

Tales from the Crypto

Nicole Fowle, LPN- Epidemiologist

Agenda



- Background on cryptosporidiosis
- Public health response
- 2016 Outbreak
- Where are we now?



Background on crypto

What is Crypto?



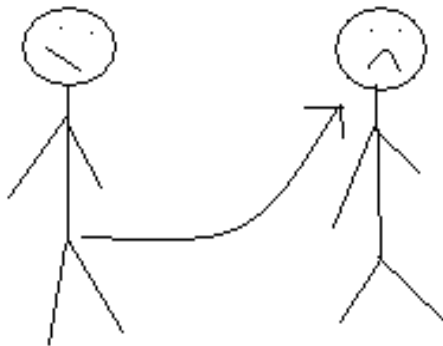
Parasite: *Cryptosporidium*



hominis



parvum

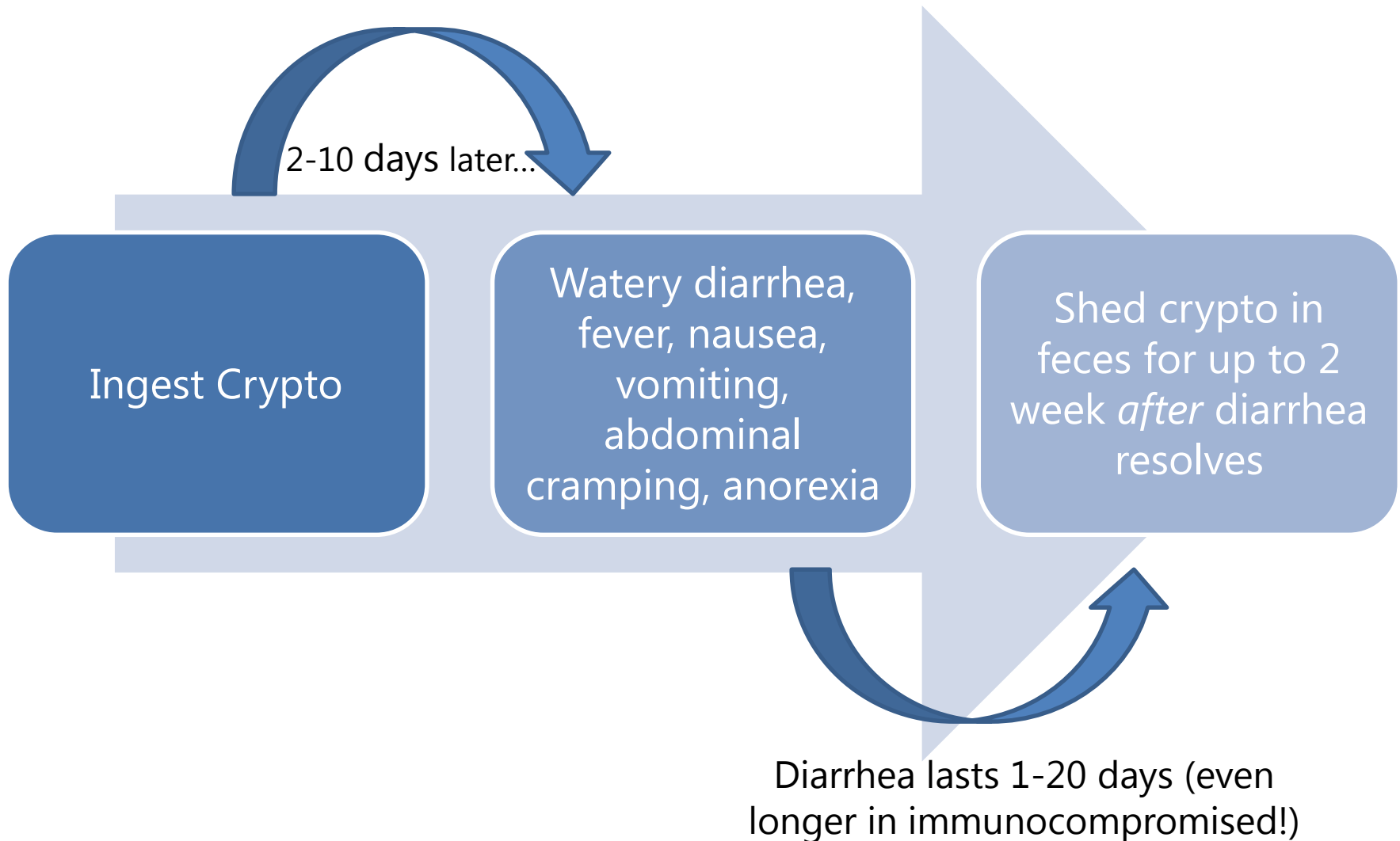


fecal-oral transmission

A sick person passes **1 million** oocysts per milliliter of diarrhea

A person only needs to ingest **10-100** oocysts to become sick

How Does it Make People Sick?



Crypto in Recreational Water



- Easily contaminated
- Only need to swallow a small number of parasites to get sick
- Parasite very resistant to normal chlorine levels





99% Inactivation of Microorganisms from Chlorine and Ozone

Organism	Chlorine		Ozone	
	Temp (°C)	CT Value	Temp (°C)	CT Value
<i>E. coli</i>	5	0.02	1	0.022
	23	0.014		
Polio virus	20	0.5-0.7	5	.22
			20	0.075
Giardia	5	56-152	5	0.53
	25	<15	25	0.017
<i>C. parvum</i>	25	9600	25	<10.0

CT value is the disinfectant concentration multiplied by the contact time

Source: University of Arizona, 2015



Public health response

Public Health - Epidemiology



Arizona Administrative Code* Requires Providers To: Report Communicable Diseases to the Local Health Department

<input checked="" type="checkbox"/> * <input type="checkbox"/> Amebiasis	<input type="checkbox"/> Hantavirus infection	<input checked="" type="checkbox"/> * <input type="checkbox"/> Salmonellosis
<input type="checkbox"/> Anthrax	<input type="checkbox"/> Hemolytic uremic syndrome	<input type="checkbox"/> Scabies
<input type="checkbox"/> Aseptic meningitis: viral	<input checked="" type="checkbox"/> * <input type="checkbox"/> Hepatitis A	<input type="checkbox"/> Severe acute respiratory syndrome
<input type="checkbox"/> Basidiobolomycosis	<input type="checkbox"/> Hepatitis B and D	<input checked="" type="checkbox"/> * <input type="checkbox"/> Shigellosis
<input type="checkbox"/> Botulism	<input type="checkbox"/> Hepatitis C	<input type="checkbox"/> Smallpox
<input type="checkbox"/> Brucellosis	<input checked="" type="checkbox"/> * <input type="checkbox"/> Hepatitis E	<input type="checkbox"/> Streptococcal Group A: invasive disease
<input checked="" type="checkbox"/> * <input type="checkbox"/> Campylobacteriosis	<input type="checkbox"/> Herpes genitalis	<input type="checkbox"/> Streptococcal Group B: invasive disease in infants younger than 90 days of age
<input type="checkbox"/> Chagas disease (American trypanosomiasis)	<input type="checkbox"/> HIV infection and related disease	<input type="checkbox"/> <i>Streptococcus pneumoniae</i> (pneumococcal invasive disease)
<input type="checkbox"/> Chancroid	<input type="checkbox"/> Influenza-associated mortality in a child	<input type="checkbox"/> Syphilis
<input type="checkbox"/> Chlamydia infection, sexually transmitted	<input type="checkbox"/> Kawasaki syndrome	<input checked="" type="checkbox"/> * <input type="checkbox"/> Taeniasis
<input type="checkbox"/> * <input type="checkbox"/> Cholera	<input type="checkbox"/> Legionellosis (Legionnaires' disease)	<input type="checkbox"/> Tetanus
<input type="checkbox"/> Coccidioidomycosis (valley fever)	<input type="checkbox"/> Leptospirosis	<input type="checkbox"/> Toxic shock syndrome
<input type="checkbox"/> Colorado tick fever	<input type="checkbox"/> Listeriosis	<input type="checkbox"/> Trichinosis
<input type="checkbox"/> Conjunctivitis: acute	<input type="checkbox"/> Lyme disease	<input type="checkbox"/> Tuberculosis, active disease
<input type="checkbox"/> Crabs/lice/bedbugs	<input type="checkbox"/> Lymphocytic choriomeningitis	<input type="checkbox"/> Tuberculosis latent infection in a child 5 years of age or younger (positive screening test result)
<input checked="" type="checkbox"/> * <input type="checkbox"/> Cryptosporidiosis	<input type="checkbox"/> Malaria	<input type="checkbox"/> Tularemia
<input type="checkbox"/> Cytospora infection	<input type="checkbox"/> Measles (rubeola)	<input type="checkbox"/> Typhoid fever
<input type="checkbox"/> Cysticercosis	<input type="checkbox"/> Meningococcal invasive disease	<input type="checkbox"/> Typhus fever
<input type="checkbox"/> Dengue	<input type="checkbox"/> Mumps	<input type="checkbox"/> Unexplained death with a history of fever
<input type="checkbox"/> Diarrhea, nausea, or vomiting	<input type="checkbox"/> Pertussis (whooping cough)	<input type="checkbox"/> Vaccinia-related adverse event
<input type="checkbox"/> Diphtheria	<input type="checkbox"/> Plague	<input type="checkbox"/> Vancomycin-resistant or Vancomycin-intermediate <i>Staphylococcus aureus</i>
<input type="checkbox"/> Ehrlichiosis and Anaplasmosis	<input type="checkbox"/> Poliomyelitis	<input type="checkbox"/> Vancomycin-resistant <i>Staphylococcus epidermidis</i>
<input type="checkbox"/> Emerging or exotic disease	<input type="checkbox"/> Psittacosis (ornithosis)	<input type="checkbox"/> Varicella (chickenpox)
<input type="checkbox"/> Encephalitis, viral or parasitic	<input type="checkbox"/> Q fever	<input checked="" type="checkbox"/> * <input type="checkbox"/> <i>Vibrio</i> infection
<input type="checkbox"/> Enterohemorrhagic <i>Escherichia coli</i>	<input type="checkbox"/> Rabies in a human	<input type="checkbox"/> Viral hemorrhagic fever
<input type="checkbox"/> Enterotoxigenic <i>Escherichia coli</i>	<input type="checkbox"/> Relapsing fever (borreliosis)	<input type="checkbox"/> West Nile virus infection
<input checked="" type="checkbox"/> * <input type="checkbox"/> Giardiasis	<input type="checkbox"/> Reye syndrome	<input type="checkbox"/> Yellow fever
<input type="checkbox"/> Gonorrhea	<input type="checkbox"/> Rocky Mountain spotted fever	<input checked="" type="checkbox"/> * <input type="checkbox"/> Yersiniosis
<input type="checkbox"/> <i>Haemophilus influenzae</i> : invasive disease	<input type="checkbox"/> * <input type="checkbox"/> Rubella (German measles)	
<input type="checkbox"/> Hansen's disease (Leprosy)	<input type="checkbox"/> Rubella syndrome, congenital	

