Re-Assessment of the Risks of Protozoa in New Zealand’s Natural Waters

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<table>
<thead>
<tr>
<th>Catchment Type</th>
<th>Number of Sites</th>
<th>% Samples Containing Cryptosporidium</th>
<th>% Samples Containing Giardia</th>
<th>% Samples Containing E. coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater/Springs</td>
<td>8</td>
<td>0%</td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td>Bush Catchments</td>
<td>7</td>
<td>1%</td>
<td>3%</td>
<td>84%</td>
</tr>
<tr>
<td>Intermediate Rivers</td>
<td>7</td>
<td>1%</td>
<td>5%</td>
<td>87%</td>
</tr>
<tr>
<td>Lowland Rivers</td>
<td>5</td>
<td>43%</td>
<td>59%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Intro to Protozoa

- What are protozoa?
- Why are they problematic for drinking water suppliers?

Ref: Centers for Disease Control and Prevention https://www.cdc.gov/parasites/giardia/index.html
# Sampling for Protozoa in Groundwater

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Sites Sampled</th>
<th>Number of Samples Taken</th>
<th>Number of Samples Positive For Protozoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>39</td>
<td>1,130</td>
<td>0</td>
</tr>
<tr>
<td>Overseas</td>
<td>&gt;58</td>
<td>507</td>
<td>73 (14%)</td>
</tr>
<tr>
<td>Total</td>
<td>&gt;97</td>
<td>1,637</td>
<td>73 (4%)</td>
</tr>
</tbody>
</table>
Outbreaks of Giardiasis and Cryptosporidiosis

New Zealand
- Giardia and Cryptosporidium are the top two causes of outbreaks of waterborne illnesses (ESR 2015, 2016 and 2018)
- But hard to attribute to type of water source

Overseas
- Outbreaks related to contaminated groundwater have been reported in the UK and USA
- Outbreaks are often associated with a clear contamination event or pathway
1992 – 1993 Cryptosporidiosis outbreak in Warrington, UK with 47 confirmed cases (Brigman, et al., 1995)

Ref: Centers for Disease Control and Prevention
https://www.cdc.gov/parasites/crypto/index.html
Natural Filtration Mechanisms

Pathogen Diameters Compared to Aquifer Matrix Dimensions Ref: taken from ARGOSS, 2001; British Geological Survey ©NERC in Schmoll, et al., 2006
Bypassing Mechanisms

- Karst or fissured bedrock
- Deep sewer pipes
- Condition of bores
- Condition of other infrastructure
- Overland flow

Ref: Govt of Newfoundland and Labrador at American Geosciences Institute
https://www.americangeosciences.org/critical-issues/factsheet/managed-aquifer-recharge
WHO acknowledges that the potential for contamination of groundwater exists

USEPA considers that ‘true’ groundwaters do not contain protozoa

Ref: Health Navigator New Zealand [https://www.healthnavigator.org.nz/health-a-z/g/giardia/]
- Unless secure, treatment for protozoa is required (except for Section 10)
- Secure groundwater classification relies on the natural filtering mechanisms and long residence times within the aquifer

Best Practice

- Source water protection barriers
- Well and water system integrity barriers
- Septic system integrity barriers
- Operations and system maintenance barriers
- Disinfection requirements

Sanitary Protection of a Typical Bore Ref: Ministry of Health, 2018
Where to Now?

- Estimate that 40-45% of the population served by networked supplies >25 people drink groundwater
- Lack of evidence that protozoa is of high risk in NZ groundwaters
- Opportunity to make changes to the DWSNZ
- Balance of cost and risk
References/Questions