

# Population Health Analytics in Action: Data and tools for assessing health inequities and population health priorities

**APHEO 2018 Conference**  
**November 27, 9:00 – 9:45am**

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# Outline

- To review key trends in population health outcomes and health equity in Ontario
  - Several calls to action on reducing inequalities in health – how are we doing?
- To discuss the ways that diverse population-based data sources can be used to monitor health inequities and inform health system decision-making
  - What does linking with other data sources reveal?
- Demonstrate how population health monitoring and measurement is the foundation for strong and robust health system

# Ontario Population Trends in Improved Mortality Informing Sustainability & Equity of the health care system



## **OPTIMISE asks three questions:**

- Is our health system contributing to reducing and treating illness? (effectiveness)
- Is our health system reaching those who need it? (equity)
- Is our health system improving the health of the population?

# Terminology to describe “early” mortality

**Avoidable**

**Public health amenable deaths**

**Amenable mortality**

**Deaths amenable to medical care**

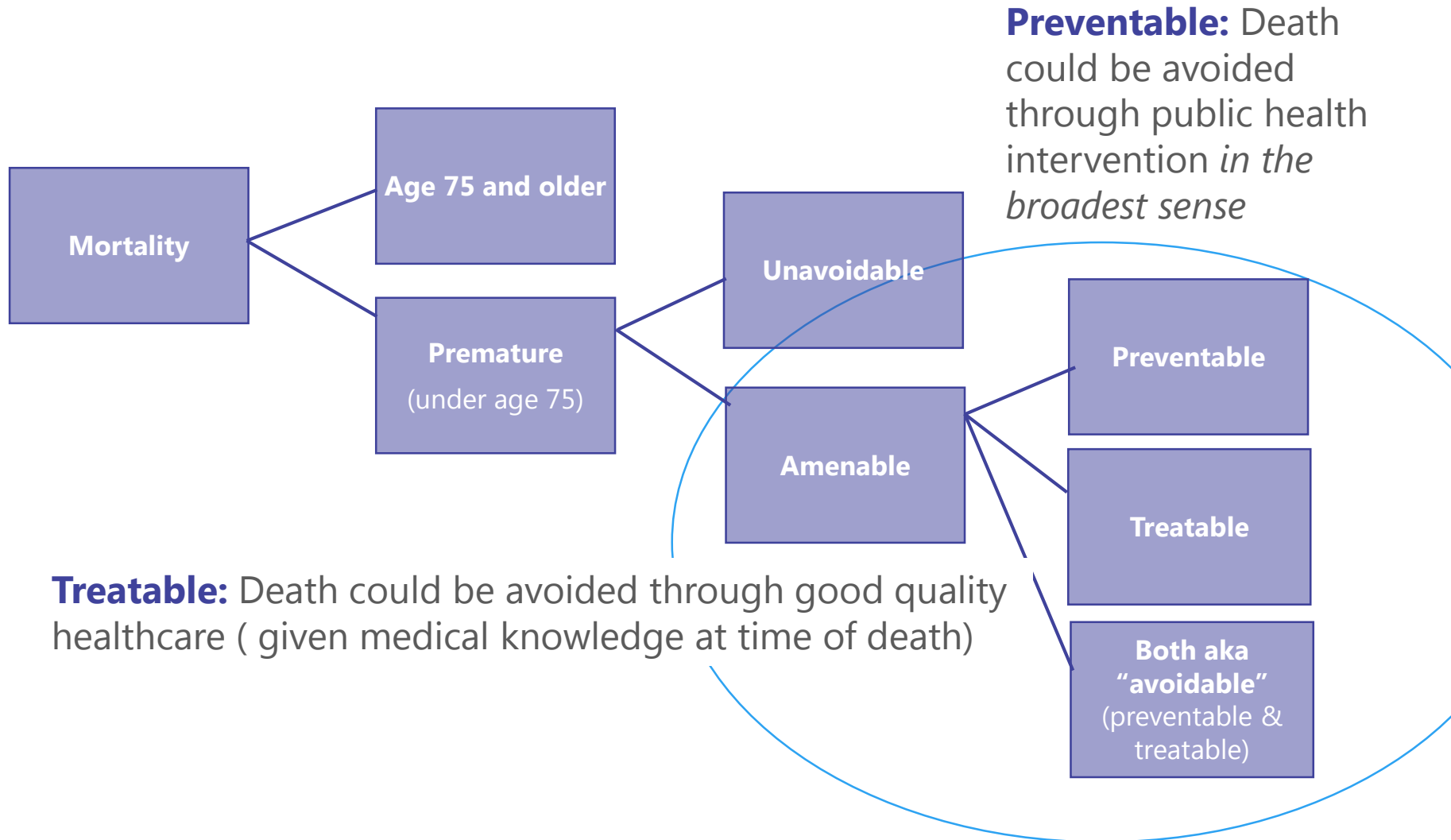
**Premature mortality**

**Preventable deaths**

**Potential Years of Life Lost**

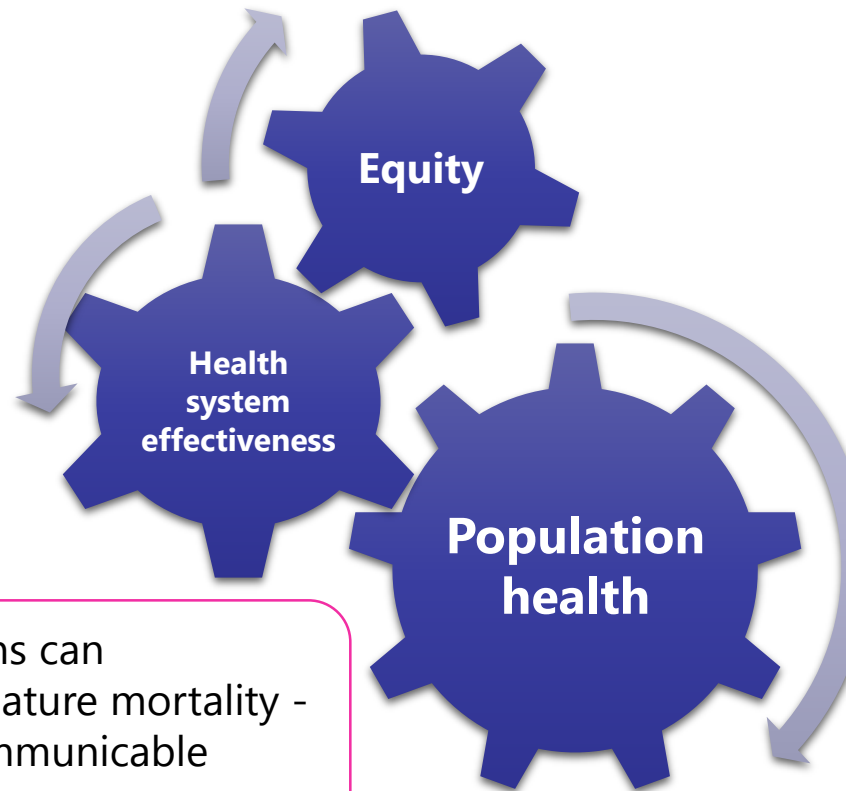
**Treatable deaths**

# Premature and Amenable Mortality



# What do *premature deaths* tell us about our health system?

**Reduction in premature mortality is one of the UN Sustainable Development Goals**



Who is getting left behind?

Health care interventions can significantly delay premature mortality - particularly for non-communicable diseases

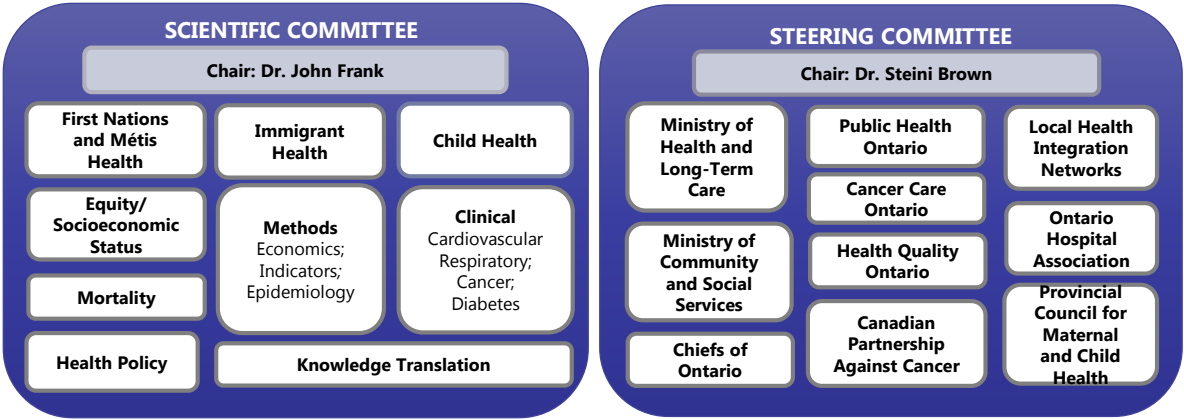
Many deaths can be prevented through effective public health and preventive care

# OPTIMISE Governance Structure

## Research Team

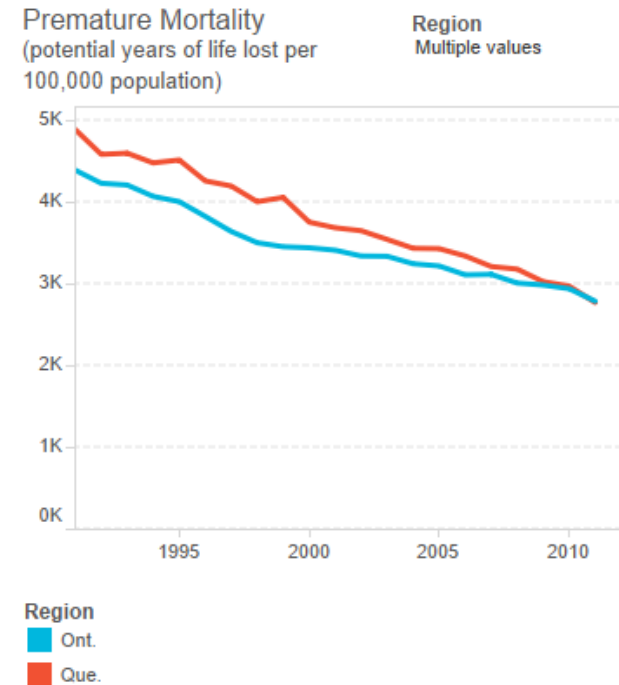


### OPTIMISE COMMITTEES



# Trends and relative positions are important

- **Timing** and **pace** of declines can be indicative of health care performance
- **Relative positions** can identify groups being left behind or emerging issues
  - Access
  - Broader determinants of health
- Premature mortality is robust and responsive



# Possibilities proposed for mortality trends



Larger absolute and relative declines in lower SES groups = narrowing in absolute and relative inequalities



Larger absolute but smaller relative in lower SES groups = narrowing in absolute but widening of relative



Smaller absolute and smaller relative declines in lower SES groups, leading to a widening of absolute and relative inequalities

# Highlights from the Ontario Atlas of Adult Mortality

## ONTARIO ATLAS OF ADULT MORTALITY

1992-2015

TRENDS IN LOCAL HEALTH INTEGRATION NETWORKS



**February  
2018**

**September  
2018**

## ONTARIO ATLAS OF ADULT MORTALITY

1992-2015

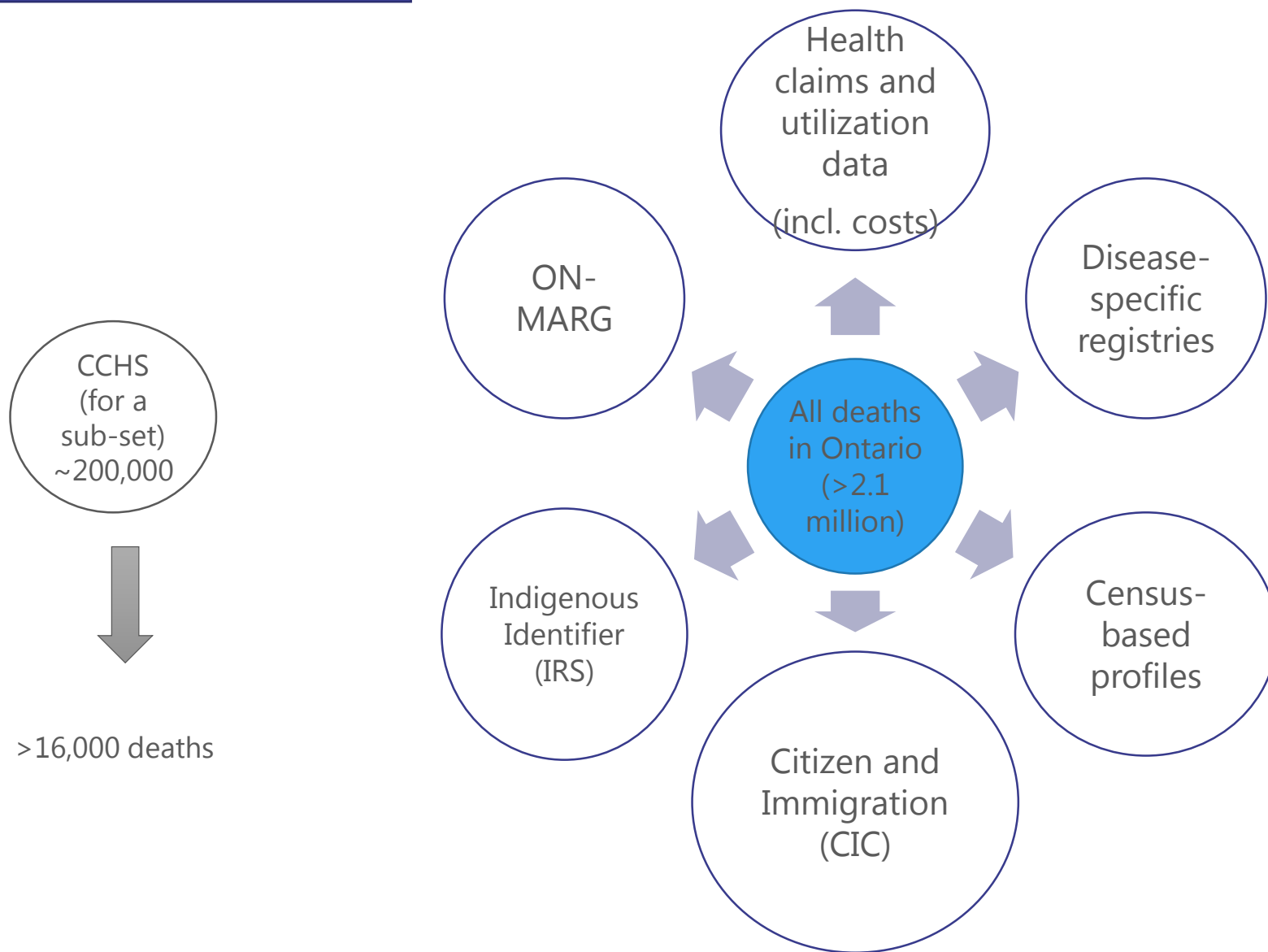
*VERSION 2.0:*

TRENDS IN PUBLIC HEALTH UNITS



<https://pophealthanalytics.com/reports/>

# OPTIMISE data sources



# What did we measure?

Mortality rate due to all causes

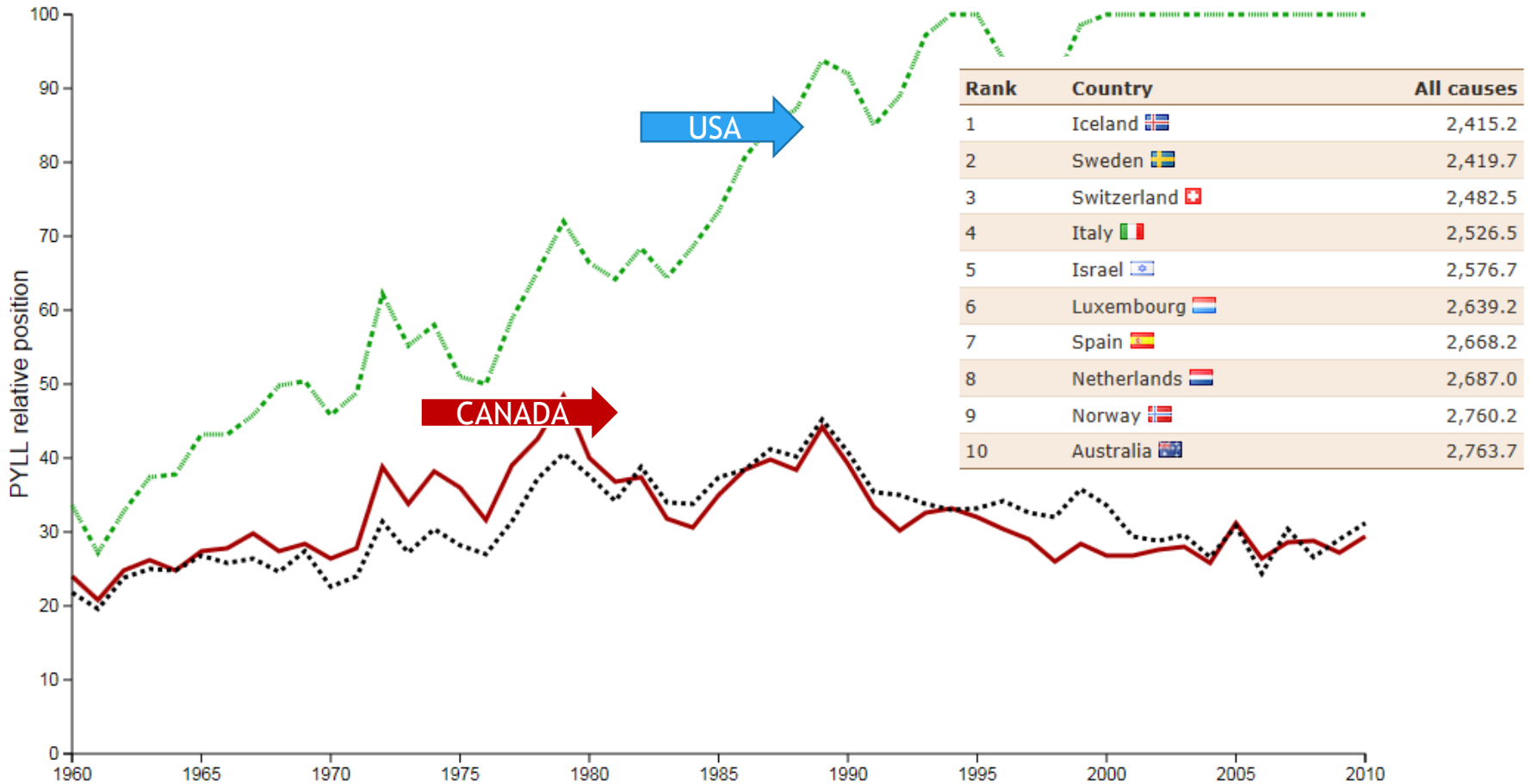
Cause-specific mortality rate

Premature mortality (Death before 75)