Submit a report by telephone or through an electronic reporting system authorized by the Department within 24 hours after a case or suspect case is diagnosed, treated, or detected or an occurrence is detected.

* If a case or suspect case is a food handler or works in a child care establishment or a health care institution, instead of reporting within the general reporting deadline, submit a report within 24 hours after the case or suspect case is diagnosed, treated, or detected.

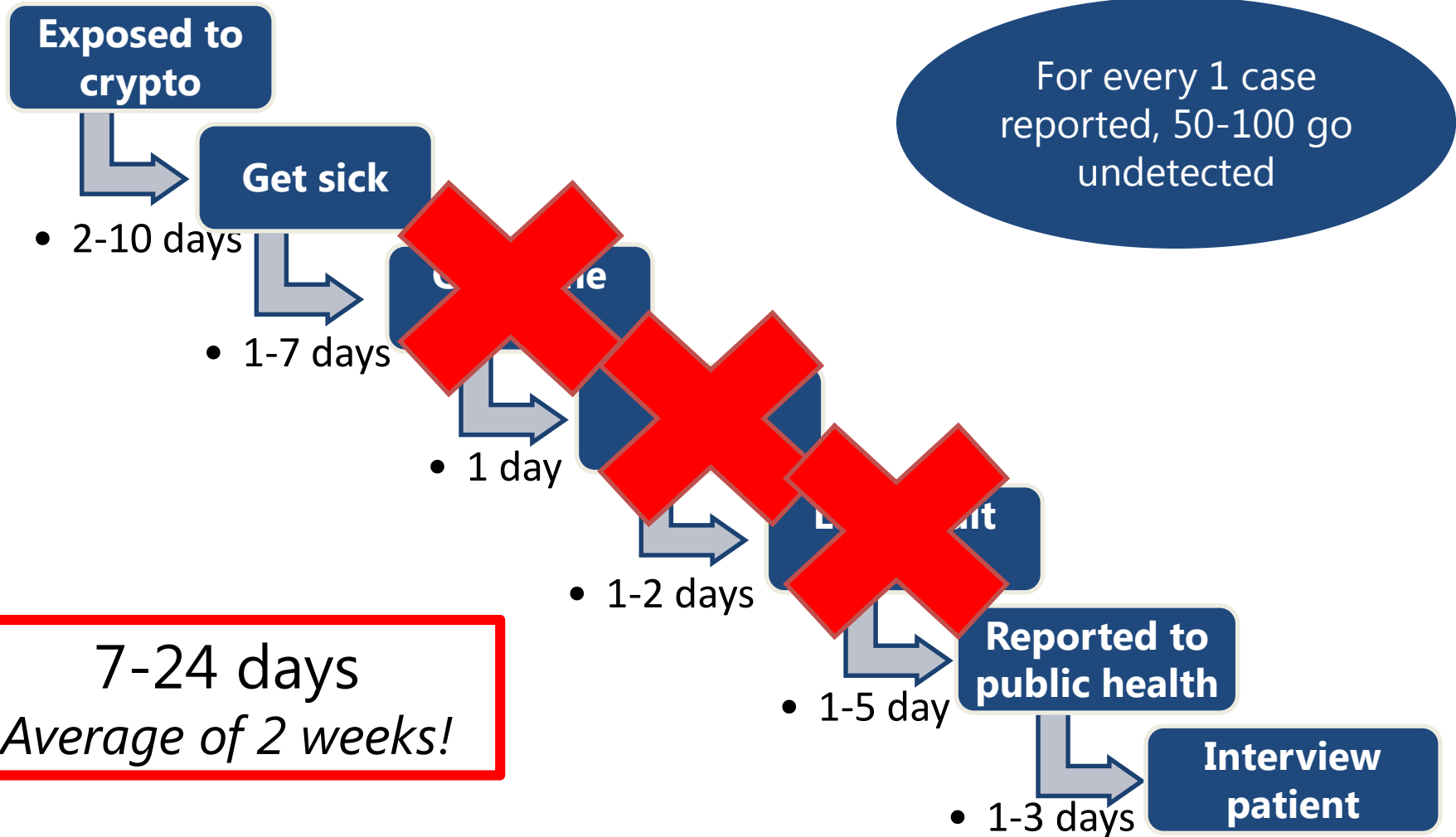
Submit a report within one working day after a case or suspect case is diagnosed, treated, or detected.

Submit a report within five working days after a case or suspect case is diagnosed, treated, or detected.

Submit a report within 24 hours after detecting an outbreak.



Journey to Public Health



The Interview



- Common ways people are exposed
 - Animal contact
 - Travel
 - Untreated drinking water
 - **Recreational water**
- Compare interviews- any common exposures?



2016 Outbreak

First Indication of an Outbreak...

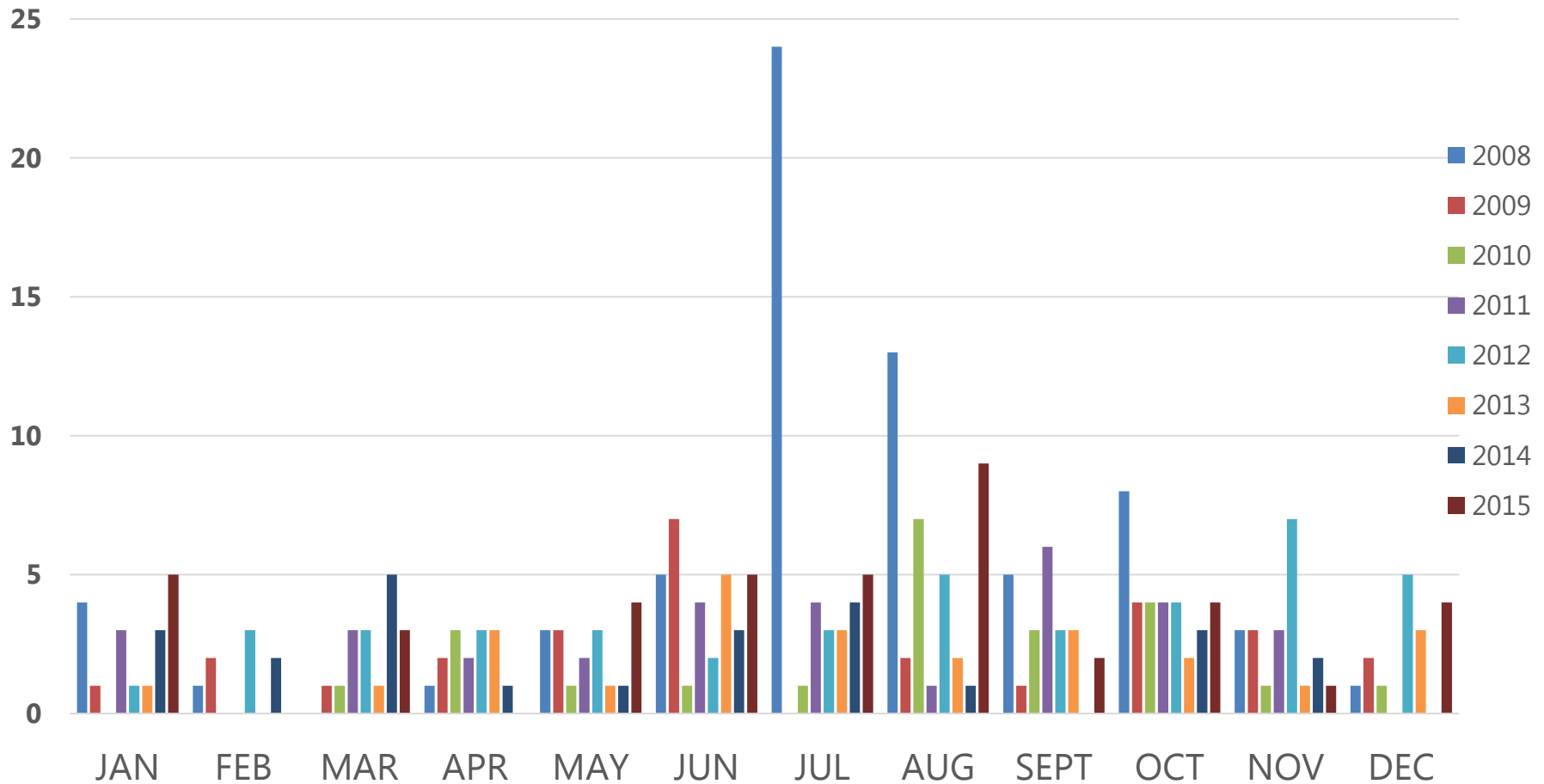


- August 1: Received notification of GI outbreak
 - Little league team from Coconino County visited Maricopa County Waterpark A
 - 30 of 36 experiencing severe GI symptoms
 - High attack rate – maybe norovirus?
- August 3: Waterpark A
 - 1 complaint to MCES mentioning Waterpark A
 - 5 out of 8 crypto cases investigated mentioned Waterpark A

