



# Linked health data: New research opportunities for health information

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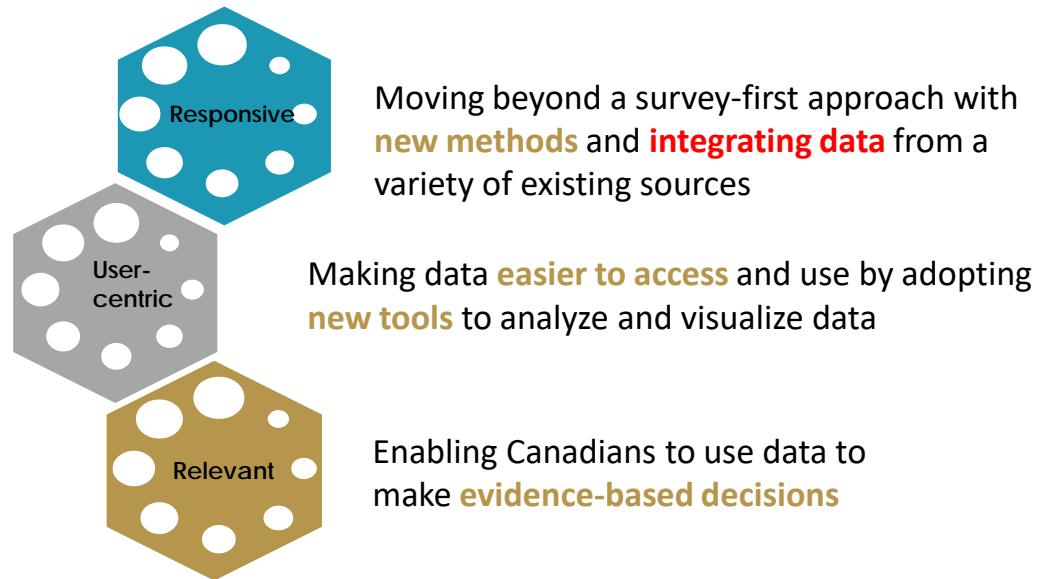
Delivering insight through data for a better Canada



Statistics  
Canada Statistique  
Canada

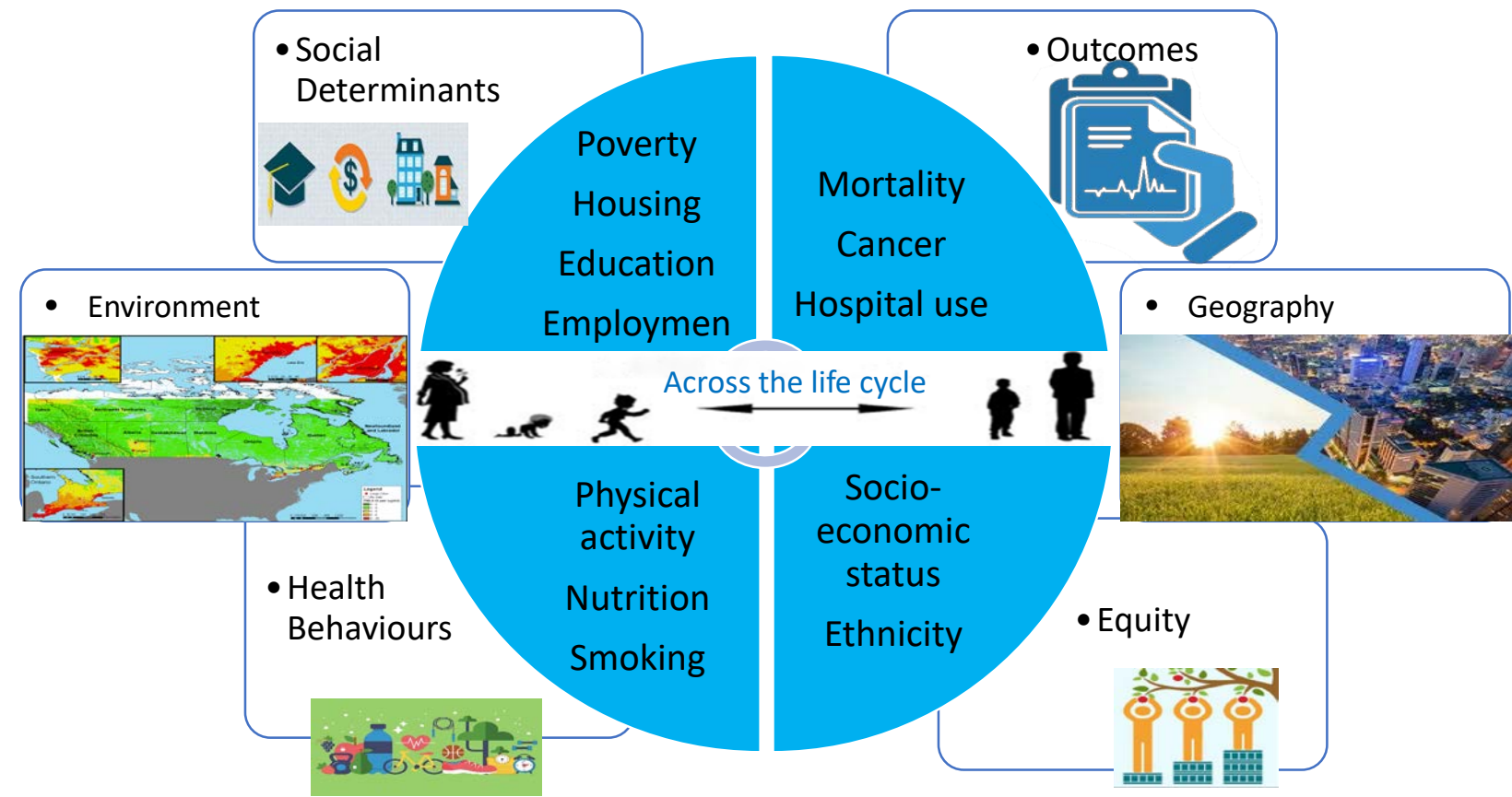
Canada

## Statistics Canada Modernization – Data Integration key to the future

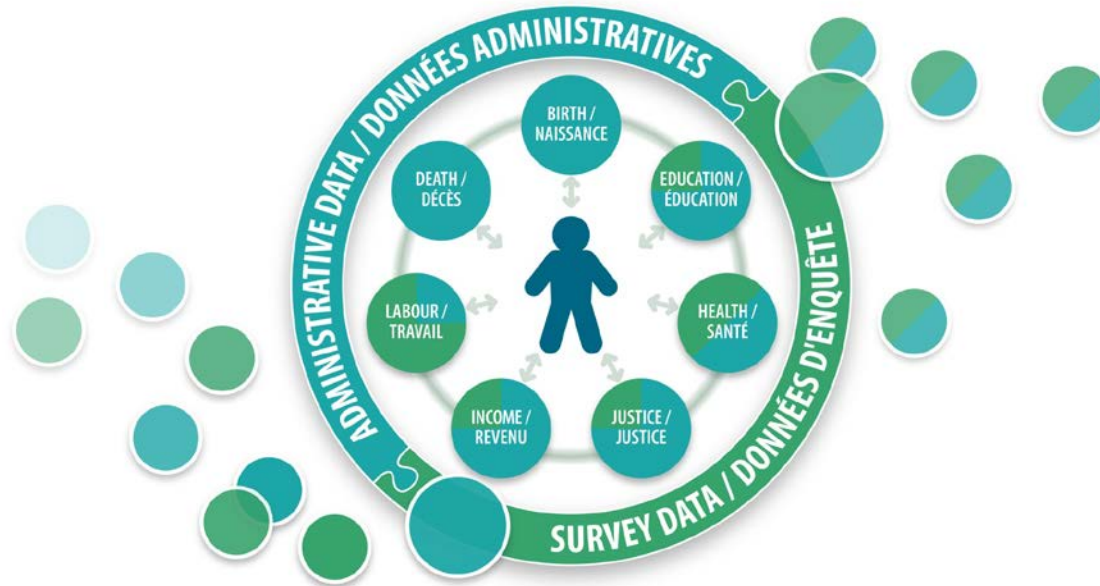


Enabling efficient data management and access

# Population Health Data @StatCan



## Social Data Linkage Environment (SDLE)



<https://www.statcan.gc.ca/eng/sdle/index>

- Secure **virtual linkage environment** that stores only personal identifiers
- SDLE is **NOT a large integrated data** base of survey information about individuals.
- **Strong governance**, adherence to policy and privacy requirements - *Directive on Microdata Linkage*
- **Suite of services, tools and support** for analysts and external researchers

