Epidemiology of Tuberculosis in Indigenous Children in Canada: Implications for Clinicians, Surveillance Systems, and Policy

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Presenter Disclosure

• In the past 12 months, Dr. Giroux has had no relevant financial relationships with the manufacturer(s) of commercial services discussed in this CME activity.

• Dr. Giroux does not intend to discuss an unapproved/investigative use of a commercial product/device in their presentation.
TRC #19

We call upon the federal government, in consultation with Aboriginal peoples, to establish measurable goals to identify and close the gaps in health outcomes between Aboriginal and non-Aboriginal communities, and to publish annual progress reports and assess long-term trends. Such efforts would focus on indicators such as: infant mortality, maternal health, suicide, mental health, addictions, life expectancy, birth rates, infant and child health issues, chronic diseases, illness and injury incidence, and the availability of appropriate health services.
Objectives

• Identify current demographics, clinical presentations, and outcomes of childhood tuberculosis in Indigenous children in Canada

• Contextualize how this data is related to social determinants of health and how it undermines the need for continued surveillance

• Better select at-risk Indigenous children for evaluation and testing
Method: Active Surveillance

**Monthly Form**
1. Active Pediatricians
2. Active pediatric subspecialists
3. Select non-pediatricians (includes vertical TB programs)

**Data Collection Form**
- Sent if physician notifies case of TB
- Inclusion:
  - <15y
  - Retreatment, proven, or presumed TB
Epidemiology
Case Reporting: Sept 2013-Oct 2016

306 Notifications to CPSP

251 Notifications Reviewed

+10 Cases

10 Deleted, 26 Discarded
6 Excluded, 13 No Response

200 Cases Included

30 Excluded, 31 Duplicates

200 Cases Included
Indigenous Status

• Indigenous:
  • First Nations: n=78 (39%)
  • Inuit: n=35 (18%)
  • Métis: <5

• Canadian-Born
  • Non-Indigenous: n=43 (22%)
  • Not Specified: n=11 (6%)

• Non-Canadian Born: n=30 (15%)

Note on Métis Data & Additive Data:
Privacy policy for the CPSP does not allow for raw numbers of <5 to be presented.
For the purposes of this presentation, Métis data is excluded from analysis and is not included in FN/I numbers.

FN/I Group: N=113 (57%)
Non-Indigenous Group: N=84 (43%)
## Age Distribution

<table>
<thead>
<tr>
<th>Age Group</th>
<th>First Nations/Inuit</th>
<th>Non-Indigenous</th>
</tr>
</thead>
</table>
| **<1 year** | FN/I: N=12 (43%)  
First Nations: n=6 (21%)  
Inuit: n=6 (21%) | Non-Indigenous: N=16 (57%) |
| **1-4 years** | FN/I: N=45 (56%)  
First Nations: n=33 (41%)  
Inuit: n=12 (15%) | Non-Indigenous: N=35 (44%) |
| **5-9 years** | FN/I: N=23 (64%)  
First Nations: n=15 (42%)  
Inuit: n=8 (22%) | Non-Indigenous: N=13 (36%) |
| **10+ years** | FN/I: N=33 (62%)  
First Nations: n=24 (45%)  
Inuit: n=9 (17%) | Non-Indigenous: N=20 (38%) |
Incidence

First Nations: 64/70 (91%) lived on-reserve
Inuit: no cases in Inuvialuit or Nunatsiavut

Nunavut
28/28 (100%)
28 Inuit

BC
0/8 (0%)
No Indigenous

Alberta
N=21
<5 Indigenous

Manitoba
59/62 (95%)
59 First Nations

Saskatchewan
14/17 (82%)
14 First Nations

Ontario
N=32
<5 Indigenous

Quebec
7/28 (25%)
7 Inuit

StatsCan Census 2016
Rates: Total

<table>
<thead>
<tr>
<th>Province</th>
<th>Cases (Percentage)</th>
<th>Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nunavut</td>
<td>28 (14%)</td>
<td>82</td>
</tr>
<tr>
<td>BC</td>
<td>8 (4%)</td>
<td>0.39</td>
</tr>
<tr>
<td>Alberta</td>
<td>21 (10.5%)</td>
<td>0.93</td>
</tr>
<tr>
<td>Manitoba</td>
<td>62 (31%)</td>
<td>8.6</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>17 (9%)</td>
<td>2.6</td>
</tr>
<tr>
<td>Quebec</td>
<td>28 (14%)</td>
<td>0.73</td>
</tr>
<tr>
<td>Ontario</td>
<td>32 (16%)</td>
<td>0.49</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td>1.2</td>
</tr>
</tbody>
</table>