Historical Trend



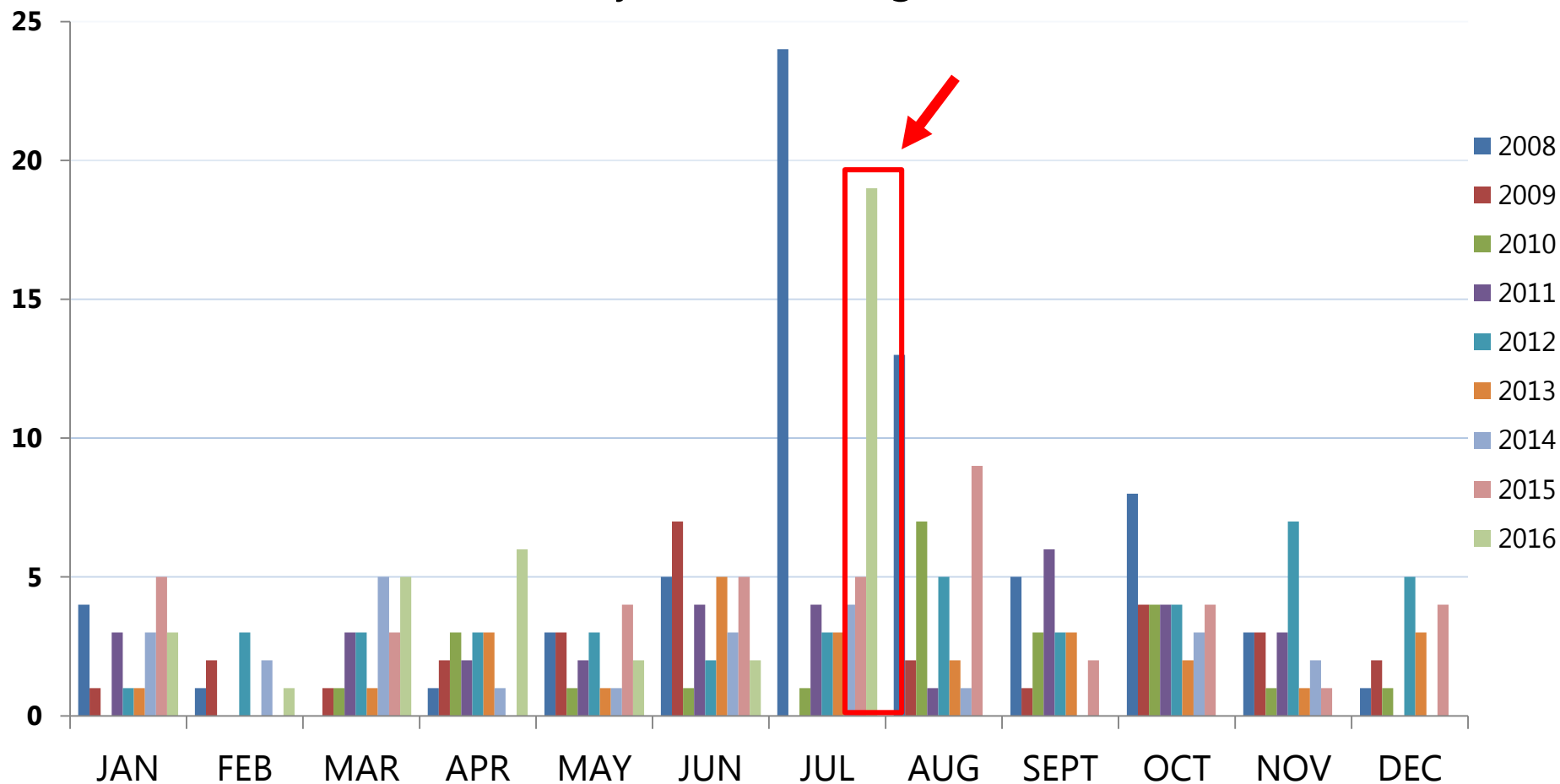
Cryptosporidiosis Incidence by Month of Onset,
2008-2015



August 3 - Outbreak?



Cryptosporidiosis Incidence by Month of Onset
January 1, 2008 - August 3, 2016



Public Health Action



- Early interviews suggested recreational water as a common exposure
- Developed questionnaire with a focus on recreational water
 - *Where did you swim two weeks before getting sick? Did you swim while sick? Where?*
 - *Do you know anyone else who was sick? (Identify probable cases)*
- Public Messaging
 - Media interviews
 - Webpage & FAQs

Parasite Outbreak Plagues Arizona Swimming Pools

By Jamie A.



More Than 100 Sickened in Arizona Cryptosporidium Parasite Outbreak

by ELIZABETH CHUCK

More than 100 people in Maricopa County, Arizona, have been infected with

advertisement

Crypto outbreak sickens more than 100 in Phoenix area



Lindsey Collom, The Republic | azcentral.com 9:18 p.m. MST August 19, 2016

The parasite is often spread through contaminated water ingested at recreational areas and has a high tolerance to chlorine.

1 in 3 teens will attend more than

U.S. & WORLD

THE DAY'S TOP NATIONAL AND INTERNATIONAL NEWS

More Than 100 Ill After Parasite Found in Arizona Swimming Pools

The highly contagious parasite is hard to

Parasite Outbreak at Swimming Pools Spreads Across Arizona

August 21, 2016

Diarrhea-causing parasites called cryptospori

si

OUTBREAKS

Diarrheal sickness infects more than 100 people in Arizona

Published August 21, 2016 · FoxNews.com



Preventing Crypto



- Post healthy swimming signage
- Adequate number of restrooms and diaper changing stations
- Promote bathroom breaks for young swimmers
- Pool design
 - Filtration
 - Supplementary treatment
 - Ultraviolet (UV)
 - Ozone



Public Messaging



- Messaging for schools & daycares

Time to Kill or Inactivate Germs in Chlorinated Water *

Germ	Time
<i>E. coli</i> O157:H7 Bacterium	Less than 1 minute
Hepatitis A Virus	About 16 minutes
<i>Giardia</i> Parasite	About 45 minutes
Crypto Parasite	About 15,300 minutes or 10.6 days ¹

Source: CDC, 2016

- Don't go swimming for 7-10 days after pool exposure
- Don't hyperchlorinate personal pools— increased risk of chemical injury

Intervention - August 5



Public Health

- Identify **TWO** unrelated lab confirmed cases name the same recreational water venue
 - Swam 2 weeks before sick
 - Swam while sick

Environmental Services

- Contact recreational water venue
- Provide CDC guidelines for remediation

Remediation of Aquatic Facilities



- Used CDC *Hyperchlorination to Kill Crypto* guidelines
- ES visit to guide this process
- Revisit if new exposure date identified

HEALTHY SWIMMING

Fecal Incident Response Recommendations for Aquatic Staff

What do you do when you find poop in the water?



