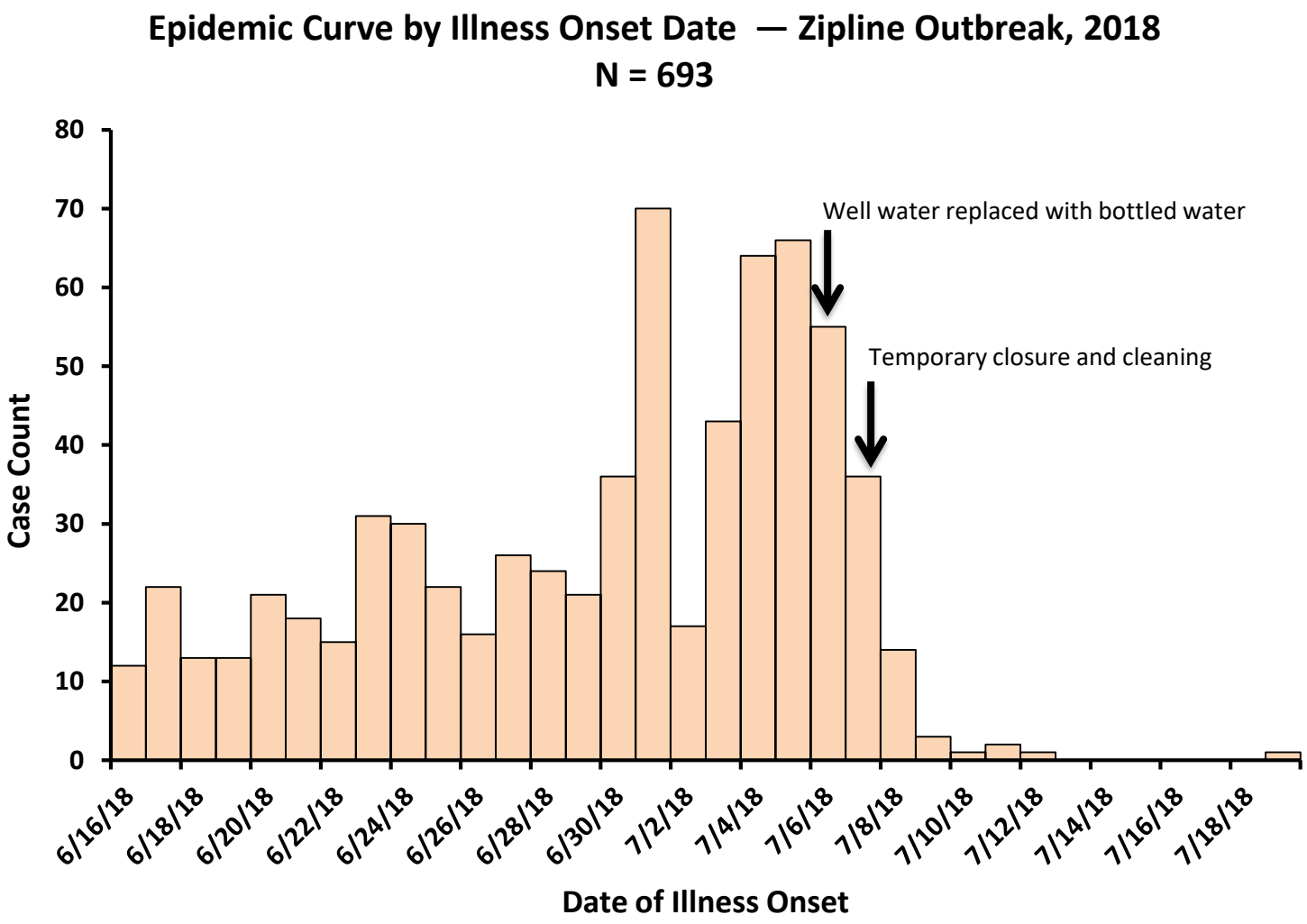
	No. (%)
Age (yrs), median (Q1, Q3)	40 (27- 48)
Age Group (yrs)	
<1	0
1-4	1 (0.1)
5-9	2 (0.3)
10-19	64 (9)
20-49	491 (71)
50-74	133 (19)
> or equal to 75	2 (0.3)
Unknown	0
Sex	
Female	389 (56)
Male	304 (44)
Race	
White	643 (94)
Black/African American	7 (1)
Asian	17 (2)
Other	15 (2)
Ethnicity	
Hispanic	32 (5)
Not Hispanic	605 (95)

Epidemiologic Investigation Results



Cases represented 35 states across the U.S.

