Waterborne diseases and public health implications

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Houston-Galveston Area Council
June 20th, 2018
Epidemiology Background

- Texas has a list of reportable disease
- Reports come in from hospitals, laboratories, doctor’s offices, etc.
- We investigate the reports that come in
- Provide control measures and education
- The information is submitted to the Department of State Health Services in Austin
Waterborne Diseases

- E.coli
- Salmonella
- Salmonella typhi
- Shigella
- Campylobacter
- Vibrio
- Legionella
- Norovirus
- Hepatitis A
- Cryptosporidium
Bacterial Pathogens

- E.coli, Salmonella, Salmonella typhi, Shigella, Vibrio, **Legionella** and Campylobacter

- Cause diarrheal illness
  - Legionella causes Pneumonia or Pontiac Fever

- All can be contracted through contaminated water

- Prevention: hand hygiene, boiling water (1 min), source protection, halogenation of water
  - Legionella: maintain water systems at specific temperatures, disinfection of recreational water systems, prevent water stagnation, prevent biofilms
Case Study: E.coli O157 in Cabool, Missouri, 1989

- 243 cases, 32 hospitalized, 4 deaths
- Contamination of municipal water supply
  - Exceptionally cold weather
  - Water meter replacements and two breaks in distribution lines
  - No practice of line disinfection
  - No sampling or disinfection after line breaks
  - Surface water run-off infiltrated system, open culverts, sewage and storm runoff found near water pipe – after storms
  - Sewage lines crossed water lines
Case Study: E. coli O157 in Cabool, Missouri, 1989

- Mitigation efforts:
  - Boil water order
  - Chlorination program for community water supply
  - System disinfection of water supply
### Case Counts of Waterborne Bacterial Pathogens in Harris County Jurisdiction by Year

<table>
<thead>
<tr>
<th>Bacterial Pathogen</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>160</td>
<td>162</td>
<td>167</td>
<td>216</td>
<td>246</td>
</tr>
<tr>
<td>Vibrio Cholerae</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salmonella</td>
<td>459</td>
<td>340</td>
<td>375</td>
<td>503</td>
<td>337</td>
</tr>
<tr>
<td>E.Coli (STEC)</td>
<td>107</td>
<td>59</td>
<td>73</td>
<td>81</td>
<td>67</td>
</tr>
<tr>
<td>Shigellosis</td>
<td>576</td>
<td>99</td>
<td>219</td>
<td>390</td>
<td>89</td>
</tr>
<tr>
<td>Typhoid Fever</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Vibrio non-Cholerae</td>
<td>13</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>Legionella</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>14</td>
</tr>
</tbody>
</table>

*Data collection is still ongoing*
**Viral Pathogens**

- **Norovirus**
  - Cause: diarrheal illness
  - Prevention: source protection, disinfection

- **Hepatitis A**
  - Cause: Inflammation of the liver, Gastrointestinal symptoms, jaundice
  - Prevention: source protection, disinfection, resistant to combined chlorines

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**Case Counts of Waterborne Viral Pathogens in Harris County Jurisdiction by Year**

<table>
<thead>
<tr>
<th>Viral Pathogen</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A</td>
<td>5</td>
<td>1</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

*Data collection is still ongoing
  ** Norovirus is not a reportable condition, only in outbreak situations
Case Study: Norovirus in Finland, 1998-2003

- 48 outbreaks
- Norovirus caused 18 of these outbreaks
- Most caused by sewage contamination of surface water systems
  - Many plants still used surface water (lakes and rivers) as raw water
  - Inadequate disinfection was a common reason for outbreaks
  - When snow melts in spring it causes surface runoffs and flooding
  - Poor sewage disposal in private homes and rentals
Case Study: Norovirus in Finland, 1998-2003

- Mitigation efforts:
  - Increased awareness of viral risks
  - Laboratory techniques have been improved
  - Capacity for analyzing environmental samples has increased
Parasitic Pathogens

- Cryptosporidium
  - Parasite
  - Causes diarrheal illness
  - Can be contracted through contaminated water
  - Prevention: source protection, boil water (1 min), filtration, reverse osmosis

*Data collection is still ongoing*
Case Study: Cryptosporidium in Milwaukee, Wisconsin 1993