Overview of MC Pools



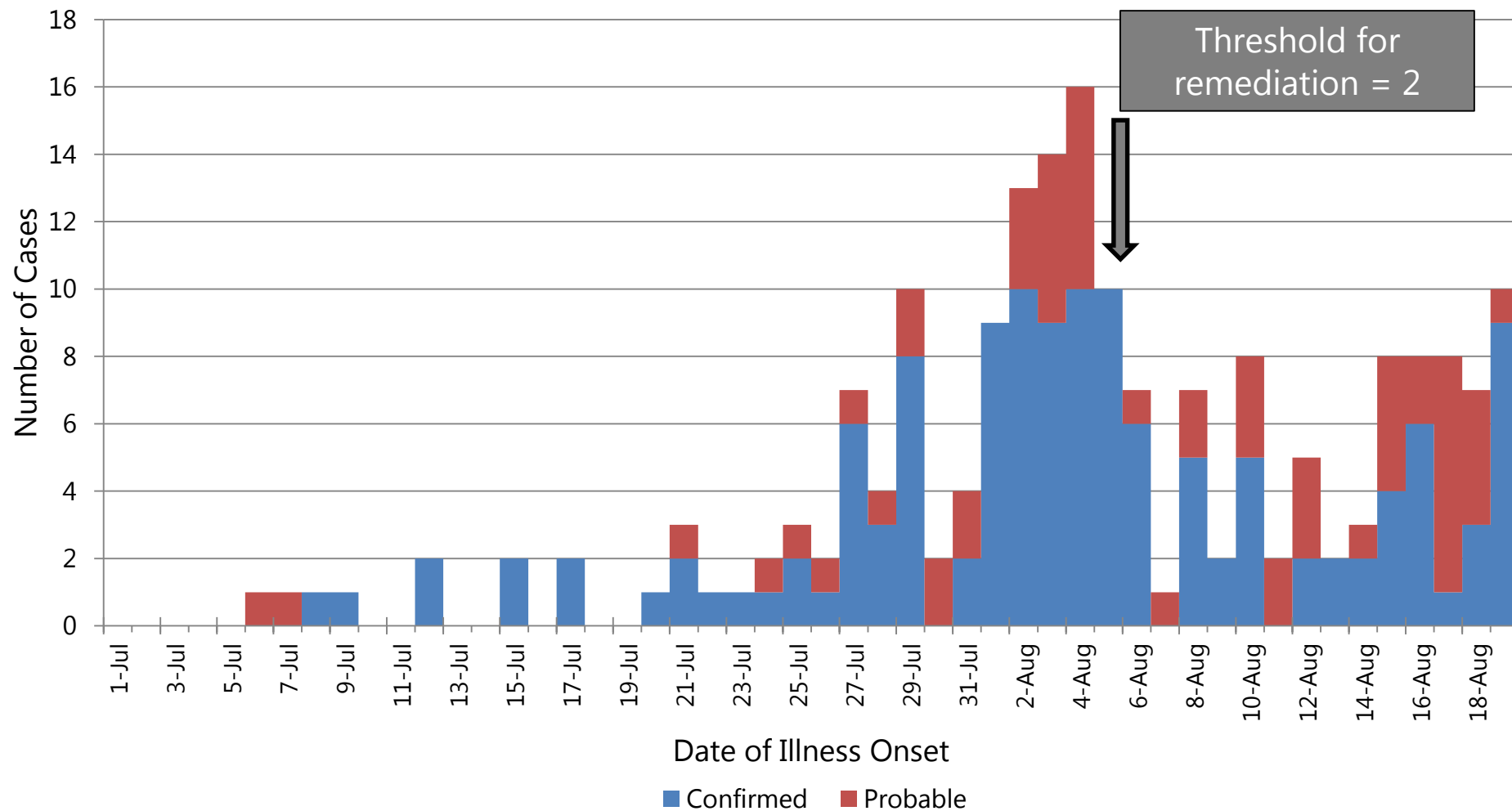
- Over 8,800 public/semi-public swimming pools in Maricopa County
 - Average of 2 inspections per year per facility (based on license)



Evaluation – August 18



Number of Confirmed and Probable Cases of Cryptosporidiosis



Intervention Take II – August 19



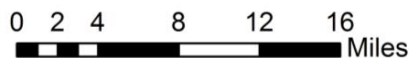
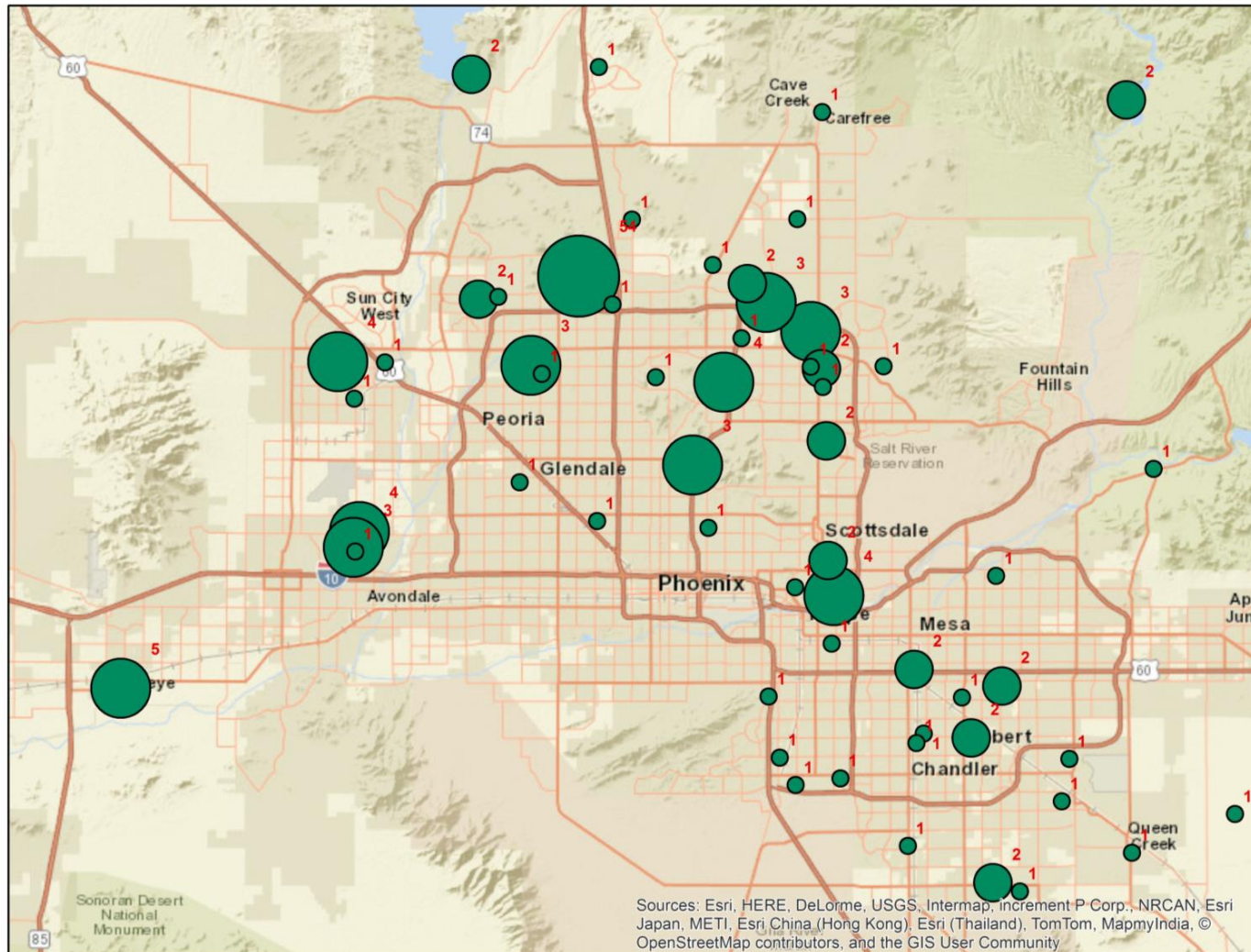
Public Health

- Identify **ONE** lab confirmed case with recreational water venue exposure
 - Swam 2 weeks before sick
 - Swam while sick