# Canadian Census Health and Environment Cohorts (CanCHECs)



## What are the CanCHECs?

Population-based linked datasets that follow the non-institutional population (long-form) at time of census for different health outcomes

Mortality

Hospitalization


Cancer

## Why the CanCHECs?

National health administrative data lack socio-economic and ethno-cultural identifiers beyond basic demographic data

Census data (long-form) contain detailed socio-economic and ethno-cultural information

## Why the CanCHECs?



Putting them together enables us to examine administrative health outcomes across many characteristics including income, education, occupation, language, ethnicity, First Nations, Métis, Inuit, and immigration





# The CanCHEC cohorts

1991  
Cohort

1996  
Cohort

2001  
Cohort

2006  
Cohort

2011  
Cohort\*

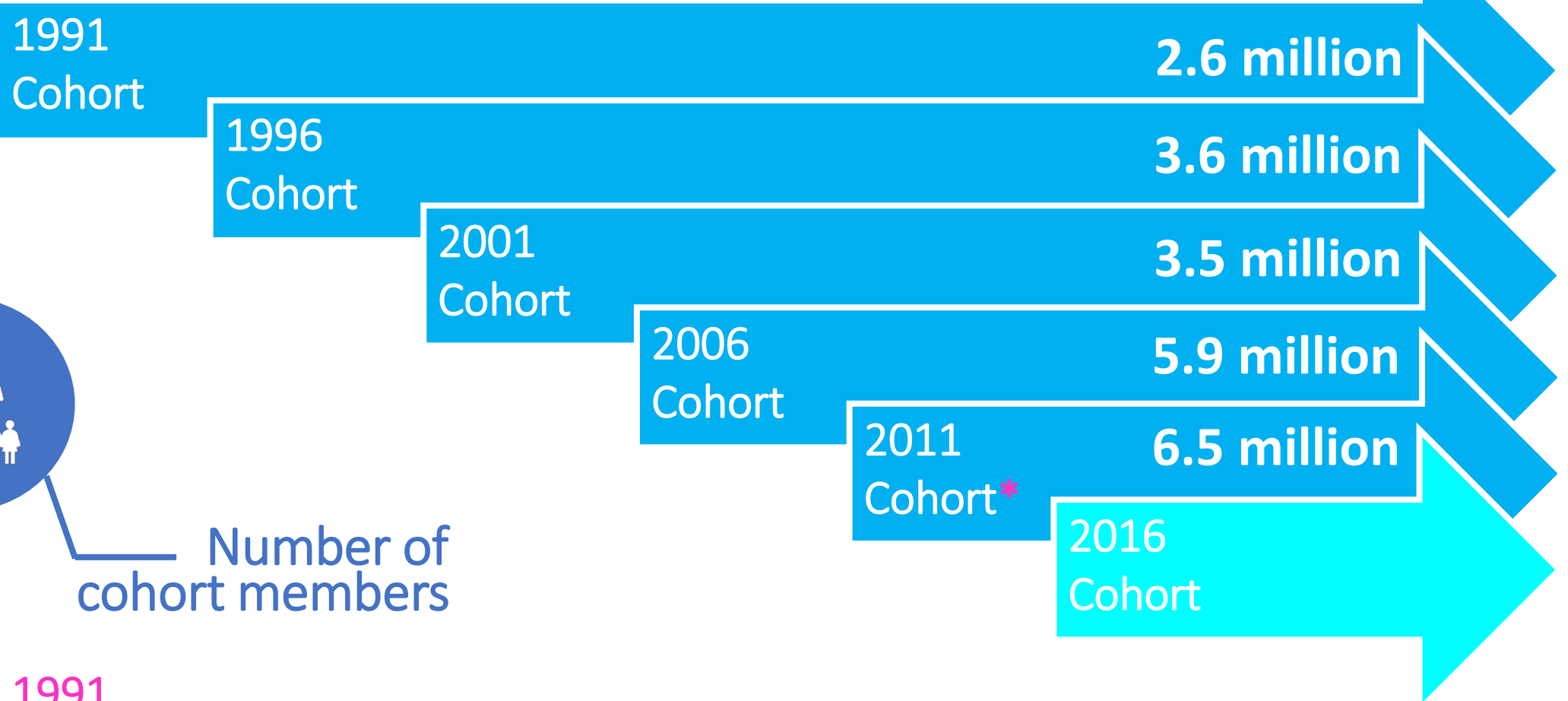
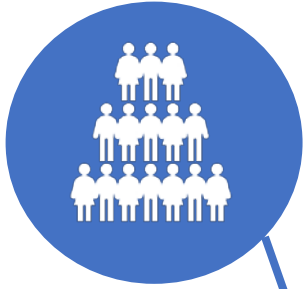
2016  
Cohort