Amendable mortality

Measures of inequality

**PYLL for selected countries, 1960 to 2010: Relative position; All causes; Both sexes**

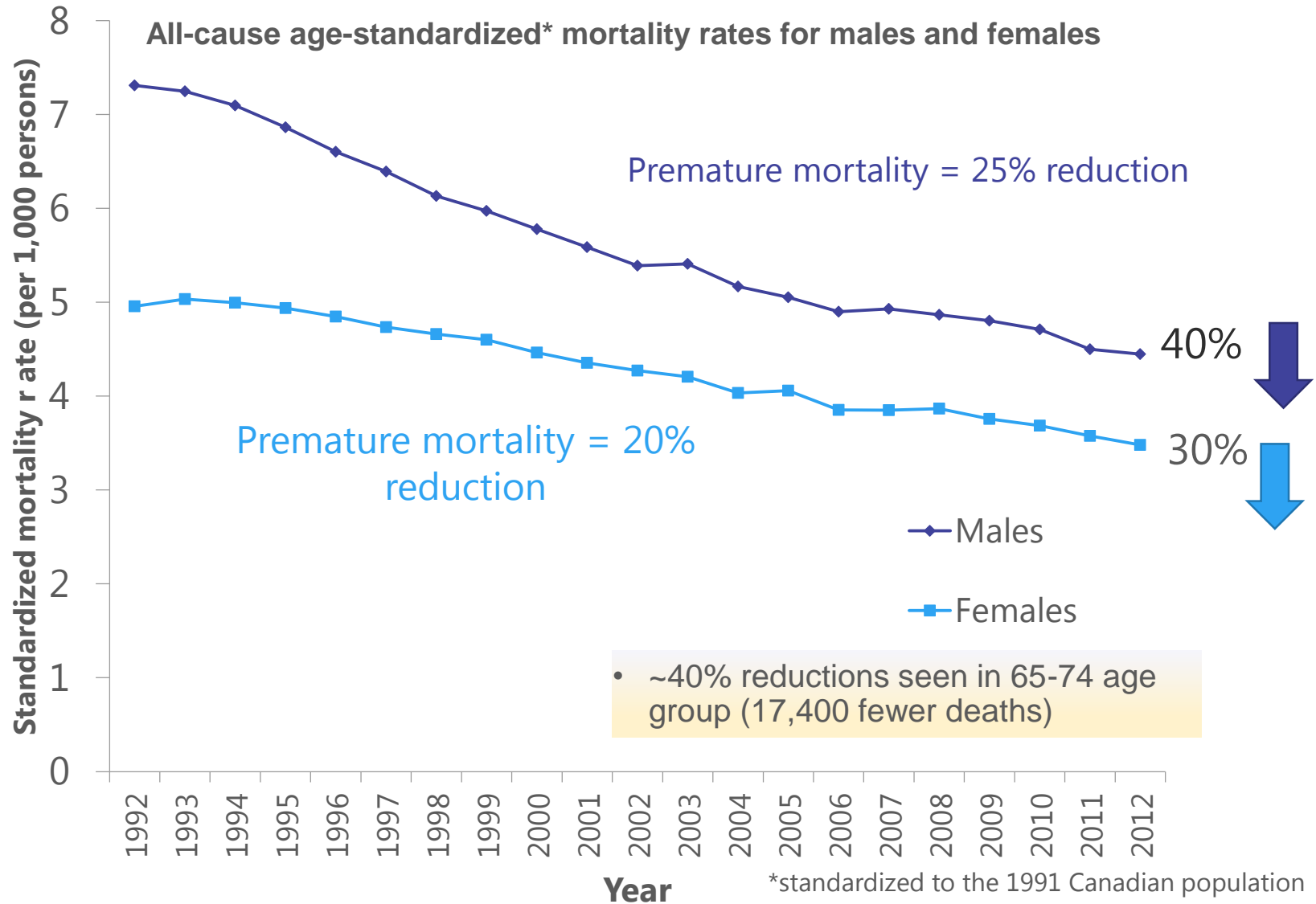


Source:

1 Canadian Institute for Health Information, *Canada's International Health System Performance Over 50 Years* (Ottawa, Ont.: CIHI, 2016).

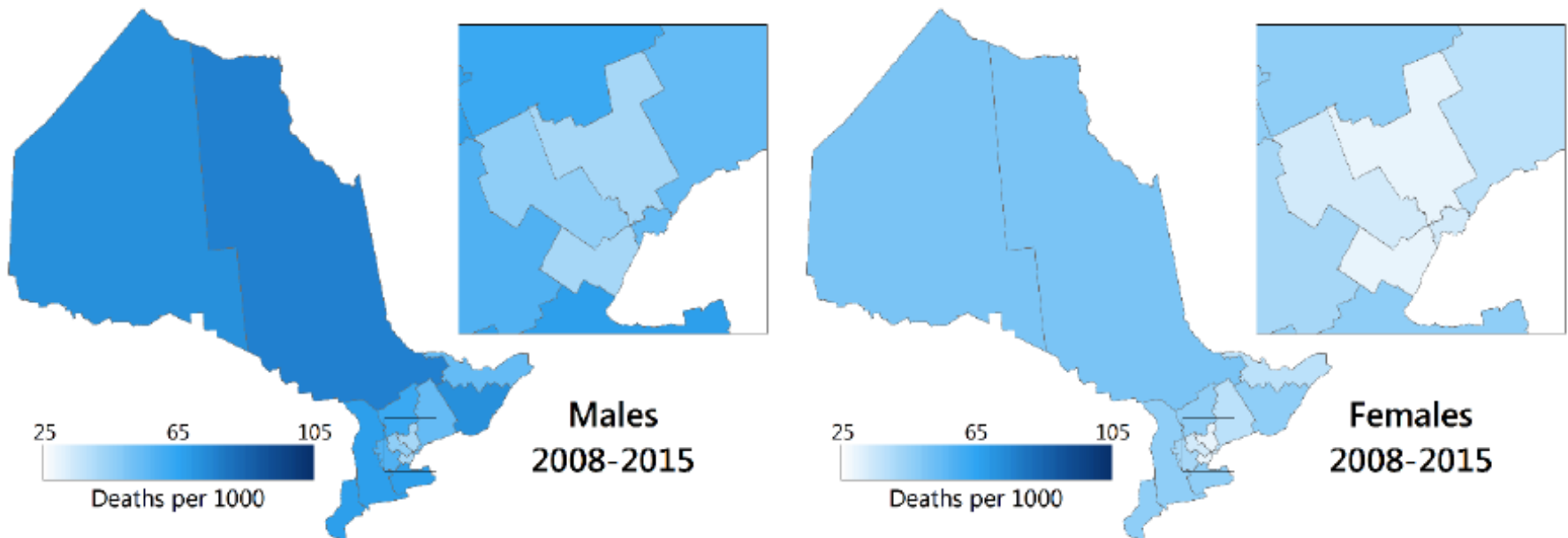
2 OECD (Organisation of Economic Cooperation and Development) 2015. *OECD Health Statistics 2014*. Paris: OECD. Viewed 23 June 2015.

# Mortality Trends by Sex



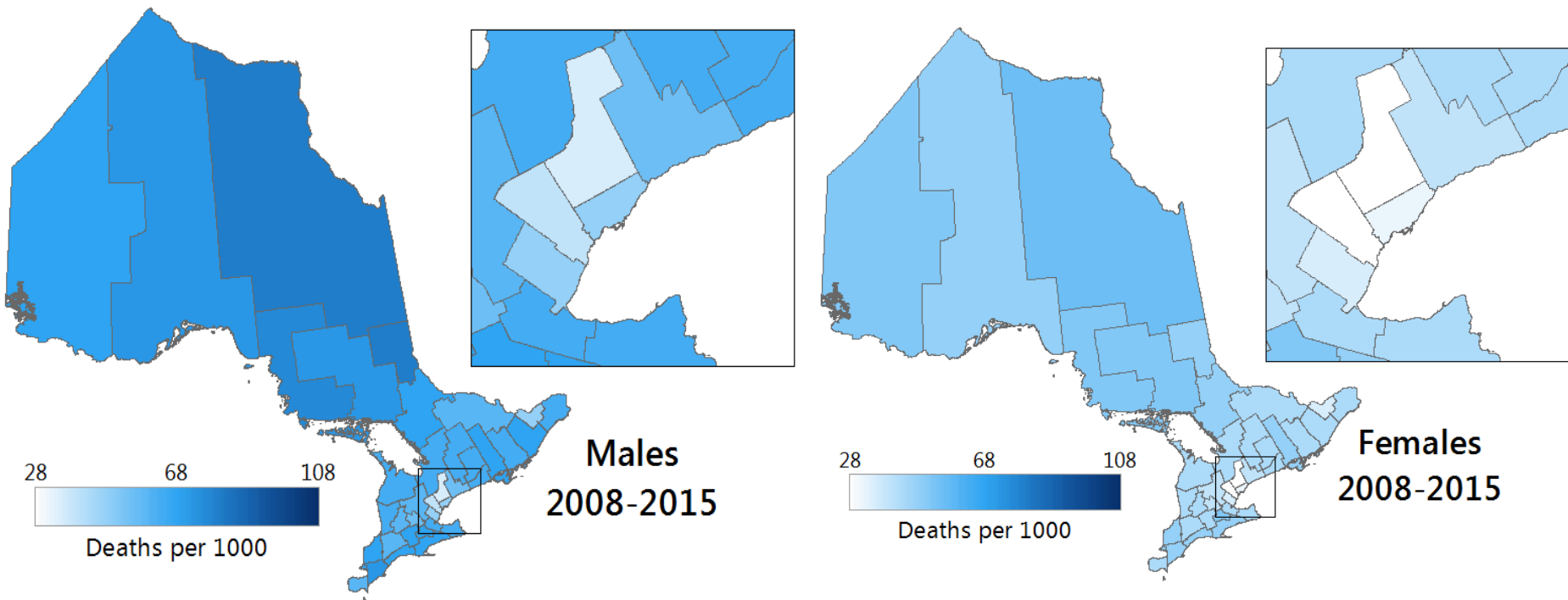
# All-Cause Mortality

Cumulative age standardized all-cause mortality in Ontario by LHINs, total deaths per 1000

