Household risk factors and prevalence of *Helicobacter pylori* infection in Aklavik, NWT

Katharine Fagan-Garcia, Janis Geary (Huntington), Karen J. Goodman and CANHelp Working Group

Department of Medicine (Gastroenterology) and Department of Public Health Sciences, University of Alberta
Chronic gastritis

Gastric or duodenal ulcer
5-15%

Stomach cancer
<1%

Helicobacter pylori
Helicobacter pylori

- Estimated to infect half or more of world’s population
- High prevalence in less developed regions

Adapted from Helicobacter Foundation website, 2006 (www.helico.com/h_epidemiology.html)
The concern about *H. pylori* in the north

- **Manitoba**: 1997 adults, 35%
- **Nova Scotia**: 1994 adults, 38%
- **Greenland**: 2003 adults
- **Nunavut**: 1999 all ages
- **Northern Manitoba**: 1999 children
- **Greenland**: 2005 adults
- **Russia**: 1998 adults
- **Alaska**: 2006 all ages

**Canadian multiethnic populations**

**Area:** Manitoba, Nova Scotia
**Year:** 1997, 1994
**Age:** adults

**Area:** Greenland, Nunavut, Northern Manitoba
**Year:** 2003, 1999, 1999
**Age:** adults

**Area:** Russia
**Year:** 1998
**Age:** adults

**Area:** Alaska
**Year:** 2006
**Age:** all ages
Aboriginal population of Canada

- Percentage of population, by province or territory

Canada
- 4%
  - First Nations 2%
  - Métis 1%
  - Inuit <1%

- NL 5%
- NS 3%
- NB 2%
- PE 1%

Statistics Canada, Census 2006
The concern about *H. pylori* in northern Canada

- High level of community concern due to stomach cancer deaths in some families
- Concern of local health authorities
- Community leaders asking for research to find solutions

- Collaborative research group established to address the concerns
Canadian North *Helicobacter pylori* Working Group

- Multiple community organizations
- Multiple Health authorities (Yukon, NWT and Alberta)
- External advisors (Health policy and Arctic investigations)
- Investigators from U of A
  - Epidemiology (Karen Goodman)
  - Anthropology (Christopher Fletcher)
  - Gastroenterology (Sander van Zanten, Justin Cheung, Amy Morse, Richard Fedorak)
  - Microbiology (Monika Keelan)
  - Pathology (Safwat Girgis)
Canadian North *Helicobacter pylori* Working Group

Use a collaborative and participatory approach:
- To obtain representative data for developing public health strategies for control of *H. pylori* infection
- To conduct policy analysis
- To develop knowledge exchange strategies
Aklavik, NWT
Aklavik, NWT

  - 90% Inuvialuit (Inuit) or Gwich’in Dene (First Nation)
The Aklavik *H. pylori* project

- **Pilot project**
- **Aims:**
  - Investigate *H. pylori* infection in Aklavik
    - Screen residents for *H. pylori* infection (UBT)
    - Collect clinical/epidemiologic data
    - Endoscopy
    - Treatment
    - Evaluate the effectiveness of anti-*H. pylori* therapies
    - Follow those treated long-term
  - **Knowledge exchange**
  - **Conduct policy analysis**
**Testing for \textit{H. pylori}: Urea breath test**

\textit{H. pylori} produces urease

Urease breaks down urea, releasing carbon dioxide

Ingest labeled urea

Labeled carbon dioxide exhaled

Baseline breath sample

2\textsuperscript{nd} breath sample

Amount of labeled carbon dioxide measured

Baseline – 2\textsuperscript{nd} sample = test value

\textbf{In Aklavik:}

(333 tested)

58\% positive
The image contains a graph showing the prevalence of *H. pylori* infection in various populations. The graph indicates that in Aklavik, 58.62% of tested individuals were positive for *H. pylori*. The data is broken down by area and year, with specific information on age groups and infection rates. The graph compares infection rates among Canadian multiethnic populations, Canadian Aboriginal populations, and Non-Canadian Aboriginal populations.
The Aklavik *H. pylori* project

