Socioeconomic determinants of cancer incidence, mortality, and survival in Canada

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Plan of presentation

- Cancer and deprivation
- Cancer registration in Canada
- Objectives
- Methods
- Preliminary results
- Next steps
Inequalities in health reflect social inequalities in society….Clear evidence from industrialized and less developed societies shows that both cancer incidence and cancer survival are related to socioeconomic factors. Lower social classes tend to have higher cancer incidence and poorer cancer survival overall than higher social classes, although this pattern differs for specific cancers.

## Deprivation and cancer

<table>
<thead>
<tr>
<th>Positive associations</th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
<td>Lung</td>
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<td>Lung</td>
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<tr>
<td>Pharynx</td>
<td></td>
<td>Oesophagus</td>
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<tr>
<td>Nose</td>
<td></td>
<td>Cervix uteri</td>
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<td>Oral cavity</td>
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<td>Stomach</td>
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<td>Oesophagus</td>
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<td>Liver</td>
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<td>Stomach</td>
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<tr>
<td>Liver</td>
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<table>
<thead>
<tr>
<th>Inverse associations</th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
<td>Colorectal</td>
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<td>Colorectal</td>
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<tr>
<td>Brain</td>
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<td>Melanoma of skin</td>
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<tr>
<td>Melanoma of skin</td>
<td></td>
<td>Breast</td>
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<tr>
<td></td>
<td></td>
<td>Ovary</td>
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</tbody>
</table>

Cancer registration in Canada

With the addition of Quebec in 1970, population coverage was brought to 100%.

Strength = Coverage
The Canadian Cancer Registry does not contain information on socioeconomic status (SES) or ethnicity. Historically, studies of cancer inequalities have used postal code derived area-based measures of SES.
The 1991 Canadian Census Cohort:
a novel opportunity

For the first time in Canada we have data on cause-specific cancer incidence and mortality by individual measures of SES in a large, representative sample of Canadians (~15% of the population 25 years + at the inception of the cohort in 1991)

Probabilistic linked dataset

- Long-form census (1991)
- Annual residence (1985-2007)

Objectives

- To investigate the incidence, mortality, and survival of the most commonly occurring cancers in Canada in relation to individual markers of socioeconomic status.

- To improve our understanding of the etiology of each cancer by examining histological subtypes across socioeconomic gradients.
The Focus

A national perspective

Four most common cancers:
- lung
- breast
- colorectal
- prostate

Three key SES variables:
- educational attainment
- income adequacy
- occupational skill level

Hard to identify groups
- i.e. Aboriginal peoples

Age, period, birth cohort analysis
Methods

Incidence analysis
- Calculate rates by SES/stratifying variables
- Derive rate ratios, rate differences, population attributable fractions

Mortality and survival analysis
- Cox regression modeling of age and fully-adjusted relative risk
Preliminary results
(LUNG CANCER INCIDENCE ONLY)
Lung cancer in Canada: What do we know?

- Lung cancer is the 2\textsuperscript{nd} most common cancer diagnosis in Canada and the leading cause of deaths among men and women.

- Incidence rates have been decreasing among men since 1984 (APC 0.1) and increasing among women (APC 3.9) since 1972.

- Lung cancer is a type of cancer that shows one of the Strongest positive association with deprivation. This is particularly true for squamous cell carcinomas (among men).

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The Cohort

Census cohort members: ~ 2,734,800

All cancer diagnoses (1991-2003): ~232,000


Incidence rate ratios by educational attainment (reference group: university degree)

IRR lung combined = 5.5
IRR squamous = 8.0
IRR adenocarcinoma = 4.0
IRR small cell = 5.5

Crude incidence rates per 100,000 person years

- No High school
- High School
- Post Secondary
- University

IRR lung combined = 5.5
IRR squamous = 8.0
IRR adenocarcinoma = 4.0
IRR small cell = 5.5
Incidence rate ratios by income adequacy quintiles (reference group: highest quintile)

- IRR squamous = 2.4
- IRR small cell = 2.1
- IRR adenocarcinoma = 1.5
- IRR lung combined = 2.1
Incidence rate ratios by occupational skill level (reference group: professional)

- IRR squamous = 11.7
- IRR lung combined = 7.8
- IRR small cell = 5.3
- IRR adenocarcinoma = 4.5

Crude incidence rates per 100,000 person years

- All lung cancers
- Squamous cell
- Adenocarcinoma
- Small cell lung

No Occupation
Unskilled
Semi-skilled
Skilled, technical
Management
Professional
Incidence rate ratios by place of birth (reference group: North America, Europe, former USSR)

IRR small cell (E Asia/N Africa & M East/ SE Asia/S Africa/Caribbean/S Asia) = 7.1/6.6/13.1/7.1/NR/NR

IRR lung combined (E Asia/N Africa & M East/ SE Asia/S Africa/Caribbean/S Asia) = 1.8/3.5/6.9/2.6/4.8/4.7

IRR squamous (E Asia/N Africa & M East/ SE Asia/S Africa/Caribbean/S Asia) = 2.3/2.7/4.7/NR/6.3/6.7

IRR lung adenocarcinoma (E Asia/N Africa & M East/ SE Asia/S Africa/Caribbean/S Asia) = 1.0/1.8/1.6/4.7/2.5/4.4

NR = data not releasable
Population attributable risk

Socioeconomic inequalities in lung cancer incidence are associated with:

- Over 68% of education related excess incidence
- Over 28% of income related excess incidence
- Over 69% of occupation related excess incidence
- ~1.4% less incidence among Aboriginal Canadians (overall) but 25% excess incidence among the Inuit
- ~4.9% less incidence among those born outside of North America, Europe, and the former USSR
What this study adds

- Results show a positive association between incidence and deprivation for income, occupation, and education
- All associations are marked by a gradient
- IRRs are especially high for those without an occupation compared to professionals
- Individuals born in North America, Europe or former USSR have significantly higher incidence rates than those born elsewhere
- For all 3 key SES variables, the association between incidence and deprivation is the strongest for squamous cell cancers

- Birth cohort analysis to investigate historical smoking patterns, change in cigarette constituents, role of environmental risks
- Cox proportional hazards modelling to understand SES interactions
Project timelines

- 06/2013: Launch project (lung and breast cancer incidence analyses)
- 12/2013: Complete incidence analyses
- 01/2014: Presentations (Health Data Users 2013, NAACCR 2014); peer reviewed publications
- 06/2014: Complete all analyses by April 2014
- 06/2014: Start mortality and survival analyses
- 13/2014: Initiate prostate & colorectal cancer incidence analyses

Initiate prostate & colorectal cancer incidence analyses
Acknowledgements

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THANK YOU

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