Epidemiologic Investigation Results



Epidemiologic Investigation Results

Clinical and Epidemiologic Data, Cases (N = 693)

	No. (%)
Incubation in days	
Median	1
Q1, Q3	1 –2
Duration of illness in days	
Median	2
Q1, Q3	2- 3
Sought Care:	
With a medical provider	51 (7)
At an Emergency Department	20 (3)
Hospitalized	3 (0.4)
Symptoms*	
Nausea	625/667 (94)
Diarrhea	623/677 (92)
Abdominal cramps	534/630 (85)
Fatigue	498/598 (83)
Vomiting	524/637 (82)
Body aches	451/593 (76)
Headache	435/586 (74)
Chills	406/579 (70)
Fever	258/522 (49)
Constipation	53/424 (13)
Bloody stool	15/434 (4)

*Denominators changed by characteristic; percentage is calculated from number who responded

Epidemiologic Investigation Results

- Case control study evaluated several exposures

- Unadjusted analysis implicated multiple exposures:
  - Mountain top zipline course
  - Mountain biking
  - Consumed beverage purchased from Facility C
  - Consumed drinking water from onsite water stations

- Final, adjusted analysis (multivariate logistic regression model) results:

Exposure	Odds Ratio adjusted	95% Confidence Interval		P-value
		Lower Limit	Upper Limit	
Mountain Biking	2.5	1.4	4.5	0.0025
Onsite Water	4.4	3.1	6.3	<0.0001

Clinical Lab Results

- 15 stool specimens collected from residents of 7 states (including TN)
- 9 of 15 specimens **positive**
- 8 of 9 Noro positive specimens genotyped:
  - 1 Noro GI
  - 7 Noro GII

Clinical sample results

Test Result	Number	Norovirus Genogroup Result (if available)	Number of Positive Specimens by Genogroup
Positive Norovirus	7	GI	1
		GII	6
Positive Norovirus *AND* Enteropathogenic *E. Coli* (EPEC)	2	GI	0
		GII	1
Negative for Enteric Testing	6	N/A	N/A

Environmental Lab Results

Water sample and filter sample testing summary

Collection Date	Sample Type	Collecting Agency	Testing Location	Test Result
7/5/18	Water	TDEC	SPHL	**Positive** for total coliforms and *E. coli*
7/7/18	Water	TDH	SPHL	**Positive** for total coliforms and *E. coli* EPEC **Positive** by BioFire EPEC **Positive** by culture *E. coli* O45 by PFGE
7/7/18	POU Filter	TDH	CDC*	**Positive** for Bacteroides HF183 gene **Positive** for eae gene
N/A	Membrane filter	SPHL	CDC*	**Positive** for eae gene
7/12/18*	Water	TDEC	SPHL	**Negative** for total coliforms and *E.coli*
Week of 7/30/18*	Water	TDEC	SPHL	**Negative** for total coliforms and *E.coli*

*samples taken post-remediation

Environmental Lab Results

- 30 swabs collected, tested individually for Norovirus by PCR

Swab Location
staff harnesses
staff gloves
staff helmets
steering wheels & shifters, ATVs
staff radios
iPads for check-in/registration
water cooler
drink machine
rock climbing wall/hang board
bathroom door handle (inside), sink faucet
toilet
inside of old water coolers
outside of old water coolers incl. dispenser
new water cooler (end of Line 2)
new water cooler (start of Line 2)

Swab Location
harnesses - Treetop course
handle bars - Mountain Top course
harnesses - Mountain Top course
helmets
handle bars - Treetop course
passenger seating areas, ATVs
benches of breakroom table
table surface, microwave handle, fridge handle
staff lockers
staff merchandise area
old water cooler on mountain bike course
mountain bike handle bars
spiral stair handrail (start of Line 1)
handrails (Line 2)
bridge cables, handrails (end of Line 2)