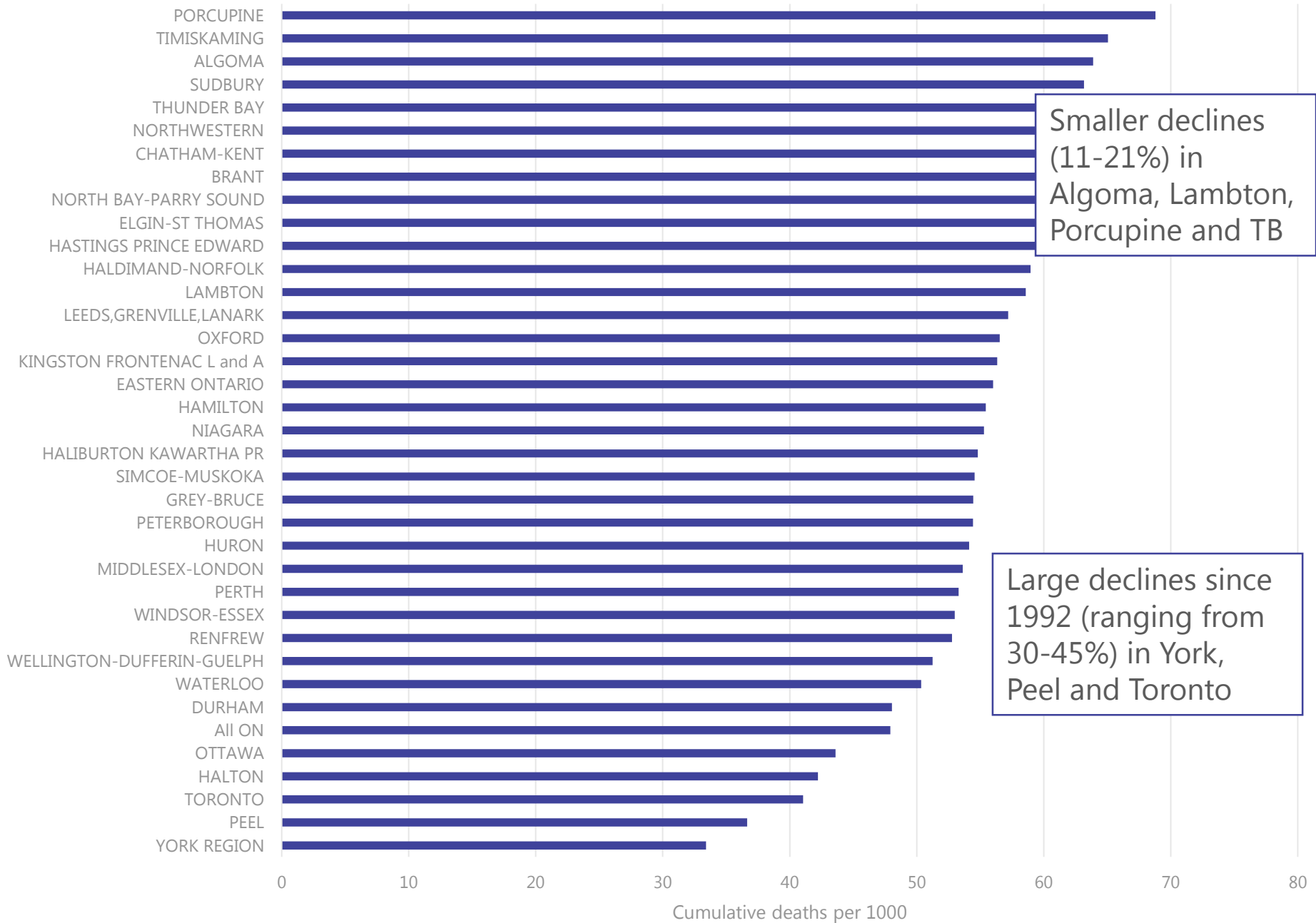


# All-Cause Mortality

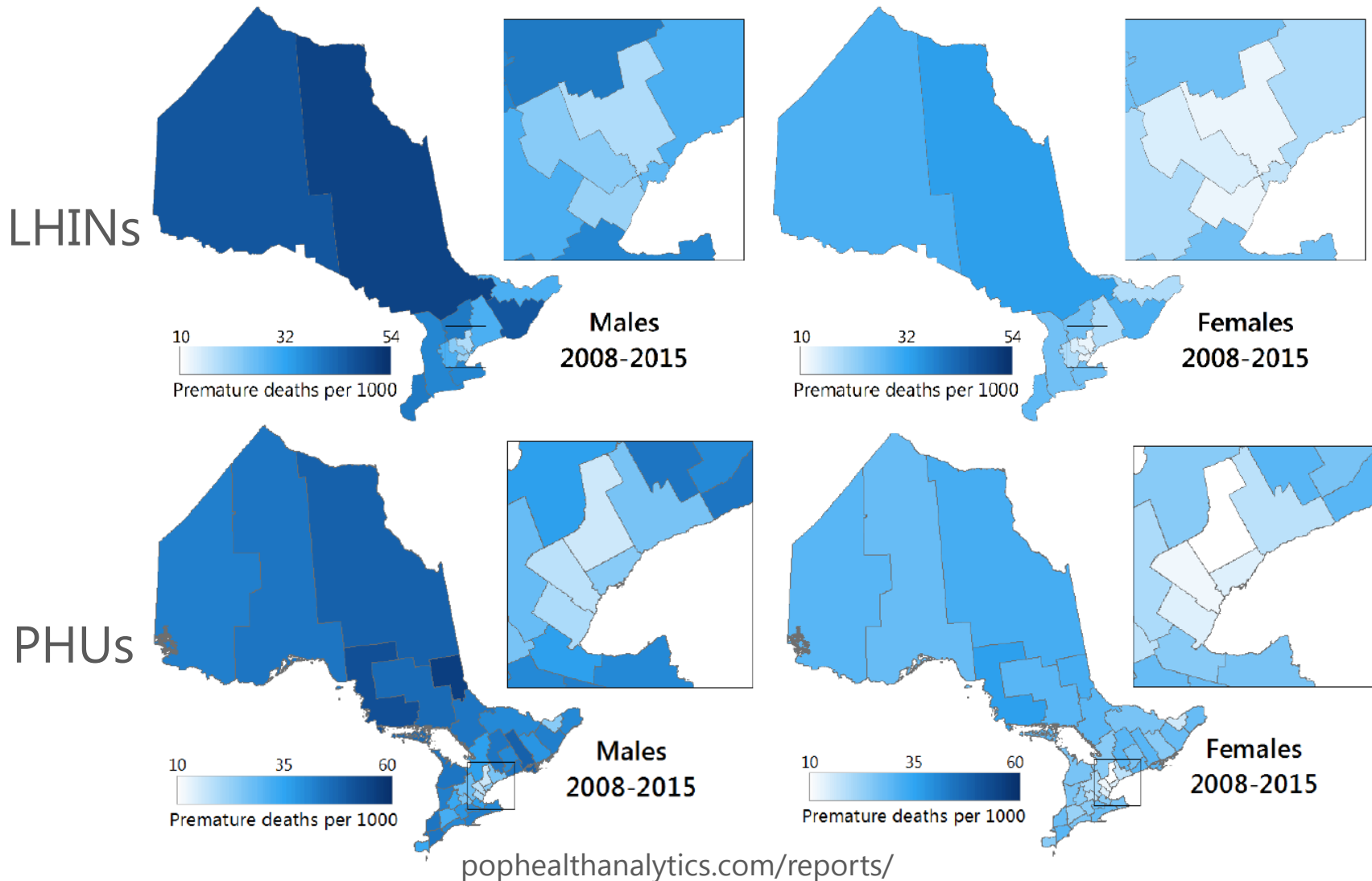
Cumulative age standardized all-cause mortality in Ontario by PHU, total deaths per 1000



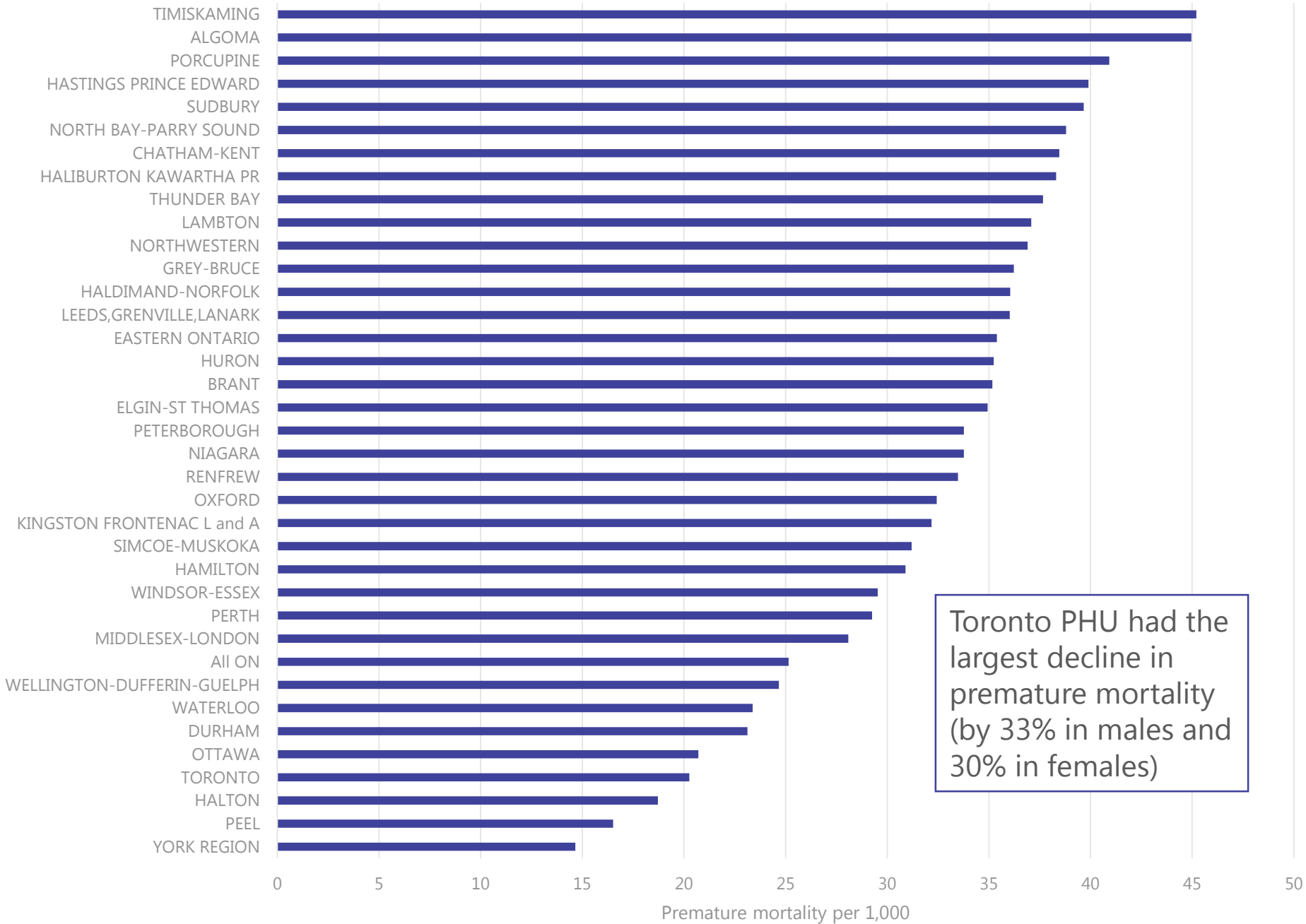
# Age standardized all-cause mortality (2008-2015) by PHU



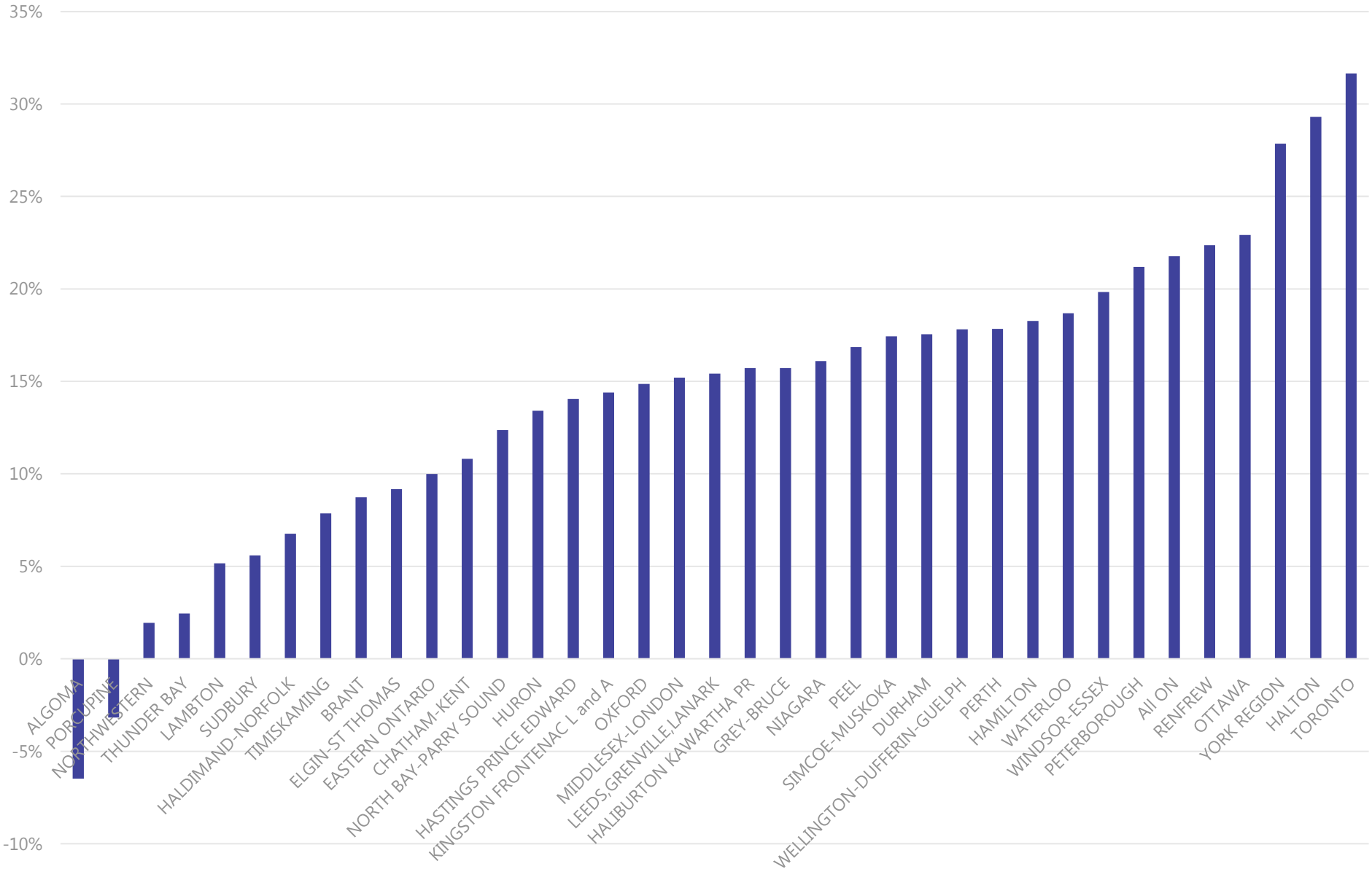
# Geographic variation of premature mortality in Ontario, 2008-2015



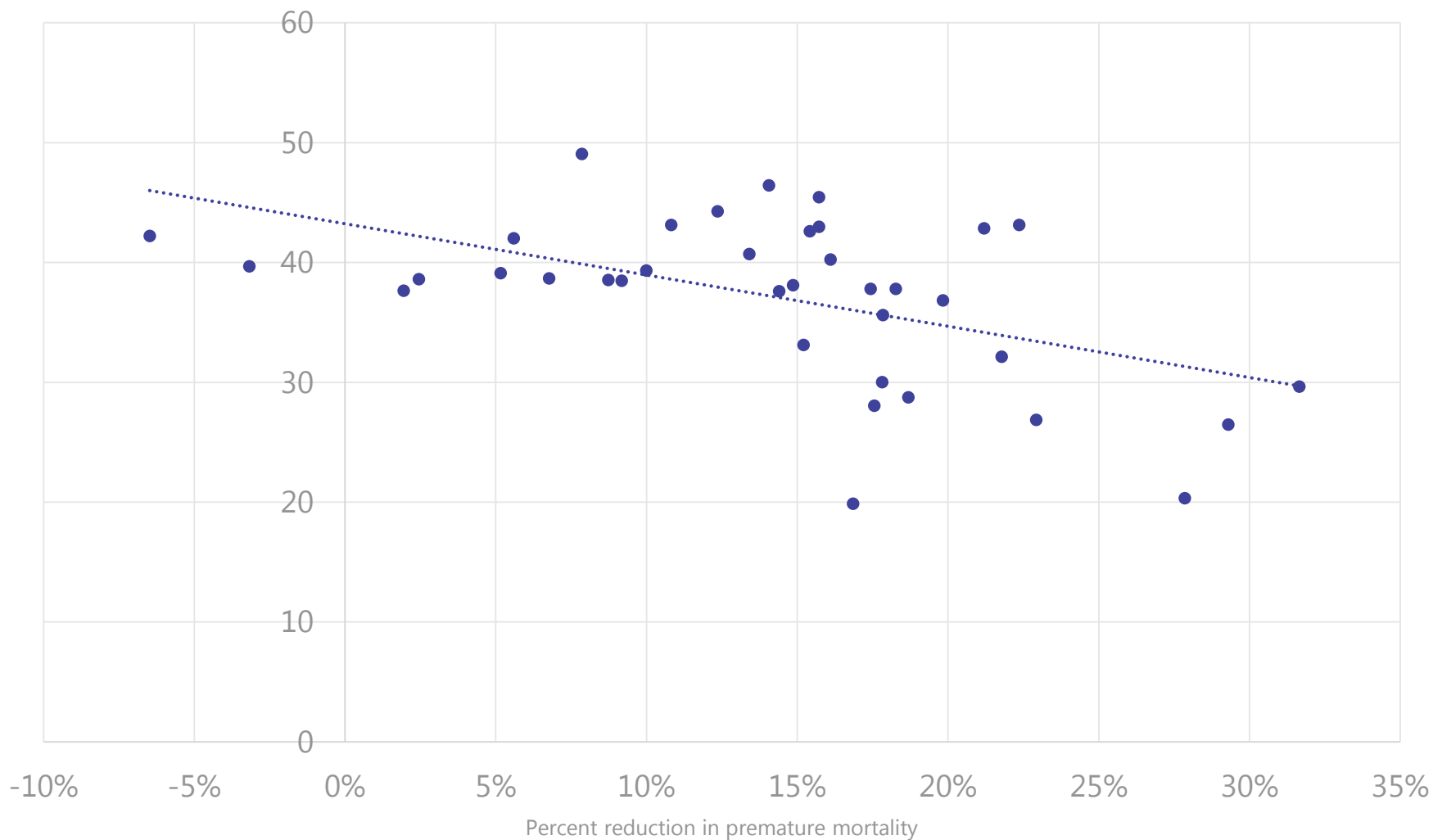
# Premature mortality by PHU, per 1000 (2008 - 2015)



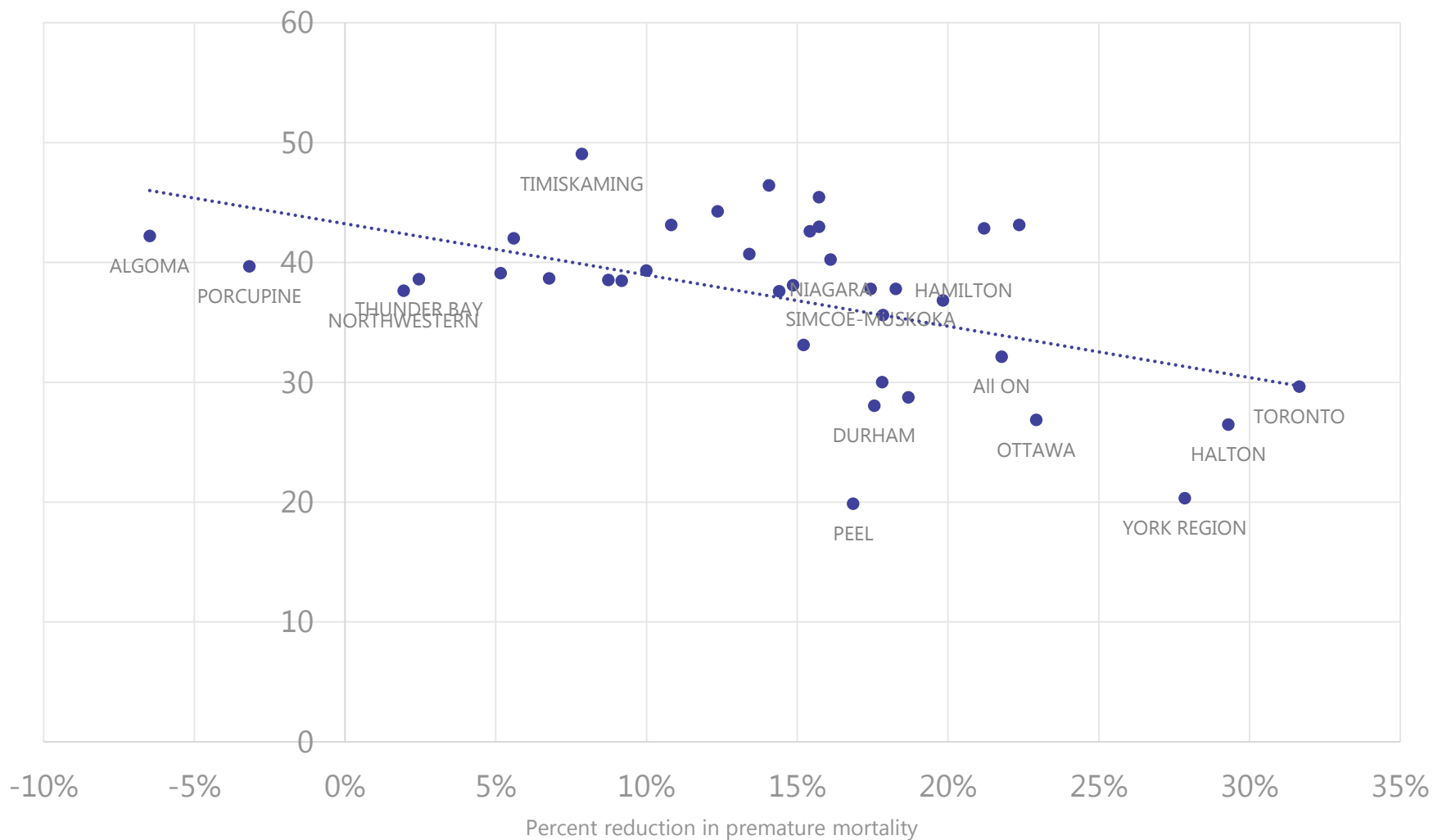
# Percent reduction in premature mortality across PHU (1992 to 2015)



