Using linked data for advanced analytics in health research

Spotlight on the Canadian Census Health and Environment Cohorts (CanCHECs)

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Canada

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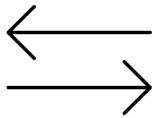

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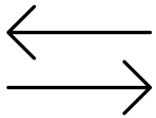

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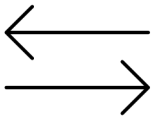

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- administrative health outcome data generally lack detailed information about the characteristics of individuals experiencing the outcomes

The CanCHECs

- Canadian Census Health and Environment Cohorts (CanCHECs)
  - Linkage between long-form census respondents for census years 1991, 1996, 2001, 2006 and 2016 (National Household Survey respondents in 2011) with administrative health data and annual mailing address postal codes

The CanCHECs

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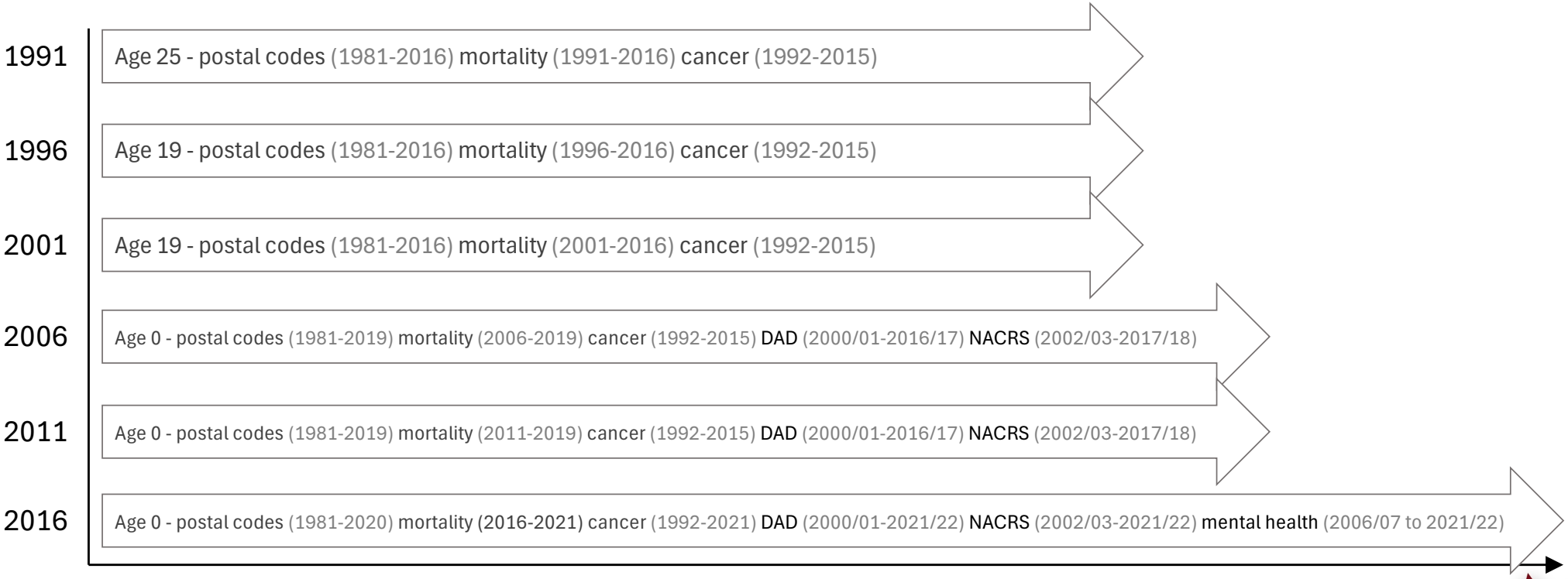

DAD = Discharge Abstract Database, NACRS = National Ambulatory Care Reporting System

The CanCHECs

Mortality

(2023) Mortality inequalities of Black adults in Canada

(2024) Risk factors and inequities in transportation injury and mortality in the CanCHECs

(2022) Industrial air pollutant emissions and mortality from Alzheimer's disease in Canada.