1991



\*will be available in Spring 2019

# The CanCHEC cohorts



Number of cohort members

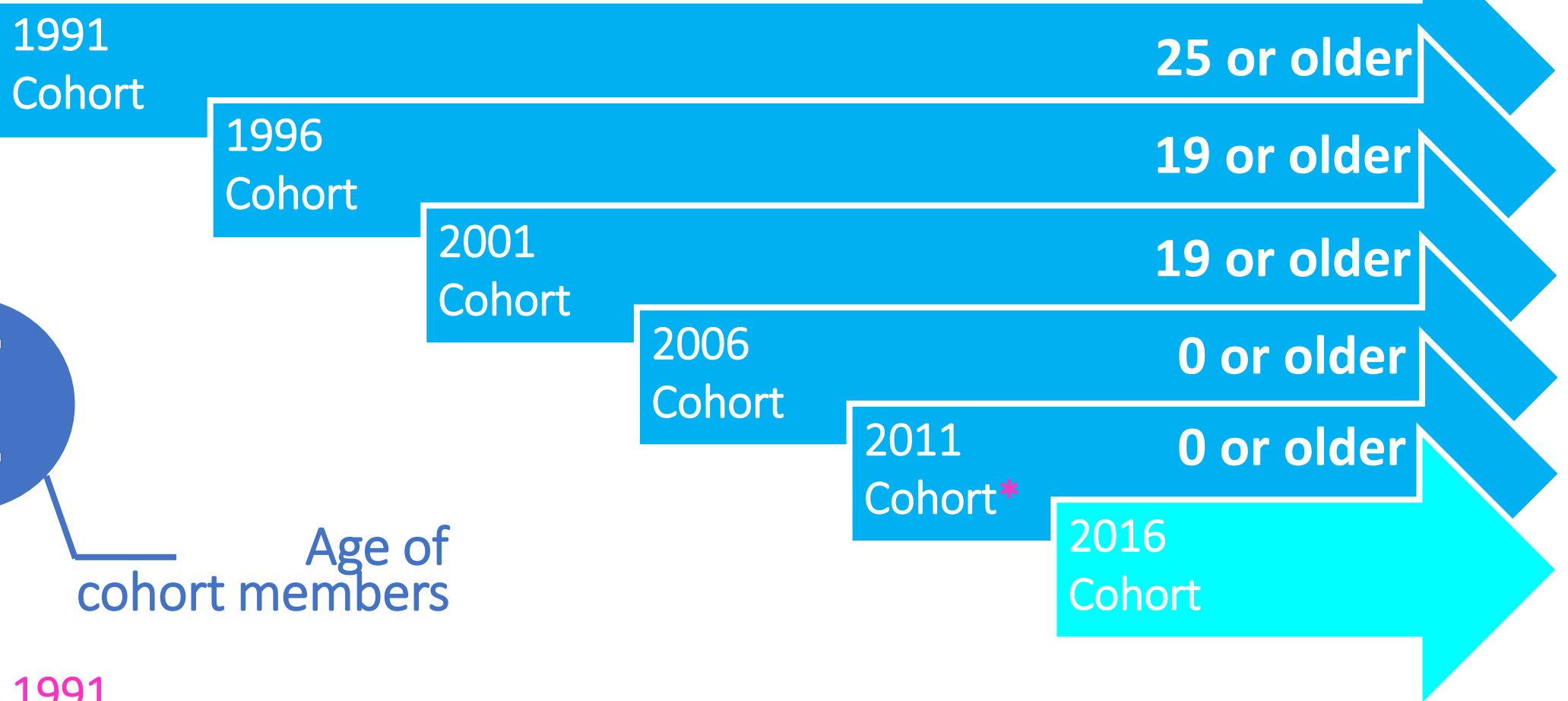
1991



\*will be available in Spring 2019

<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3901>

# The CanCHEC cohorts



Age of cohort members

1991

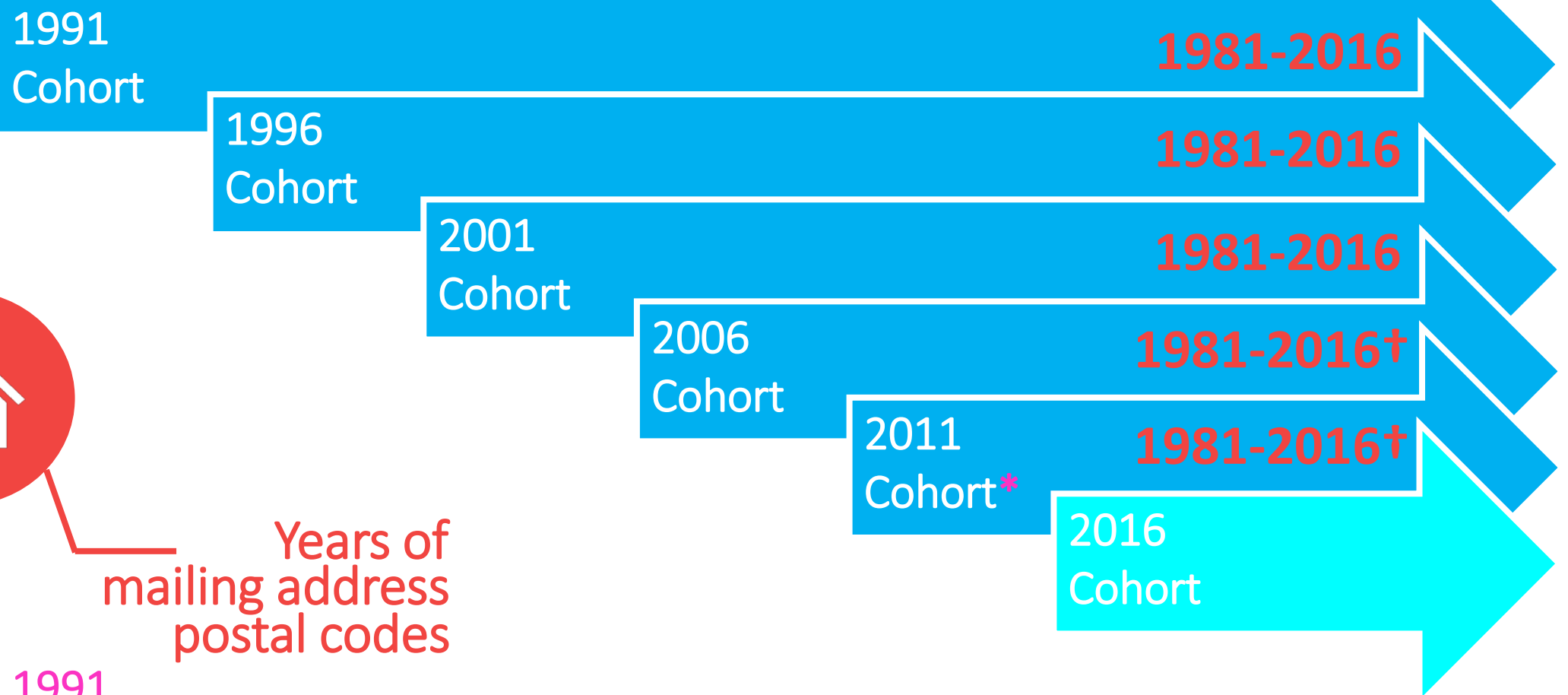


\*will be available in Spring 2019

<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3901>



# The CanCHEC cohorts



Years of mailing address postal codes

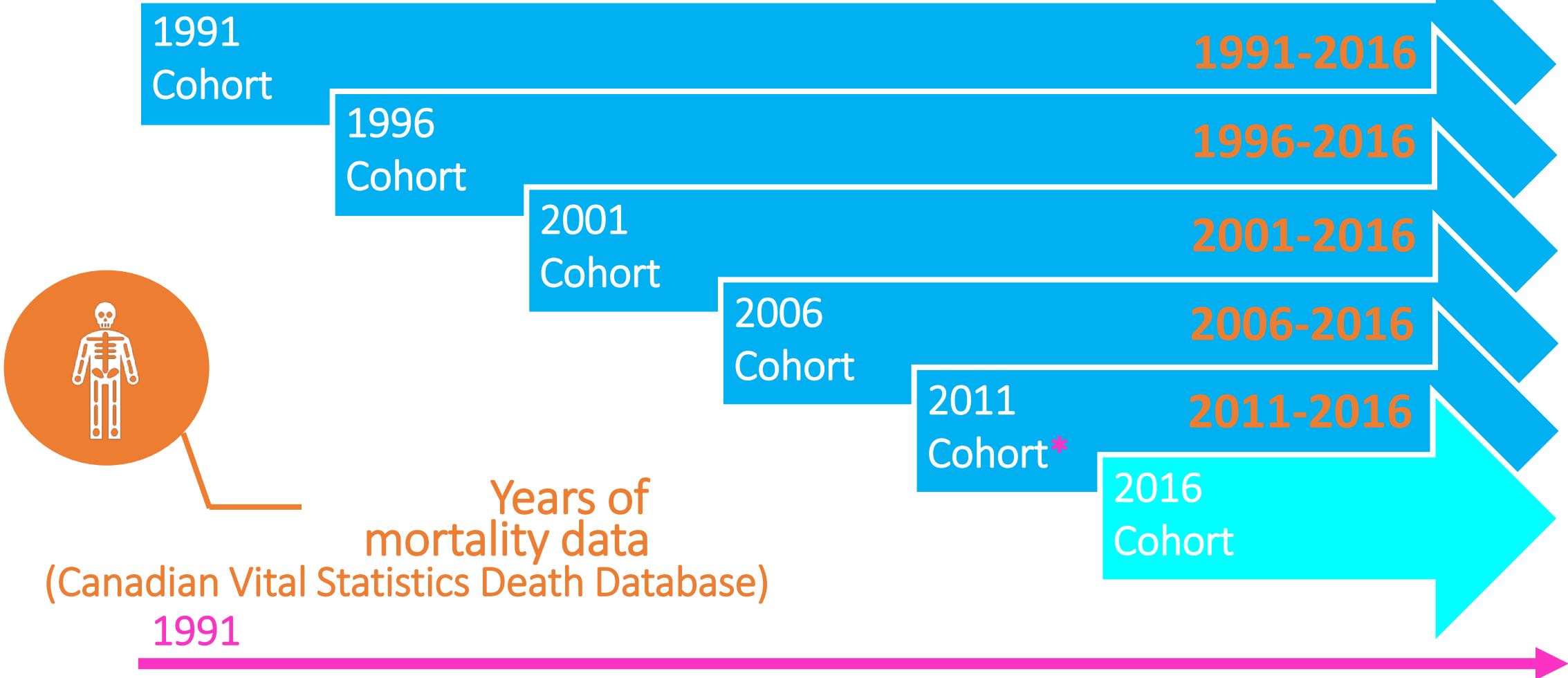
1991



\*will be available in Spring 2019



# The CanCHEC cohorts



<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233>

# The CanCHEC cohorts



1991  
Cohort

1992-2015

1996  
Cohort

1992-2015

2001  
Cohort

1992-2015

2006  
Cohort