Environmental Lab Results

- 30 swabs collected, tested individually for Norovirus by PCR
  - 2 of 30 **positive** for Norovirus
    - 2 positive reflex tested with BioFire and were negative

Swab Location
staff harnesses
staff gloves
staff helmets
steering wheels & shifters, ATVs
staff radios
iPads for check-in/registration
water cooler
drink machine
rock climbing wall/hang board
bathroom door handle (inside), sink faucet
toilet
inside of old water coolers
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mountain bike handle bars
spiral stair handrail (start of Line 1)
handrails (Line 2)
bridge cables, handrails (end of Line 2)

Environmental Lab Results

- 30 swabs pooled into 9 groups, tested by BioFire

Staff Gear	staff harnesses
	staff gloves
	staff helmets
	steering wheels & shifters, ATVs
	staff radios

Lobby	iPads for check-in/registration
	water cooler
	drink machine
	rock climbing wall/hang board

Bathroom	bathroom door handle (inside), sink faucet
	toilet

Old Water Coolers	inside of old water coolers
	outside of old water coolers incl. dispenser

New Chest Coolers	new water cooler (end of Line 2)
	new water cooler (start of Line 2)

harnesses - Treetop course	**Visitor Gear**
handle bars - Mountain Top course	
harnesses - Mountain Top course	
helmets	
handle bars - Treetop course	
passenger seating areas, ATVs	

benches of breakroom table	**Staff Breakroom**
table surface, microwave handle, fridge handle	
staff lockers	
staff merchandise area	

old water cooler on mountain bike course	**Mountain Bike Course**
mountain bike handle bars	

spiral stair handrail (start of Line 1)	**Course Handrails**
handrails (Line 2)	
bridge cables, handrails (end of Line 2)	

Environmental Lab Results

- 30 swabs pooled into 9 groups, tested by BioFire
  - 4 of 9 pools positive

Lobby	iPads for check-in/registration
	water cooler
	drink machine
	rock climbing wall/hang board

Bathroom	bathroom door handle (inside), sink faucet
	toilet

benches of breakroom table	**Staff Breakroom**
table surface, microwave handle, fridge handle	
staff lockers	
staff merchandise area	

old water cooler on mountain bike course	**Mountain Bike Course**
mountain bike handle bars	

Environmental Lab Results

- 30 swabs pooled into 9 groups, tested by BioFire
  - 4 of 9 pools positive

Enteropathogenic *E. coli* (EPEC)

Lobby

iPads for check-in/registration

Bathroom

Staff Breakroom

Mountain Bike Course

Environmental Lab Results

- 30 swabs pooled into 9 groups, tested by BioFire
  - 4 of 9 <u>pools</u> **positive**

Lobby	iPads for check-in/regist
	water cooler
	drink machine
	rock climbing wall/hang
Bathroom	bathroom door handle (
	toilet

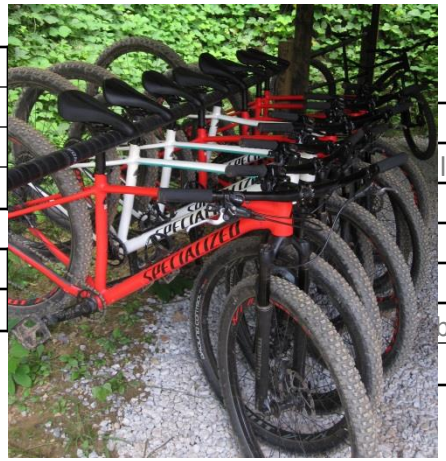
kroom table	**Staff Breakroom**
icrowave handle, fridge handle	
se area	
r on mountain bike course	**Mountain Bike Course**
andle bars	

Enteropathogenic *E. coli* (EPEC)
<u>AND</u>
Cryptosporidium

Environmental Lab Results

- 30 swabs pooled into 9 groups, tested by BioFire
  - 4 of 9 <u>pools</u> **positive**

Lobby	iPads for check-in/registration
	water cooler
	drink machine
	rock climbing wall/hang board
Bathroom	bathroom door handle (inside), sink faucet
	toilet



le, fridge handle	**Staff Breakroom**
bike course	**Mountain Bike Course**

Enteroaggregative *E. coli* (EAEC)
<u>AND</u>
Giardia lamblia

Environmental Lab Results

- 30 swabs pooled into 9 groups, tested by BioFire
  - 4 of 9 pools positive

Enteroinvasive *E. coli* (EIEC)

