Environmental Exposures, *Helicobacter pylori* Infection and Gastritis in Canadian Arctic Communities

EV. Hastings, Y. Yasui, P. Hangington, KJ. Goodman
About *Helicobacter pylori*

**What is it?**

Helical, flagellar, gram-negative bacterium that inhabits the lining of the stomach and/or duodenum.
About *Helicobacter pylori*

Associated Disease

Three main diseases:

1. Chronic Gastritis
2. Peptic Ulcer Disease
3. Gastric Cancer
Transmission

What We Know So Far...

• Person-Person Transmission
  • Fecal-Oral Route
  • Gastro-Oral Route
  • Oral-Oral Route
Transmission

What We Know So Far...

• Initial infection most frequently occurs in childhood

• Sheds most readily during acute gastroenteritis

• No public health control measures

• Frequency of transmission through environmental sources is unknown
Motivation
Canadian North *Helicobacter pylori*
The CANHelp Team

Communities
Aklavik, Northwest Territories
Old Crow, Yukon Territory
Tuktoyaktuk, Northwest Territories
Fort McPherson, Northwest Territories

NWT Agencies
Rachel Munday, Nurse in Charge, Aklavik Health Center
Leah Seaman, Public Health Physician, Beaufort-Delta Regional Health Authority
Kami Kandola, Chief Public Health Officer, NWT Health and Social Services
John Morse, Former Medical Director, Stanton Territorial Health Authority
Susan Chatwood, Director, Institute for Circumpolar Health Research

Yukon Agencies
Brendan Hanley, Yukon Medical Officer of Health
Jodi Butler Walker, Arctic Health Research Network Yukon
Nurse in Charge, Old Crow Health Centre
Darius Elias, MLA, Yukon Legislature

Alberta Health Services
Robert Bailey, Director, Northern Health Services Network
The CANHelp Team

**University of Alberta:**
- Epidemiology: Karen Goodman, Hsiu-Ju Chang
- Global Health: Laura Aplin
- Anthropology: Christopher Fletcher
- Gastroenterology: Sander van Zanten, Richard Fedorak
- Microbiology: Monika Keelan
- Pathology: Safwat Girgis
- Biostatistics: Yutaka Yasui

**External:**
- Health Policy: Carl Phillips
- Arctic Investigations: Michael Bruce
- Cancer Investigations: David Forman

**Researchers in Training:**
- Public Health Sciences: Amy Colquhoun, Ashley Wynne, Emily Hastings, Janis Geary, Katharine Fagan-Garcia, Megan Lefebvre
- Anthropology: Sally Carraher
- Gastroenterology: Justin Cheung, Amy Morse
- Microbiology: Maysoon Mahmood, Megan Burlet
Context

Epidemiology of *H. pylori* in Canada
Of the 194 persons with biopsies:

<table>
<thead>
<tr>
<th>Inflammation</th>
<th>All <em>H. pylori</em>-positive (n=129)</th>
<th><em>H. pylori</em>-positive patients from Edmonton (n=401)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild (%)</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Moderate (%)</td>
<td>47</td>
<td>55</td>
</tr>
<tr>
<td>Severe (%)</td>
<td>43</td>
<td>5</td>
</tr>
</tbody>
</table>
Several community members feared that contamination of local water sources is affecting digestive health.
Fear that animals may play a role in transmission
Objectives

This analysis examines two hypotheses regarding how environmental exposures may affect digestive health:

1. Environmental sources of biological contamination may facilitate transmission of *H. pylori*

2. Exposure to environmental sources of chemical contamination may influence the development of severe gastritis.
Methods

Communities Involved

Aklavik, Northwest Territories
- 2006 Population: 590
- 90% Inuvialuit or Gwich’in Dene
- Accessed air, water or ice-road

Tuktoyaktuk, Northwest Territories
- 2011 Population: 854
- 84% Inuvialuit, Gwich’in or Metis
- Accessed air, water or ice-road
Methods

Community Project Components

- **H. pylori** screening by urea breath test (UBT)
- Clinical and epidemiological questionnaires
- Endoscopy
- Treatment
- Knowledge Exchange
- Policy Development
Methods

13C-Urea Breath Test
Methods

Endoscopy → Histology
Methods

Statistical Analysis

• Descriptive Statistics
• Multivariable logistic regression
• Statistical software used: Stata 10
Results

Prevalence of *H. pylori* in both communities combined was 61%
## Results

### Pathways for Zoonotic Transmission

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>HP+ (%)</th>
<th>OR</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mice/Mouse Droppings in the Home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>328</td>
<td>196 (60)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>40</td>
<td>31 (78)</td>
<td>4.6</td>
<td>(1.2, 18)</td>
</tr>
<tr>
<td><strong>Cared for Animals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>91</td>
<td>59 (65)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>277</td>
<td>167 (60)</td>
<td>0.82</td>
<td>(0.38, 1.8)</td>
</tr>
<tr>
<td><strong>Cared for Dogs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>99</td>
<td>62 (63)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>269</td>
<td>165 (61)</td>
<td>0.72</td>
<td>(0.33, 1.6)</td>
</tr>
<tr>
<td><strong>Cared for Cats</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>332</td>
<td>212 (64)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>36</td>
<td>15 (42)</td>
<td>1.36</td>
<td>(0.34, 5.4)</td>
</tr>
<tr>
<td><strong>Contact with Animal Innards</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>89</td>
<td>52 (58)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>279</td>
<td>175 (63)</td>
<td>1.6</td>
<td>(0.70, 3.6)</td>
</tr>
</tbody>
</table>

* Adjusted for demographic characteristics, waterborne and zoonotic exposures
## Pathways for Waterborne Transmission

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>HP+ (%)</th>
<th>OR</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever Consumed Untreated Water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>86</td>
<td>54 (63)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>282</td>
<td>173 (61)</td>
<td>0.36</td>
<td>(0.14, 0.94)</td>
</tr>
<tr>
<td><strong>Consumed Untreated Water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>245</td>
<td>152 (62)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>123</td>
<td>75 (61)</td>
<td>0.85</td>
<td>(0.40, 1.8)</td>
</tr>
</tbody>
</table>

*+ Adjusted for demographic characteristics, waterborne and zoonotic exposures*
Untreated Water Consumption and Severe Gastritis Prevalence
Results

Untreated Water Consumption and Severe Gastritis

• The fully adjusted odds ratio for the effect of consuming untreated water in the past year compared to not having done so on severe gastritis was:

2.8 (1.1, 7.2)
Discussion

Untreated Water Consumption and Severe Gastritis

*H. pylori* – associated gastritis

- By-products of the bacteria have a direct toxic effect on the stomach lining

Chemical degradation and gastritis

- Most commonly a result of acid reflux and certain medications
- Regular ingestion of low levels of chemical contaminants found in the environment
  - Mercury
Discussion

Untreated Water Consumption and Severe Gastritis

- Due to the direction of atmospheric and ocean currents, the circumpolar north is subject to high levels of pollutants from all over the world

- Contamination of the Arctic Ocean and fresh waters with heavy metals has been documented
Conclusion & Future Directions

• Positive association between exposure to mice *H. pylori* infection.

• Other investigated zoonotic and waterborne exposures do not appear to play an important role in the transmission of *H. pylori* in the study populations.

• Positive association between consuming untreated water and severe gastritis

• Further investigation of alternate transmission pathways

• Discussions with communities about what they would like to focus on next
Acknowledgements

Special thanks to the communities: Aklavik and Tuktoyaktuk!
Thank You! Questions?