- Pilot project
- Aims:
  - Investigate *H. pylori* infection in Aklavik
    - Screen residents for *H. pylori* infection (UBT)
    - Collect clinical/epidemiologic data
  - Endoscopy
  - Treatment
  - Evaluate the effectiveness of anti-*H. pylori* therapies
  - Follow those treated long-term
- Knowledge exchange
- Conduct policy analysis
Household questionnaire

- Representatives from Aklavik households interviewed to collect data on household characteristics
  - Questions about members of the household, the house itself (if it is owned or rented, # rooms, etc.), water uses/source, animal contact, diet, income, health care

- 145 participating households
  - 64% of Aklavik households (total 228) (2009 NWT Community Survey, Housing Component, NWT Bureau of Statistics)
Household-level risk factors for *H. pylori* infection

- Major mode of transmission
  - person-to-person transmission within family
  - Early in life

- Household crowding
- Low socioeconomic status
- Low education of parents

- Also:
  - Water source
  - Diet
Analysis

- Compared individual *H. pylori* status (from UBT and endoscopy) to household exposures

- Analyzed all questions from household questionnaire
  - For known and hypothesized risk factors

- Calculated % *H. pylori* positive (and 95% confidence intervals) and unadjusted odds ratios for each stratified variable
Individuals included in the analysis

- **296 individuals**
  - Tested for *H. pylori* and included in a household survey
  - 46% of estimated 2008 Aklavik population of 642 (NWT Bureau of Statistics)

- Individual demographics:

  - **H. pylori positive**

  ![Graph showing H. pylori infection by sex, age, and ethnicity]

  - **Unadjusted OR**
    - **Sex**
      - Male: 1.00 (0.5-1.4)
      - Female: 0.87 (0.5-1.4)
    - **Age**
      - 1-14: 1.00 (0.8-4.3)
      - 15-24: 1.91 (0.9-5.0)
      - 25-39: 2.22 (0.5-1.9)
      - 40-59: 0.99 (0.4-2.3)
      - 60-82: 1.02 (0.4-2.3)
    - **Ethnicity**
      - Aboriginal: 1.00 (0.1-0.5)
      - Non-Aboriginal: 0.25 (0.1-0.5)
Household demographics

- **H. pylori** positive

**Number of people in the household**

- 1-2: 64 (n=84)
- 3-4: 55 (n=96)
- 5-6: 67 (n=98)
- 7-8: 78 (n=18)

**Number of children in the household**

- 0: 61 (n=151)
- 1: 57 (n=65)
- 2: 60 (n=42)
- 3-6: 87 (n=38)

**Number of people per bedroom (crowding)**

- <1: 56 (n=119)
- 1.01-2: 67 (n=154)
- 2.01-3: 80 (n=20)

Unadjusted OR

- 1-2: 1.46 (0.8-2.7)
- 3-4: 1.00 (0.9-3.0)
- 5-6: 1.67 (0.8-9.3)
- 7-8: 2.84 (0.5-1.5)
- 0: 1.00 (0.5-1.5)
- 1: 0.85 (0.5-1.9)
- 2: 0.94 (1.6-11.5)
- 3-6: 4.23 (1.0-2.6)
- <1: 1.00 (1.0-9.8)
- 1.01-2: 1.57 (1.0-2.6)
- 2.01-3: 3.10 (1.0-9.8)
Household demographics

- **H. pylori positive**

### Highest education by a household member

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Unadjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 11 or less</td>
<td>1.00</td>
<td>(0.5-1.5)</td>
</tr>
<tr>
<td>Highschool</td>
<td>0.83</td>
<td>(0.3-0.9)</td>
</tr>
<tr>
<td>More than highschool</td>
<td>0.48</td>
<td></td>
</tr>
</tbody>
</table>