1992-2015

2011  
Cohort\*

1992-2015

2016  
Cohort

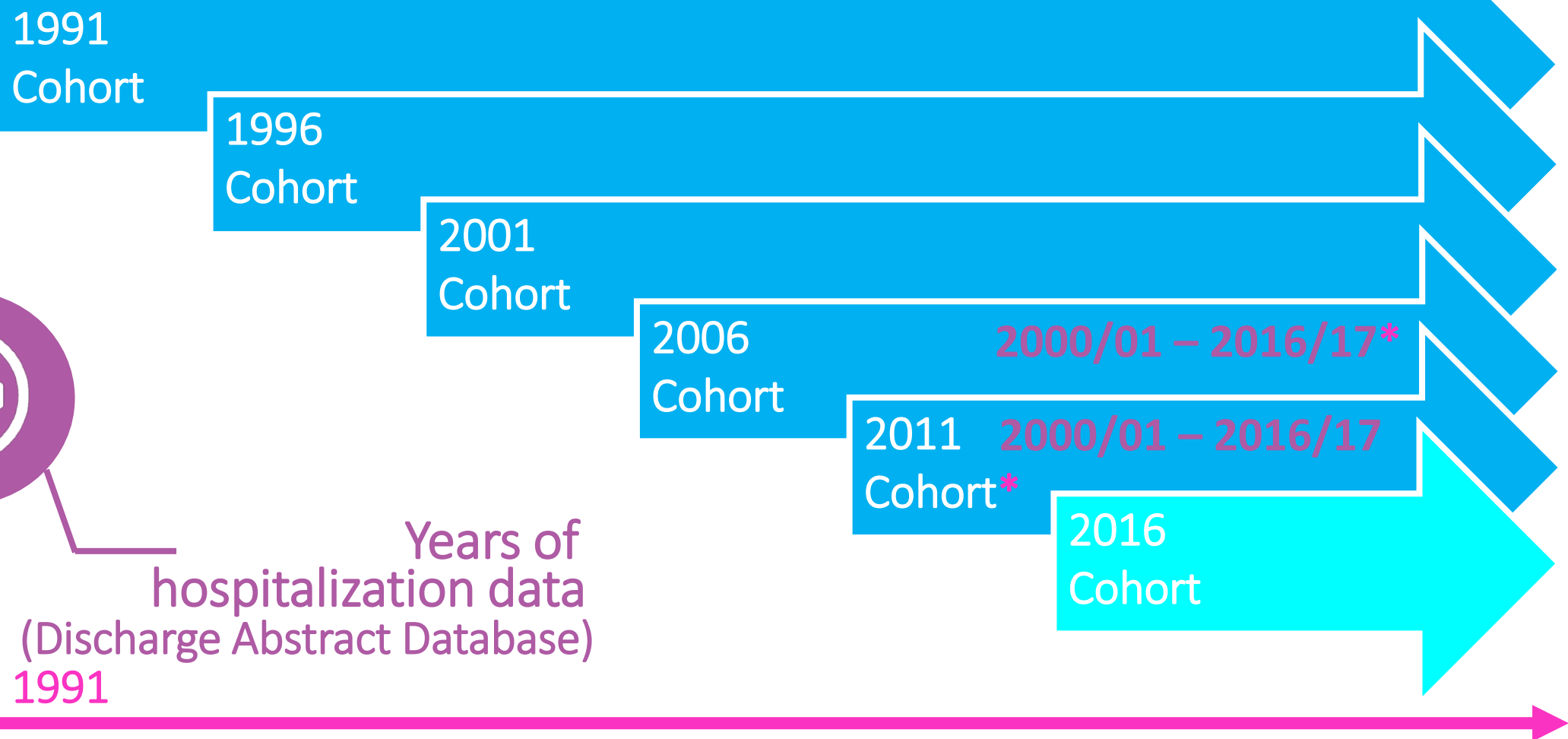
Years of  
cancer data  
(Canadian Cancer Registry)  
1991

<http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3207>





# The CanCHEC cohorts

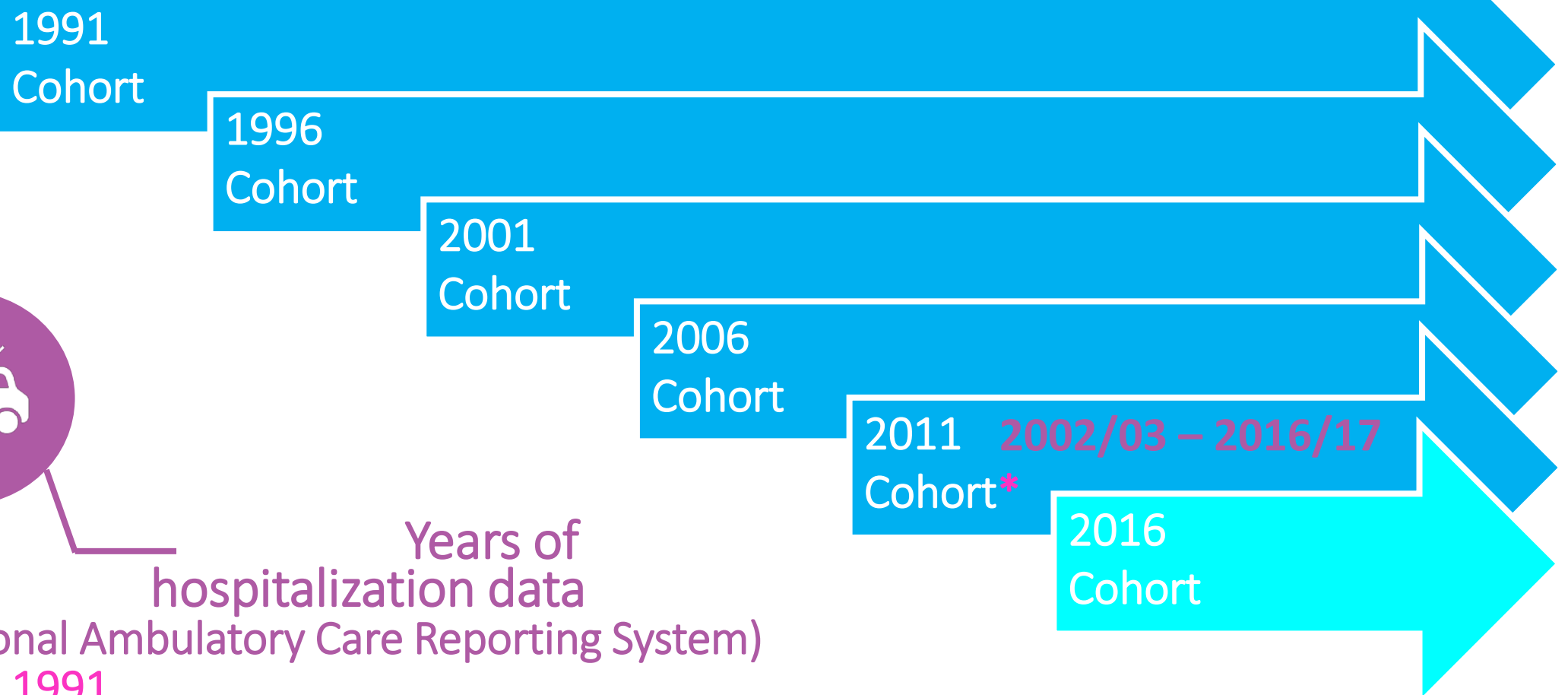


Years of hospitalization data (Discharge Abstract Database)  
1991

<https://www.cihi.ca/en/discharge-abstract-database-metadata>



# The CanCHEC cohorts



Years of hospitalization data  
(National Ambulatory Care Reporting System)  
1991

<https://www.cihi.ca/en/national-ambulatory-care-reporting-system-metadata>

## Important features of the CanCHECs

Household  
population

Cohort  
weights

Bootstrap  
weights

Users create their  
own analytical  
cohort file (keys  
are provided)