Environmental Services

- Contact recreational water venue
- Provide CDC guidelines for remediation

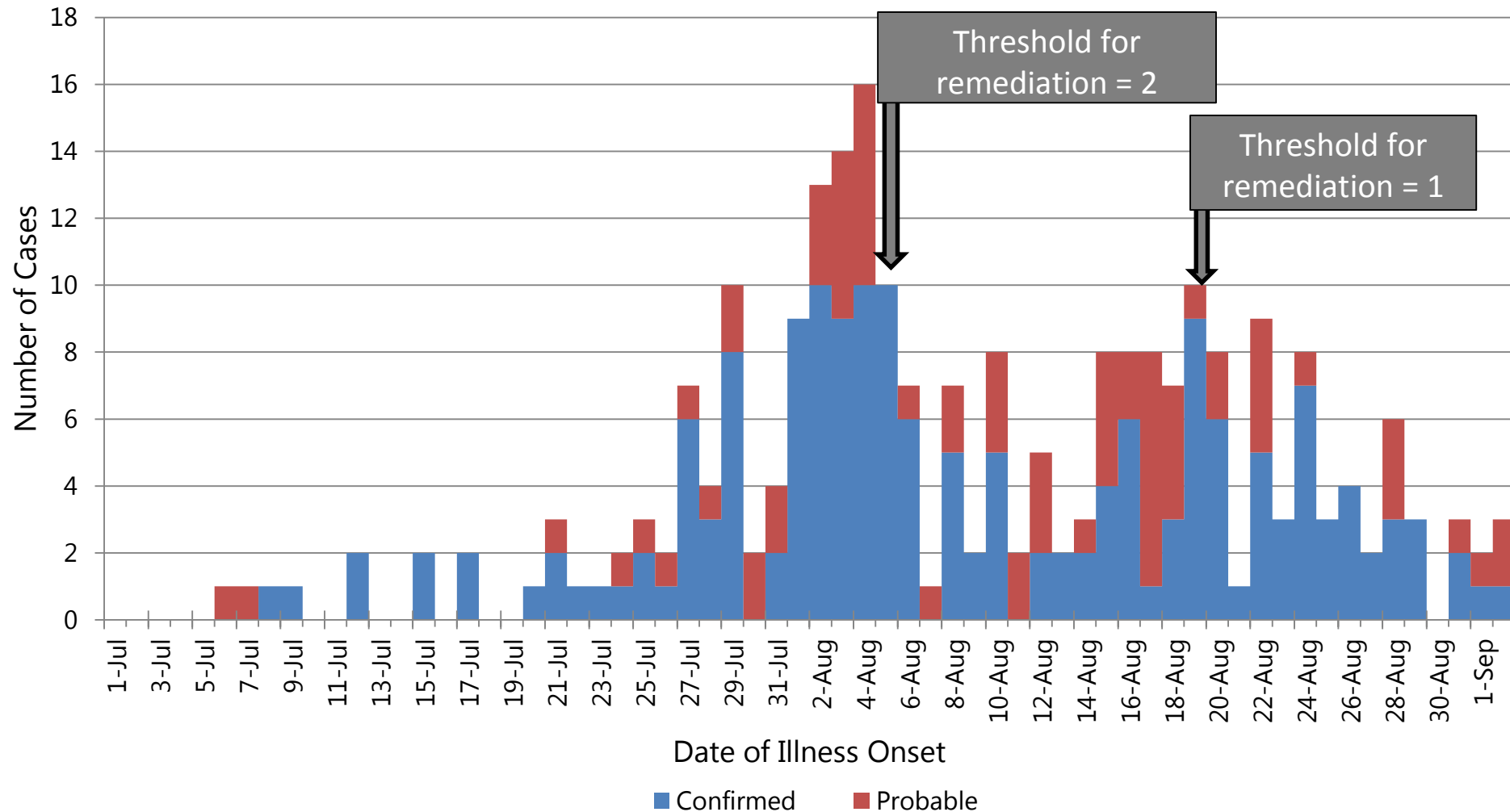
Potential Exposure Sites



Re-Evaluation – September 2



Number of confirmed and probable cases of cryptosporidiosis

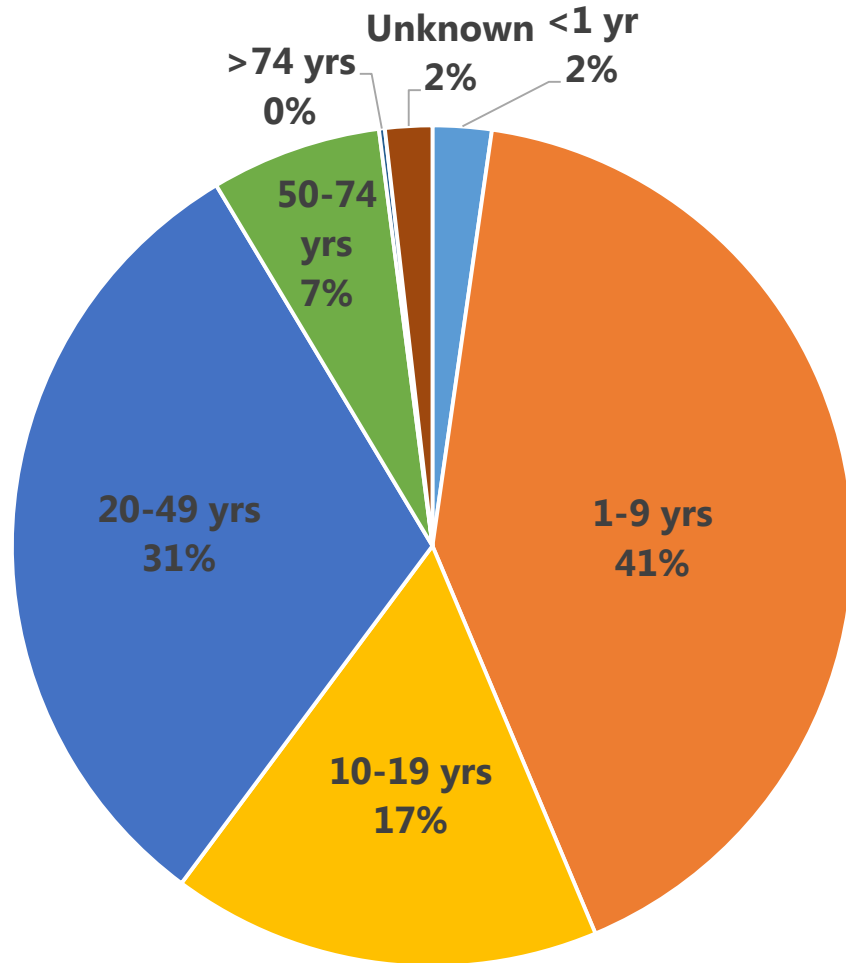


Secondary Specimen Results



County	Sample Number	Species	Subtype	Local Case Status	Symptom Onset Date	Date Collected
<i>Maricopa</i>	1	Unable to detect @ CDC		Lab confirmed case via DFA	8/1/16	8/27/16
<i>Maricopa</i>	2	Unable to detect @ CDC		Probable (Sibling of lab confirmed case)	8/10/16	8/27/16
<i>Maricopa</i>	3	Unable to detect @ CDC		Lab confirmed via DFA	8/10/16	8/26/16
<i>Maricopa</i>	4	C. hominis	unknown	Lab confirmed via PCR (1 exposure: Waterpark A 8/14/16)	8/18/16	8/29/16
<i>Coconino</i>	5	C. hominis	A12G1	-	-	-
<i>Coconino</i>	6	C. hominis	A12G1	-	-	-
<i>Coconino</i>	7	C. hominis	A12G1	-	-	-
<i>Coconino</i>	8	C. hominis	A12G1	-	-	-

Outbreak Demographics

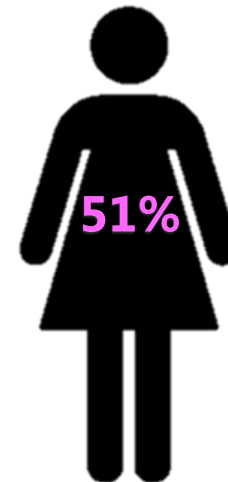


442 cases

Hospitalization
Rate: 20%

75 aquatic
facilities
identified

Interview
Response Rate:
90%



High-Risk Settings & Occupations



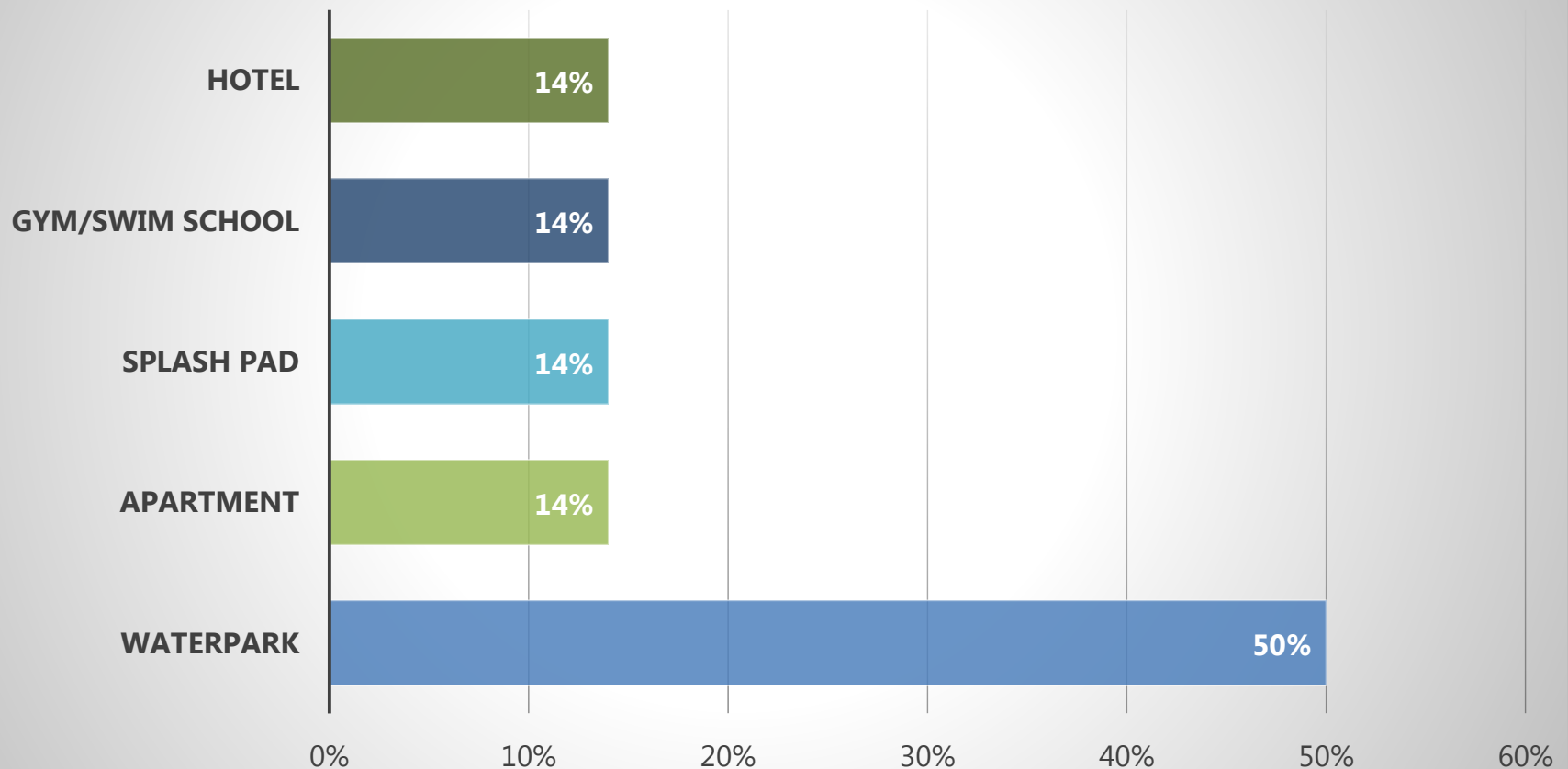
Occupation/Setting	Cases	Worked or Attended While Ill
Childcare	32	13 (41%)
Food Handler	5	2 (40%)
Healthcare	6	1 (17%)
Recreational Water	4	2 (50%)