### Combined annual household income

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Unadjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$25,000</td>
<td>1.00</td>
<td>(0.3-1.6)</td>
</tr>
<tr>
<td>$25,000-49,000</td>
<td>0.65</td>
<td>(0.2-1.0)</td>
</tr>
<tr>
<td>$50,000-74,000</td>
<td>0.43</td>
<td>(0.1-0.6)</td>
</tr>
<tr>
<td>&gt;=$75,000</td>
<td>0.30</td>
<td></td>
</tr>
</tbody>
</table>
Other household characteristics

- Other variables:
  - **Higher prevalence**
    - More household members were born in the territories
    - Living in public housing
    - Presence of mice in the house
  - **Lower prevalence**
    - Moved more times in the past 5 years
    - Car ownership
    - Anyone spent time outside Aklavik
  - **No difference**
    - Years at current address
    - Dogs in or around the house
    - Anyone spent time on the land/in the bush
    - Use of traditional healing methods
Household water

- *H. pylori* positive

- **Household ever uses river water for drinking**

  - **Unadjusted OR**
    - **No** (n=206): 1.00
    - **Yes** (n=83): 2.03 (1.1-3.6)

- **Other variables:**
  - **Higher prevalence**
    - More times water tank runs out
    - Ever uses river water for bathing, washing dishes, washing clothes
  - **Lower prevalence**
    - Drinking water is always purified or treated
  - **No difference**
    - Problems with sewage/water
    - Use of bottled water or treated water trucked to water tank
Household diet

- *H. pylori* positive
- Times consumed per week

<table>
<thead>
<tr>
<th></th>
<th>Meat</th>
<th>Smoked/salted fish</th>
<th>Fruit and vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=65)</td>
<td>(n=94)</td>
<td>(n=56)</td>
</tr>
<tr>
<td>Unadjusted OR</td>
<td>1.00</td>
<td>1.66</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>(0.9-3.2)</td>
<td>(0.7-3.0)</td>
<td>(1.4-8.0)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0.01-1</td>
<td>1.01-3.5</td>
</tr>
<tr>
<td></td>
<td>(n=112)</td>
<td>(n=98)</td>
<td>(n=38)</td>
</tr>
<tr>
<td>Unadjusted OR</td>
<td>1.00</td>
<td>0.80</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>(0.5-1.4)</td>
<td>(0.6-2.7)</td>
<td>(1.0-12.5)</td>
</tr>
<tr>
<td></td>
<td>0-1</td>
<td>1.01-3.5</td>
<td>3.51-6.99</td>
</tr>
<tr>
<td></td>
<td>(n=36)</td>
<td>(n=98)</td>
<td>(n=60)</td>
</tr>
<tr>
<td>Unadjusted OR</td>
<td>1.00</td>
<td>0.69</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>(0.3-1.6)</td>
<td>(0.2-1.6)</td>
<td>(0.2-1.3)</td>
</tr>
</tbody>
</table>
Household diet

- Other variables:
  - **Higher prevalence**
    - More locally harvested meat
    - More store-bought meat
    - More processed meat
  - **Lower prevalence**
    - More fruit
    - More vegetables (raw and/or cooked)
    - More store-bought fish
  - **No difference**
    - Consumption of eggs
    - Consumption of milk (and milk by type)
  - **Unclear**
    - Smoked/salted meat
    - Locally harvested fish
Conclusions

- Diverse known or suspected risk factors for *H. pylori* infection, assessed at the household level, appear to be strongly associated with individual *H. pylori* status among residents of Aklavik
Future directions

- Further analysis of associations between household exposures and *H. pylori* infection status
  - To adjust for potential confounders and household effects (multi-level analysis)

