Socioeconomic gradient in health in Canada: Is the gap widening or narrowing?

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Outline

Introduction

- Systematic differences in health among different social groups are a key global public health challenge (Marmot 2005).

- Inequality in health status exists for a broad set of health indicators (*e.g.*, *self-reported health status, mortality and disability*) and for many measures of social position (*e.g.*, *income, education, occupation and marital status*).

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- In spite of the overall improvement in health over the past four decades, social inequalities in health in Canada exist over an extensive set of health measures and illnesses, including risk factors and behaviours.

- Although inequalities in health can result from differences in health seeking behaviours of individuals and/or differential access to health care, social determinants of health (e.g., income and education) play an important role in the observed inequalities in health.

- There are significant socioeconomic inequalities in health in Canada (Humphries and van Doorslaer 2000; Safaei 2007; Jiménez-Rubio et al. 2008; McGrail et al. 2009; CIHI 2015).

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Notwithstanding increased attention to the analysis of the socioeconomic inequalities in health worldwide, relatively little work has been reported in Canada.

Objective

Using data from the Canadian longitudinal National Population Health Survey (NPHS) we examined the socioeconomic status-health gradient in Canada and and across five main regions in Canada (the APs, QC, ON, PPs and BC) over the period between 1998/99 and 2010/11.

- This study contributes to the existing literature in several distinct ways:
  - *First*, we extended the analysis of socioeconomic inequalities in health in Canada using the frailty index (FI).
  - *Second*, we quantified education- and income-related inequalities in Canada as whole and across five main regions in Canada.
  - *Finally*, using longitudinal data from the NPHS we examined trends in socioeconomic inequalities in the FI and the HUI in Canada over time.

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Data
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Statistical Analysis

Data

- We used Canada's longitudinal National Population Health Survey (NPHS).
- The first cycle of data collection began in 1994/95 (n=17,626) and continued biennially thereafter until 2010/11 (11 waves).
  - The first two waves of the survey were excluded from our analysis because they do not have information on the "best estimate" for total household income.
  - Adult 25 years and older

- **Outcome variables**
  1. Frailty Index (FI) measures proportion of deficits accumulated in individuals. The FI ranges between 0 and 1.

  $$\frac{Number\ of\ health\ deficits\ in\ individual}{Total\ number\ of\ health\ deficits\ measured}$$

  2. Health Utility Index (HUI) measures health-related quality of life. It ranges between -0.360 to 1 (perfect health status), with zero indicating a state equivalent to death.

- Socioeconomic status
  1. Educational attainment (less than secondary school graduation, secondary school graduation, some postsecondary, and post-secondary graduate)
  2. Quintiles of equivalised household income to measure individual .

- Control variables
  - Age, sex, and race/ethnicity (white and non-white)

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Measuring socioeconomic inequalities