## Strengths of the CanCHECs

Consistent linkage methodology

Can examine trends over time

New outcomes added

Linked at individual level

Follow-up extended periodically

# How can the CanCHECs be used?

## Population groups

Immigrant  
First Nations, Métis, Inuit  
Visible minority



## Exposures

Air pollution  
Ultraviolet radiation  
Greenness  
Community



## Socioeconomic status

Education  
Income  
Occupation  
Housing



Mortality



Hospitalization



Cancer

# How *have* the CanCHECs been used?

## *Trends in mortality inequalities*

### Population groups

Immigrant  
First Nations, Métis, Inuit  
Visible minority



### Exposures

Air pollution  
Ultraviolet radiation  
Greenness  
Community



### Socioeconomic status

Education  
Income  
Occupation  
Housing



Mortality



Hospitalization



Cancer





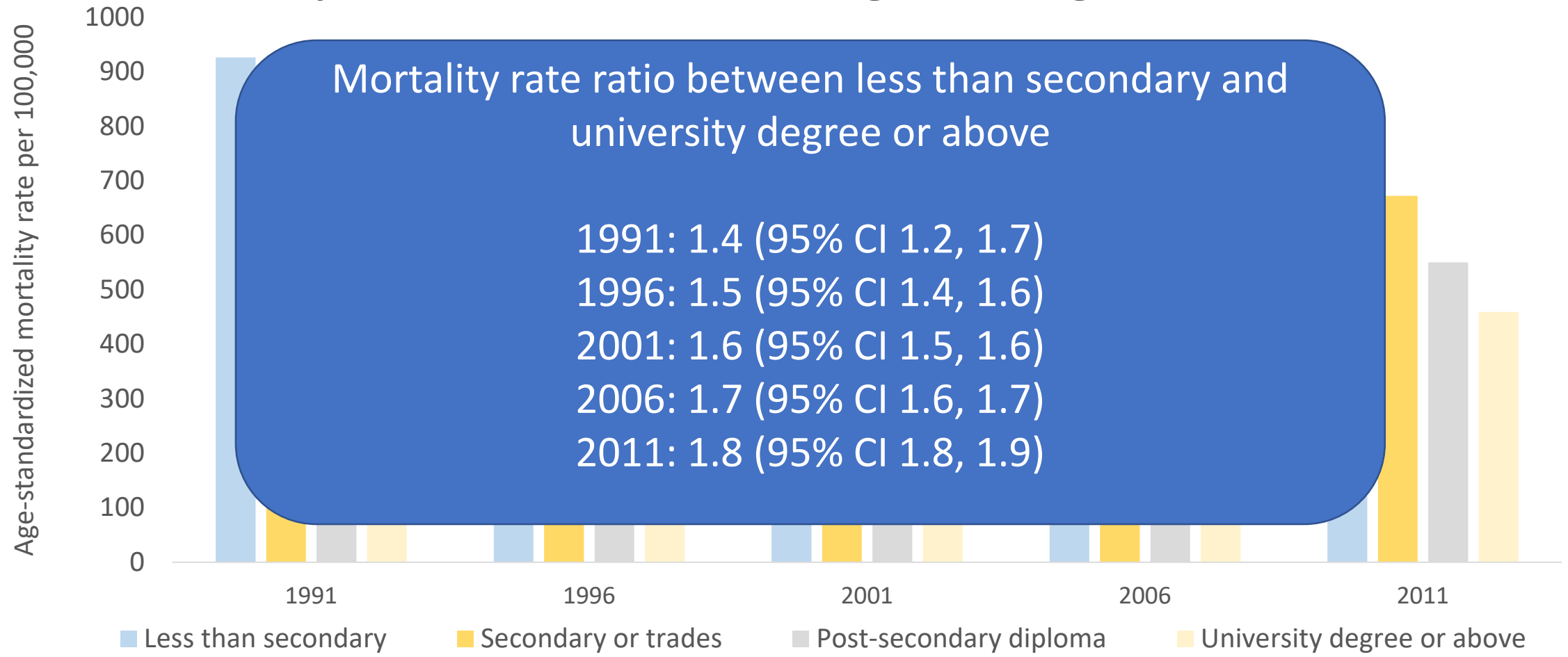
**All-cause mortality has declined over time but education-related inequalities have increased among women aged 25 or older**



Source: Marshall-Catlin E, Bushnik T, Tjepkema M. Trends in mortality inequalities among the adult household population. *Health Reports (in press)*.



**All-cause mortality has declined over time but education-related inequalities have increased among women aged 25 or older**



Source: Marshall-Catlin E, Bushnik T, Tjepkema M. Trends in mortality inequalities among the adult household population. *Health Reports (in press)*.

# How *have* the CanCHECs been used?

*Disparities in life and health expectancies*

## Population groups

- Immigrant
- First Nations, Métis, Inuit
- Visible minority



## Exposures

- Air pollution
- Ultraviolet radiation
- Greenness
- Community



## Socioeconomic status

- Education
- Income
- Occupation
- Housing



Mortality



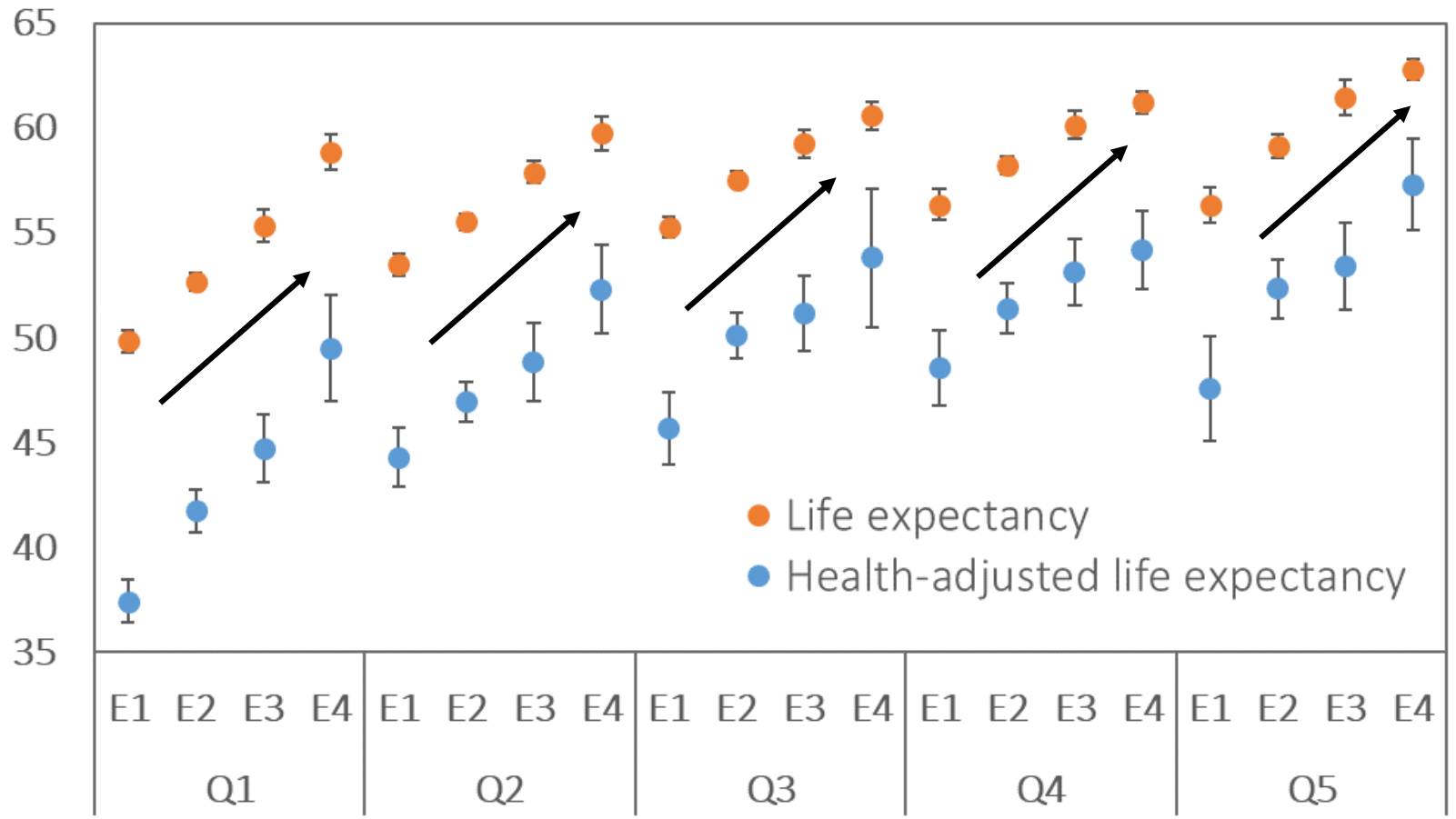
Hospitalization



Cancer



Years



There is a gradient in life expectancy and health-adjusted life expectancy at age 25 among men by level of education *within* and *across* income quintiles

Note: E1=less than secondary graduation; E2=secondary graduation; E3=postsecondary diploma or certificate; E4=university degree; Q1=1st (lowest) income adequacy quintile; Q2=2nd quintile; Q3=3rd quintile; Q4=4th quintile; Q5=5th (highest) income adequacy quintile.

Source: Bushnik T, Tjepkema M, Martel L. Socioeconomic disparities in life and health expectancy among the household population in Canada. *Health Reports (under review)*.