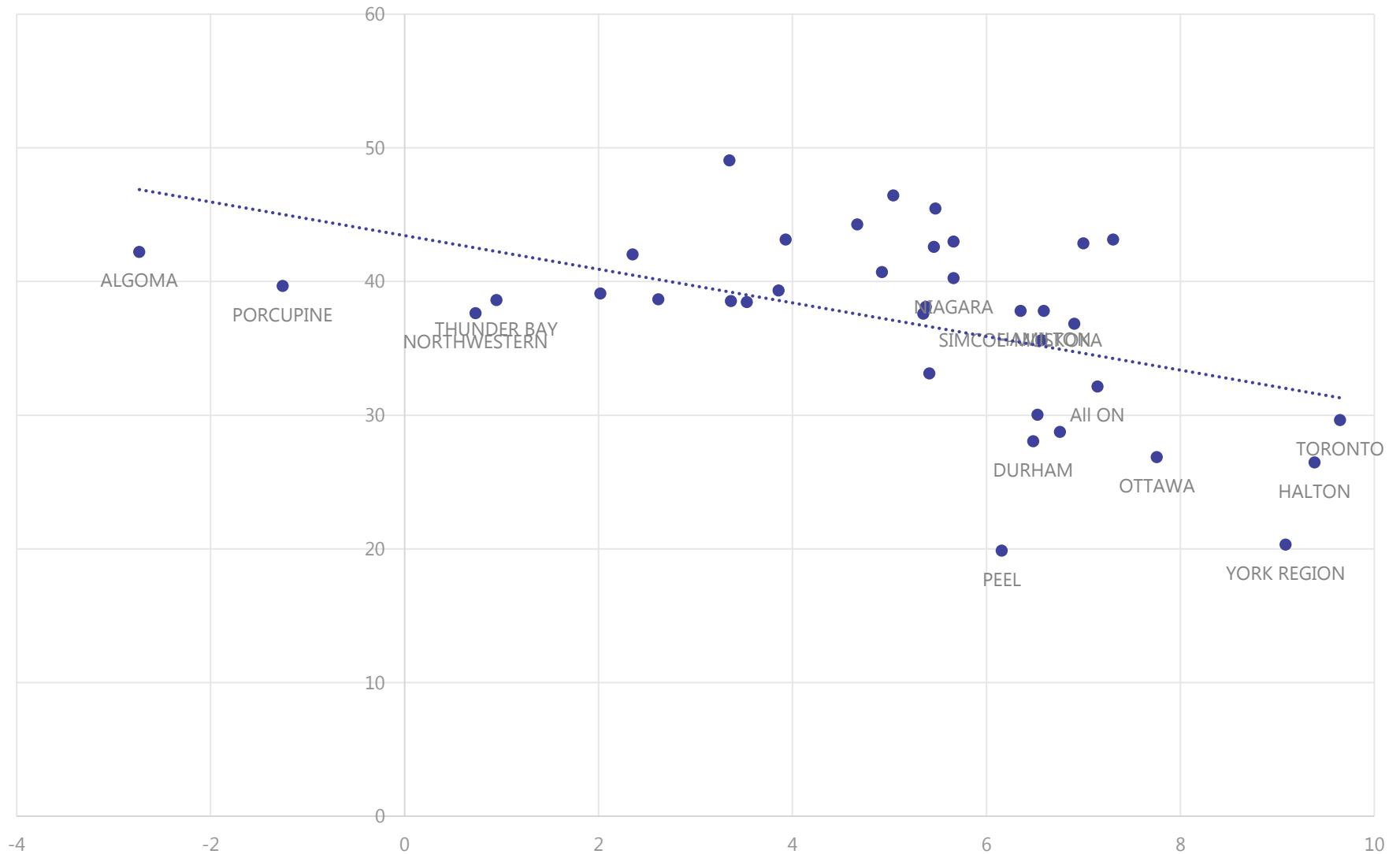
Percent reduction (1992 - 2015) in premature mortality according to baseline levels, by PHU



Percent reduction (1992 - 2015) in premature mortality according to baseline levels, by PHU



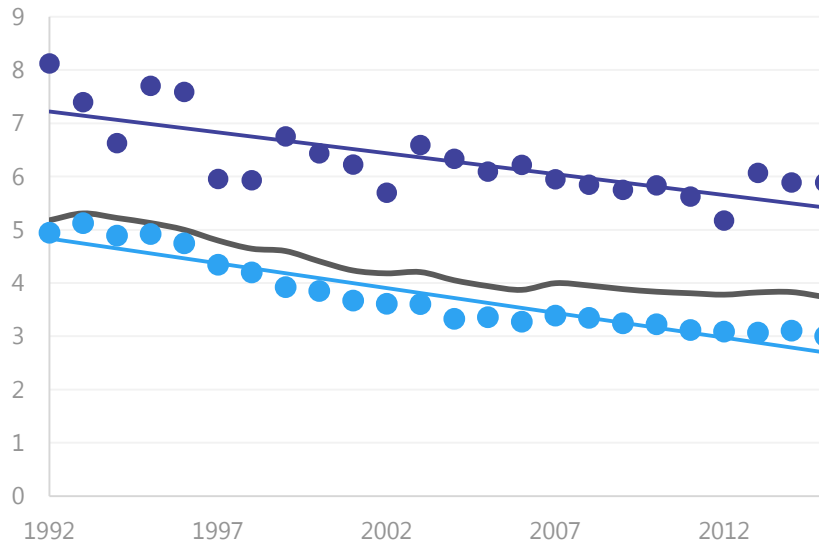
# Absolute reduction (1992 - 2015) in premature mortality according to baseline levels, by PHU