Lobby	iPads
	wate
	drink
	rock
Bathroom	bathr
	toilet

	dle
Staff Breakroom	
Mountain Bike Course	

Environmental Lab Results

- Reflex testing of individual swabs from the 4 positive pools:
  - BioFire
  - Culture

Lobby	iPads for check-in/registration
	water cooler
	drink machine
	rock climbing wall/hang board

Bathroom	bathroom door handle (inside), sink faucet
	toilet

benches of breakroom table	**Staff Breakroom**
table surface, microwave handle, fridge handle	
staff lockers	
staff merchandise area	

old water cooler on mountain bike course	**Mountain Bike Course**
mountain bike handle bars	

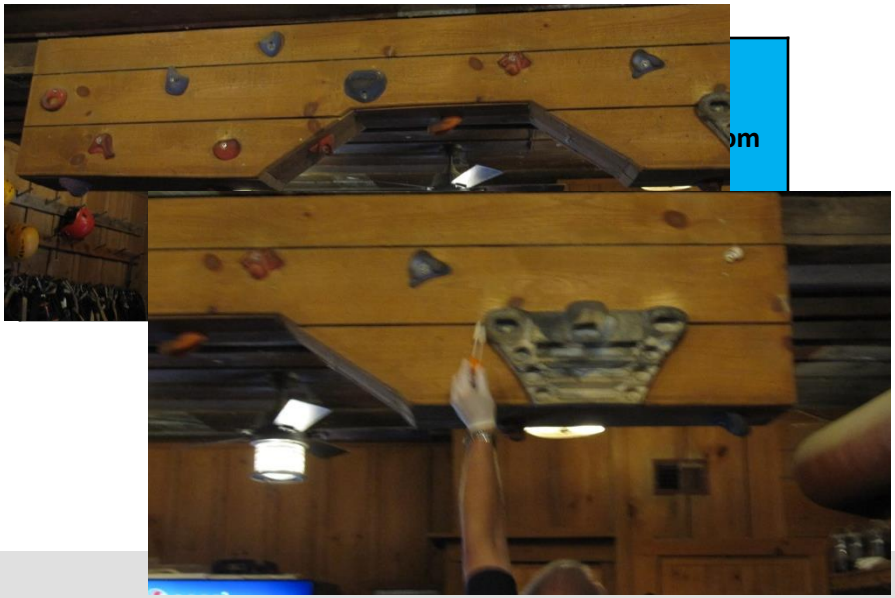
Environmental Lab Results

- Reflex testing of individual swabs from the 4 positive pools:
  - BioFire
    - 2 swabs **positive**
  - Culture
    - "Mixed" – wide variety of colonies were present and no single colony could be readily selected for identification

Enteropathogenic *E. coli* (EPEC)

Lobby	iPads for check-in/registration
	water cooler
	drink machine
	rock climbing wall/hang board
Bathroom	bathroom door handle (inside), sink faucet
	toilet

Enteropathogenic *E. coli* (EPEC)
AND
Cryptosporidium



TDEC Remediation

- Remediation of water system overseen by TDEC

- Facility C made several improvements
  - Raised wellhead 2 feet above grade
  - Installed chlorination system and 1μ filter
  - Secured a certified well operator

- Facility C permitted by TDEC as a public water system based on numbers served annually
  - Usage criteria: 25 people or more for more than 60 days a year

Environmental Health Remediation

- Employee gloves replaced
- Staff breakroom furniture replaced with non-fabric models that can be easily cleaned
- Cleaning products safe to use on patron and staff harnesses identified and purchased
- Surface cleaning procedures and recommended cleaning schedule reviewed
- Sample ill worker policy provided

Public Health Recommendations to Facility

- Follow TDEC recommendations for maintaining and treating well water in order to provide safe water for customers and staff
- Conduct routine disinfection of high touch surfaces with a disinfectant approved for bacteria and viruses to reduce the potential for illness transmission
- Develop and enforce sick employee exclusion policy
- Encourage handwashing with soap and water