Cancer

(2023) Site-specific cancer incidence by race and immigration status in Canada 2006–2015: a population-based data linkage study

(2022) Assessing geographic and industry-related trends in bladder cancer in Ontario: A population-based study.

Hospitalization

(2024) Creating an 11-year longitudinal substance use harm cohort from linked health and census data to analyze social drivers of health

(2020) Geographic variation in preventable hospitalisations across Canada: a cross-sectional study

Study

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Impact of lowering fine particulate matter from major emission sources on mortality in Canada: A nationwide causal analysis

Hong Chen[a,b,c,d,1], Matthew Quick[e], Jay S. Kaufman[f,g], Chen Chen[h], Jeffrey C. Kwong[b,c,d,i], Aaron van Donkelaar[j], Jun Meng[j,k], Randall V. Martin[j], JinHee Kim[b,d], Eric Lavigne[l,m], Li Bai[c], Yi Li[f], Michael Tjepkema[e], Tarik Benmarhnia[h], and Richard T. Burnett[a]

Edited by Maureen Cropper, University of Maryland, College Park, College Park, MD; received June 3, 2022; accepted October 17, 2022

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- produce nationally representative estimates from the 2006 CanCHEC of
- the health benefits resulting from ambient fine particulate matter ($PM_{2.5}$) reductions across multiple mitigation strategies, emission sources, and time periods over the course of a decade.

Study

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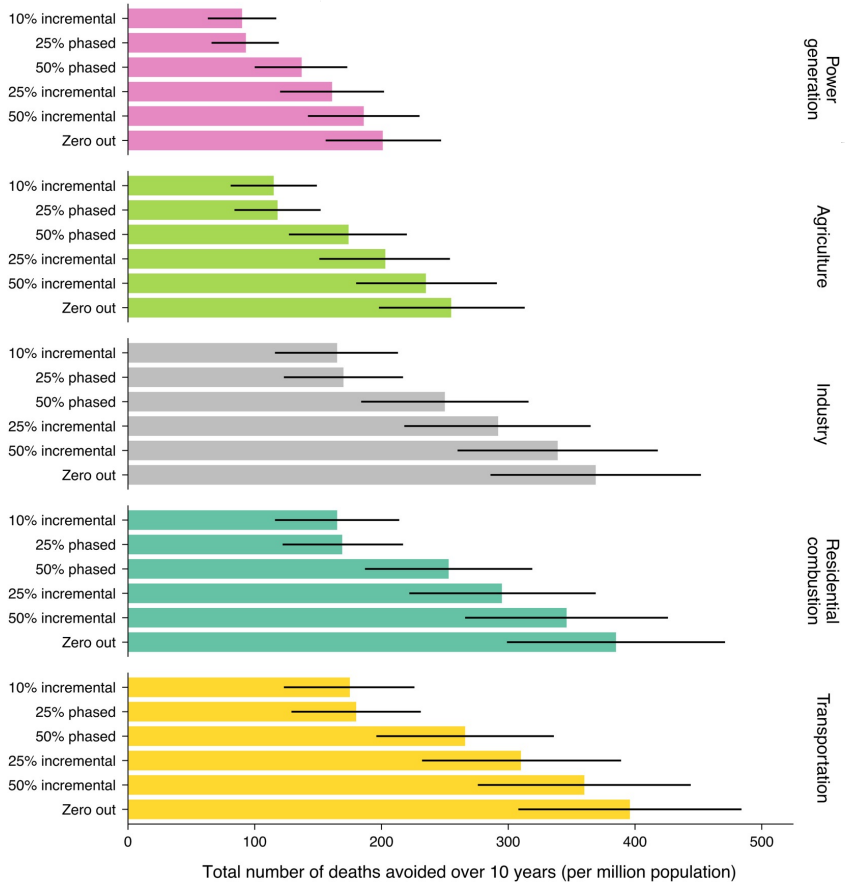
1. calculated the number of premature deaths that would have been averted if air pollution had decreased
2. derived the number of years of life that would have been gained if air pollution had decreased
3. computed the economic benefit from these interventions using willingness-to-pay metrics that account for both direct and indirect costs