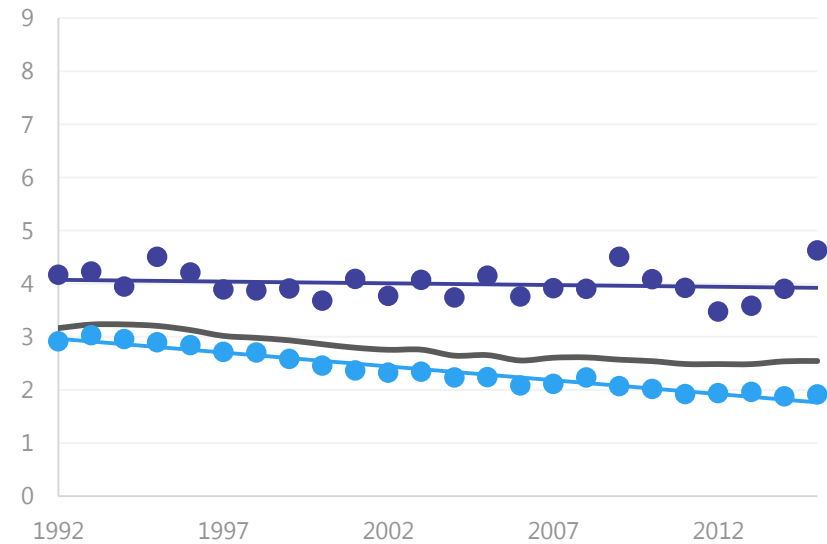
# Variation in Premature Deaths by PHU

Premature (under age 75) death rate per 1000 population

Males



Females

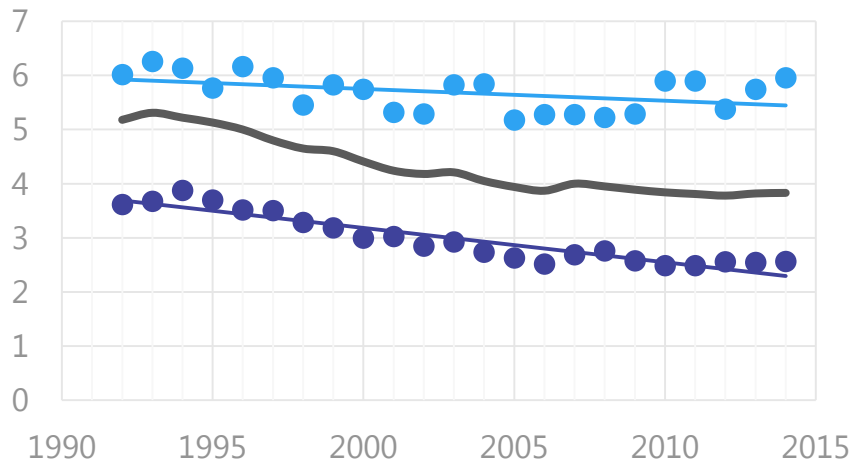


● Toronto PHU    ● Porcupine PHU    — All Ontario

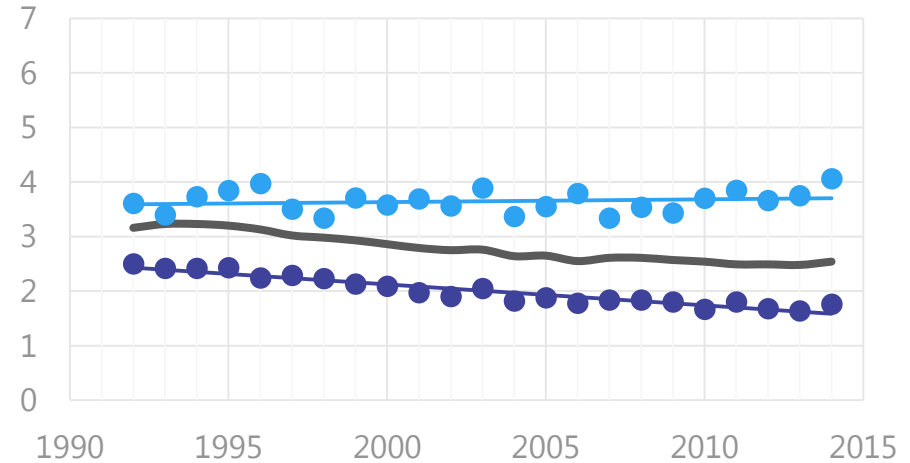
# Variation in Premature Deaths by LHIN

Premature (under age 75) death rate per 1000 population

Males



Females

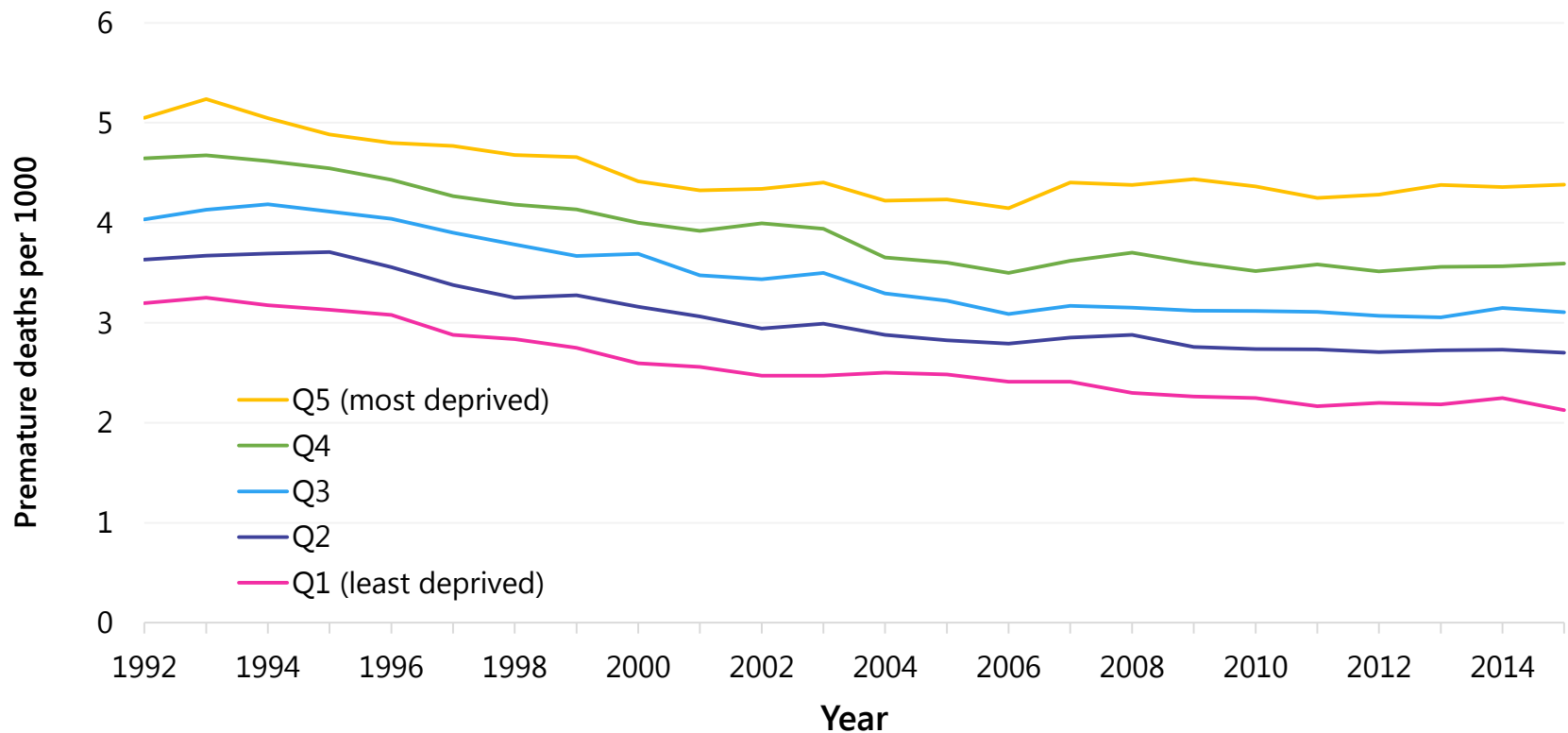


● North West    ● Mississauga Halton    — All Ontario

# SES trends

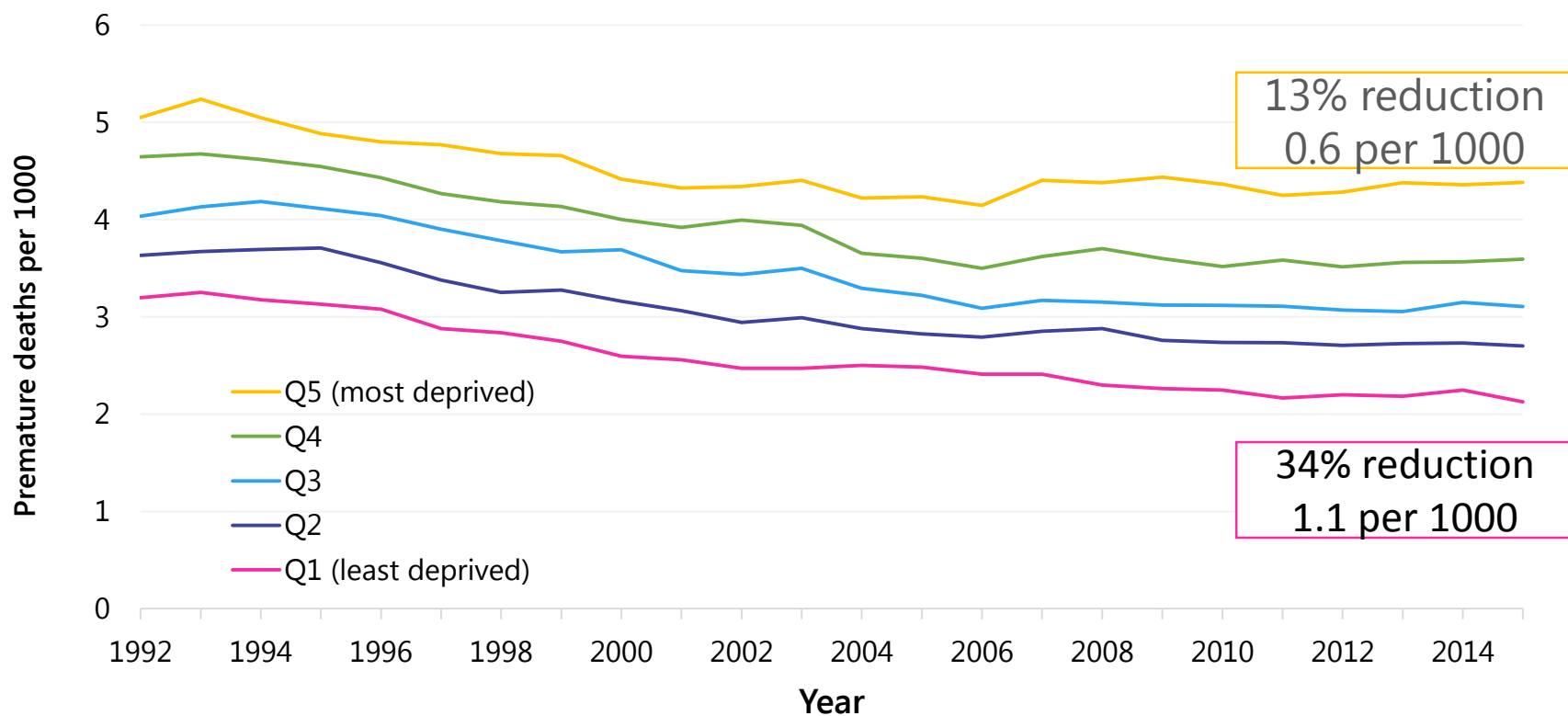
# Premature mortality and SES – Ontario

## Premature mortality by material deprivation quintile, deaths per 1000



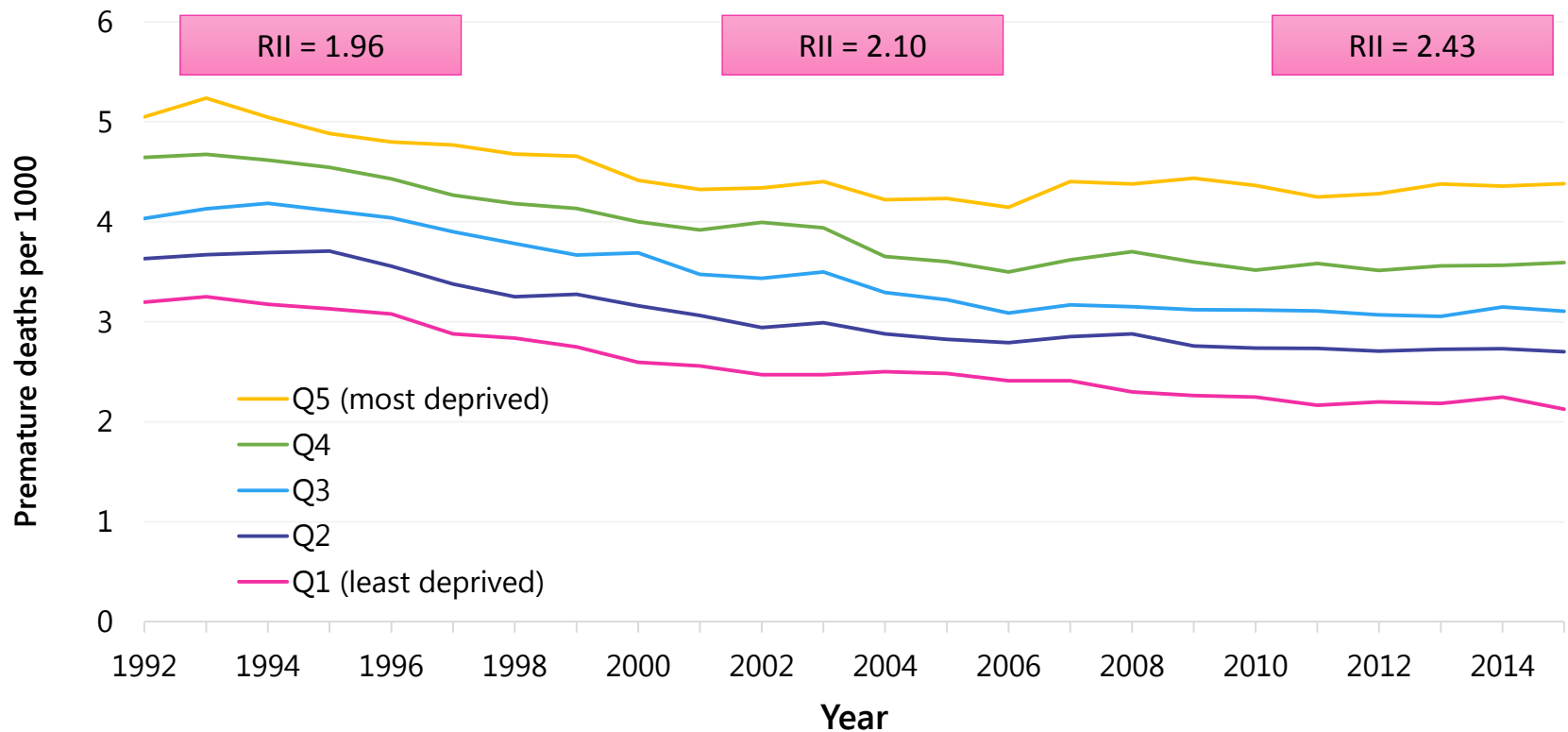
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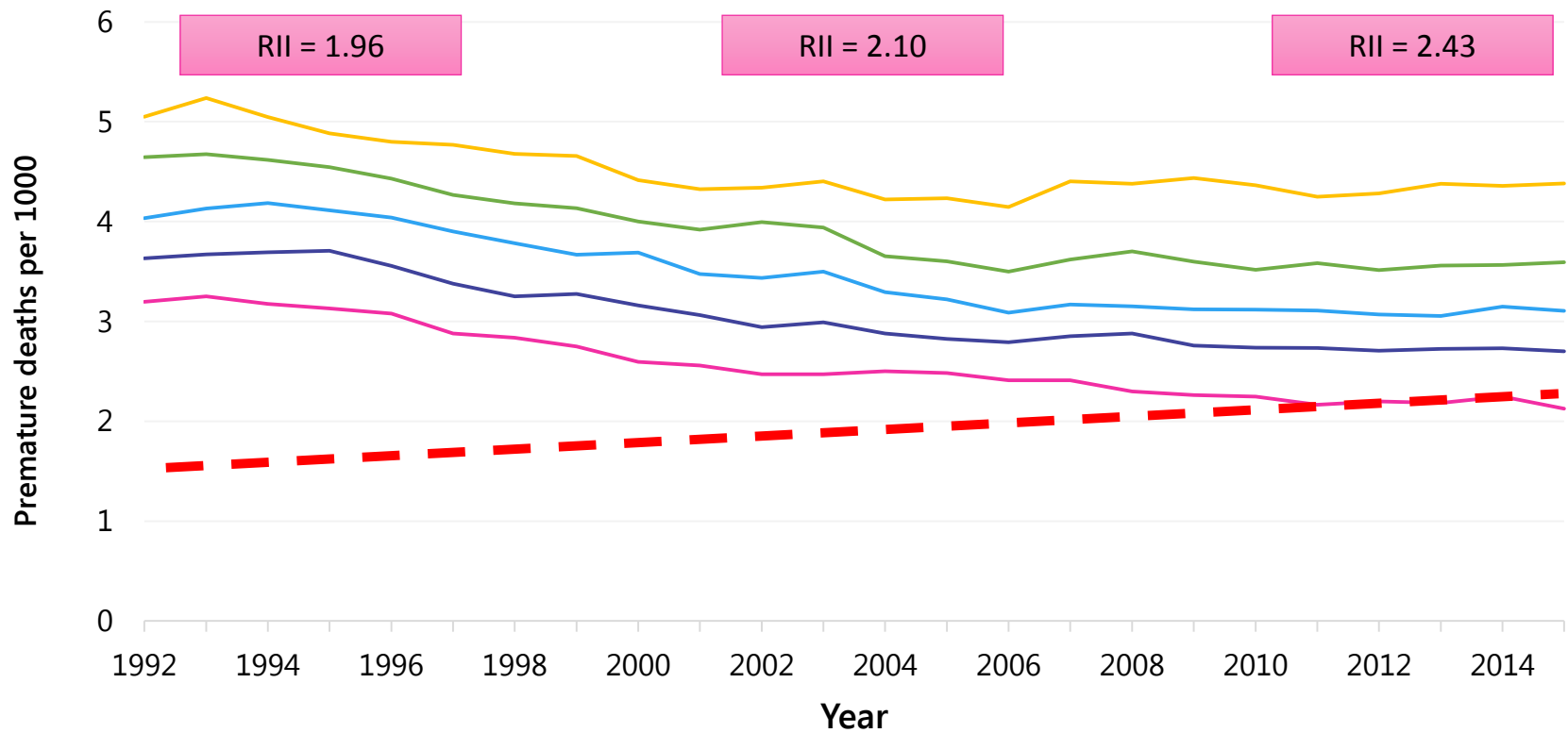
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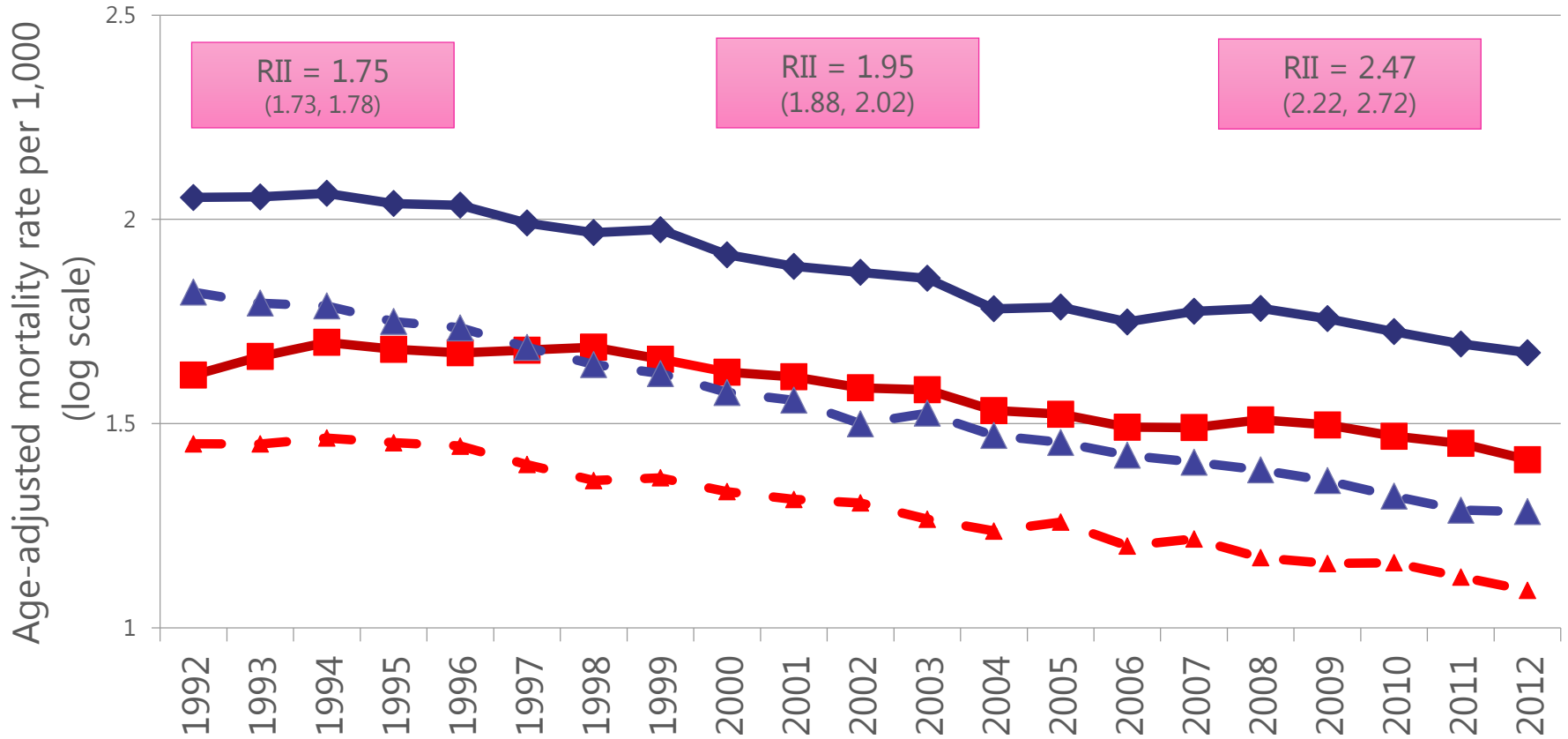


# Premature mortality and SES – Ontario

## Premature mortality by material deprivation quintile, deaths per 1000



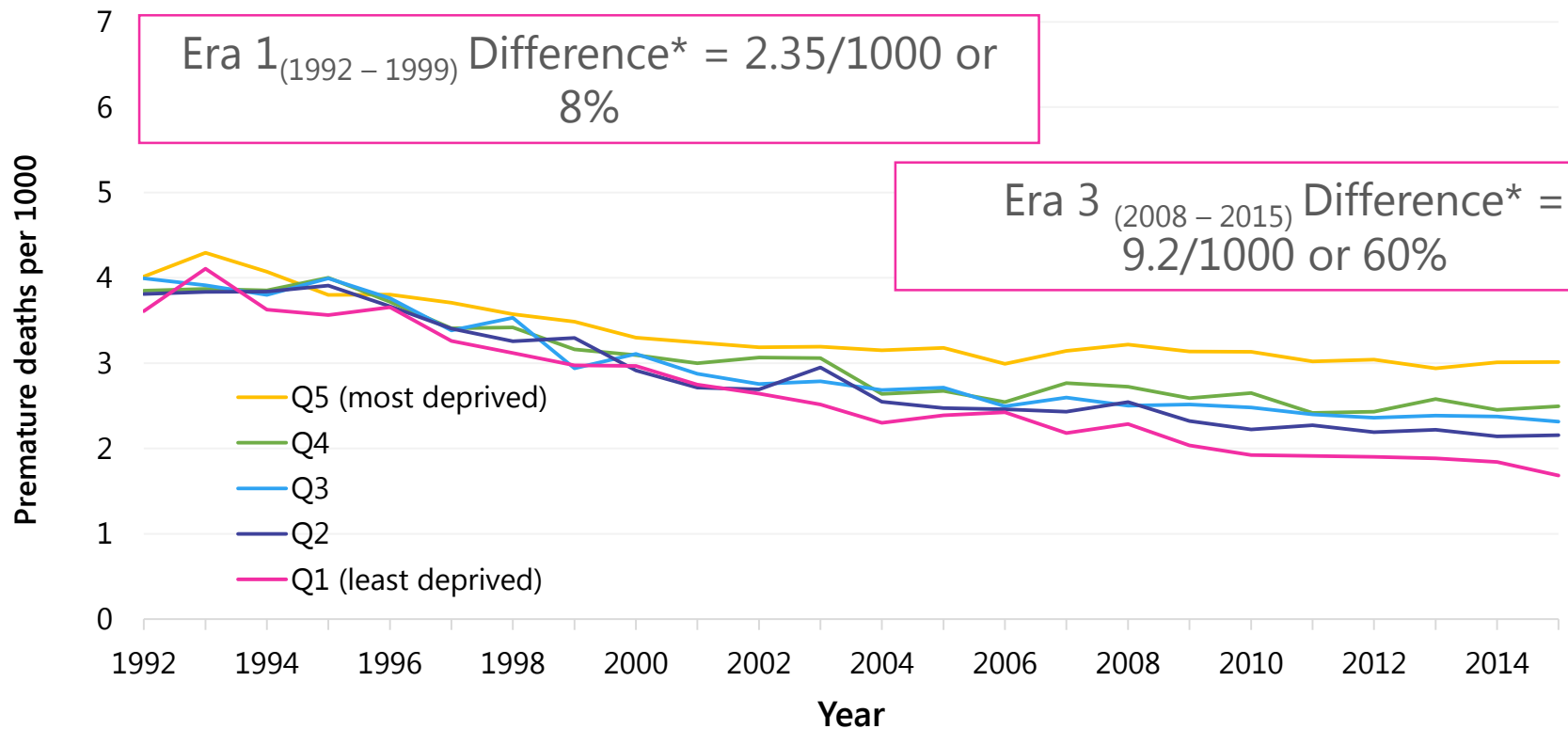
- ◆ Males - lowest income
- Females - lowest income
- ▲ Males - highest income
- ▲ Females - highest income



