Colorectal cancer incidence in Aboriginal Ontarians: a cautionary ecologic tale

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North American Association of Central Cancer Registries
Ottawa, Ontario
June 25, 2014
Outline

- Cancer burden in Ontario’s Aboriginal population
- Methods and results
- Discussion and cautionary messages
- Conclusions
Ontario’s Aboriginal population

- 301,430 in 2011 (2.4% of population)
  - First Nations (201,100, 67%)
  - Métis (86,015, 29%)
  - Inuit (3,360, 1%)

- First Nations (FN) people can be further divided:
  - Registered or non-registered
  - Living on or off an Indian reserve
Cancer burden in Aboriginal Ontarians

• Cancer incidence is expected to increase more for Aboriginals than other Ontarians

• Survival rates for major cancers in FN, Inuit and Métis (FNIM) communities are lower when compared with general population

• Need for routine monitoring of cancer burden in Aboriginal populations
  – But Canadian cancer registries do not collect information on Aboriginal status or other racial and ethnic groups

Rates age-standardized to the 1991 Canadian population
Horizontal bars around First Nations rates indicate 95% confidence limits

Source: Marrett LD, Chaudhry M (Cancer Causes Control, 2003); Marrett LD (unpublished data, 2007).
Objectives

• To estimate colorectal cancer incidence in Aboriginal Ontarians by using an ecologic approach

• To evaluate the ecologic approach used by estimating the colorectal cancer burden in Ontario First Nations people living on Indian reserves
Methods: Colorectal cancer cases

• Invasive colorectal cancer cases (ICD-O-3 codes C18, C19, C20, and C26.0) diagnosed 1998–2009 identified from Ontario Cancer Registry (N=84,157)

• Assigned census geographic identifiers using the Postal Code Conversion File plus (PCCF+)

| Dissemination area (DA) | Census subdivision (CSD) |

• PCCF+ uses a population-weighted random allocation procedure to handle rural areas where postal codes often cover multiple DAs and CSDs
Methods: Residence in high-Aboriginal areas

• Captured individuals who self-identified as being an Aboriginal person of First Nations, Métis, or Inuit identity on the 2001 and 2006 Canadian censuses

• Identified DAs where relatively high percentages of population report Aboriginal identity
  – Cut-off of 33% to distinguish between ‘high’ and ‘low’
Methods: Residence on Indian reserves

- Sensitivity analysis using only cases that had a high probability of residing on an Indian reserve at diagnosis
- Identified Indian reserves in Ontario from the CSD type in the 2001 and 2006 Canadian censuses
- Identified reserves where the accuracy of assignment using PCCF+ was high
  - Reserves covered by one or more postal codes, each which mapped to the reserve with a probability of 0.90 or greater
Methods: Statistical analysis

• Classified each case as residing
  – In a high- or low-Aboriginal area
  – On or off an accurately-assigned Indian reserve

• Calculated age-standardized incidence rates and 95% confidence intervals to compare colorectal cancer incidence in
  – High-Aboriginal areas
  – Low-Aboriginal areas
  – Indian reserves
Colorectal cancer incidence by type of Aboriginal area and sex, Ontario, 1998–2009
Colorectal cancer incidence rate ratios (vs. low-Aboriginal areas) by age group, Ontario, 1998-2009
High-Aboriginal areas vs. Indian reserves

• Compared with low-Aboriginal areas, colorectal cancer incidence was
  – 43% higher for residents of high-Aboriginal areas
  – 14% higher for residents of Indian reserves

• Why such a large difference and why differences by age group?
  – Short answer: PCCF+!
  – All reserves are captured as high-Aboriginal areas
  – Many reserves are located in rural areas where accuracy of assignment of reserve residents to reserves using PCCF+ varies
A PCCF+ example: Wiarton, Ontario

- N0H 2T0, a rural postal code, covers three CSDs
  - South Bruce Peninsula, Bruce County
  - Cape Croker Reserve, Bruce County
  - Georgian Bluffs, Grey County
- Covers 21 DAs
The age distributions are different

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Age distribution of on-reserve population, Canada</th>
<th>Age distribution of total population, Ontario</th>
<th>Ontario colorectal cancer incidence rates, crude (per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-14 years</td>
<td>34.1%</td>
<td>18.2%</td>
<td>0.0</td>
</tr>
<tr>
<td>15-24 years</td>
<td>18.6%</td>
<td>13.4%</td>
<td>0.7</td>
</tr>
<tr>
<td>25-54 years</td>
<td>36.5%</td>
<td>43.7%</td>
<td>17.8</td>
</tr>
<tr>
<td>55-64 years</td>
<td>6.0%</td>
<td>11.2%</td>
<td>111.6</td>
</tr>
<tr>
<td>65+ years</td>
<td>4.9%</td>
<td>13.6%</td>
<td>301.2</td>
</tr>
</tbody>
</table>

- Compared to general population:
  - On-reserve population is younger
  - Colorectal cancer patients are older

- PCCF+ assigns too many older, non-Aboriginal colorectal cancer patients to reserves when random allocation is required

Data sources: Census of Canada & Ontario Cancer Registry, 2006
Caution: using an ecologic approach

• Area-level % of Aboriginal residents is not necessarily representative of individual-level Aboriginal status

• Limited ability to capture entire Aboriginal population of Ontario

😊 On-reserve First Nations: All DAs belonging to Indian reserves are high-Aboriginal

😄 Off-reserve First Nations and Métis: Less than 10% of high-Aboriginal DAs are off-reserve
Aboriginal Classification
- Low Aboriginal (< 33% of pop.)
- High Aboriginal (≥ 33% of pop.)
- Unable to classify

Data source: 2006 Census of Canada, Statistics Canada
Caution: using PCCF+ to assign geographic identifiers

• Potential for misclassification by DA/CSD of residence when population-weighted random allocation is used

• Potential for even greater misclassification when age distribution of study population differs from total population
Conclusions

• Area-level analyses can be used to address data gaps in Aboriginal health, but do so with caution

• Can examine subgroup of First Nations people living on accurately-assigned Indian reserves to reduce influence of PCCF+

• We still observed elevated rates of colorectal cancer in Indian reserves

• Imperative to address risk factor prevalence and screening uptake to reduce future colorectal cancer burden in Ontario’s Aboriginal population
Acknowledgements

Co-authors:
Diane Nishri
Elisa Candido
Loraine Marrett