StatsCan Census 2016
## Subgroup Rates

### Indigenous vs. Non-Indigenous Subgroups

<table>
<thead>
<tr>
<th>Group (Canada, Total)</th>
<th>Rate per 100,000</th>
<th>Differential Rate</th>
<th>Rate per 100,000</th>
<th>Differential Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous (Overall)</td>
<td>8.61</td>
<td>17x higher</td>
<td>85.5</td>
<td>N/A</td>
</tr>
<tr>
<td>Nunavut: Inuit</td>
<td>85.5</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Nunavut: Non-Indigenous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quebec: Inuit</td>
<td>48.5</td>
<td></td>
<td>0.54</td>
<td>90x higher</td>
</tr>
<tr>
<td>Quebec: Non-Indigenous</td>
<td></td>
<td></td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Manitoba: First Nations</td>
<td>42.0</td>
<td></td>
<td>0.49</td>
<td>86x higher</td>
</tr>
<tr>
<td>Manitoba: Non-Indigenous</td>
<td></td>
<td></td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Saskatchewan: First Nations</td>
<td>11.3</td>
<td></td>
<td>0.64</td>
<td>18x higher</td>
</tr>
<tr>
<td>Saskatchewan: Non-Indigenous</td>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Alberta: First Nations</td>
<td>2.28</td>
<td></td>
<td>0.86</td>
<td>2.7x higher</td>
</tr>
<tr>
<td>Alberta: Non-Indigenous</td>
<td></td>
<td></td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>Ontario: First Nations</td>
<td>1.08</td>
<td></td>
<td>0.47</td>
<td>2.3x higher</td>
</tr>
<tr>
<td>Ontario: Non-Indigenous</td>
<td></td>
<td></td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Canadian-Born, Non-Indigenous/No Spec*</td>
<td>0.52</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Comparator group

StatsCan Census 2016
## International Indigenous Comparisons

### Group (Canada Total)

<table>
<thead>
<tr>
<th>Group</th>
<th>Rate per 100,000</th>
<th>Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous (Overall)</td>
<td>8.61</td>
<td>17x higher</td>
</tr>
<tr>
<td>First Nations (Overall)</td>
<td>9.10</td>
<td>18x higher</td>
</tr>
<tr>
<td>First Nations, On-Reserve</td>
<td>20.2</td>
<td>39x higher</td>
</tr>
<tr>
<td>Inuit</td>
<td>54.3</td>
<td>104x higher</td>
</tr>
<tr>
<td>Canadian-Born, Non-Indigenous/No Spec*</td>
<td>0.52</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Group (Ages 0-14 unless spec.)

<table>
<thead>
<tr>
<th>Group</th>
<th>Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indians/Alaska Natives (2014)*</td>
<td>11 cases; ~1.2 per 100,000</td>
</tr>
<tr>
<td>Native Hawaiians, Other Pacific Islanders (2014)*</td>
<td>22 cases; ~11 per 100,000</td>
</tr>
<tr>
<td>Australian Indigenous (2014)</td>
<td>4 cases; 1.7 per 100,000</td>
</tr>
<tr>
<td>Australian Non-Indigenous (2014)</td>
<td>29 cases; 0.8 per 100,000</td>
</tr>
<tr>
<td>New Zealand Māori (2006-2010, 0-24 years)**</td>
<td>Avg 11.6/yr 3.5 per 100,000</td>
</tr>
<tr>
<td>New Zealand non-Māori (2006-2010, 0-24 years)**</td>
<td>Avg 29.4/yr 2.8 per 100,000</td>
</tr>
</tbody>
</table>

*Likely an underestimate as denominator used was approximate population per for ages 0-18 in US per race/ethnicity

**Only includes hospitalized children/youth
Clinical Presentation, Testing, and Treatment

Implications for Surveillance and Public Health
## Contact Types

<table>
<thead>
<tr>
<th></th>
<th>Close Household</th>
<th>Close Non-Household</th>
<th>Visit to Endemic Country</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Nations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N=63)</td>
<td>43 (68.3%)</td>
<td>19 (30.2%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Inuit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N=24)</td>
<td>13 (54.2%)</td>
<td>9 (37.5%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total FN/I</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N=87)</td>
<td>56 (64%)</td>
<td>28 (32%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Non-Indigenous</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N=44)</td>
<td>30 (68.2%)</td>
<td>4 (9.1%)</td>
<td>7 (16%)</td>
</tr>
</tbody>
</table>

**Implications:**
- Community-based TB strategies are needed for First Nations and Inuit communities.
Previous Latent TB & Latent TB Therapy

First Nations/Inuit

• 16 (14%) had previous diagnosis and treatment for LTBI:
  • First Nations: 9/77 (12%)
  • Inuit: 7/34 (21%)

Non-Indigenous

• <5 had previous diagnosis of LTBI, but not all were treated
  • Non-Canadian Born 7.7%
  • Canadian-Born Non-Indigenous or Not Specified: 2%

Implications:

• Unclear if reactivation, incomplete LTBI treatment, or re-infection
• Previous LTBI treatment should not lead to under-investigation of TB in Indigenous children
### Symptom Duration (in days) Before Diagnosis

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Non-Indigenous</th>
<th>Indigenous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median (IQR)</td>
<td>Range</td>
</tr>
<tr>
<td>Fever</td>
<td>23 (6-40)</td>
<td>1-210</td>
</tr>
<tr>
<td>Night Sweats</td>
<td>42 (21-149)</td>
<td>2-210</td>
</tr>
<tr>
<td>Cough (Productive)</td>
<td>56 (35-56)</td>
<td>2-180</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>