Rosella et al. BMJ Open 2016

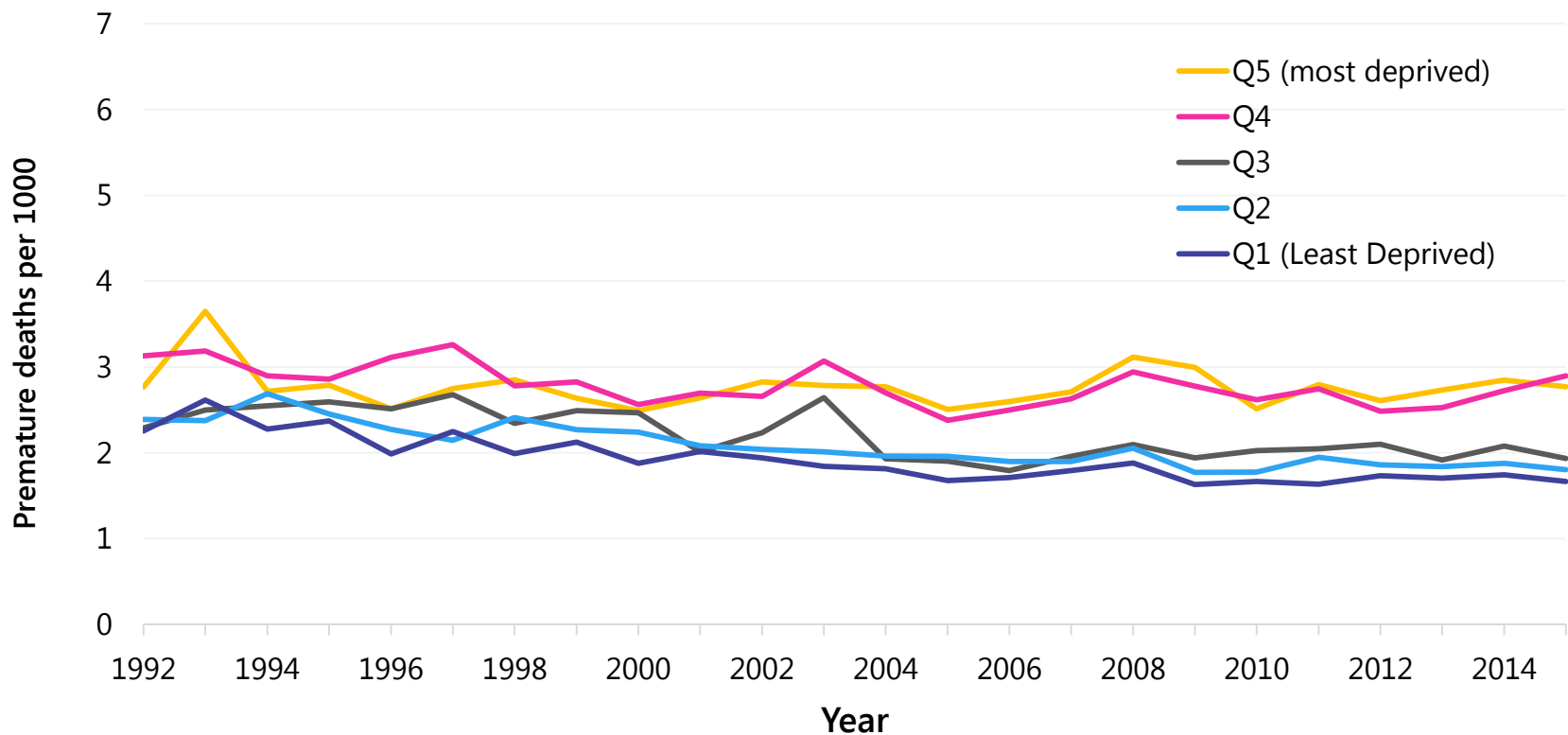
# Premature mortality and SES – Toronto

## Premature mortality by material deprivation quintile, deaths per 1000



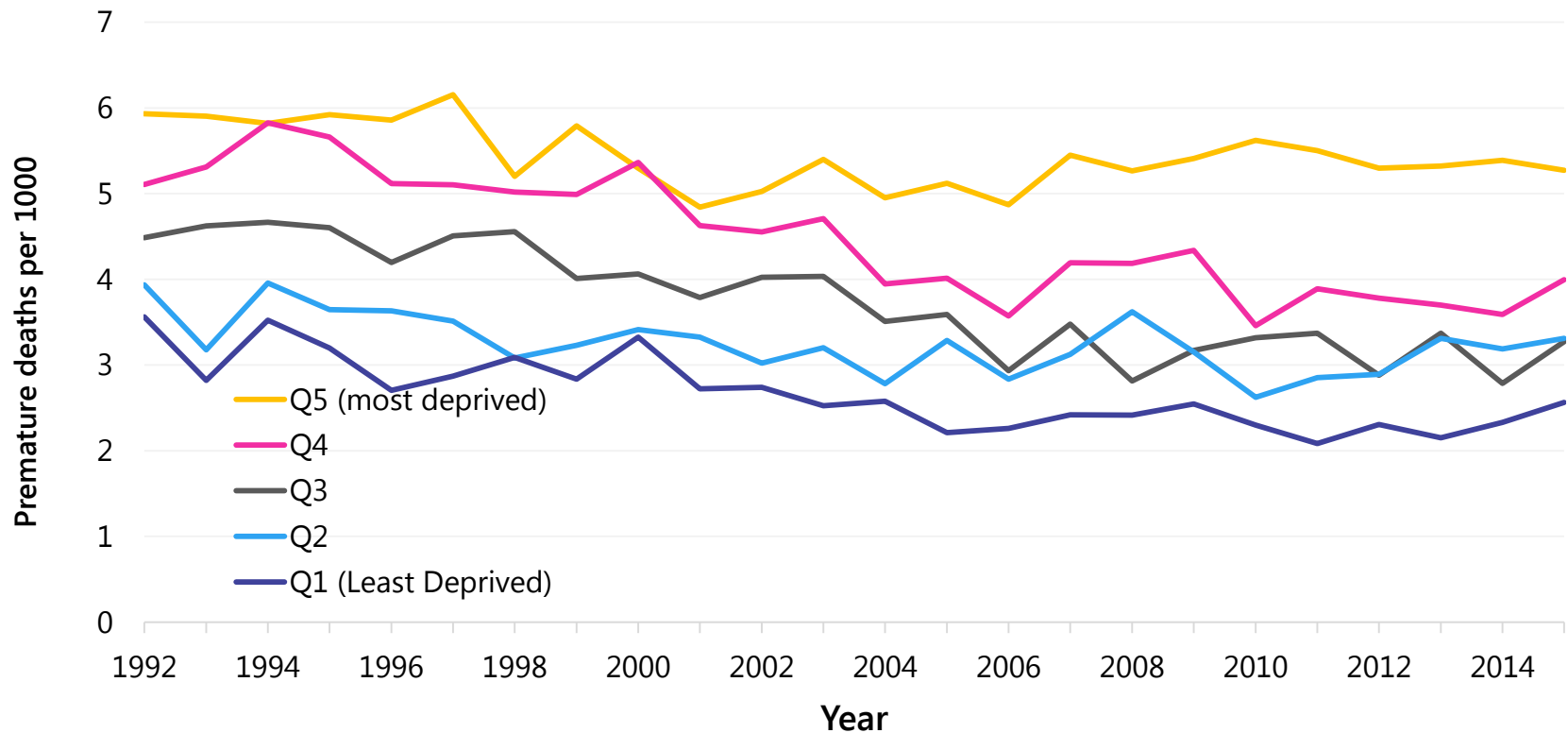
# Premature mortality and SES – Peel

Premature mortality by material deprivation quintile, deaths per 1000



# Premature mortality and SES – Hamilton

Premature mortality by material deprivation quintile, deaths per 1000



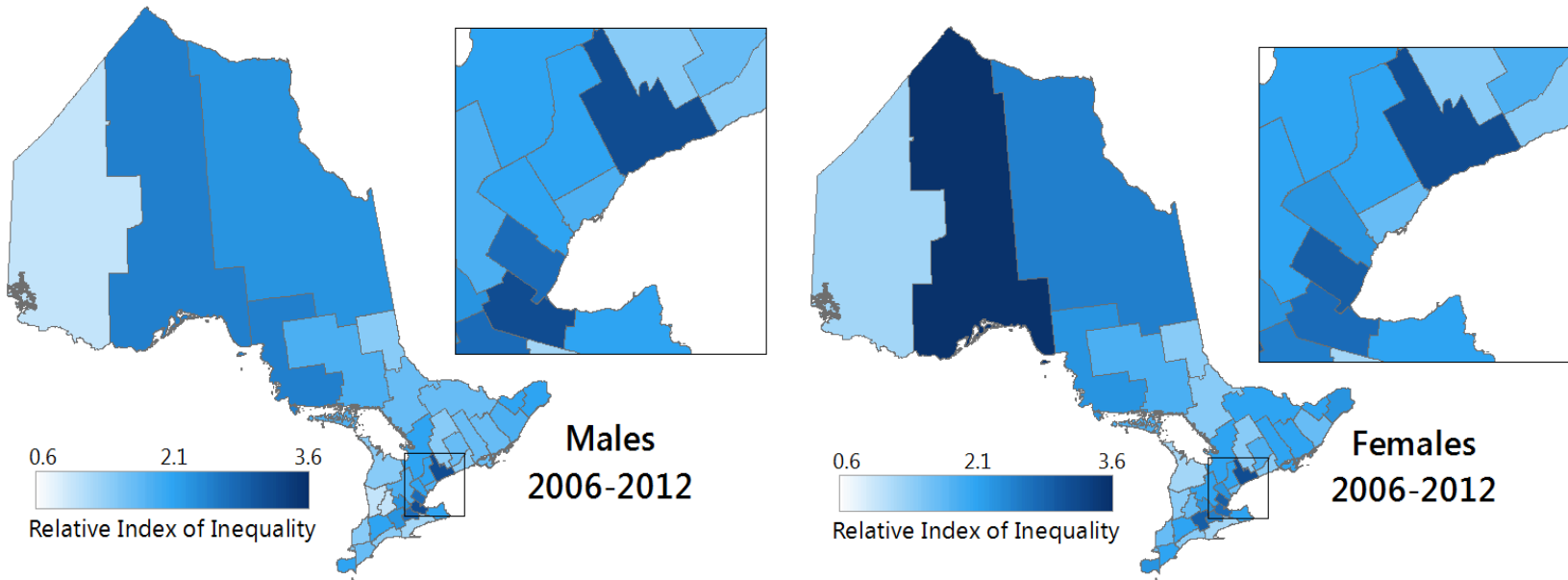
# Premature Mortality by Material Deprivation

Premature mortality (<75 years old) rate per 1000 population, according to the least deprived (Q1) and most deprived (Q5) neighbourhoods, 1992-2014



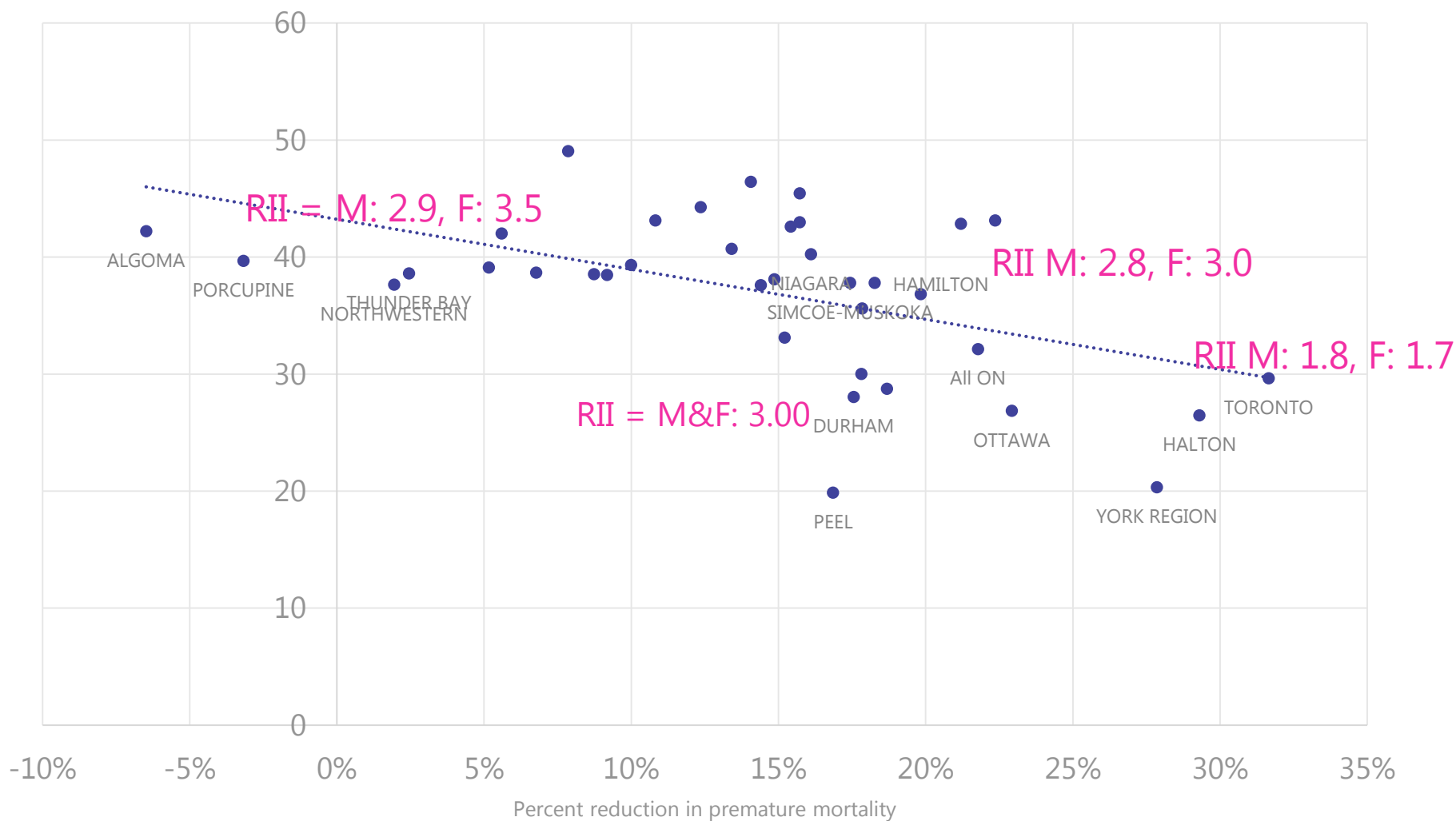
# Premature mortality and SES

## Relative Index of Inequality (RII)



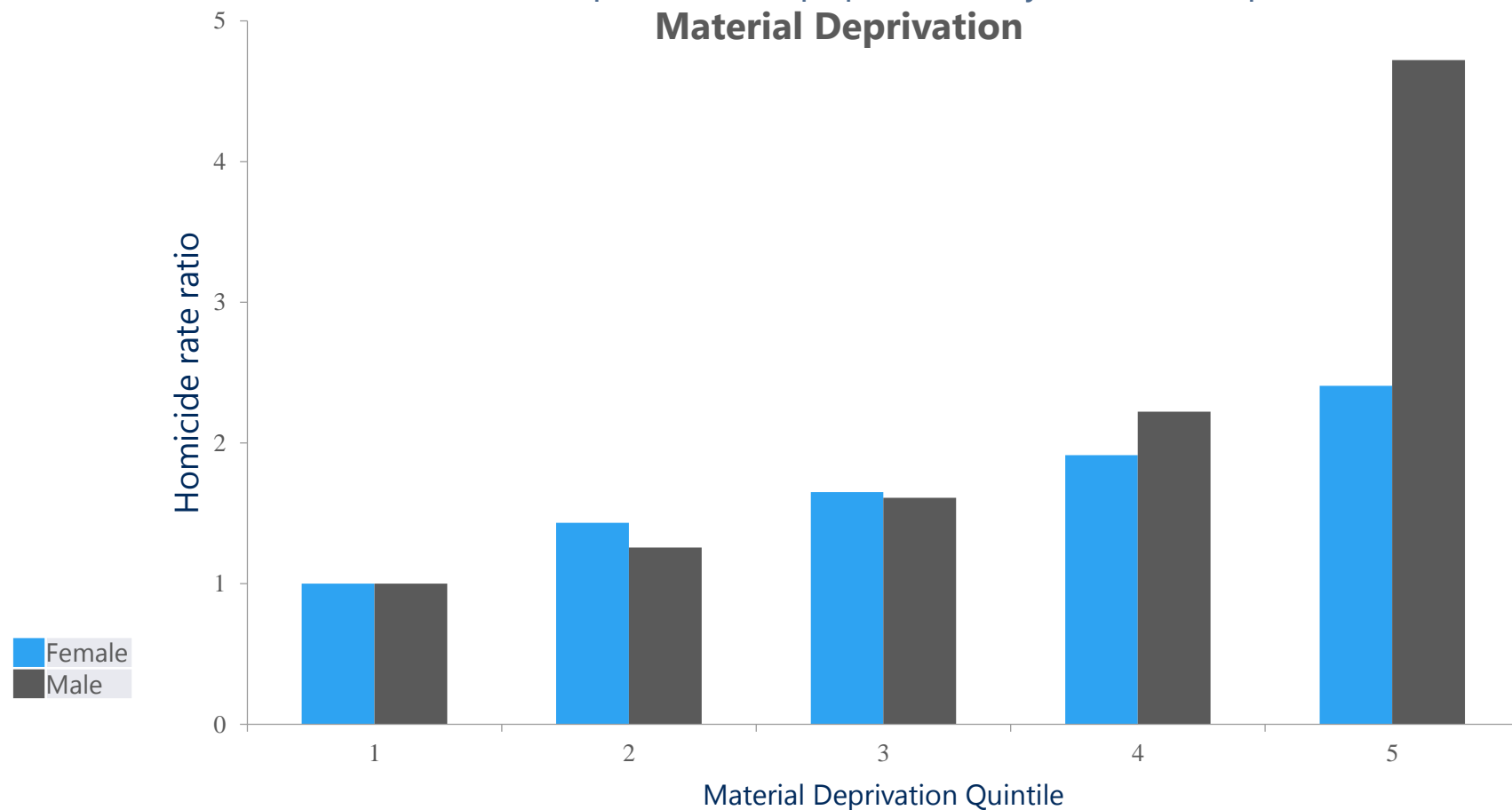
The Relative Index of Inequality (RII) describes the relative disadvantage associated with low socioeconomic status in a population