Public Water Exposures



Public Treated Water Facilities Visited Pre-Onset of Symptoms



Public Water Exposures



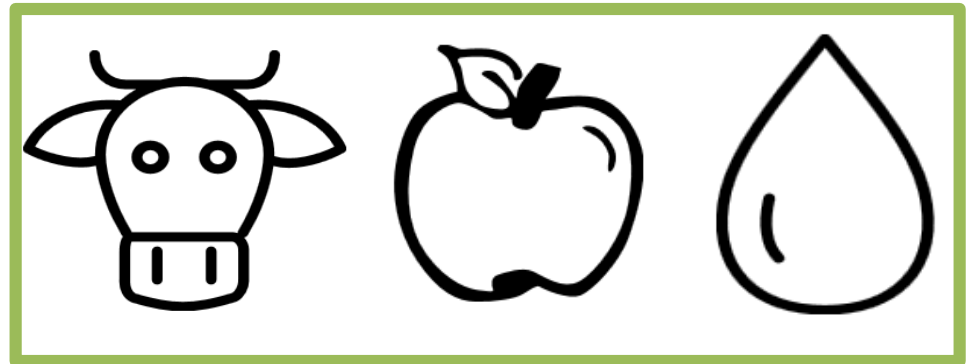
- 43 (**17%**) reported any type of water exposure **after** onset of diarrhea
 - 26 (**60%**) treated public recreational water exposure

Type of Facility	Cases Visited Post-Onset (%)
Apartment	7 (27%)
Gym/swim school	7 (27%)
Hotel	6 (23%)

Other Exposures



- 18 (**7%**) of cases reported contact with animals
 - Livestock/cattle
 - Petting zoo
 - Farm residence
- 11 (**4%**) of cases reported high-risk foods
 - Unpasteurized dairy or juice
 - Non-potable water



Other Exposures



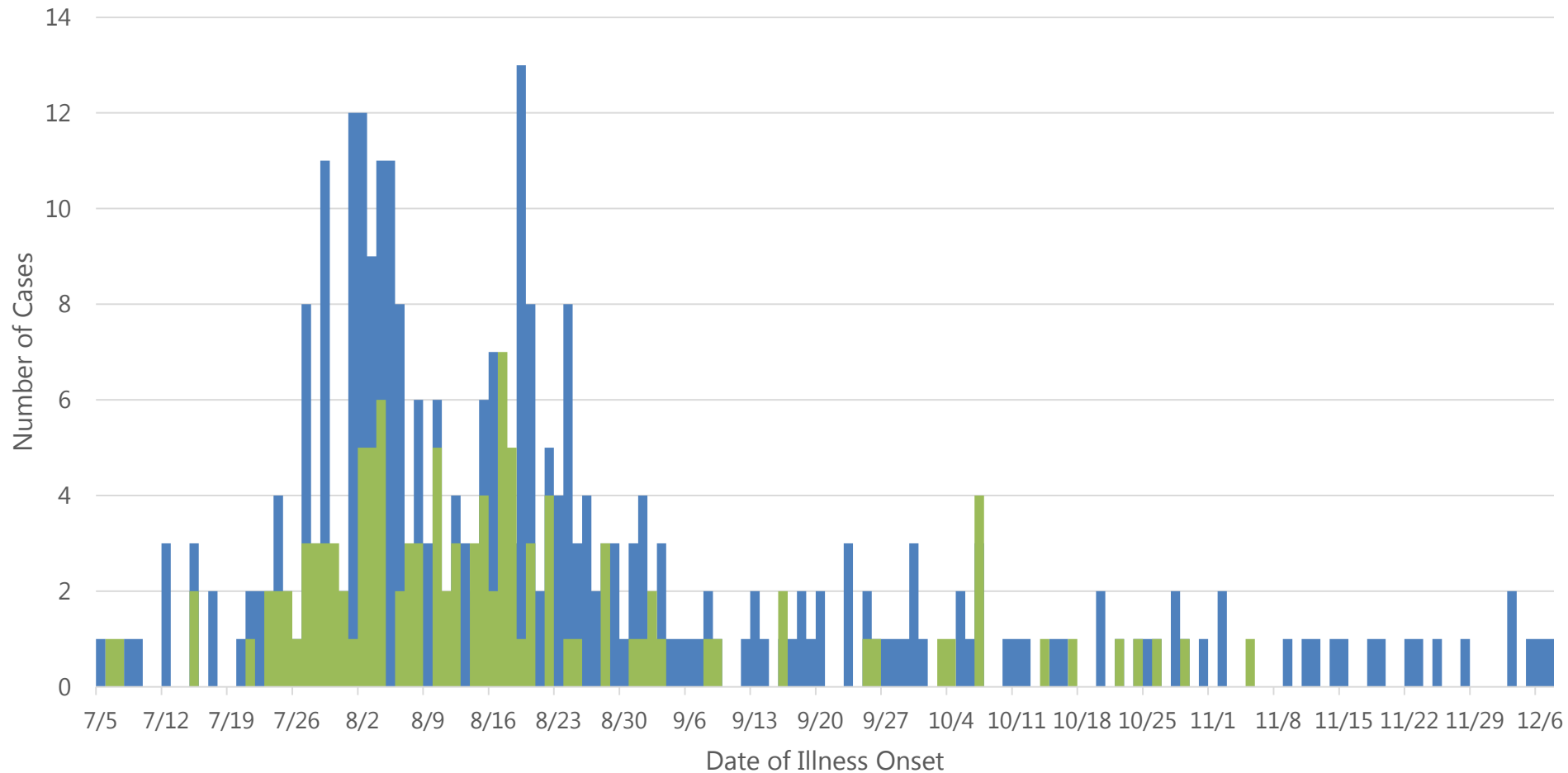
- 50 (**19%**) cases reported **no** water, animal or food exposures
 - Possible person-to-person transmission



2016 Outbreak Epi Curve



Number of Confirmed and Probable Cases of Cryptosporidiosis*, Maricopa County, 2016



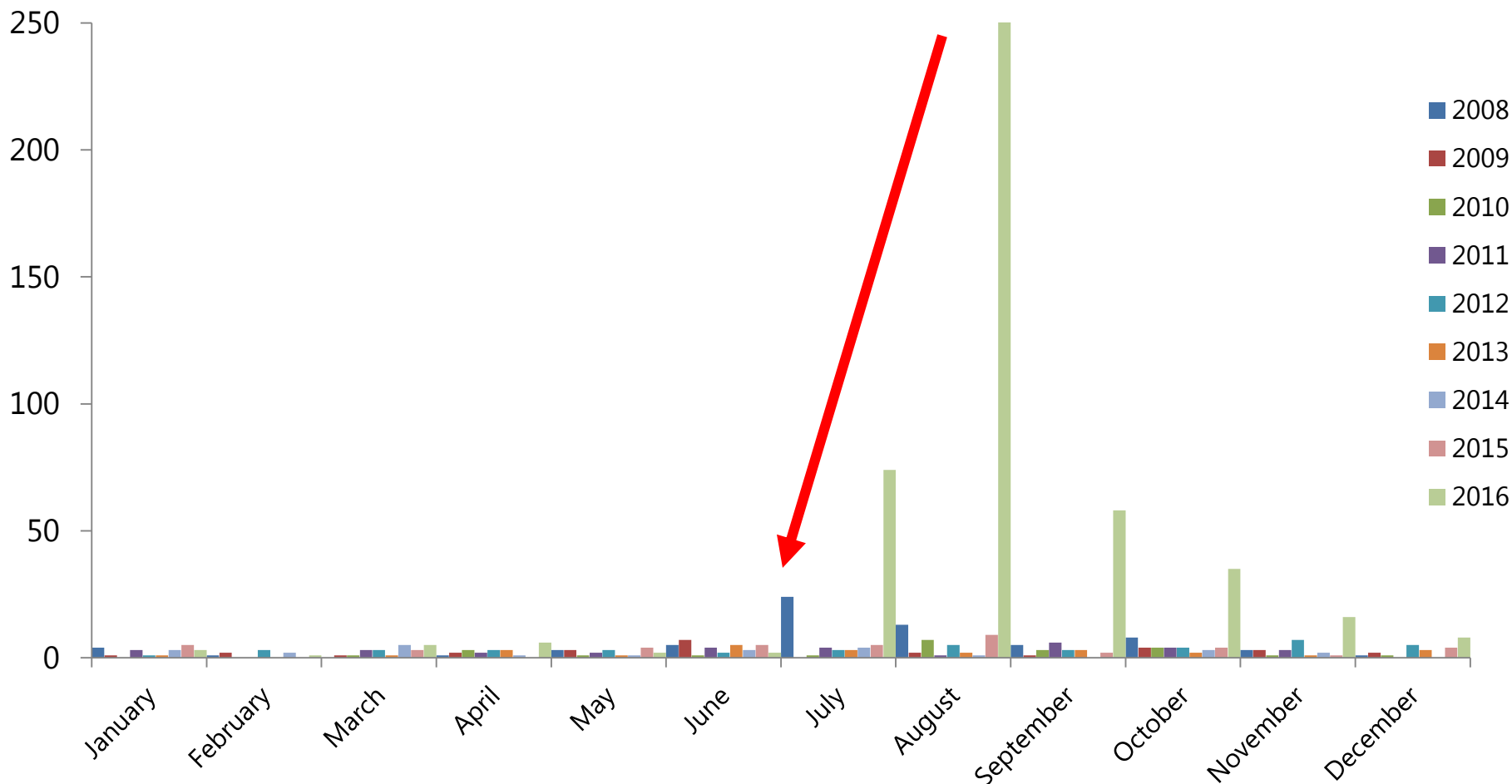
* Among 412 cases with date of illness onset available