- Slope and relative indices of inequality
  - The SII and RII are regression-based measures that take the whole socioeconomic distribution into account.
  - The SII and RII involve calculating the mean of health outcome for each socioeconomic group and then ranking groups by their SES.
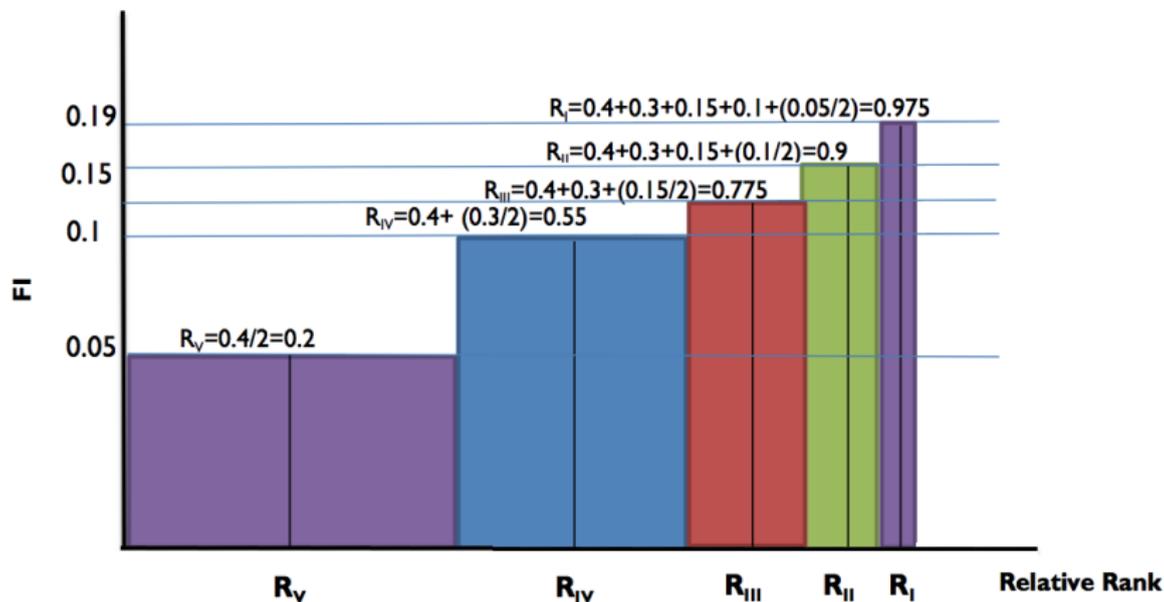
- The SII defined as the slope of the regression line between a group's health status and its relative rank.
- $RII = SII/\mu$, where μ is the mean level of health.

$$g(Y_i) = \alpha + \beta R_i + \sum_k \delta_k X_{ki} + \varepsilon$$

- where Y_i and R_i index the HUI or the FI and the corresponding fractional rank for the individual. X_{ki} indexes a set of adjustment variables (age, sex, and race/ethnicity).
- β is the coefficient of interest and represents the RII or SII.
- We used GLM with normal errors and a logarithmic link function to estimate RII and an identity link function to calculate SII.

- We examined trends in the adjusted RII and SII by including the two-way interaction term between fractional rank and time (wave) to our model as follows (Ernstsen et al. 2012):
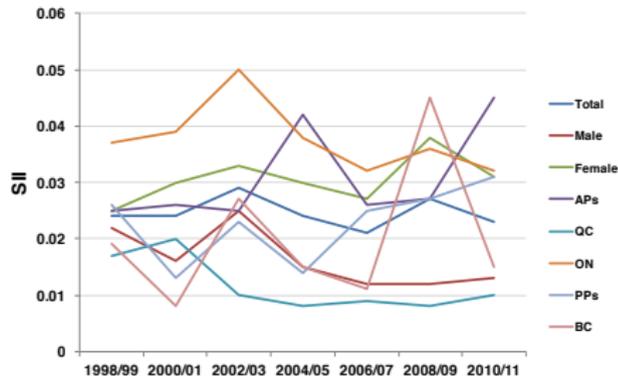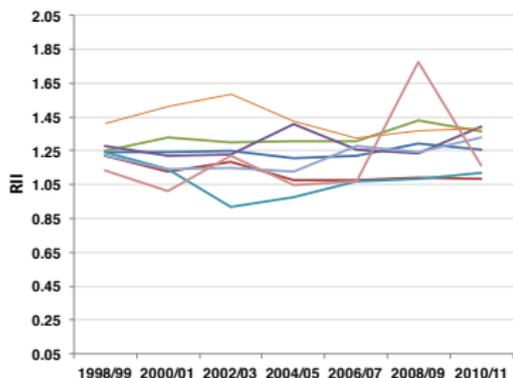
$$g(Y_i) = \alpha + \beta R_i + \sum_k \delta_k X_{ki} + \theta W_{ti} + \gamma W_{ti} R_i + \varepsilon$$

