Choice of Relative or Cause-Specific Approach to Cancer Survival Analysis Impacts Estimates Differentially by Cancer Type, Population and Application:
Evidence From a Comparison of First Nations and Non-Aboriginals in Canada
Background: Cancer survival estimation

Cancer survival

Crude

All-cause/observed

Cause-specific

Net

Relative
Background: Cause-specific survival

- Estimates net mortality (mortality associated with a dx of cancer) under certain assumptions
- Deaths attributed to cancer are considered events, deaths due to other causes are censored

+: relatively simple to calculate and understand

-: assumes
  a) you know the “true” cause of death
  b) there is a clear distinction between CA and non-CA deaths
  c) differential misclassification of cause of death by subgroup of interest is negligible
Background: Relative Survival

- A measure of excess mortality as a result of cancer
- The relative survival ratio (RSR) is the ratio of the observed survival in the patient group to the expected survival of a comparable group from the general population

+: no COD data required, measures excess mortality irrespective of whether it is directly or indirectly attributable to the cancer

-: must have an estimate of expected survival in a comparable group from the general population
Motivation: Inconsistent methods applied

- Total: 58
  - All-cause/observed: 23
  - Cause-specific: 32
    - Relative: 9
  - Definition of cause of death provided: 6
  - Described life tables: 6
    - Life tables specific to geographic region: 1
    - Life tables specific to calendar time: 0
AIMS

To assess differences in results produced by two permutations of cause-specific and relative survival applied to estimating cancer survival and disparities in cancer survival, using data from First Nations and non-Aboriginal populations in Canada.
Background: Cancer survival estimation

- Single populations
- Compare populations
- Cause-specific
  - Broad definition of cancer death
  - Narrow definition of cancer death
  - Ideal life tables
  - Less than ideal life tables
- Relative
Methods

Data: 1991 Canadian Census Mortality Cohort

Four approaches:
1. relative survival analyses with ethnicity-specific life tables (RS-ELT);
2. relative survival with general population life tables (RS-GLT);
3. cause-specific survival with a broad definition of cancer death (CS-Broad);
4. and cause-specific survival with a narrow definition of cause of death (CS-Narrow)

Cancers:
Colorectal  Prostate  Stomach
Lung & bronchus  Kidney  Oral Cavity and Pharynx
Breast  NHL  Cervix
Results: Stomach cancer survival

Figure P.7. 5-year age-standardized stomach cancer survival estimated using four methods, by sex and ethnicity.
Results: Stomach cancer survival disparities

Figure P.8. Excess mortality rate ratios and hazard ratios for stomach cancer survival among First Nations compared to non-Aboriginals estimated using four methods.
Results: Breast cancer survival

Figure P.9. 5-year age-standardized breast cancer survival estimated using four methods, by ethnicity.
Results: Breast cancer survival disparities

Breast cancer survival disparities - FN vs. non-Aboriginals

<table>
<thead>
<tr>
<th>5-year EMRR or HR</th>
<th>RS W/ ETHNICITY-SPECIFIC LT</th>
<th>RS W/ GENERAL POP LT</th>
<th>CS W/ BROAD DEF’N OF CA DTH</th>
<th>CS W/ NARROW DEF’N OF CA DTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.03</td>
<td>2.4</td>
<td>1.47</td>
<td>1.56</td>
</tr>
</tbody>
</table>

Figure P.10. Excess mortality rate ratios and hazard ratios for breast cancer survival among First Nations compared to non-Aboriginals estimated using four methods.
Results:
Single population
Results: Disparities
Why the differences?

<table>
<thead>
<tr>
<th></th>
<th>Single population estimate of survival</th>
<th>Comparison of survival between populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>Incompatibility of life tables (PSA)</td>
<td>→Differential by ethnicity</td>
</tr>
<tr>
<td></td>
<td>Non-informative censoring assumption violated due to high other cause mortality</td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>Incompatibility of life tables (screening)</td>
<td>→Differential by ethnicity</td>
</tr>
<tr>
<td>Lung</td>
<td>Misattribution of cause of death in a continuous organ system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incompatibility of life tables (smoking)</td>
<td></td>
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<tr>
<td>Other</td>
<td>Misattribution of cause of death in a continuous organ system</td>
<td></td>
</tr>
<tr>
<td>(stomach, oral cavity)</td>
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</tbody>
</table>
When estimating 5-year cancer survival, using ethnic-specific life tables produces similar estimates to RS with general population life tables.

For some cancer sites, the definition of a cancer death has a significant impact on survival rates.

For all but breast and prostate cancers, the biases associated with each method were similar in both populations and accordingly, the four methods produced comparable estimates of disparity.
Thank you

Supervisors:
Loraine Marrett
Jason Pole

Committee:
Wendy Lou

Collaborators:
Michael Tjepkema
Diane Nishri

Statistics Canada
Health Analysis Division
Toronto Research Data Centre

Cancer Care Ontario
Aboriginal Cancer Control Unit

Funder:
Canadian Institutes for Health Research

Questions?
In press at Population Health Metrics
diana.withrow@nih.gov