**Implications:**
- Greater recognition by healthcare providers and TB programs, patient/family comfort with reporting symptoms
- Asymptomatic children may have active TB disease
Intrathoracic TB

<table>
<thead>
<tr>
<th></th>
<th>Pulmonary</th>
<th>Pleura</th>
<th>Intrathoracic Lymphatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Nations (N=78)</td>
<td>32 (41%)</td>
<td>6 (7.6%)</td>
<td>47 (60%)</td>
</tr>
<tr>
<td>Inuit (N=35)</td>
<td>14 (40%)</td>
<td>8 (23%)</td>
<td>23 (66%)</td>
</tr>
<tr>
<td>Total FN/I (N=113)</td>
<td>46 (41%)</td>
<td>14 (12%)</td>
<td>71 (63%)</td>
</tr>
<tr>
<td>Non-Indigenous (N=84)</td>
<td>44 (52%)</td>
<td>5 (6.0%)</td>
<td>53 (63%)</td>
</tr>
</tbody>
</table>

Proportion with Positive Culture (when attempted)
- First Nations: 36%
- **Inuit: 25%**
- Non-Indigenous: 42%

**Implications:**
- FN/I children have lower rates of lung disease therefore clinical and radiological presentation may be less typical
- Culture positivity is lower in Inuit: overdiagnosis? More paucibacilliarly disease?
- Implications for GenXpert PCR
## Extrathoracic TB

<table>
<thead>
<tr>
<th></th>
<th>Extrathoracic Lymphatics</th>
<th>CNS/ Meningeal</th>
<th>Miliary/ Disseminated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Nations (N=78)</strong></td>
<td>2 (2.6%)</td>
<td>6 (7.7%)</td>
<td>6 (7.7%)</td>
</tr>
<tr>
<td><strong>Inuit (N=35)</strong></td>
<td>1 (2.9%)</td>
<td>5 (14%)</td>
<td>5 (14%)</td>
</tr>
<tr>
<td><strong>FN/I (N=113)</strong></td>
<td>3 (2.7%)</td>
<td>11 (9.7%)</td>
<td>11 (9.7%)</td>
</tr>
<tr>
<td><strong>Total Non-Indigenous (N=84)</strong></td>
<td>10 (11.9%)</td>
<td>5 (6.0%)</td>
<td>8 (9.5%)</td>
</tr>
</tbody>
</table>

### Proportion with Positive Culture (when attempted)
- First Nations: 44%
- Inuit: 43%
- Non-Indigenous: 59%

### Implications:
- Inuit children have higher rates of CNS/Meningeal and Miliary disease, which tend to have poorer outcomes and longer treatment
- 58% of FN/I children with either CNS or Miliary disease had BCG vaccine: effectiveness of BCG?
Implications:
- Current diagnosis and management strategies require many children to be in hospital (likely away from their communities)
- TB strategies need to cross provincial/territorial boundaries
Treatment Regimens & Resistance

- **Zero cases** of drug resistant TB, compared to 7 cases of drug resistant TB in non-Indigenous children, including 3 MDR-TB.
- **DOT Usage:**
  - 100% reported usage in First Nations/Inuit children (8% no response)
  - 94% of clinicians reported DOT was helpful

**Implications:**
- Success in implementation of DOT for Indigenous children
- Drug-resistant TB is in children in Canada; surveillance must be vigilant
What do we do next?
Support Indigenous-Lead Strategies

Guiding Principles: Health Canada’s Strategy Against TB for First Nations On-Reserve

1. Preventing, diagnosing, and managing TB

2. Targeting populations at greatest risk for TB, and work with these communities

3. Developing and maintaining partnerships

Source: Health Canada’s Strategy Against TB for First Nations On-Reserve
Support Indigenous-Lead Strategies

Inuit Tuberculosis Elimination Framework: ITK

1. Enhance TB Care and prevention programming
2. Reduce poverty, improve social determinants of health and create social equity
3. Empower and mobilize communities
4. Strengthen TB care and prevention capacity
5. Develop and implement Inuit specific solutions
6. Ensure accountability for TB elimination

Source: Inuit Tuberculosis Elimination Framework, ITK
Thank You/Marsee

• Dr. Shaun Morris, Dr. Ian Kitai, Dr. Susanna Talarico (Hospital for Sick Children)
• Aaryn Montgomery-Song (BSc Student, U of T)
• Alainna Jamal (MD-PhD Student, U of T)
• 25 Co-Investigators across Canada
• CPSP Participants for volunteering their time
• CPSP Staff (Dr. Charlotte Moore-Hepburn, Melanie Laffin)

• Dr. Radha Jetty
• Inuit Tapiriit Kanatami, Assembly of First Nations, Métis National Council
THEME: It’s TIME

• It’s TIME to test and treat latent TB infections
• It’s TIME strengthen TB education and awareness among healthcare providers
• It’s TIME to speak up
• It’s TIME to end stigma
• It’s TIME to End TB

#EndTB
#WorldTBDay
#ItsTime