Lessons Learned

- This investigation highlighted a gap in the identification of facilities that require regulation and inspection by TDH/TDEC
  - Unless food or water is served onsite, outdoor adventure companies are not standardly inspected by TDH
  - Additionally, TDEC does not monitor or regulate wells if they do not meet specific usage criteria

- Increased interaction with high tourism locations is recommended to ensure public health and other agency recommendations are being met

Environmental Health Proactive Approach

- On-the-ground outreach conducted to identify outdoor adventure companies
  - 39 sites identified and visited

- Visits ensured the proper permits and regulations were in place
  - One campground without pool permit; pool closed
  - Another business referred to TDEC for public water system review and subsequently permitted

Environmental Health Proactive Approach

- TDH State Environmental Health Director reached out to several tourism organizations in Sevier County
  - Sevierville Chamber of Commerce
  - Gatlinburg Convention and Visitors Bureau
  - Pigeon Forge Chamber of Commerce
  - Smoky Mountain Tourism and Development Council

- Organizations shared norovirus information and cleaning guidance to food and non-food establishments

Improving TDH Surveillance

- TDH Foodborne Illness Complaint System
  - Captures illness complaints reported to health departments across the state of Tennessee
  - In response to this outbreak, questions added to collect information about the outdoor adventure activities

- May aid in the early detection of similar outbreaks in the future

Did you perform any outdoor or organized adventure activity?	◯ Yes ◯ No ◯ Unknown (Examples: caving, camping, hiking, mountain biking, rafting, zip lining, off road ATV or vehicle, etc.)
If "Yes" what activity?	☐ Zip Lining ☐ Caving ☐ Camping ☐ Hiking ☐ Mountain Biking ☐ Rafting ☐ Canoeing ☐ Off Road ATV/Vehicle ☐ Other
If "Other," please specify.	_____
Date/Time of activity	_____
Incubation time between illness onset and outdoor activity time (hours)	_____
Establishment name	_____
Establishment address	_____
Establishment city	_____
Establishment county	_____
Did you consume any food or beverages (including water) while visiting the facility?	◯ Yes ◯ No

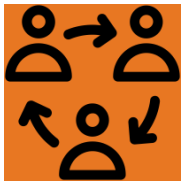
If "Yes" please list the food/beverage items consumed.	_____
Do you know anyone else who became ill after the activity?	◯ Yes ◯ No
How many became ill in your party? (including yourself)	_____
If "Yes," are you willing to provide us with their name and contact information?	◯ Yes ◯ No
First and last name, phone number, and email	_____
Did you notice illness among other individuals at the facility? (visitors, staff members, etc.)	◯ Yes ◯ No
If "Yes" please specify	☐ Staff Members ☐ Visitors/customers ☐ Other
If "Other" please specify	_____
If known, what symptoms did they experience?	☐ Diarrhea ☐ Vomiting ☐ Nausea ☐ Abdominal Cramps ☐ Fever ☐ Headache ☐ Other

TN Department of Health

Conclusions

- Large, multi-pathogen outbreak associated with an outdoor adventure company
- Clinical testing identified norovirus and EPEC
- Well water testing indicated fecal contamination and the presence of *E. coli* and EPEC
- Environmental swabbing identified numerous pathogens
  - EPEC, EAEC, EIEC, *Cryptosporidium* and *Giardia lamblia*

Conclusions



- Spread of illness was multimodal and multifactorial
  - Contaminated well water used for drinking
  - Environmental contamination on high touch surfaces
  - Person-to-person transmission

- Timely communication was imperative
  - Facility decontamination
  - Water supply remediation and regulation
  - Sick worker policy implementation

Acknowledgements

East Tennessee Regional Health Office

- Communicable Disease
- Environmental Health
- Epidemiology
- Regional Leadership

TN Department of Health Central Office

- Foodborne Program
- Waterborne Program
- CDC EIS Officer
- Environmental Health
- Communications

State Public Health Labs

- Knoxville and Nashville

Tennessee Department of Environment and Conservation

State Public Health Agencies

- Arizona, Florida, Massachusetts, North Carolina, Ohio, and Wisconsin

CDC Waterborne Disease Prevention Branch

Thank you!