- Expansion of project to additional communities in northern Canada
  - 6 Yukon First Nations Communities, 5 NWT Inuvialuit Settlement Region Communities, International collaboration (Alaska and Greenland)
  - Screening for *H. pylori* infection and analysis of household questionnaires
Thank you

- Dr. Karen Goodman
- Janis Huntington
- Laura Aplin
- Amy Colqhoun
- Megan Johnston
- and other past research assistants who collected all the data

- The rest of the CANHelp Working Group

- Institute of Aboriginal People’s Health
- Network Environments for Aboriginal Health Research (NEAHR)
  - Anisnabe Kekendazone, Ottawa
  - Nasivvik, Universite Laval
- w/ Canadian Association for Gastroenterology & Industry Partners

- Alberta Heritage Foundation for Medical Research
- ArcticNet National Centre of Excellence
- Indian and Northern Affairs Canada
- Canadian Circumpolar Institute
### Other household characteristics

<table>
<thead>
<tr>
<th></th>
<th>% HP +</th>
<th>Unadjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household members born in the territories</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>45 (24-68)</td>
<td>0.42 (0.17-1.03)</td>
</tr>
<tr>
<td>Some</td>
<td>58 (44-71)</td>
<td>0.71 (0.39-1.30)</td>
</tr>
<tr>
<td>All</td>
<td>66 (60-72)</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Living in rented public housing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>54 (45-62)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>73 (65-80)</td>
<td>2.30 (1.41-3.74)</td>
</tr>
<tr>
<td><strong>Presence of mice in the house</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62 (55-68)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>76 (60-88)</td>
<td>1.92 (0.90-4.11)</td>
</tr>
<tr>
<td><strong>Times moved in past 5 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>66 (59-74)</td>
<td>1.00</td>
</tr>
<tr>
<td>1-2</td>
<td>64 (53-75)</td>
<td>0.91 (0.52-1.62)</td>
</tr>
<tr>
<td>3-5</td>
<td>47 (30-65)</td>
<td>0.45 (0.21-0.95)</td>
</tr>
<tr>
<td><strong>Someone in house owns a car</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>73 (65-80)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>54 (45-62)</td>
<td>0.43 (0.26-0.70)</td>
</tr>
<tr>
<td><strong>Anyone spent time outside Aklavik</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>69 (62-76)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>56 (46-66)</td>
<td>0.57 (0.35-0.94)</td>
</tr>
<tr>
<td><strong>Presence of dogs in or around house</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>65 (56-73)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>62 (53-70)</td>
<td>0.89 (0.55-1.44)</td>
</tr>
<tr>
<td><strong>Anyone spent time on the land/in the bush</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>63 (57-69)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>66 (53-78)</td>
<td>1.13 (0.62-2.07)</td>
</tr>
<tr>
<td><strong>Use of traditional healing methods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62 (55-68)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>67 (55-78)</td>
<td>1.26 (0.71-2.24)</td>
</tr>
</tbody>
</table>
## Household water

<table>
<thead>
<tr>
<th></th>
<th>% HP +</th>
<th>Unadjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How often water tank runs out</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>59 (48-69)</td>
<td>1.00</td>
</tr>
<tr>
<td>&lt;1/month</td>
<td>61 (50-72)</td>
<td>1.10 (0.60-2.01)</td>
</tr>
<tr>
<td>1/month+</td>
<td>75 (64-84)</td>
<td>2.06 (1.07-3.99)</td>
</tr>
<tr>
<td><strong>Household ever uses river water for bathing (also washing dishes/clothes)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62 (56-68)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>72 (57-84)</td>
<td>1.59 (0.80-3.17)</td>
</tr>
<tr>
<td><strong>Drinking water is always purified or treated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>68 (58-76)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>60 (53-67)</td>
<td>0.73 (0.44-1.20)</td>
</tr>
<tr>
<td><strong>Household uses bottled water for drinking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>63 (57-69)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>63 (45-78)</td>
<td>0.97 (0.47-2.02)</td>
</tr>
<tr>
<td><strong>Household uses treated water trucked to water tank for drinking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>63 (47-78)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>63 (57-69)</td>
<td>1.00 (0.50-1.98)</td>
</tr>
<tr>
<td><strong>Problems with water/sewage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>63 (56-69)</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>64 (52-75)</td>
<td>1.06 (0.62-1.83)</td>
</tr>
</tbody>
</table>
## Household diet