- A statistically significant coefficient for the γ implies changes of the RII and SII over time.
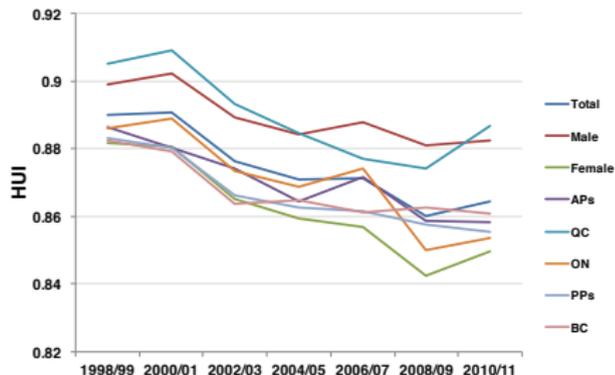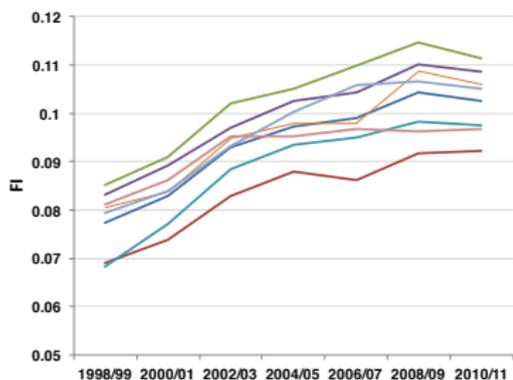
Education-related inequalities in the FI among Canadian adults: 1998/99- 2010/11

Trend Analysis

Relative and absolute educational inequalities increased for women (p= 0.041 and 0.003, respectively).

Trend Analysis

Relative income-related inequalities increased for men and women (p= 0.038 and 0.006, respectively).
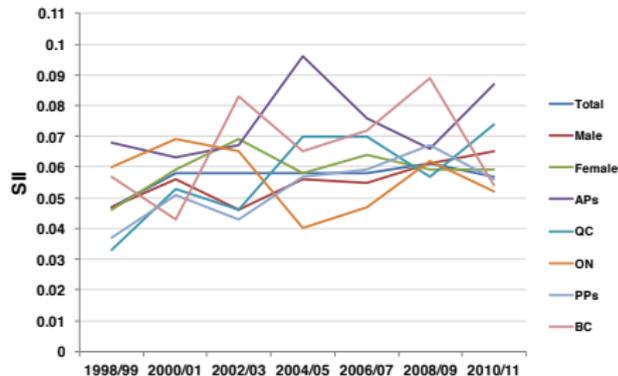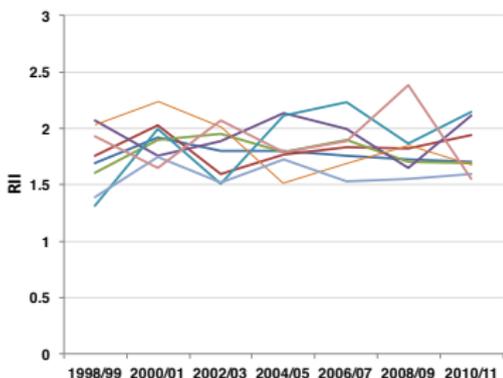
Education-related inequalities in the HUI among Canadian adults: 1998/99- 2010/11