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TN Zipline Outbreak: CDC EM Lab Perspective

Amy Kahler, MS

Centers for Disease Control and Prevention,
Waterborne Disease Prevention Branch

CDC Outbreak Response

- Outbreak investigations by CDC result from requests for assistance from state and local health departments and abroad
- Requests include assistance with:
  - Responding to emergencies
  - Quantifying impact of diseases
  - Investigating infectious disease outbreaks
- Epi-Aids and Lab-Aids are short-term requests for on site CDC assistance

2016 Lab-Aid response in North Carolina

Environmental Investigations in Waterborne Outbreaks

- Complement epi data suggesting water/environmental exposure route
- Link water samples and ill persons to confirm water as transmission vehicle
- Design environmental mitigation and remediation strategies
- **CDC EM lab actively involved in >110 outbreak responses domestically and abroad over last 10 years.**

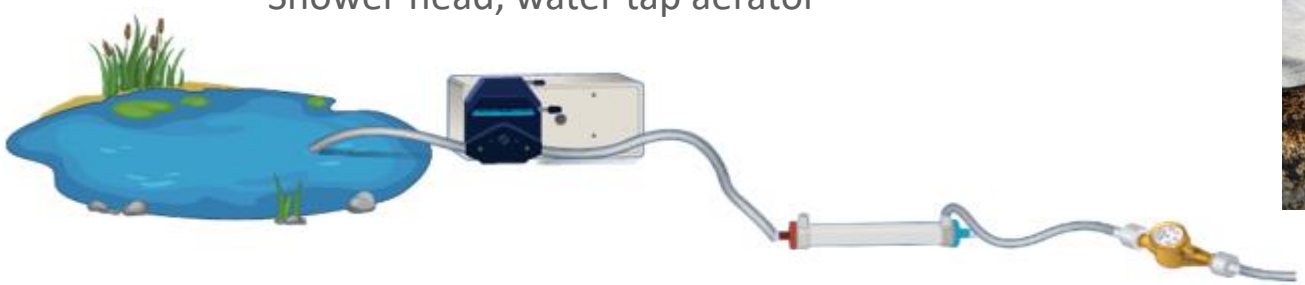
2018 Atlanta Water Main Break

WDPB Environmental Microbiology Lab

- **Laboratory research**
  - Develop **methods for recovering** low concentration microbes from environment
  - Investigate pathogen **prevalence, ecology, and risk factors** associated with waterborne disease
  - Understand **transport, survival, and disinfection susceptibility** of microbes in environment
- **Outbreak and emergency response**
  - Investigate **the cause and source** of waterborne disease and outbreaks
  - Conduct sampling to link suspected **etiologic agents** between case and water exposure
    - Sampling assistance or supplies for local sampling efforts
  - Assay for **water quality** parameters, **microbial indicators**, and **fecal source markers**
    - Sample processing
    - General water quality testing (e.g., *E. coli*)
    - Rapid pathogen testing via real-time PCR
    - Parasite sequencing/genotyping