# How *have* the CanCHECs been used?

*First Nations, Métis, Inuit  
life expectancy*

## Population groups

Immigrant  
First Nations,  
Métis, Inuit  
Visible  
minority



## Exposures

Air pollution  
Ultraviolet  
radiation  
Greenness  
Community



## Socioeconomic status

Education  
Income  
Occupation  
Housing



Mortality

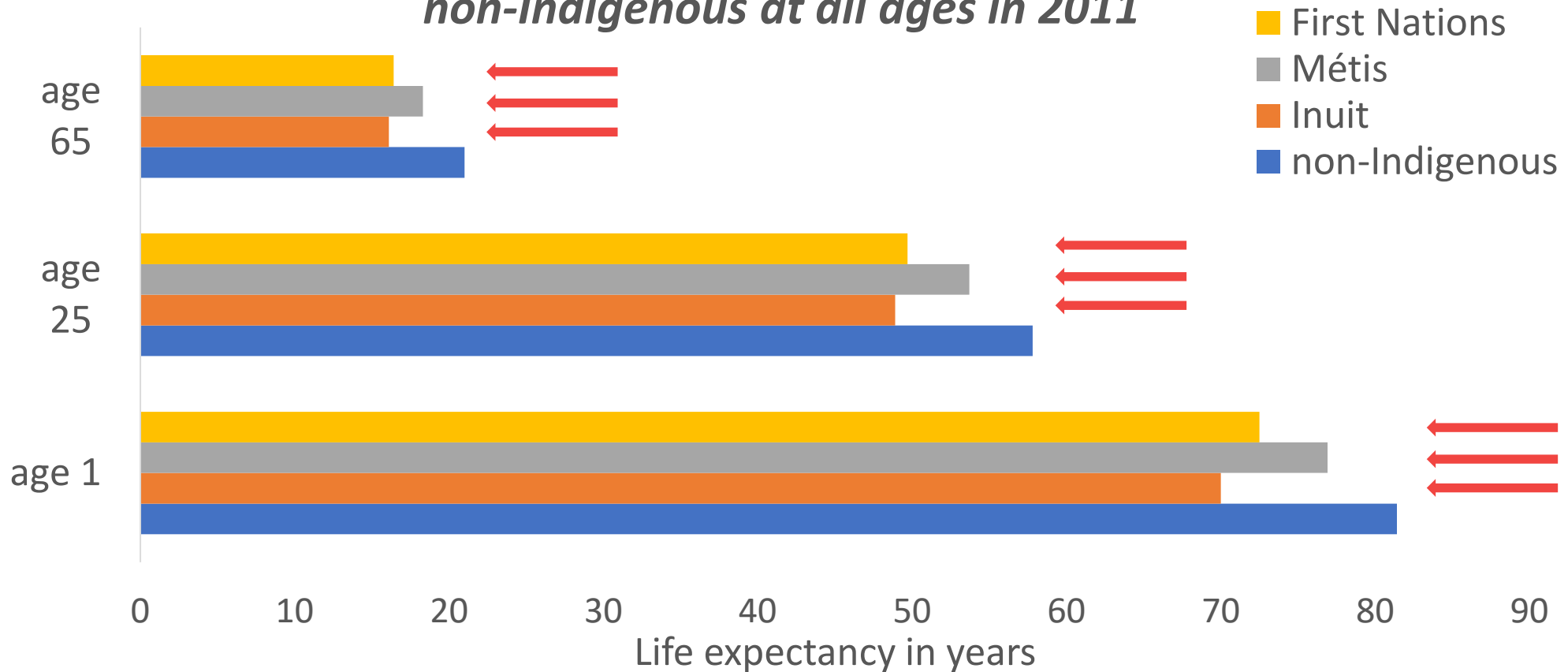


Hospitalization



Cancer

***Life expectancy for the male First Nations, Métis, and Inuit household population was significantly lower than for the non-Indigenous at all ages in 2011***



Source: Tjepkema M, Bushnik T, Bougie E. Life expectancy of the Indigenous household population in Canada. *Health Reports (under review)*.



# How *have* the CanCHECs been used?

## *Opioid poisoning hospitalizations*

2011 National Household Survey (NHS)

### Population groups



- Immigrant
- First Nations, Métis, Inuit
- Visible minority

### Socioeconomic status



- Education
- Income
- Occupation
- Housing

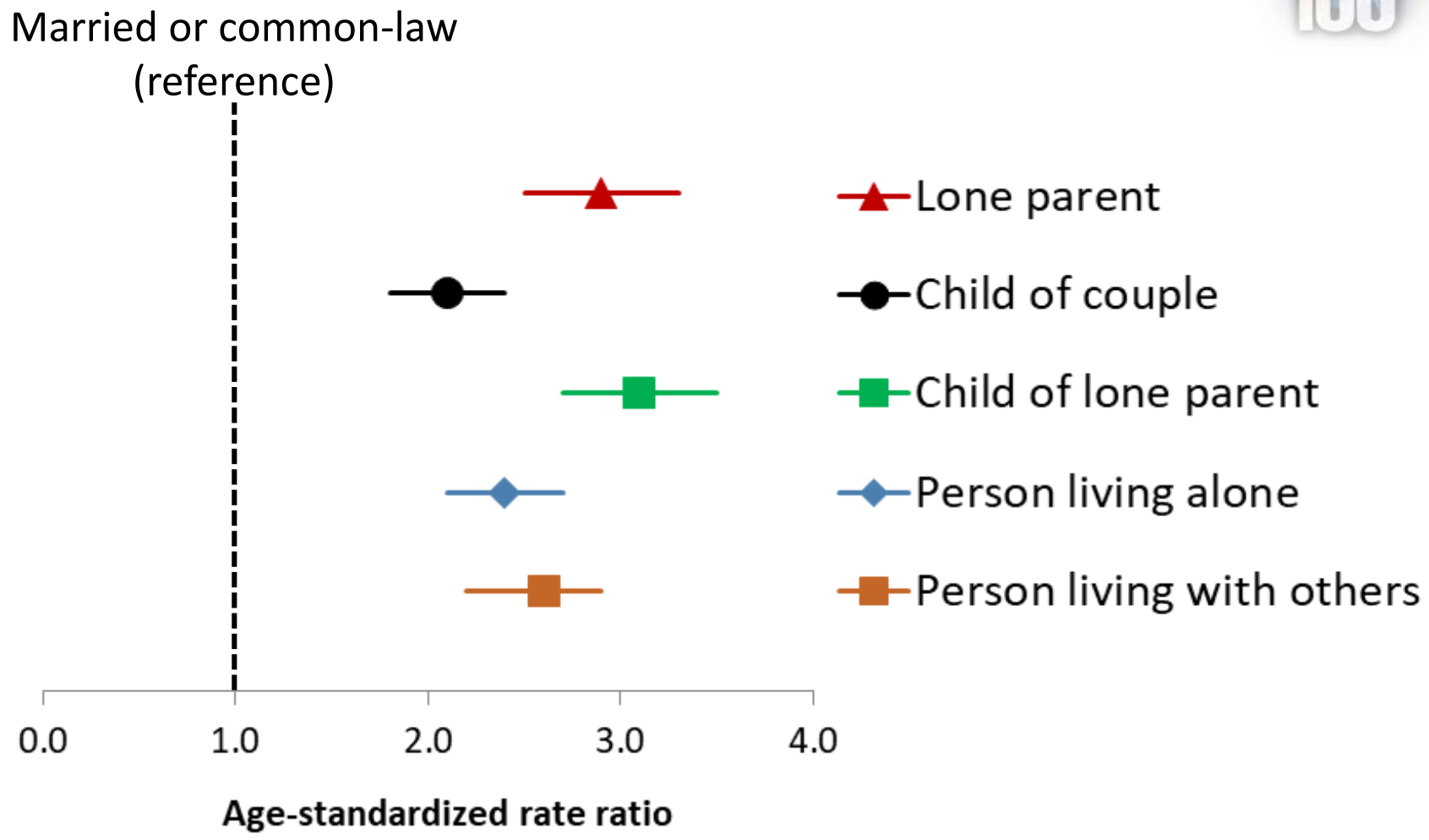


Mortality



Hospitalization

Age-standardized rates of hospitalization due to opioid poisonings were 3 times higher among parents and children in lone-parent households compared to those who were married or had a common-law partner (with or without children)



Source: Carrière G, Garner R, Sanmartin C. Social and economic characteristics of those experiencing hospitalizations due to opioid poisonings. *Health Reports* 2018; 29(10): 23-28. 27

# Considerations when using the CanCHECs

Population  
exclusions

2011 NHS  
Collective dwellings  
not in scope

Under age 1  
mortality  
bias

Change over  
time in census  
variables

Census  
characteristics  
at baseline  
only

No  
information  
on health  
behaviours

# Canadian Community Health Survey (CCHS) linked to hospital, mortality data, and historical postal code files

## What are linked Canadian Community Health Survey (CCHS) data?

CCHS is a nationally representative cross-sectional sample survey of the household population (non-institutional) - linked to different health outcomes

Hospitalization

Mortality

Historical postal codes

CCHS: <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226>

# What are linked Canadian Community Health Survey data?

## Health determinant behaviours

Smoking  
Physical activity  
Body mass index



**Hospitalization**  
Discharge Abstract Database (DAD) (1999/2000-2017/2018)  
National Ambulatory Care Reporting System (NACRS) (2002/2003-2017/2018)  
Ontario Mental Health Reporting System (OHMRS) (2006/2007-2017/2018)

## Population groups

Immigrant  
First Nations, Métis, Inuit  
Visible minority



## Socioeconomic status

Education  
Income  
Occupation  
Housing



**Mortality**  
Canadian Vital Statistics Database – Death (2000-2017)



**Historical PostCodes**  
(2000-2016)





# What are these hospital data from CIHI?

**Discharge Abstract Database (DAD)**  
1999/2000 to 2017/2018:  
demographic, administrative and clinical data for acute care, some psychiatric, chronic rehabilitation and day surgery hospital discharges.