<table>
<thead>
<tr>
<th>Food Type</th>
<th>0-1</th>
<th>3.51+</th>
<th>% HP +</th>
<th>Unadjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store-bought meat</td>
<td>0-3.5</td>
<td>7+</td>
<td>53 (42-64)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>71 (61-80)</td>
<td>2.12 (1.16-3.89)</td>
</tr>
<tr>
<td>Locally harvested meat</td>
<td>0-1</td>
<td>3.51+</td>
<td>61 (50-71)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>71 (61-80)</td>
<td>1.59 (0.86-2.95)</td>
</tr>
<tr>
<td>Processed meat</td>
<td>0</td>
<td>1.01+</td>
<td>54 (39-69)</td>
<td>0.50 (0.24-1.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70 (60-79)</td>
<td>1.00</td>
</tr>
<tr>
<td>Fruit</td>
<td>0-1</td>
<td>3.51+</td>
<td>73 (63-81)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>53 (41-65)</td>
<td>0.43 (0.23-0.80)</td>
</tr>
<tr>
<td>Raw vegetables</td>
<td>0</td>
<td>3.51+</td>
<td>71 (51-87)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>52 (37-67)</td>
<td>0.43 (0.16-1.18)</td>
</tr>
<tr>
<td>Cooked vegetables</td>
<td>0-1</td>
<td>3.51+</td>
<td>72 (60-83)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>62 (52-71)</td>
<td>0.62 (0.32-1.21)</td>
</tr>
<tr>
<td>Store-bought fish</td>
<td>0</td>
<td>0.01+</td>
<td>69 (61-77)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>58 (50-66)</td>
<td>0.61 (0.37-1.00)</td>
</tr>
<tr>
<td>Eggs</td>
<td>0-2</td>
<td>7+</td>
<td>62 (52-71)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60 (45-74)</td>
<td>0.93 (0.46-1.89)</td>
</tr>
<tr>
<td>Milk</td>
<td>0-6.99</td>
<td>7+</td>
<td>65 (55-74)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>62 (54-69)</td>
<td>0.87 (0.53-1.44)</td>
</tr>
<tr>
<td>Smoked/salted meat</td>
<td>0</td>
<td>0.01-1</td>
<td>65 (55-74)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.01+</td>
<td>59 (48-68)</td>
<td>0.76 (0.43-1.35)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>68 (56-78)</td>
<td>1.14 (0.61-2.14)</td>
</tr>
<tr>
<td>Locally harvested fish</td>
<td>0-1</td>
<td>1.01-2</td>
<td>60 (52-68)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.01+</td>
<td>73 (60-84)</td>
<td>1.77 (0.92-3.41)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>64 (51-76)</td>
<td>1.17 (0.63-2.15)</td>
</tr>
</tbody>
</table>
Aboriginal peoples of Canada

- Percentage of population, by province or territory

Canada 4%
First Nations 2%
Métis 1%
Inuit <1%

Statistics Canada, Census 2006
Aboriginal peoples of northern Canada

<table>
<thead>
<tr>
<th>Location</th>
<th>First Nations</th>
<th>Métis</th>
<th>Inuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yukon</td>
<td>21%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>NWT</td>
<td>31%</td>
<td>9%</td>
<td>10%</td>
</tr>
<tr>
<td>Nunavut</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>84%</td>
</tr>
<tr>
<td>Canada</td>
<td>2%</td>
<td>1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

Map showing distribution of First Nations, Métis, and Inuit populations across Canada.