■ CONFIRMED ■ PROBABLE

A BIG Outbreak



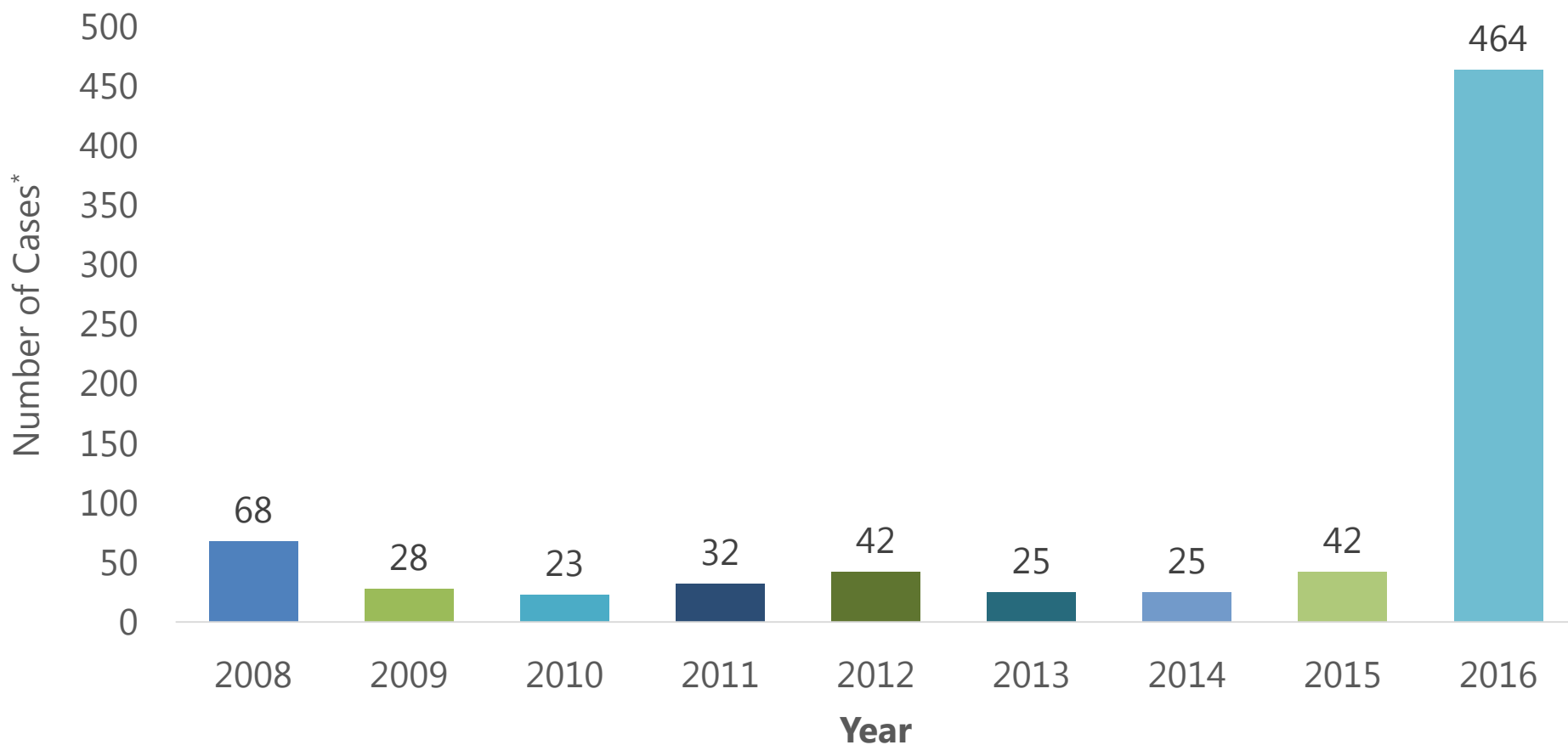
Cryptosporidiosis Incidence by Month of Onset, Maricopa County, 2008-2016



A REALLY BIG Outbreak



Number of Cases of Cryptosporidiosis by Year, Maricopa County, 2008-2016



*Confirmed and probable cases

Challenges During Outbreak



- Large amount of recreational aquatic facilities
- Labs
 - Clinical specimens
 - Environmental specimens
- Remediation guideline changes





Recommended Steps for Hyperchlorination When Chlorine Stabilizer is in the Water

Step 1: Close the aquatic venue to swimmers. If you have multiple venues that use the same filtration system—all of the venues will have to be closed to swimmers. Do not allow anyone to enter the venue(s) until the hyperchlorination process is completed.

Step 2: Using unstabilized chlorine (for example, sodium hypochlorite), raise the water's free chlorine concentration (see bullets below) and maintain water at pH 7.5 or less.¹

Step 3: Hyperchlorinate.² Chlorine stabilizer slows the rate at which free chlorine inactivates or kills Crypto, and the more stabilizer there is in the water the longer it takes to kill Crypto.

If the cyanuric acid concentration is 1–15 parts per million (ppm)³, using unstabilized chlorine.

- Raise the free chlorine concentration to 20 ppm⁴ and maintain it for 28 hours or
- Raise the free chlorine concentration to 30 ppm⁴ and maintain it for 18 hours or
- Raise the free chlorine concentration to 40 ppm⁴ and maintain it for 8.5 hours

If the cyanuric acid concentration is more than 15 ppm, lower the concentration to 1–15 ppm by draining partially and adding fresh water without chlorine stabilizer before attempting to hyperchlorinate.

Step 4: Confirm that the filtration system is operating while the water reaches and is maintained at the proper free chlorine concentration and pH for hyperchlorination.

Step 5: Backwash the filter thoroughly after hyperchlorination has been completed. Be sure to discharge directly to waste and according to state or local regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.

Step 6⁵: Allow swimmers back into the water only after hyperchlorination has been completed and the free chlorine concentration and pH are within the operating range allowed by the state or local regulatory authority.

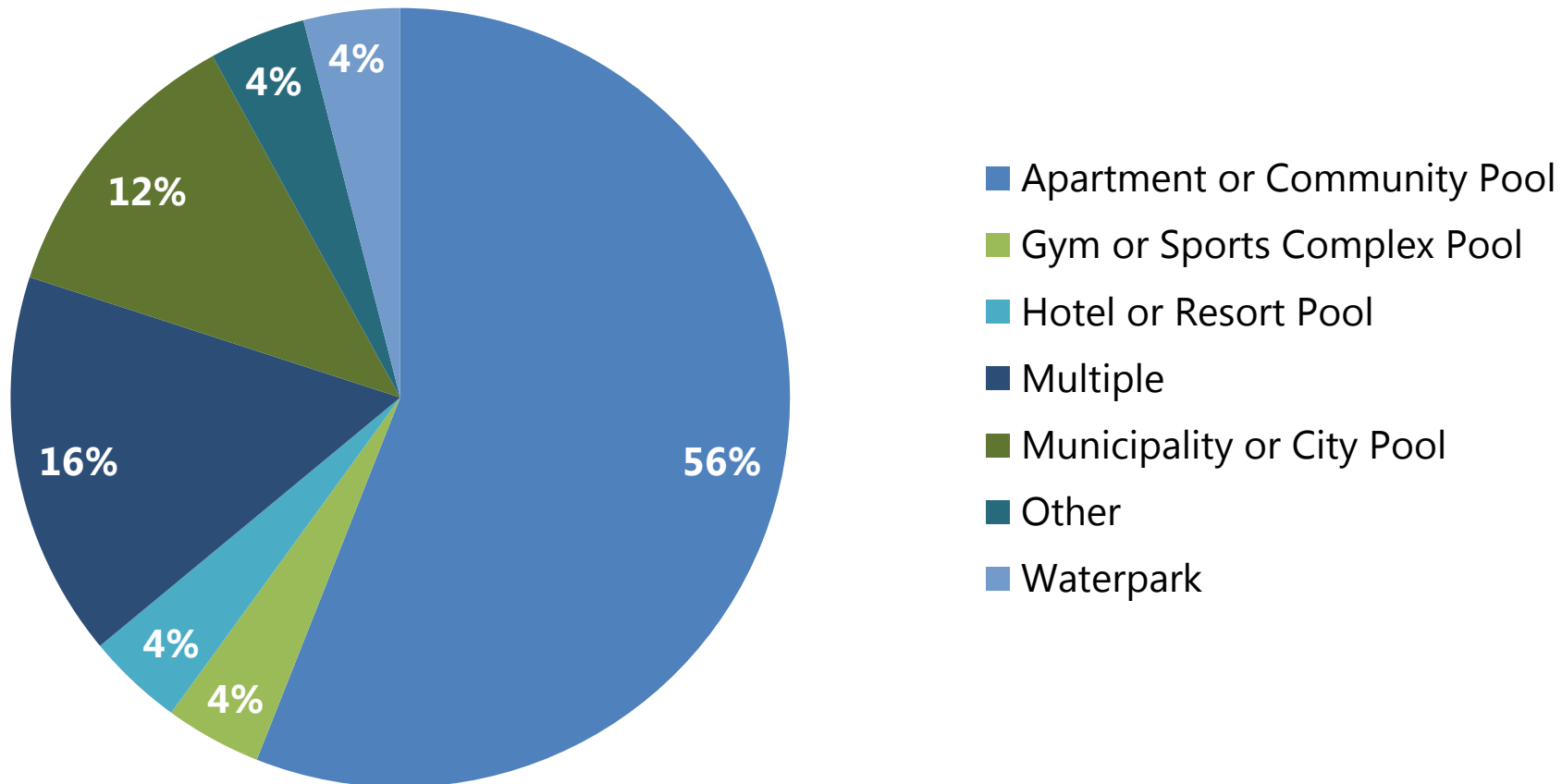


Where are we now?