**National Ambulatory Care Reporting System (NACRS)**  
2002/2003 to 2017/2018:  
demographics, visits to for ambulatory care: day surgery, emergency department, diagnostic imaging, ambulatory clinic visits (e.g. oncology care); clinical information (diagnoses, surgical interventions), administrative financial service-data.

**Ontario Mental Health Reporting System (OHMRS) 2005/2006 to 2017/2018:**

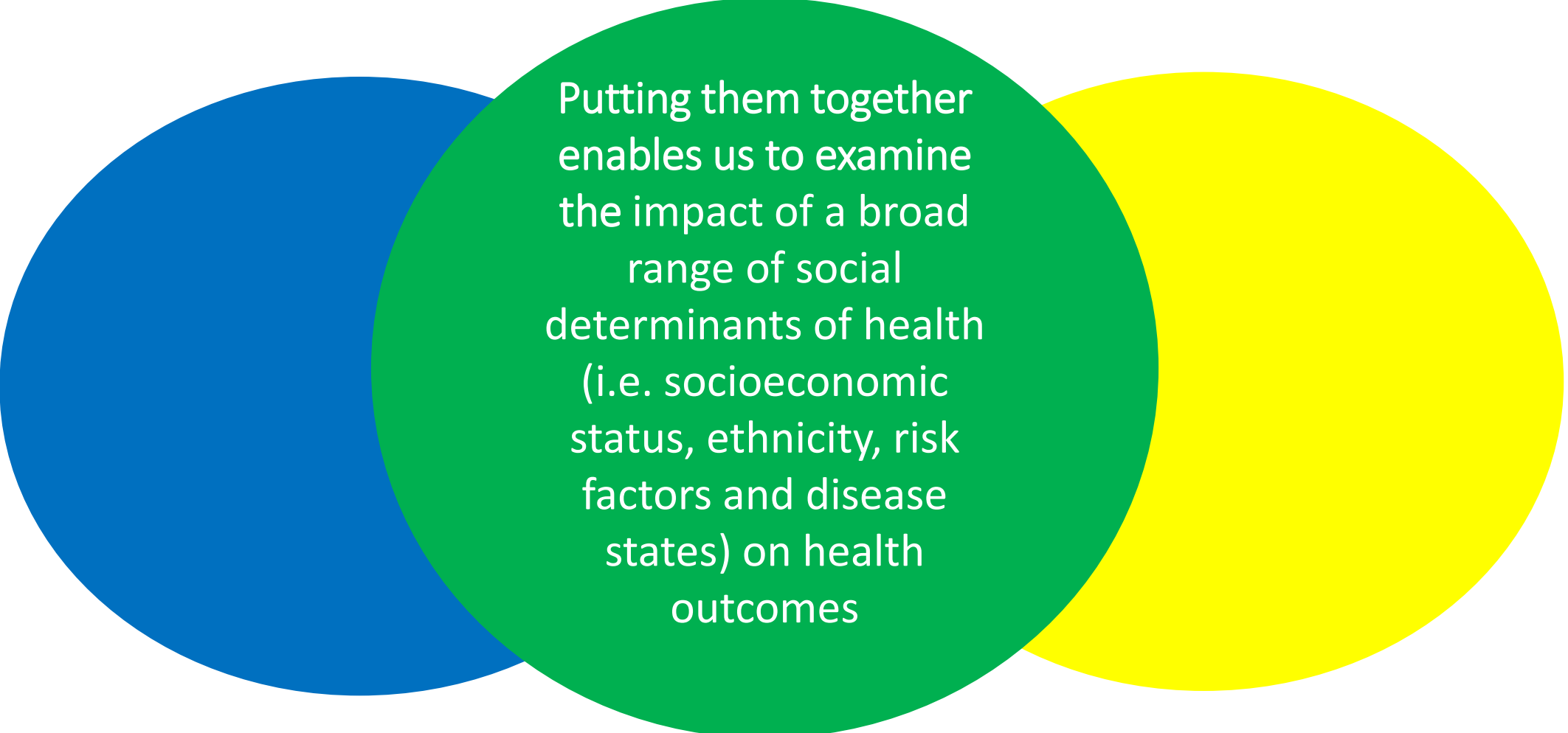
- Implemented in 2005 by CIHI on behalf of the **Ontario Ministry of Health and Long-term Care (MOHLTC)**
- Admissions to designated adult inpatient mental health beds and specialty facilities in Ontario, and these services outside of Ontario that voluntarily submit records to OHMRS
- Mandated in Ontario in 2005 thus since 2005 considered census of individuals admitted to these services for Ontario.
- Contains facility-comparative reports about outcome measures, quality indicators, System for Classification of Inpatient Psychiatry (SCIPP) Weighted Patient Days, and Mental Health Clinical Assessment Protocols (MH CAPS).

## Why link the CCHS to mortality and/or hospital records?

Nationally representative sample of Canadians with health status, health condition, lifestyle factors and socio-economic characteristics

Hospital data contain diagnostic and intervention information for in-patient visits;  
Mortality data contain timing and cause of death

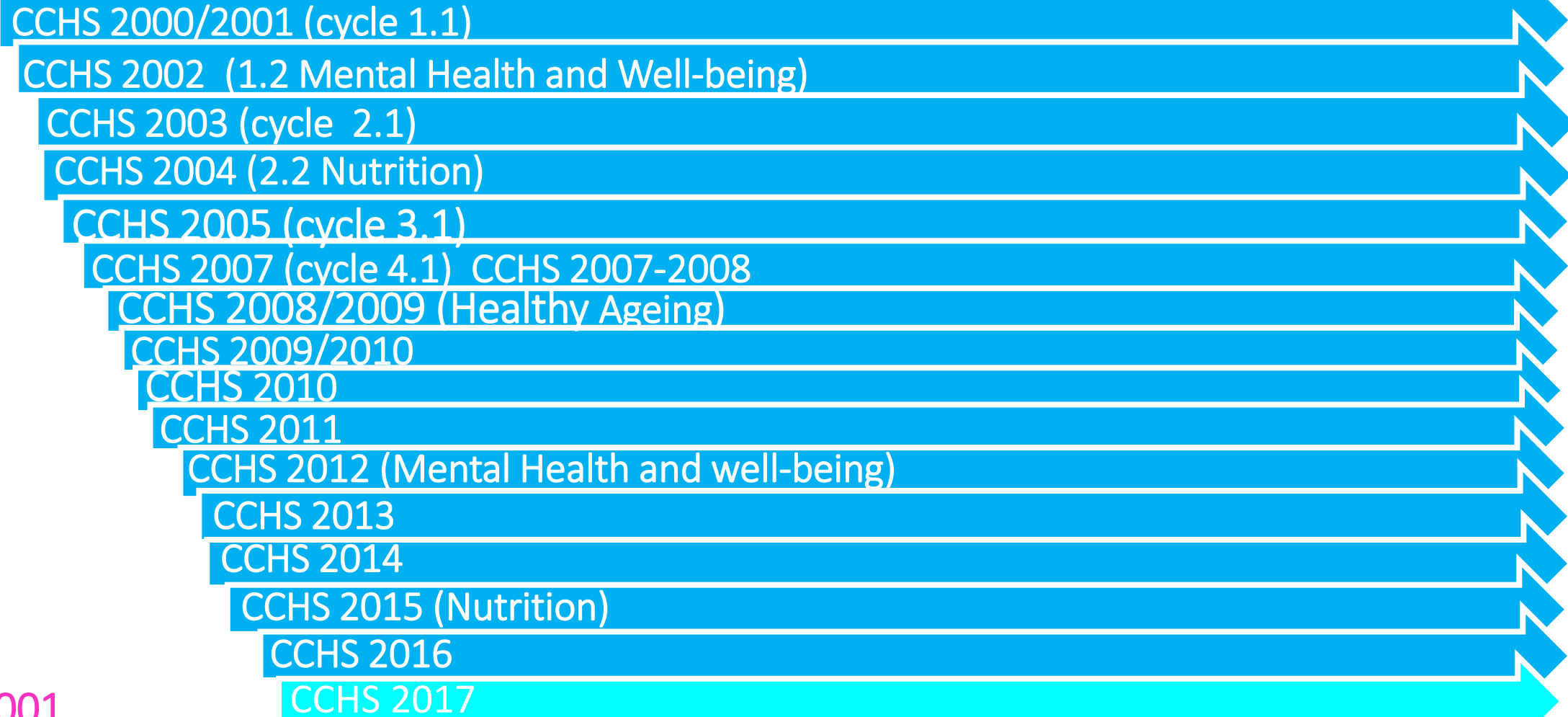
## Why link the CCHS to mortality and/or hospital records?



