

# Common Diseases Associated with H<sub>2</sub>O

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ADHS Infectious Disease Training and Exercise  
July 31-August 2, 2012



# Waterborne Diseases

- Waterborne – Pathogenic microorganisms most commonly transmitted in contaminated fresh water
- Most Common
  - Protozoa
    - Amoeba
    - Cryptosporidium
    - Cyclospora
    - Giardia
  - Bacterial
    - Campylobacter
    - Cholera
    - Legionella
    - Leptospira
  - Viral
    - Hepatitis A
    - Polio



# Everyone's Favorite – Crypto!

- Cryptosporidium – microscopic parasite
- Spore forming – oocysts
  - Highly resistant to chlorine
  - Residuals in tap water will not inactivate
- Crypto spread via contaminated fecal material
- Usually associated with recreational water exposure
- Incubation 2-10 days (average 7)
- Duration 1-2 weeks – can have recurrent bouts of diarrhea
- Young children, pregnant women, immunocompromised



# Our Crypto Outbreak

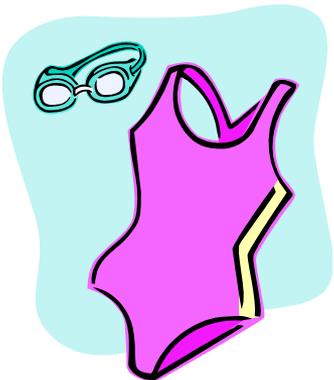
- Call came in over July 4<sup>th</sup> weekend
- Reported illnesses in swim team members from a Phoenix pool
- Four separate family complaints filed
  - Most with multiple children in swim team
  - Reported that up to 100 children could be ill
  - Team competed in several competitions at different pools
  - No cases had sought medical attention
- ES inspected pool – no violations noted
- Epi sent out specimen collection kits to the ill



# Our Hypotheses



- Sx – nausea, vomiting, diarrhea
  - No incubation period since no common event
  - However, most were recovering fairly quickly
    - Although some reporting ongoing diarrhea for 4-5 days
  - Norovirus suspected (large number ill, recovery pretty quick in most cases)
- Since this was a recreational water exposure - first thought=crypto
- However, hadn't had a crypto OB in AZ
- So, decided to test for crypto and norovirus



# Information Gathering Continues (7/8)

- Spoke to City of Phoenix Aquatics
  - Illnesses in 9 staff members
    - 2 with exposure to Salt River prior to illness
  - Aquatics policy had sx. staff excluded until 24 hours asymptomatic (no diarrhea or vomiting)
  - Parents had reported illness in 20 children
- Pool A was closed and hyper-chlorinated
- No questionnaires done at this point – thought the likelihood of crypto low



# And More Information... (7/10)

- Several swim meets held while cases symptomatic
  - Several pools implicated in Phoenix
  - At one meet, several documented vomiting incidents
- ES inspected each of these pools
- Norovirus results of humans negative, hmmm....



# The Fatal Blow... (7/14)

- Human specimens - Crypto positive!
- Investigation kicked into high gear
  - Questionnaire created and sent to SAFER
  - Interviews began
  - City of Phoenix (CoP) compiled list of ill including staff received – added to interview queue
  - Daily meetings with just about everybody
    - CoP staff
    - PIOs
    - PH and ES



# More Investigation (7/15-7/18)

- CoP closed all pools on 7/16 for hyper-chlorination
- SAFER continued interviews
- Preliminary data entered and epi curve created
- CoP tested pool water in 5 pools
  - Pool B positive for viable oocysts but no associated human cases with exposure to only that pool
  - Pool A not positive, but had been hyperchlorinated



# Final Case Definition

- **Confirmed** – Any person who developed gastrointestinal illness between 6/14/08 and 7/14/08, swam at Pool A prior to illness, and had a positive lab test for *Cryptosporidium parvum*.
- **Probable** - Any person who developed gastrointestinal illness between 6/14/08 and 7/14/08, swam at Pool A prior to illness, but did not have a lab test for *Cryptosporidium parvum*.