1. Deaths averted

If $PM_{2.5}$ from each source was reduced annually by 10% compared with the natural course:

- 90 fewer deaths (95%CI: 63–117) per million from power generation
- 115 fewer deaths per million from agriculture
- 165 fewer deaths per million from industry
- 165 fewer deaths per million from residential combustion
- 175 fewer deaths per million from transportation



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2. Years of life gained

Combined, reducing all five sources by X% would have saved Y life-years per million

X	Y
10%	2,783
25%	5,947
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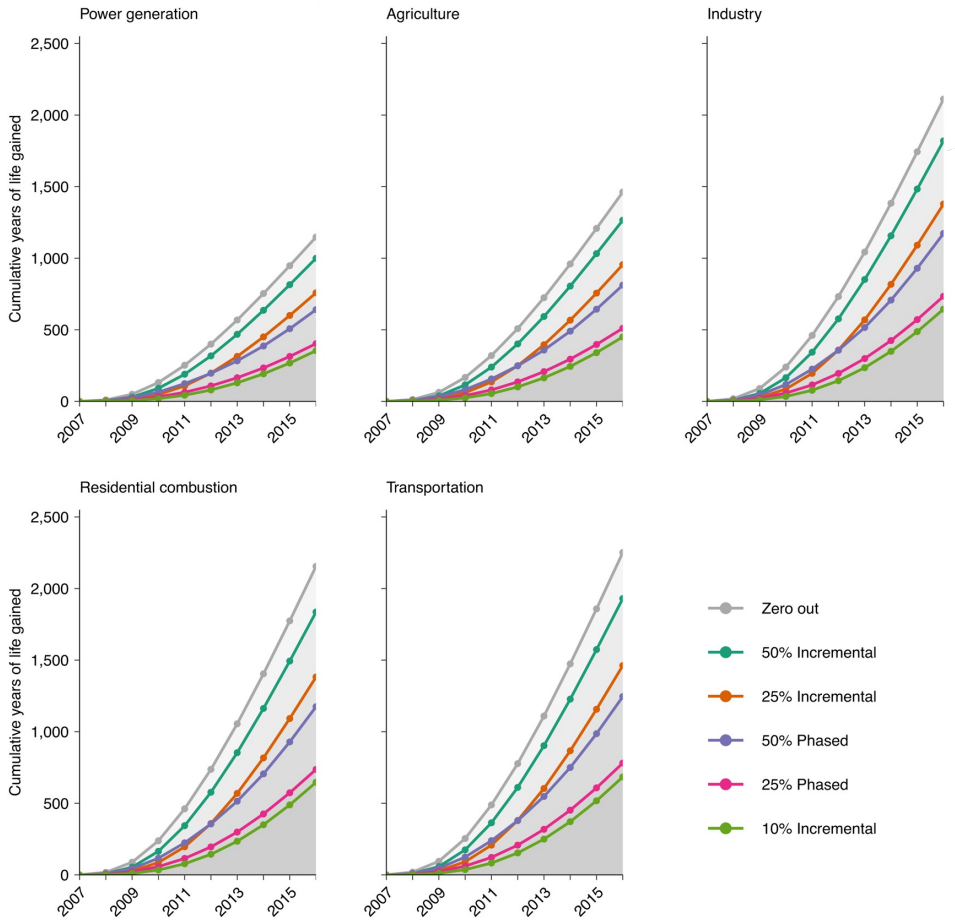