Environmental Sampling

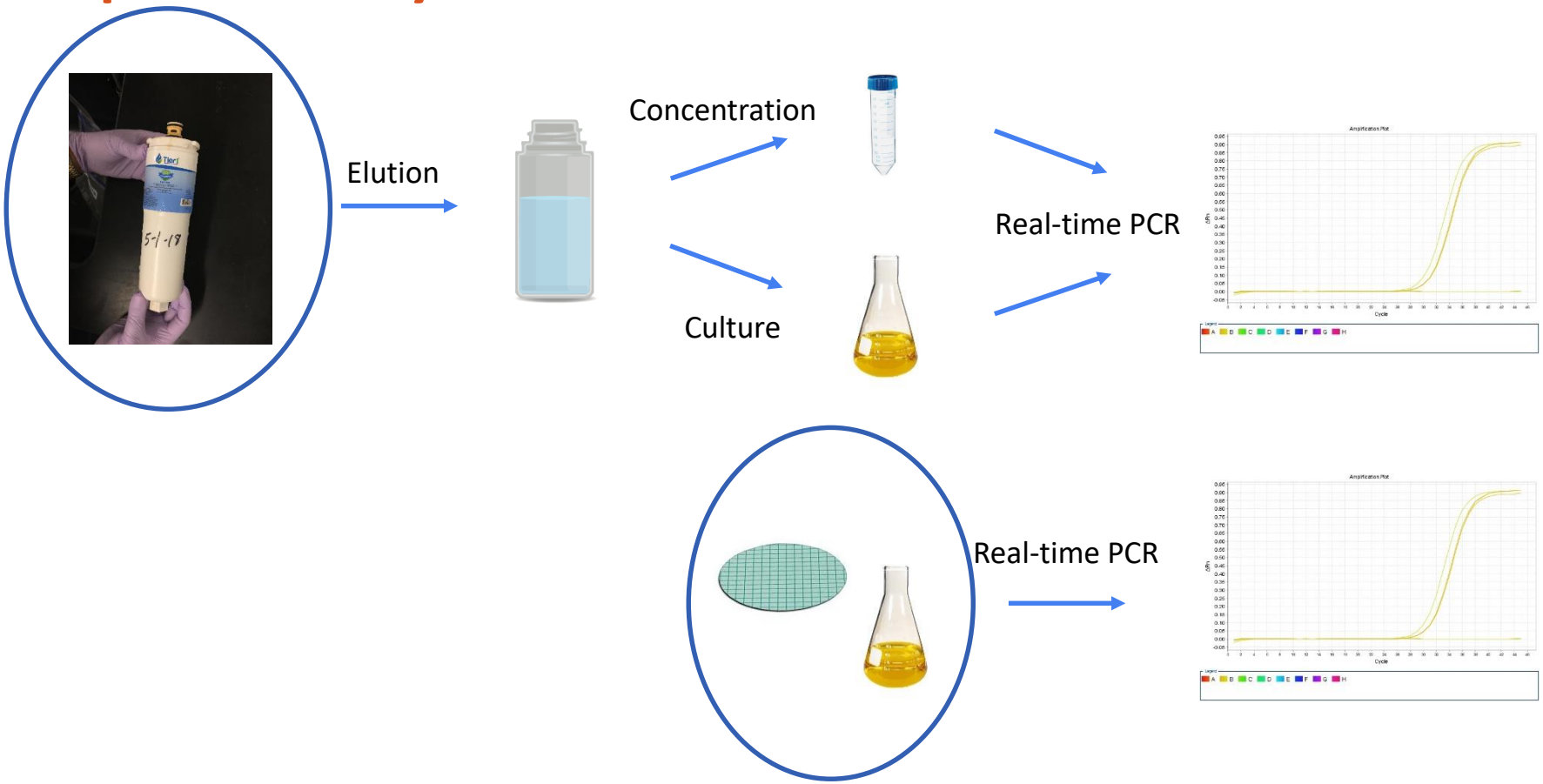
- Water
  - Grab sample of 100 mL – 1 L for general fecal indicators (e.g., *E. coli*), physical/chemical water quality
  - Large-volume via ultrafiltration of 10 L – 100+ L for pathogens
- Soil/sediment/biosolids
- Surface swabs/wipes
  - Shower head, water tap aerator
- Other
  - Filters, water meter, pipe, garden hose, “slip-n-slide,”, nasal rinsing device, contact lens case
  - Collection procedures vary and are often improvised on a case-by-case basis



Challenges with Pathogen Detection

- Environmental testing done after the fact
  - Testing can't always confirm risk of illness at time of exposure
  - Die-off/inactivation and dilution
  - Water has been treated
- Pathogens present at orders of magnitude lower levels than normal gut microflora
- Difficult to culture isolates from background microorganism community
- Often multiple potential pathogen sources

Zipline Facility in Outbreak in Tennessee



Zipline Facility in Outbreak in Tennessee

Analyte	POU Filter		Membrane filter - Culture
	Concentrated Eluate	Culture	
EPEC (eae)	Positive	Positive	Positive
Shigella (ipaH)	Not detected	Not detected	Not detected
Bacteroides HF183 (human fecal marker)	Positive		
Norovirus GI	Not detected		
Norovirus GII	Not detected		
Cryptosporidium	Not detected		

- Norovirus lab testing remaining POU filter elution for viruses (SIMPA + NGS)

2018 OutbreakNet/WASH Webinar Series

- **Last OutbreakNet/WASH Quarterly Webinar for 2018**
  - Stay tuned for our 2019 dates!

- **Topic or presentation ideas: healthywater@cdc.gov and outbreaknet@cdc.gov**

Thank you!

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.