- >400,000 cases based on symptoms
- 4,400 hospitalizations
- 69 deaths (93% attributable to PLWHA)

- During heavy rains the city’s filtration system was overwhelmed
- Cryptosporidium from Lake Michigan infected the water supply
- Possible sources: cattle, slaughterhouses, human sewage
- Water was frozen and stored
Case Study: Cryptosporidium in Milwaukee, Wisconsin 1993

- Mitigation Efforts:
  - Boil water advisory
  - Committed $417 million to infrastructure to ensure high quality water
  - Renovated facilities, strengthened source water protection, disinfection and filtration
  - Milwaukee is now a leader in a water quality and water testing
  - Created the Interagency Clean Water Advisory Council (Milwaukee Water Works and the Milwaukee Health Department)
Flood Risks to Public Health - Water Contamination

- Microbial contamination (viral, parasitic and bacterial) of flood waters
  - Hand hygiene
  - Don’t enter water with open cuts or wounds
  - Avoid standing water
  - Areas saturated with floodwater
  - Areas with visible debris
Daily Community Disease Monitoring and Community Assessment after Hurricane Harvey

- Daily Situational Reports:
  - Epi department conducted daily community disease monitoring and community assessment after Hurricane Harvey
  - Harris County case counts of bacterial, viral and parasitic waterborne illnesses did not show any marked increase post Harvey. Neither did cases in the City of Houston – except Vibrio
  - In fact, we saw the number of most disease cases actually decrease from the same time period in years prior
  - Possible Reason:
    - Interrupted patient visits
    - Lengthy turnaround time for lab tests
Hurricane Harvey and Vibrio Infections in Texas, 2017

- 3 reported confirmed *Vibrio* cases (1 out of jurisdiction case) linked to Hurricane Harvey, post hurricane flooding, & clean up in Texas
Hurricane Harvey and Vibrio Infections in Texas, 2017

- **Case #1**
  - 74 year male, Aransas Co
  - Search and Rescue team found him on 8/29/17
  - Food injury
  - Amputation of leg below knee
  - Survived

- **Case #2**
  - 65 year old male, Calhoun Co
  - Evacuated from RV park on 8/26/17
  - Returned home on 8/31/17 and began clean up
  - Injured leg and then went fishing
Hurricane Harvey and Vibrio Infections in Texas, 2017

- **Case #3**
  - 11 year old male
  - Playing in backyard, fell into stagnant water and injured knee

- **Case #4**
  - Out of Texas
  - 55 year old male, MS resident
  - Helped with post Harvey clean up in Galveston
  - Developed severe sunburn, developed wound
  - Hospitalized but survived
Flood Risks to Public Health- Arbovirus

- Vector-borne illness
- WNV and Chikungunya
  - Can be neuroinvasive or non-neuroinvasive
  - Manifest as meningitis, encephalitis, AFM, etc.
  - Fever and chills
- Zika
  - Asymptomatic 80%
  - Fever, rash, conjunctivitis, arthralgia
  - Can cause congenital microcephaly or other congenital CNS abnormalities
Flood Risks to Public Health- Arbovirus

- Mosquitoes risks
  - Populations can explode after storms/flooding
  - Can carry severe diseases
    - Zika, WNV, Chikungunya
  - Prevention: remove/empty containers that can hold water (tires, flower pots, birdbaths, etc.), Install or repair screens, sweep up lawn clippings and leaves, eliminate mosquito breading sources in the home
Flood Risks to Public Health - arbovirus

- Ongoing questions:
  - We usually see an increase in mosquito activity after any rainfall event
  - Hard to know if mosquito increase was due to Harvey, temperature or simply seasonal
  - No significant increase in mosquito-related illness either
    - Greatest activity is usually a month after the greatest abundance of mosquitoes
Questions?
Harris County Public Health

{ Vision }
- Healthy People,
- Healthy Communities,
- A Healthy Harris County

{ Values }
- Excellence
- Compassion
- Flexibility
- Integrity
- Accountability
- Professionalism
- Equity

{ Mission }
- Promoting a Health and Safe Community
- Preventing Injury and Illness
- Protecting You

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