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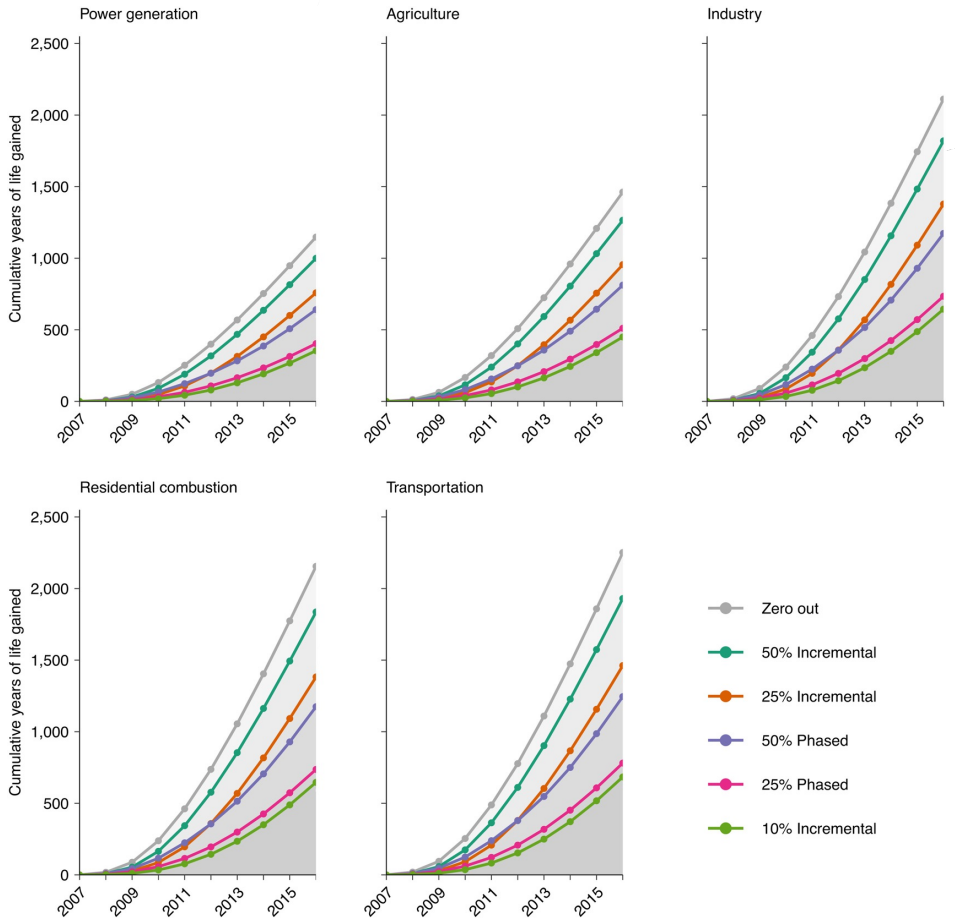
The bulk of life-years saved would have been experienced in the longer term e.g. more lives saved during the last few years of the period than within the first few years