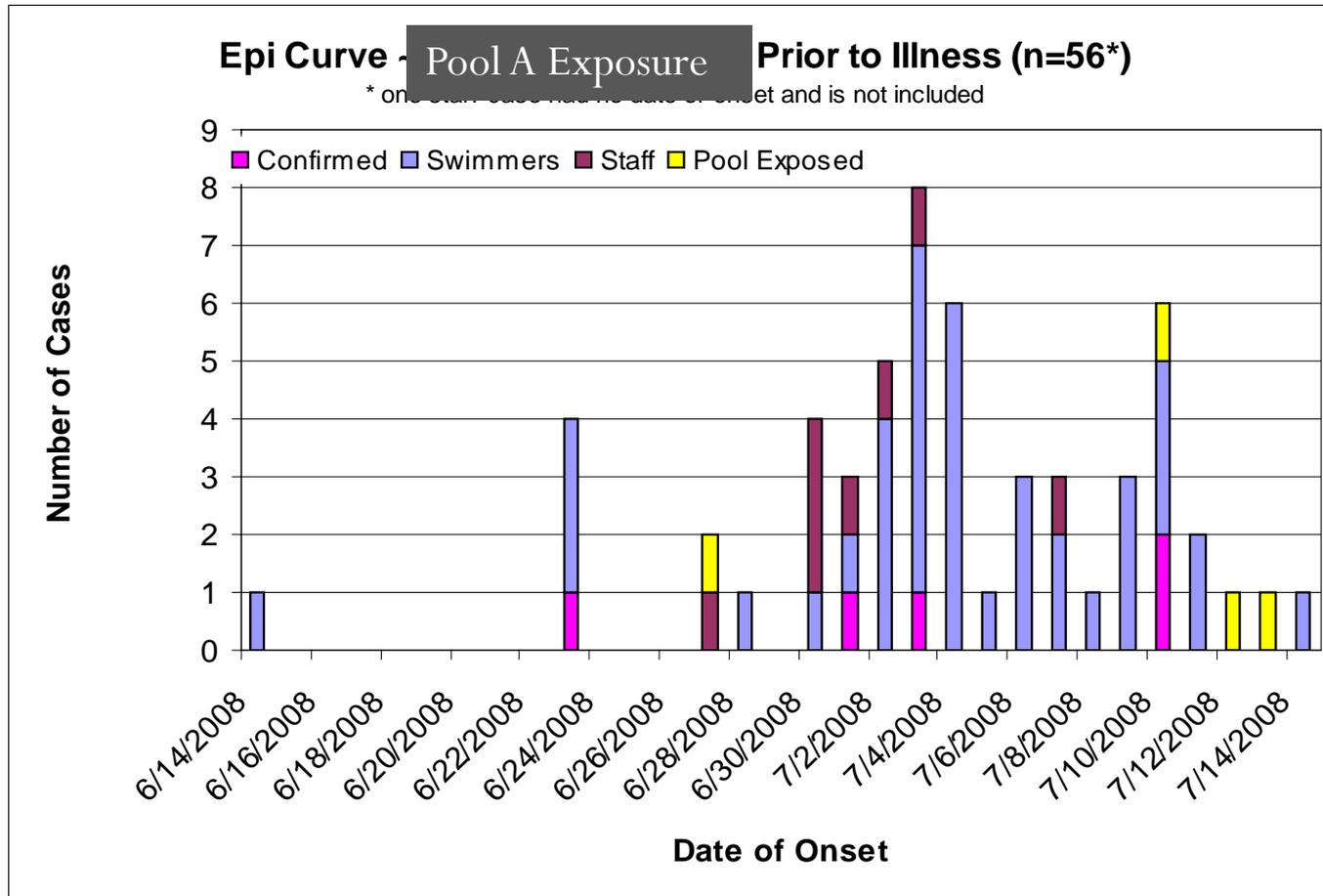


# Final Steps (7/21-7/25)

- SAFER completed interviews
- CoP re-opened pools
- More analyses completed



# Final Epi Curve – Progressive Spread



# Final Numbers

- Complaints from swimmers in 10 city pools
- 194 total reports of illness
- 83 interviewed
- 111 not able to be interviewed
- 5 confirmed (lab test positive)
- 52 probable cases (symptoms + exposure)
- 10 not ill
- 13 R/O ruled out *because* no exposure to suspect pool
- 3 R/O with no GI symptoms