Percent reduction (1992 - 2015) in premature mortality according to baseline levels, by PHU



# Homicides in Disadvantaged Neighbourhoods

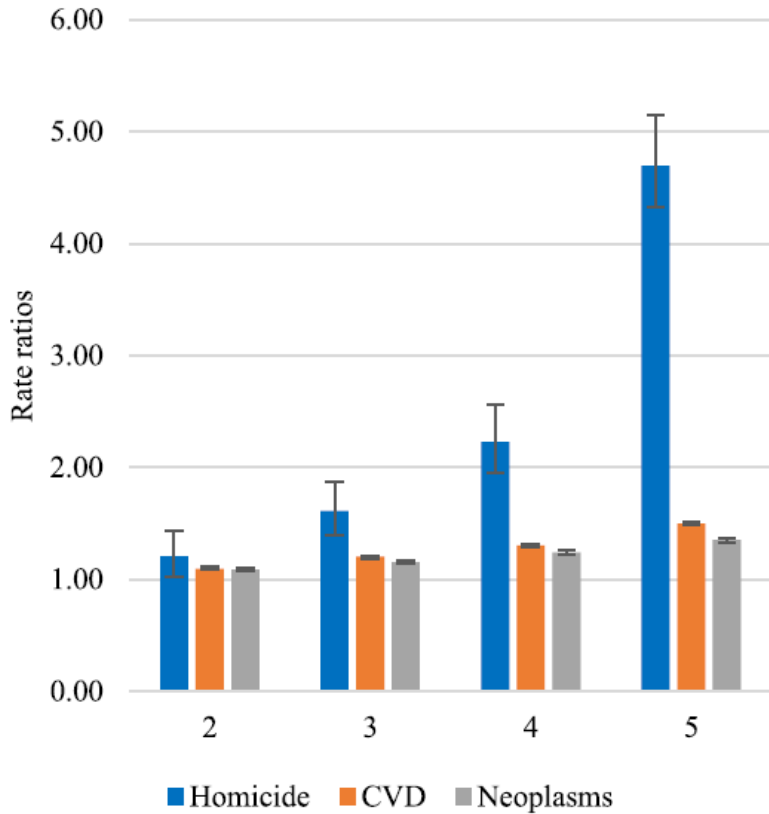
Homicide rate ratio in Ontario (per 100,000 population) by Material Deprivation, 1999-2012



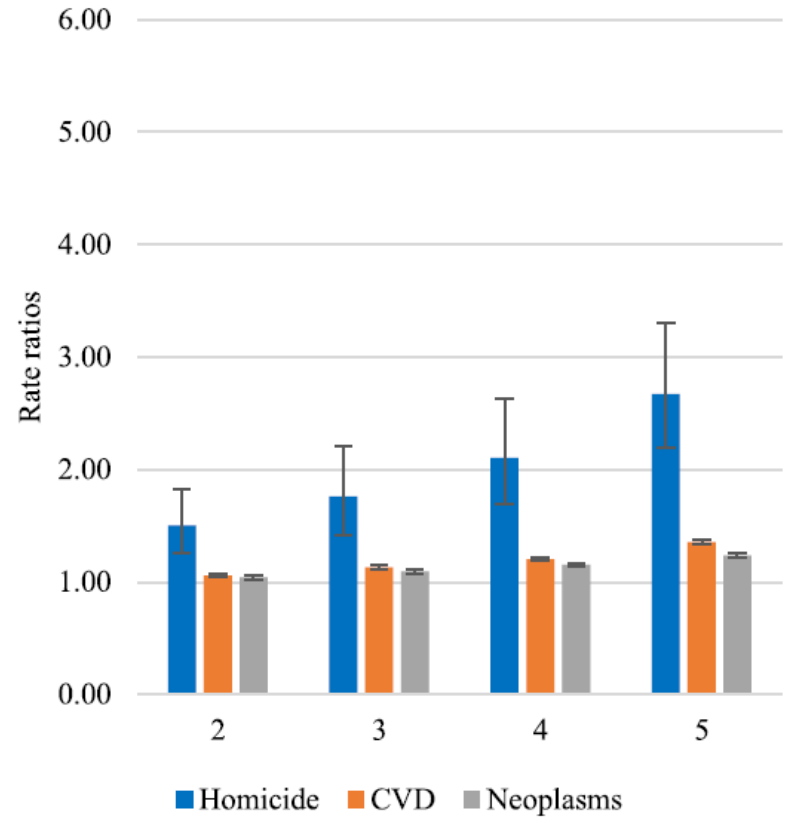
1 (the least deprived) to 5 (the most deprived)  
the first quintile is the reference group = to 1

# Material deprivation

Males



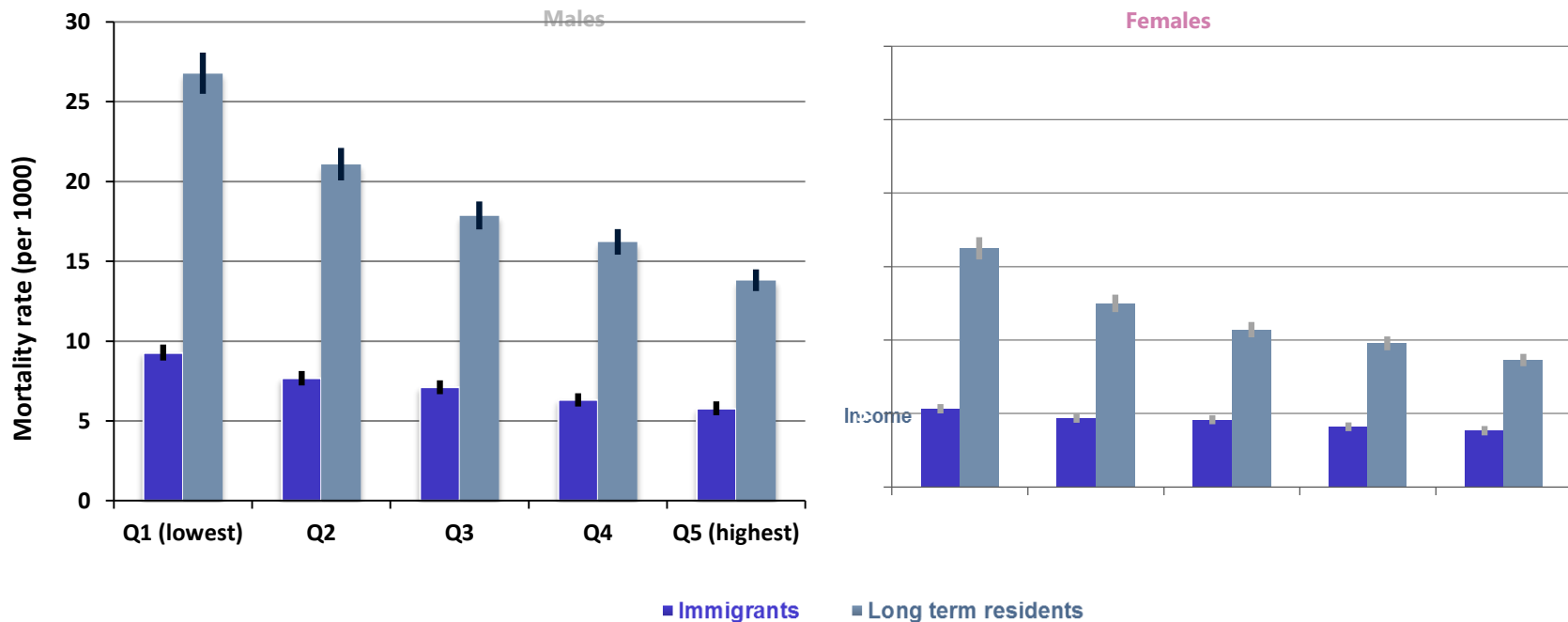
Females



# Mortality Trends by SES and Immigrants

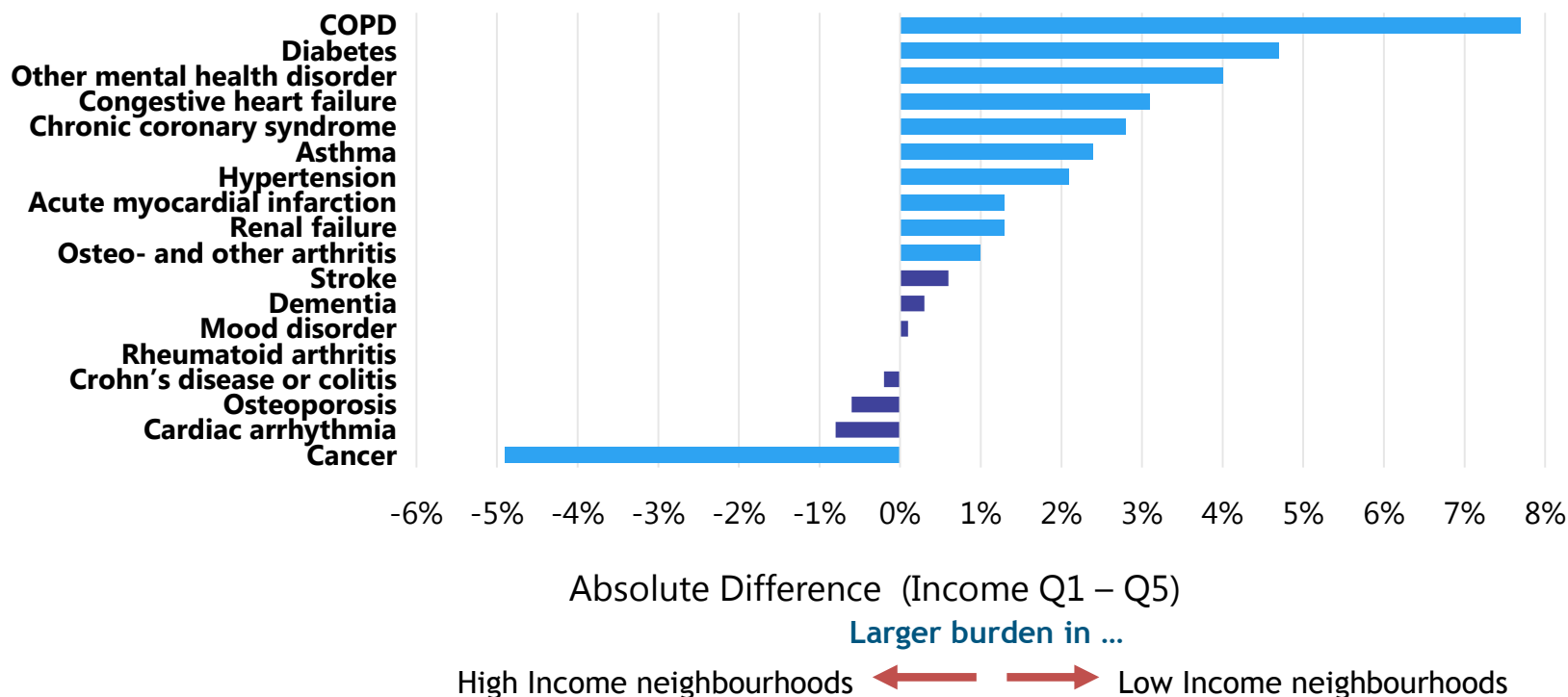
Irrespective of immigration status, a downward gradient in premature mortality was observed with each increasing income quintile.

Premature (<75 years) mortality rate (per 1000 population) in Ontario, according to **income quintiles** and **immigrant status**, 2002-2012

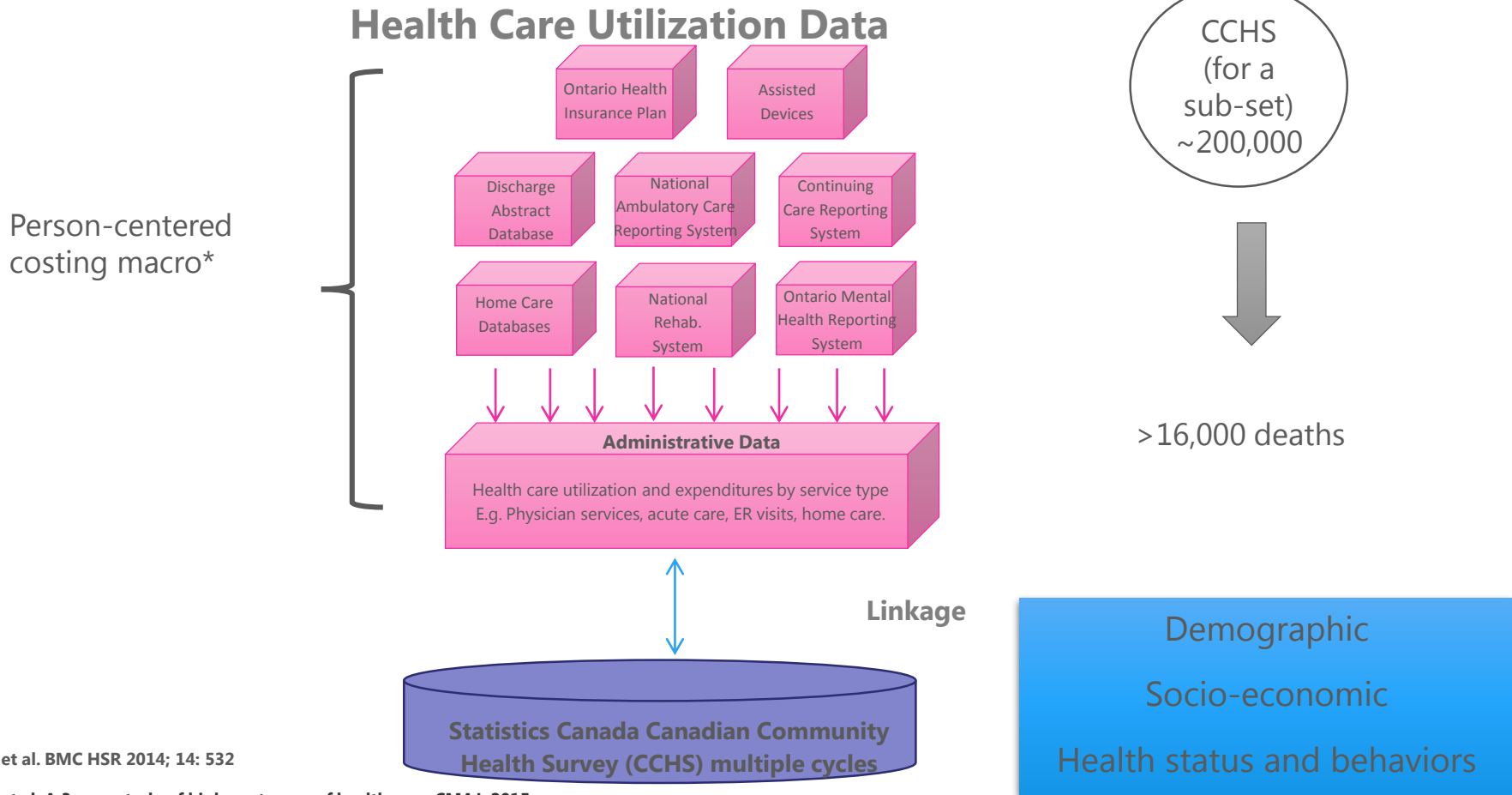


# Socioeconomic Gradients in Chronic Conditions at Time of Death

## AGE ADJUSTED ABSOLUTE PERCENTAGE DIFFERENCE In Chronic Condition At Time of Death (1994-2013) Between Area Income Quintile 1 (lowest) and 5 (highest)