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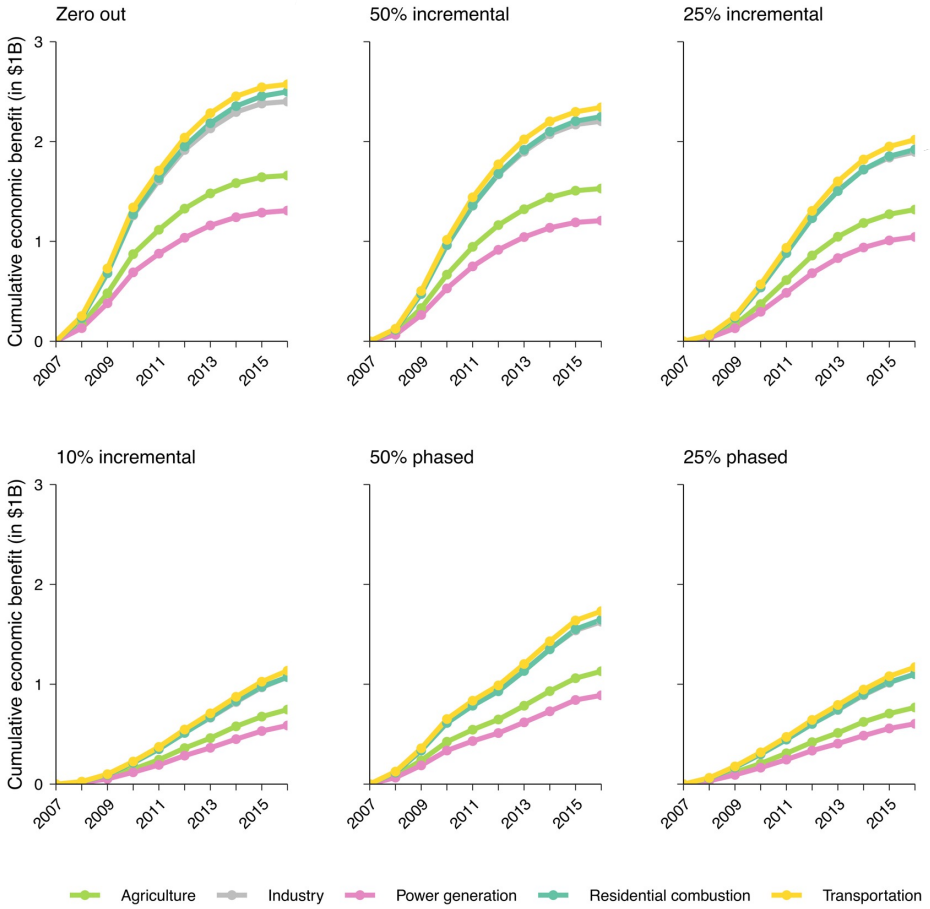
If the zero-out strategy had been deployed at baseline, per million population, the related health impacts by 2016 for all sources combined would have the economic valuation of $10.4B (95% CI: 8.1–12.7)



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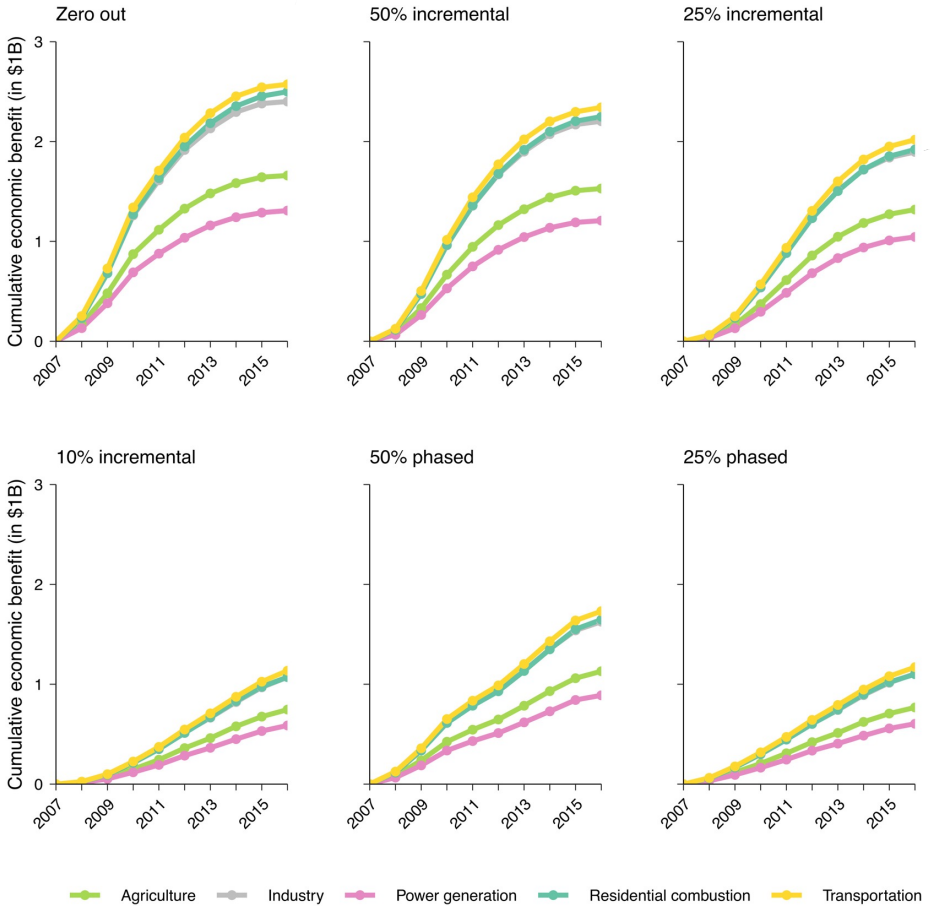