Environmental Services Annual Swimming Pool Stakeholder Meeting



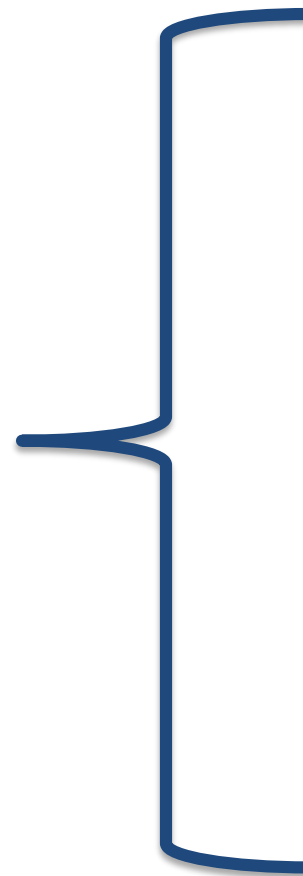
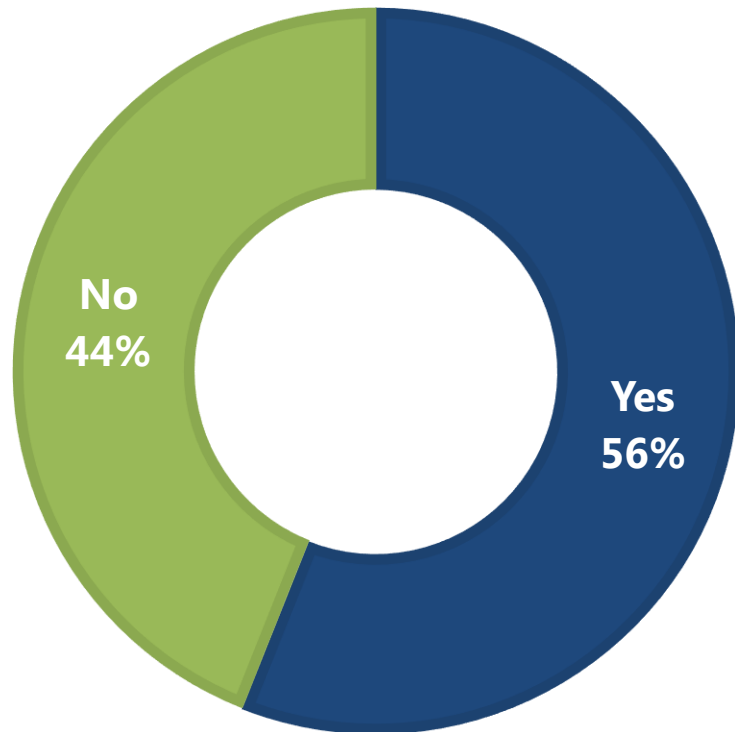
SURVEY RESPONDENTS (n=25)



Environmental Services Annual Swimming Pool Stakeholder Meeting



PROVIDE HEALTHY SWIMMING EDUCATION TO PATRONS OR STAFF



Post signs at entrance
50%

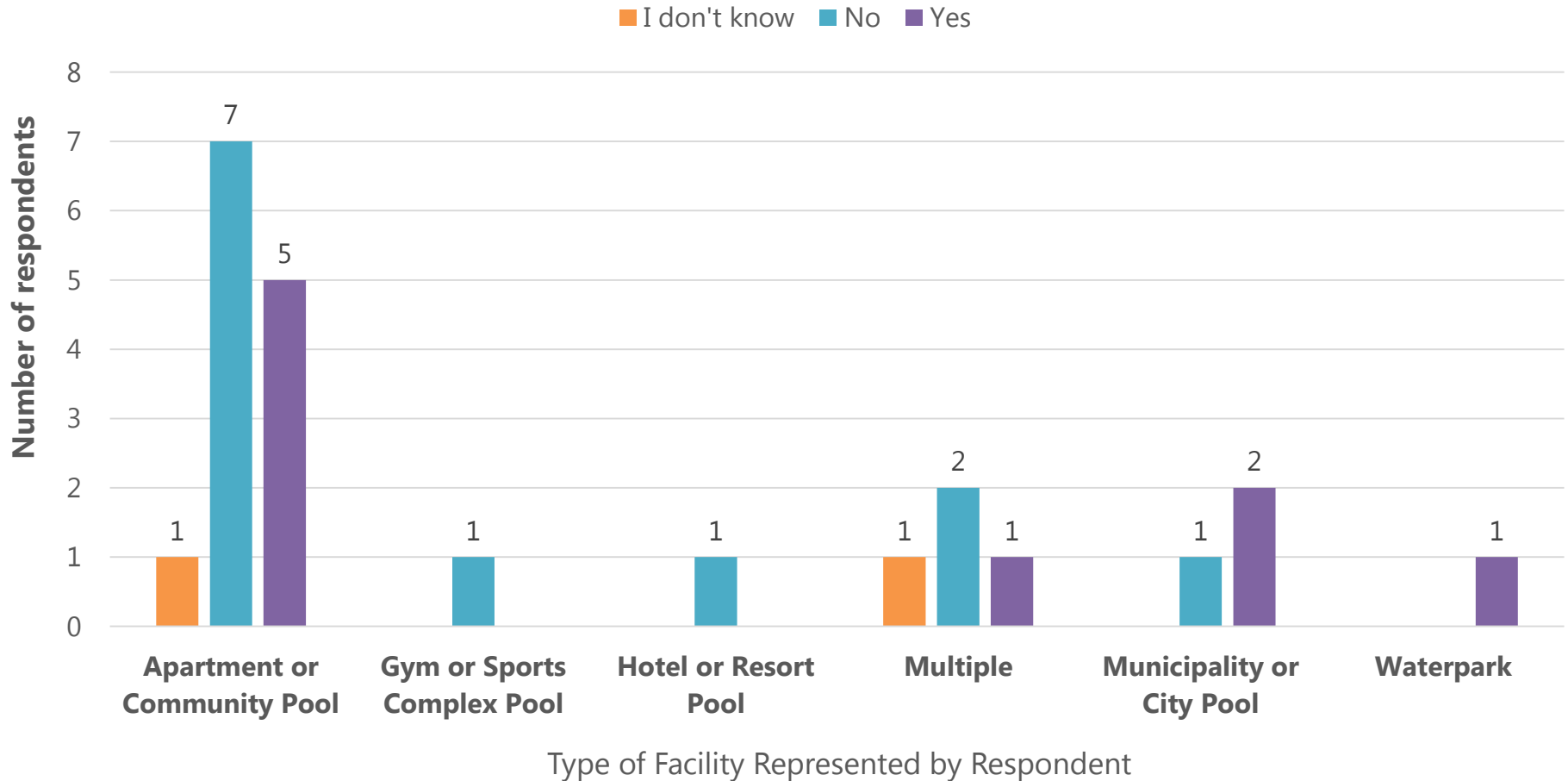
Post signs in bathrooms or changing tables
50%

Provide trainings for staff
29%

Environmental Services Annual Swimming Pool Stakeholder Meeting



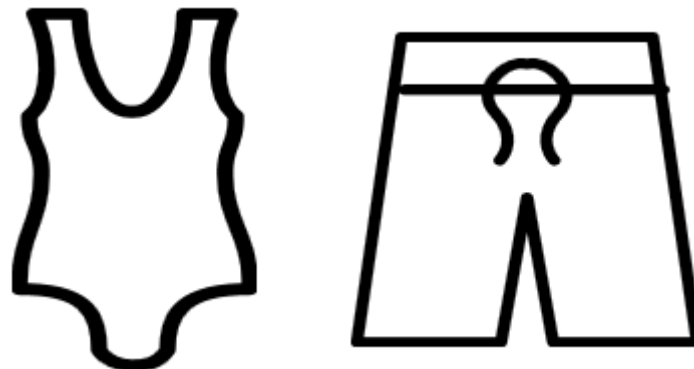
Did your facility hyperchlorinate your pool/water venue with a protocol designed to treat Crypto between July and October 2016?



Environmental Services Annual Swimming Pool Stakeholder Meeting



- 32% of facilities already had supplementary, in-line treatment systems
 - UV
 - Ozone
 - Both
- Others have researched these systems and are “somewhat” or “very likely” to have them in place for 2017 season



Environmental Services Annual Swimming Pool Stakeholder Meeting



Factor	Average Score*
Public perception that facility is “safe” from Crypto	4.7
Risk that patrons may be exposed to Crypto at your facility	4.5
Up-front cost of the supplementary treatment system (purchase and installation)	3.8
Cost to maintain the supplementary treatment system over time	3.5
Down-time required to install the supplementary treatment system	3.0

Factors of importance in the decision whether to install a supplementary, in-line treatment system for Crypto

* Respondents were asked to rate factors of importance on a scale of 1-5, which 1 being not important and 5 being very important.

Looking Ahead...



- Threshold for remediation should be **1** case reporting public pool exposure-regardless of outbreak
- Open and frequent communication with public and facilities
- More detailed questionnaire



Preventing Crypto




SWIM SAFE ARIZONA

<p>DON'T swallow pool water</p> 	<p>Take regular bathroom breaks</p> 
<p>Wash your body before swimming</p> 	<p>DON'T swim if you're sick</p> 

STAY AWAY FROM MR. CRYPTO!
WWW.CDC.GOV/HEALTHYWATER/SWIMMING
WWW.AZDHS.GOV/WATERBORNE



- **Visit the healthy swimming websites for more ideas**
 - [Maricopa County Environmental Services](#)
 - [Arizona Department of Health Services](#)
 - [Centers for Disease Control and Prevention](#)

Maricopa County Department of Public Health

- Sally Ann Iverson, DVM, MPH
- Jenn Collins, MPH
- Tammy Sylvester, MSN, RN
- Rebecca Sunenshine, MD

Maricopa County Environmental Services Department

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No Crypto! PSA



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