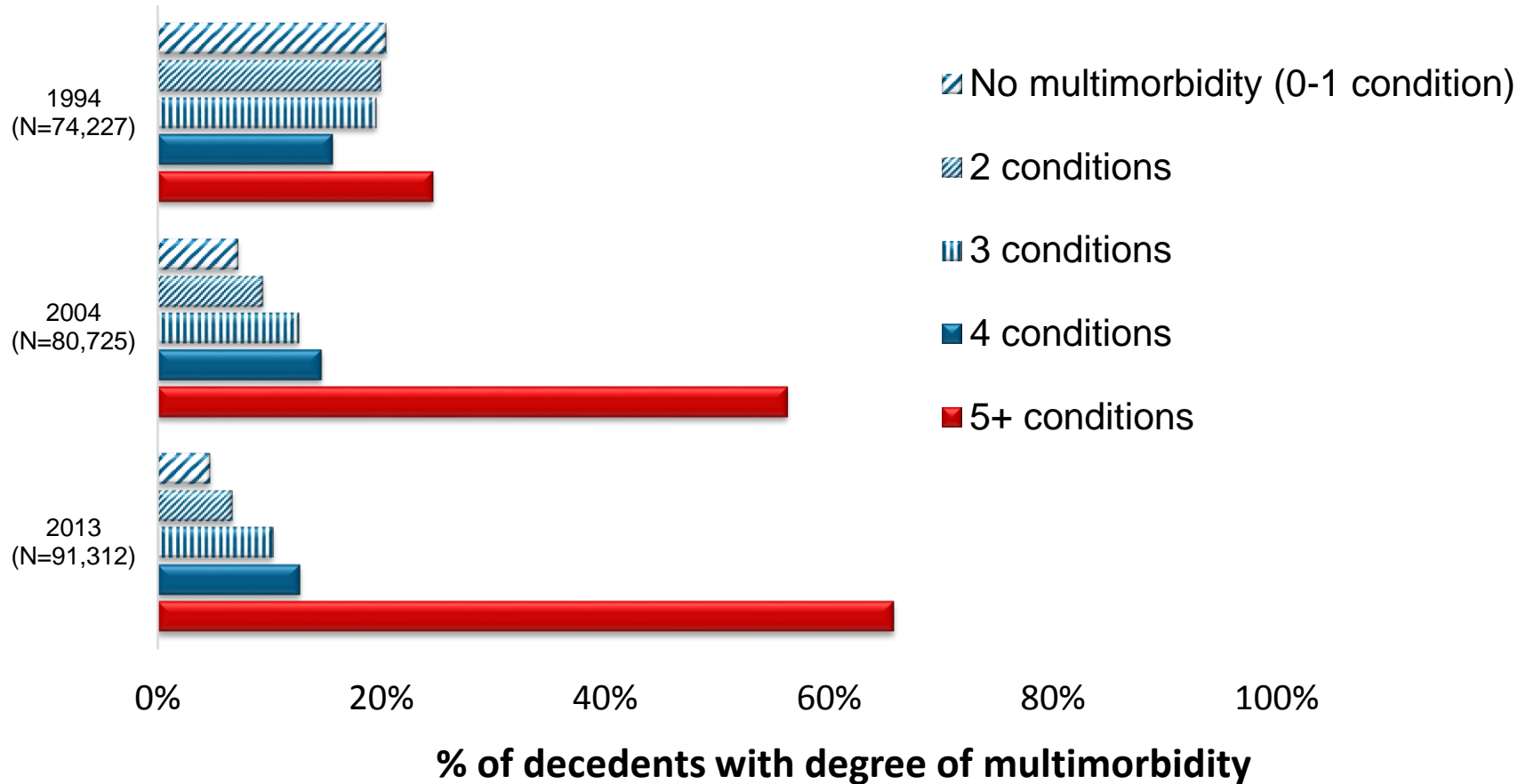
# Data Linkage

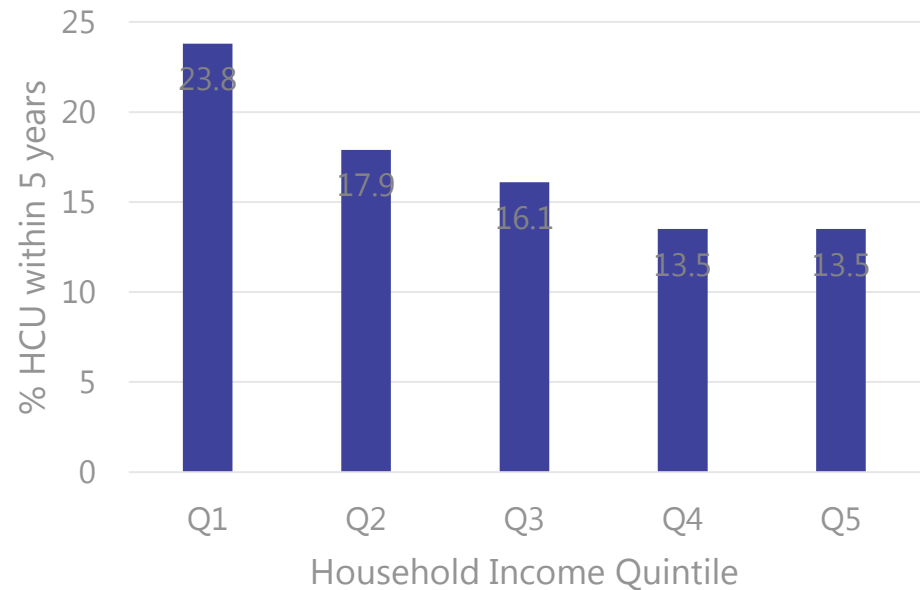
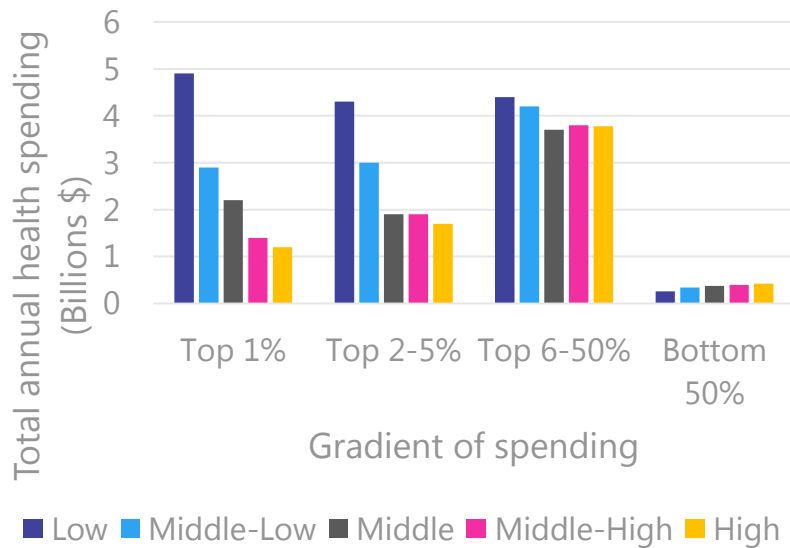


Rosella et al. BMC HSR 2014; 14: 532

\*Wodchis et al. A 3-year study of high-cost users of health care. CMAJ, 2015

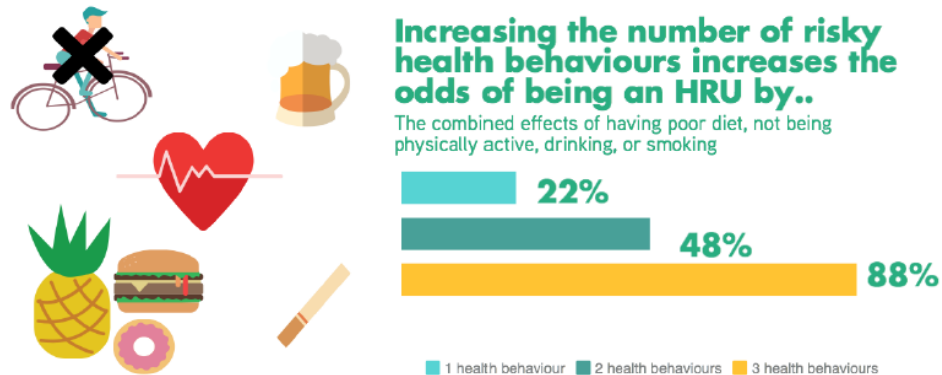
# The proportion of Ontarians that died with five or more chronic conditions rose from 39% in 1997 to 65% in 15 years





- Gradients persist with: Individual, household and ecological SES measures (including marginalization indices)
- Strongest with food insecurity and home ownership – associations strengthened after covariate adjustment

# Impact of Health Behaviours on HRU status

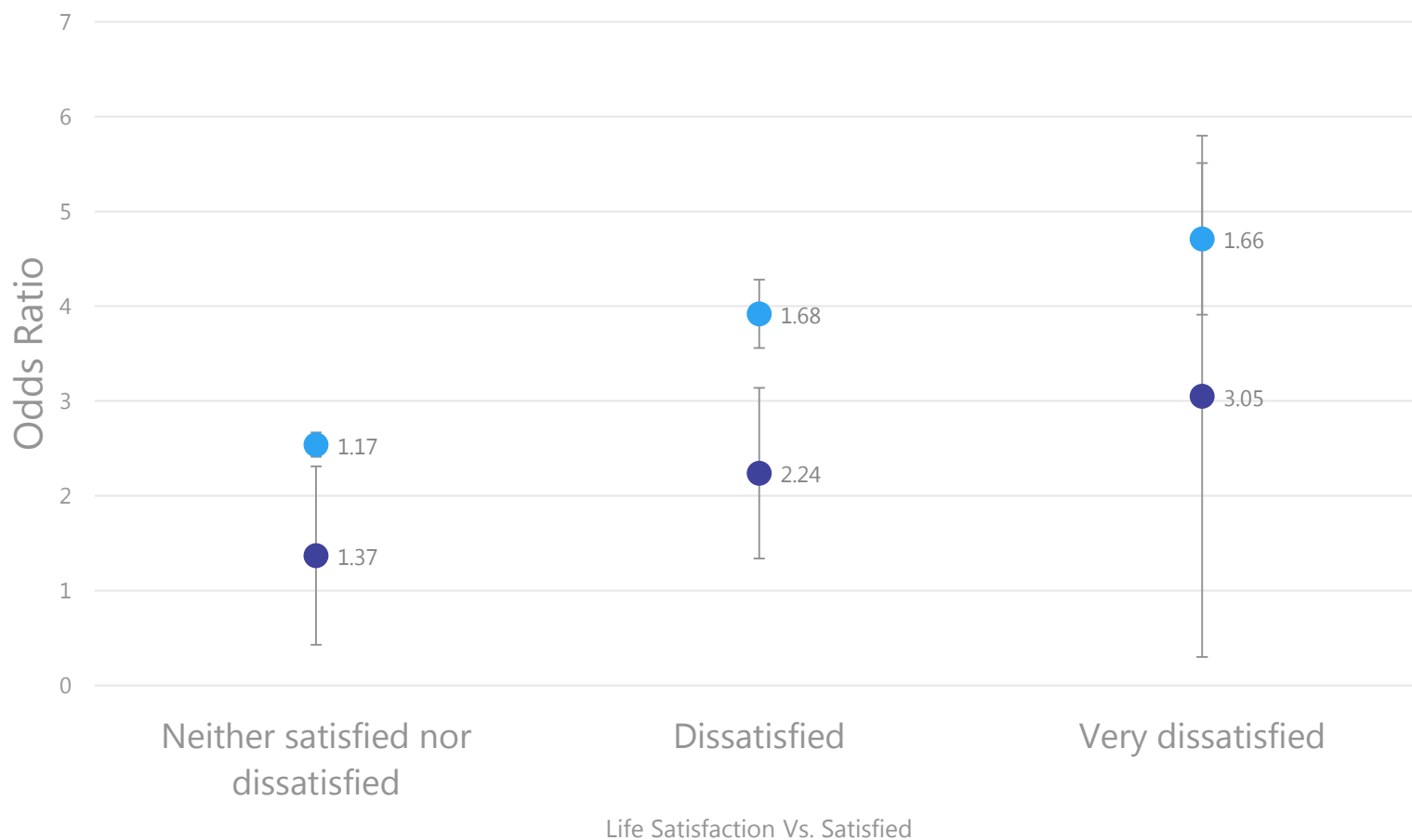


## Health behaviours linked to being in Top 5% High Resource Users



Large portion of clinical variation in HCU explained by: age, sex, ethnicity, immigration, marital status, income, having a family physician, health behaviours and self-perceived health

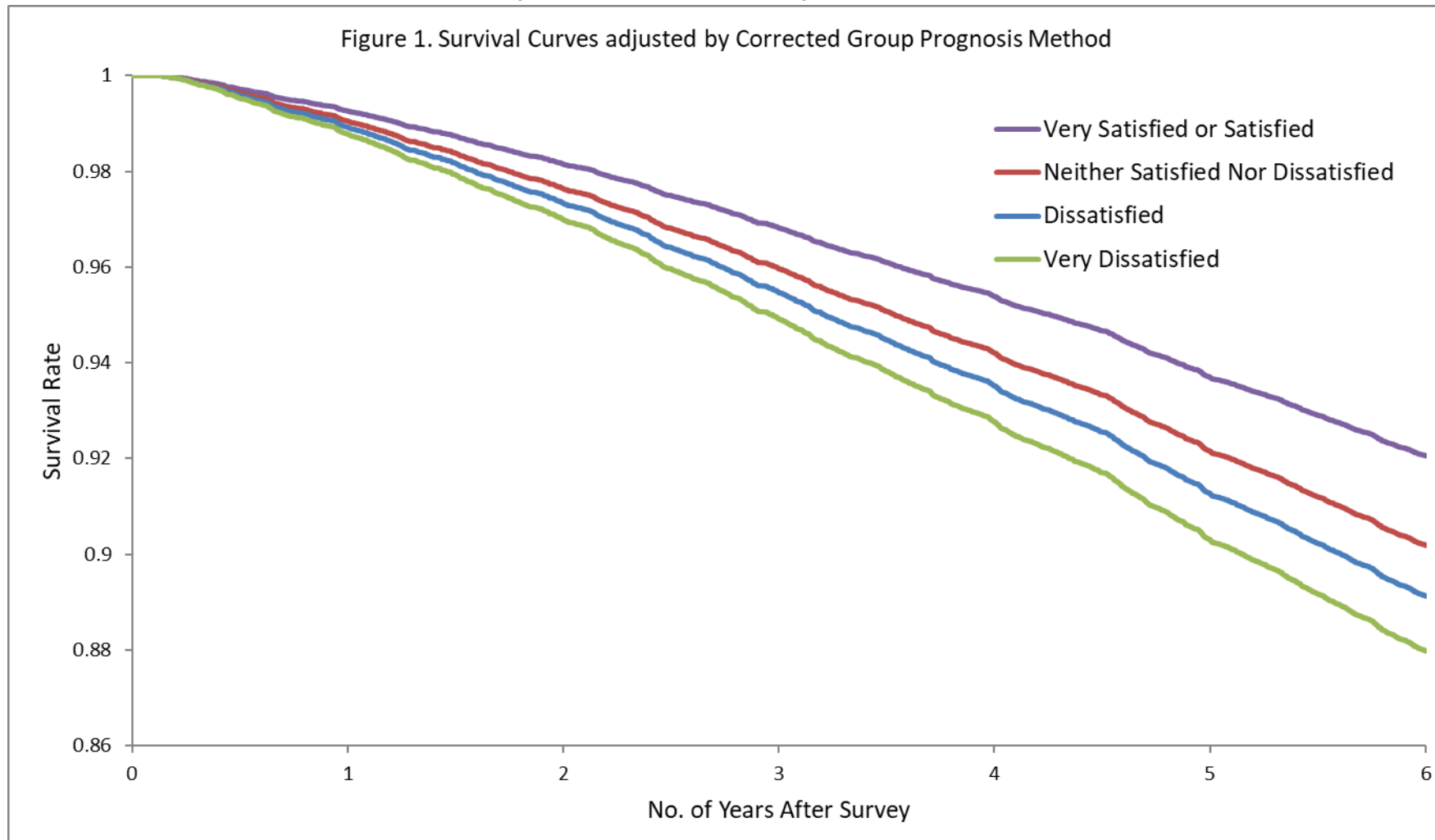
Multivariable adjusted odds ratios\* and 95% confidence intervals from multinomial logistic regression model across gradients of utilization (Top 5%, Top 6-50%, Bottom 50% (reference))



\* Fully adjusted model includes age, sex and adjusted diagnostic groups (ADG) comorbidity score, smoking, alcohol consumption, physical activity level, immigrant status, survey cycle and household income.

Goel et al. 2018 AJPM; Rosella et al. AJE, 2018 (in press)

Adjusted survival curves according to baseline life satisfaction among a cohort of 73,904 pooled Canadian Community Health Survey participants surveyed from 2003 to 2007 and followed to 2015 (Ontario, Canada).



# Back to the 3 questions...

- Is our health system contributing to reducing and treating illness? (effectiveness)
- Is our health system reaching those who need it? (equity)
- Is our health system improving the health of the population?

# Key Messages for Ontario

Mortality has fallen  
in Ontario

- However, we are average compared to peer regions

Ontarians are living  
longer

- Benefits not being shared by all Ontarians (maps, trends)

The burden of  
chronic diseases are  
high and variable

- A greater focus on prevention is warranted

# Conclusions and next steps

- **Measuring inequities using linked data offers key information about our health system system**
  - Increasing linkages to a broad range of data sources that better reflect the determinants of health and enrich measurement
  - Deep dives versus zooming out
- **Ecological versus individual measures; types of measures**
- **Re-orient the system towards people and the determinants of health**
  - Embrace a much broader vision of health and re-orient to better reflect needs of people and communities
  - Metrics of health system functioning must reflect population health

# Acknowledgements



Dr. David Henry



# Thank you – Questions?

<https://pophealthanalytics.com/reports/>

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