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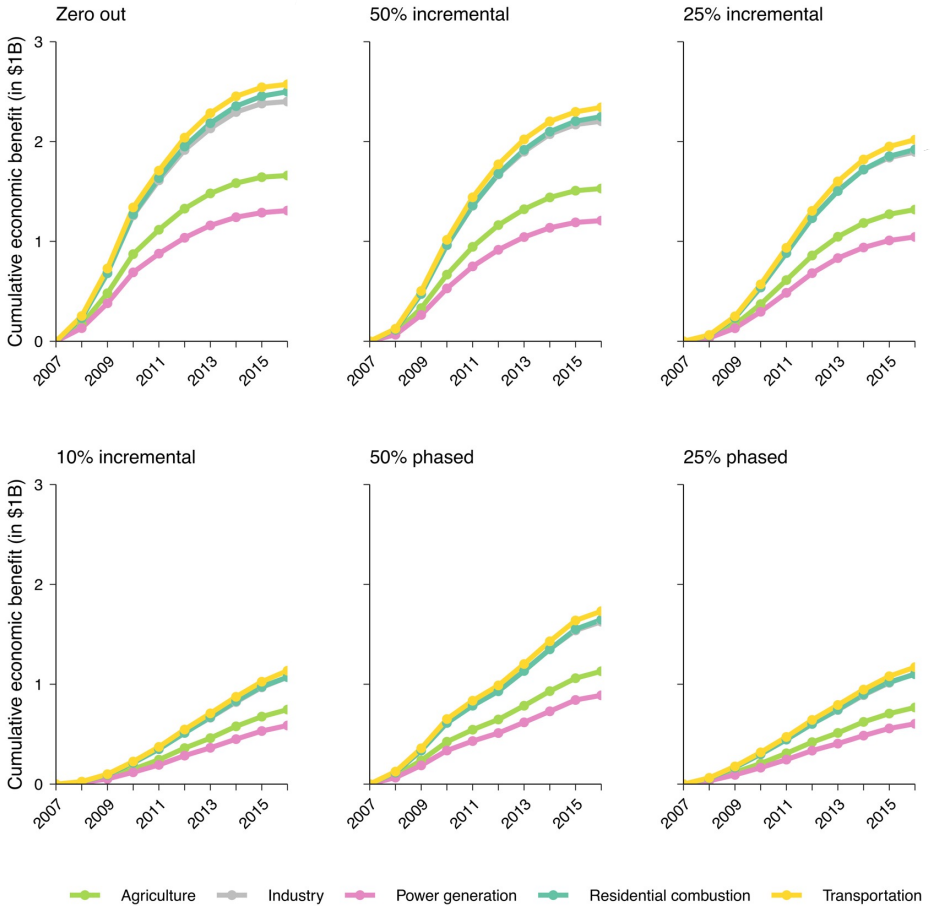
The bulk of economic benefit occurred over the long term



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Challenges of doing advanced analytics with census cohort data

- Big datasets, computational needs, analysis speed
- Hard to implement machine learning approaches

More information about census health cohorts

https://www.statcan.gc.ca/en/microdata/data-centres/data/canchec

https://crdcn.ca/data/canadian-birth-census-cohort/

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