# Lessons Learned

- Have crypto questionnaire ready to go
- Keep case definitions in mind
- Work closely with ES to monitor pool complaints
- Keep on hand CDC recommendations for management of cases and pools
- Remember what worked!
  - Hyperchlorination of pools early
  - Exclude ill swimmers for 2 weeks



**More Diseases!**

# Legionella

- Aerobic bacteria
- Causes pneumonia
  - Can cause death in 5-30% of cases
  - Treated by antibiotics
  - Risk factors – elderly, current/former smoker, chronic lung disease, immunocompromised
- Found naturally in water (particularly warm water)
  - Cooling towers
  - Misters
  - Hot tubs
  - Hot water tanks (showers)
- Infection occurs by breathing in contaminated water vapor



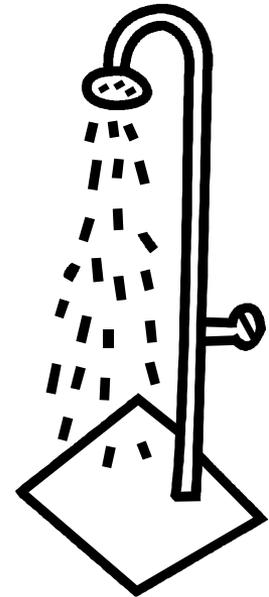
# The American Legion

- First outbreak at an American Legion convention in Philadelphia 1976
- Outbreak of pneumonia – 182 cases 29 deaths
- New organism isolated – *Legionella pneumophila*
- Source not found for this outbreak – given later experiences probably cooling towers or evaporative condensers



# Hospitals

- Cases are of particular concern
- Often associated with:
  - Ventilators
  - Cancer wards
  - Hematopoietic stem cell transplant units
- When cases identified active case finding back at least 6 months
- Active surveillance
- Risk factor identification and sampling with subtyping
- Control measures
  - Using only sterile water for nebulizers
  - Maintenance of facility water to  $>50^{\circ}\text{C}$  or  $<20^{\circ}\text{C}$  at tap
  - Chlorination to 1-2 mg/L of free residual at tap



# Legionella Facts

- Most Legionella in US is serotype 1
- Serotype 1 detected by urine antigen screen
- AZ – most disease NOT serotype 1
- Negative urine antigen test does not rule out disease in AZ
- Culture is the only way to rule out disease



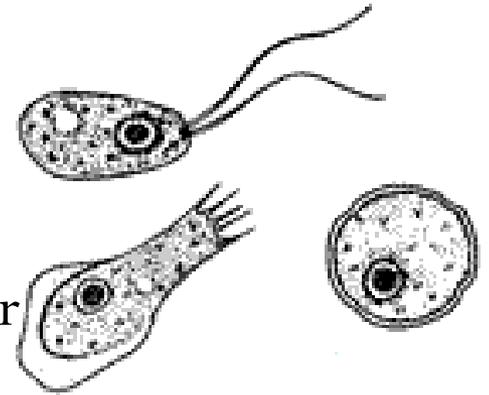
# Legionella in Maricopa County 2011

- 2011 – 34 confirmed cases 7 deaths
- Age 30-87
- No outbreaks identified



# Amoeba

- Amebiasis – infection with the amoeba *Entamoeba histolytica*
  - Forms cysts transmitted in stool
  - 90% asymptomatic
  - Incubation 2-4 weeks, duration up to years
  - Diarrhea (sometimes bloody), cramping, fever
  - Can be severe and cause deaths
- Primary amoebic meningoencephalitis (PAM) – *Naegleria fowleri*
- PAM and/or Granulomatous amoebic encephalitis – *Balamuthia mandillaris*