Trend Analysis

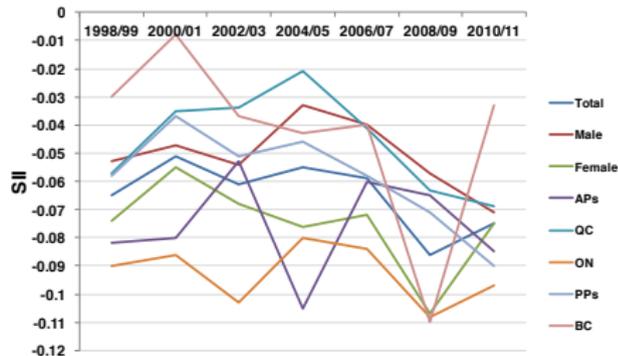Relative and absolute educational inequalities increased for women (p= 0.001 and 0.003, respectively).
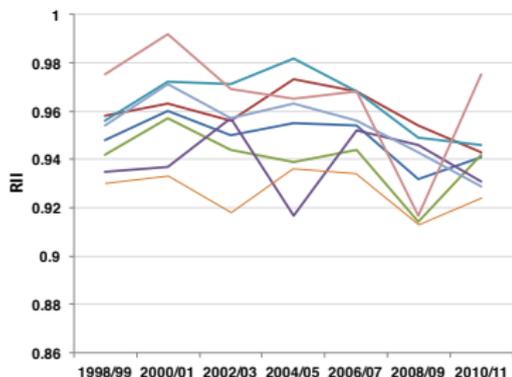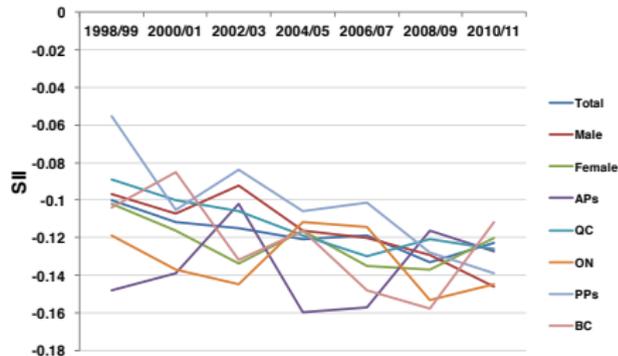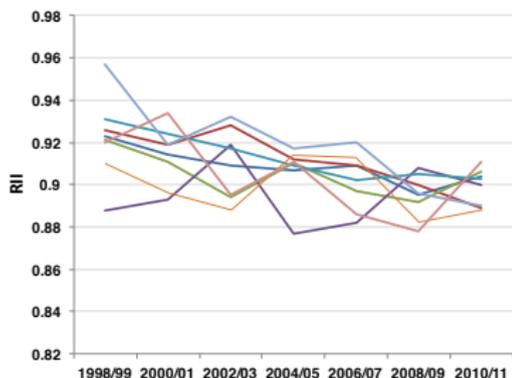
Income-related inequalities in the HUI among Canadian adults: 1998/99- 2010/11

Trend Analysis

Relative and absolute income-related inequalities increased for both men and women (P<0.05).

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- We found that education- and income-related inequalities in health were present in all five regions of Canada.

- The estimated RIIs and SIIs suggested that education-related inequalities in the FI and the HUI increased among women.

- The results also revealed that relative and absolute income-related inequalities in the HUI increased in Canada, especially among women.

- Both absolute and relative inequalities indicated that income-related inequalities in the HUI increased in Quebec and in the Prairies over time.

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Limitations

- *First*, we calculated the RIIs and the SIIs for individuals who were alive at the time of the interview in each wave.
  - The exclusion of the respondents who died between the two waves may lead to *bias* in our estimated socioeconomic inequalities in health. Since mortality rates are higher in lower SES groups and individuals who die typically tend to have the worst health status before they die, our analysis, in fact, underestimated education- and income-related inequalities in health in Canada.

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- *Second*, although using longitudinal data enabled us to examine the SES-health gradient using a sample of individuals with similar unobserved individuals' characteristics such as health endowment, there may be an issue of a reverse effect of health on income, in which health problems lead to lower income.

  - Reverse causality, however, cannot explain education-based inequalities, which are mainly determined at the early stage of life.

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- Similar to other countries in the OECD, where inequalities in health are either static or widening (Mackenbach, 2012), our study showed that the burden of ill health was concentrated among the low-income and less-educated individuals at the start, and that socioeconomic inequalities in health increased over time.

- Although some certain programs and policies (e.g., ensuring equitable access to services) can be implemented in health sector to address socioeconomic-related inequalities in health, major reduction in health inequalities is unlikely without tackling the broader social determinants of health (Michael Marmot et al. 2008).

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- Health in All Policies (HiAP) approach, which addresses the broader array of social determinants of health through the considerations of health in policy making across various sectors that affect health (e.g., housing, public safety, and education), can be considered an effective strategy to reduce socioeconomic inequalities in Canada.