# Amoeba in Maricopa County

- Amebiasis – 11 cases in 2011
- Amoebic encephalitis 2011
  - Balamuthia – case fell on potted plant, sustained laceration and soil exposure – died
- PAM – 2006
  - Child with exposure to lake water – *N. fowleri* encephalitis - died
- PAM – 2002
  - 2 children in same area
  - Exposure to same water system
  - Developed encephalitis *N. fowleri* – died

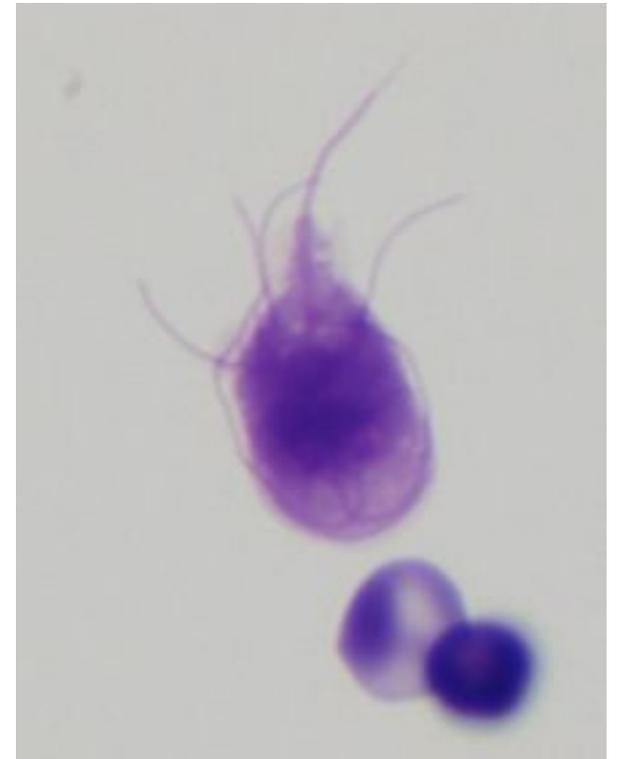
# More parasites – Giardia

- Single-celled parasite – forms infectious cysts excreted in stool
- Wide range of hosts besides humans (beaver, muskrat, rodents)
- Incubation 1-2 weeks (average 7 days) Duration 2-6 weeks
  - Symptoms diarrhea, cramps, fever, malaise, anorexia
  - Recurrent bouts of symptoms can occur
- Serious infection immunocompromised and elderly



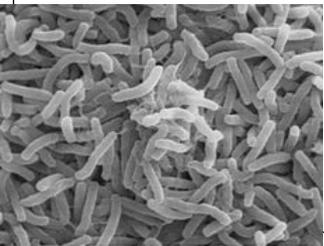
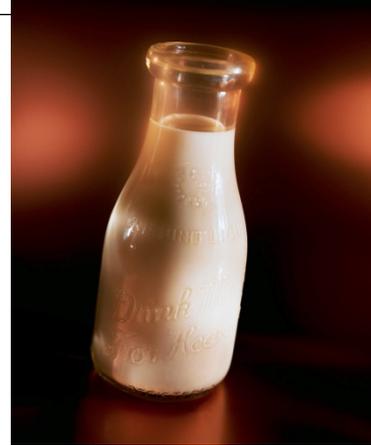
# Giardia in Maricopa County

- 2011 – 72 confirmed cases
- Age 1 – 79
- No outbreaks identified



# Others

- Campylobacter
  - In US more associated with raw milk
  - Can be transmitted in untreated water – particularly if birds/animals present
- Cholera
  - No toxigenic cholera in US
  - Rare cases associated with water exposure
  - Cases are associated with consumption of seafood (raw oysters)
- Hepatitis A
  - Rare in US – vaccination mostly eliminated transmission
  - Travelers to endemic areas at risk





## Questions?

For More Information: <http://www.maricopa.gov/PublicHealth/>

ES website: <http://www.maricopa.gov/EnvSvc/WaterWaste/SwimPools/SwimPools.aspx>

Education: <http://www.youtube.com/watch?v=KqQrD9em3sI>