Putting them together enables us to examine the impact of a broad range of social determinants of health (i.e. socioeconomic status, ethnicity, risk factors and disease states) on health outcomes



# The CCHS by cycle (Annual and Focus surveys)



2000/2001

# The CCHS sample that consented to linkage, by cycle (over 80%)

Cycle	Sample Size
CCHS 2000\2001 (cycle 1.1)	119,434
CCHS 2003 (cycle 2.1)	114,288
CCHS 2005 (cycle 3.1)	115,398
CCHS 2007\2008 (cycle 4.1)	114,078
CCHS 2009	53,106
CCHS 2010	52,828
CCHS 2011	53,629
CCHS 2012 (Mental Health and Well-being)	51,980
CCHS 2013	54,179
CCHS 2014	52,898
CCHS 2015	49,329
CCHS 2016	53,908
CCHS 2017	55,739



Sample size

2000/2001

# Linked CCHS to hospital data



Years of hospitalization data

Discharge Abstract Database (DAD)  
1999/00-2017/18



Annual CCHS 2000-2001 to 2017  
Focus: Mental Health 2002 and 2012,  
Nutrition 2004 and 2015  
Healthy Aging 2008/2009)

2000/2001 to..... 2017



April 1 1999 to..... March 31, 2018



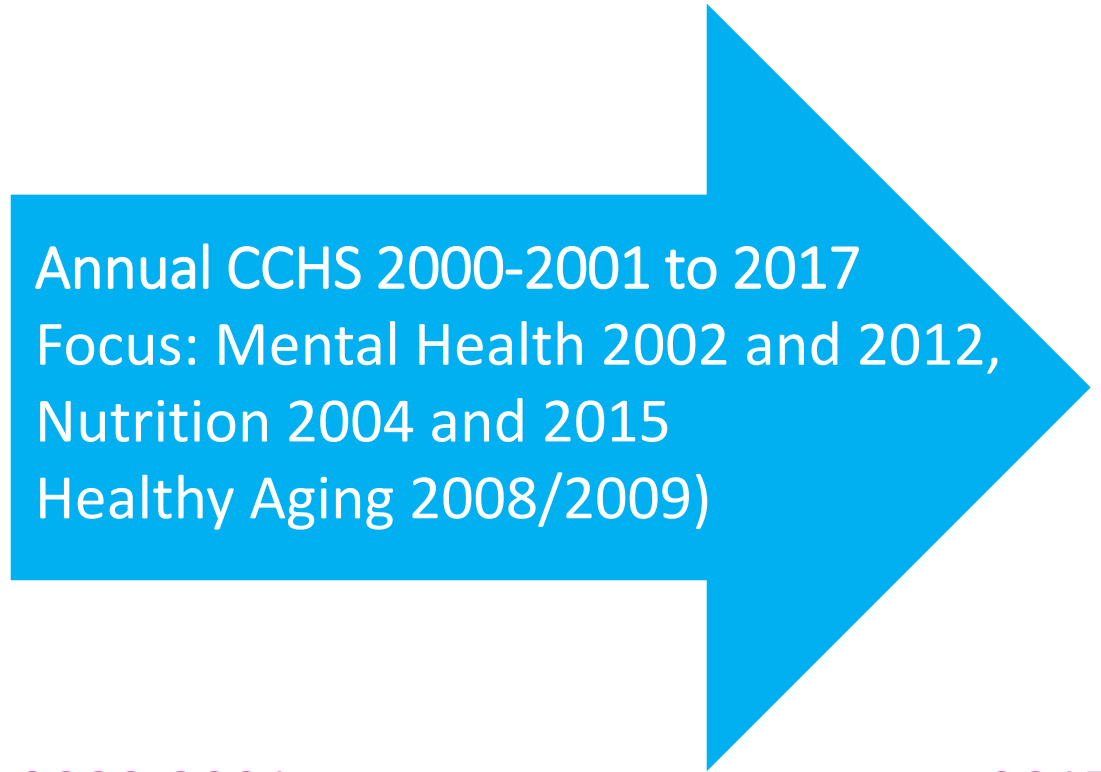
# Linked CCHS to hospital data



Years of hospitalization data

National Ambulatory Care Reporting System (NACRS)

2002/03 -2017/18



Annual CCHS 2000-2001 to 2017  
Focus: Mental Health 2002 and 2012,  
Nutrition 2004 and 2015  
Healthy Aging 2008/2009)

2000-2001 to..... 2017



April 1 2002 to..... March 31, 2018





# Linked CCHS to hospital data



Years of hospitalization data

Ontario Mental Health Reporting System (OHMRS)  
2006/07-2017/18



Annual CCHS 2000-2001 to 2017  
Focus: Mental Health 2002 and 2012,  
Nutrition 2004 and 2015  
Healthy Aging 2008/2009)

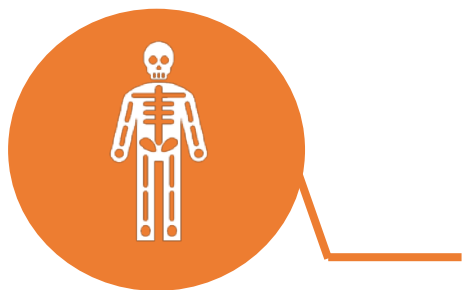
2000-2001 to..... 2017



April 1 2006 to..... March 31, 2018



# Linked CCHS to mortality data



Years of mortality data

Canadian Vital Statistics Database: Deaths  
2000-2017

Annual CCHS 2000-2001 to 2017  
Focus: Mental Health 2002 and 2012,  
Nutrition 2004 and 2015  
Healthy Aging 2008/2009

2000-2001 to..... 2017



Jan.1 2000 to..... December 31, 2017



# Linked CCHS to Historical Postal Code Files



Years of  
mailing address  
postal codes  
2000-2016

Annual CCHS 2000-2001 to 2017  
Focus: Mental Health 2002 and 2012,  
Nutrition 2004 and 2015  
Healthy Aging 2008/2009)

2000-2001 to..... 2017



2000 to.....2016



# How can linked CCHS to Mortality, DAD be used?

## Population groups

- Immigrant
- First Nations, Métis, Inuit
- Visible minority



## Socioeconomic status

- Education
- Income
- Occupation
- Housing



## Health determinant behaviours

- Smoking
- Physical activity
- Body mass index



Hospitalization



Mortality

## Population groups

Immigrant  
First Nations,  
Métis, Inuit  
Visible  
minority



# How *have* linked CCHS to Mortality, DAD been used?

*Nutritional risk, hospitalization and mortality among community dwelling Canadians aged 65 or older*

by Pamela L. Ramage-Morin, Heather Gilmour and Michelle Rotermann

## Socioeconomic status

Education  
Income  
Occupation  
Housing



Hospitalization



Mortality

## Health determinant behaviours

Smoking  
Physical activity  
Body mass index



Available at: [https://www150.statcan.gc.ca/n1/en/pub/82-003-x/2017009/article/54856-eng.pdf?st=hODS0b\\_T](https://www150.statcan.gc.ca/n1/en/pub/82-003-x/2017009/article/54856-eng.pdf?st=hODS0b_T)

How *have* linked CCHS to Mortality, DAD been used?

## Nutritional Risk Among Seniors – the issues, the need to know

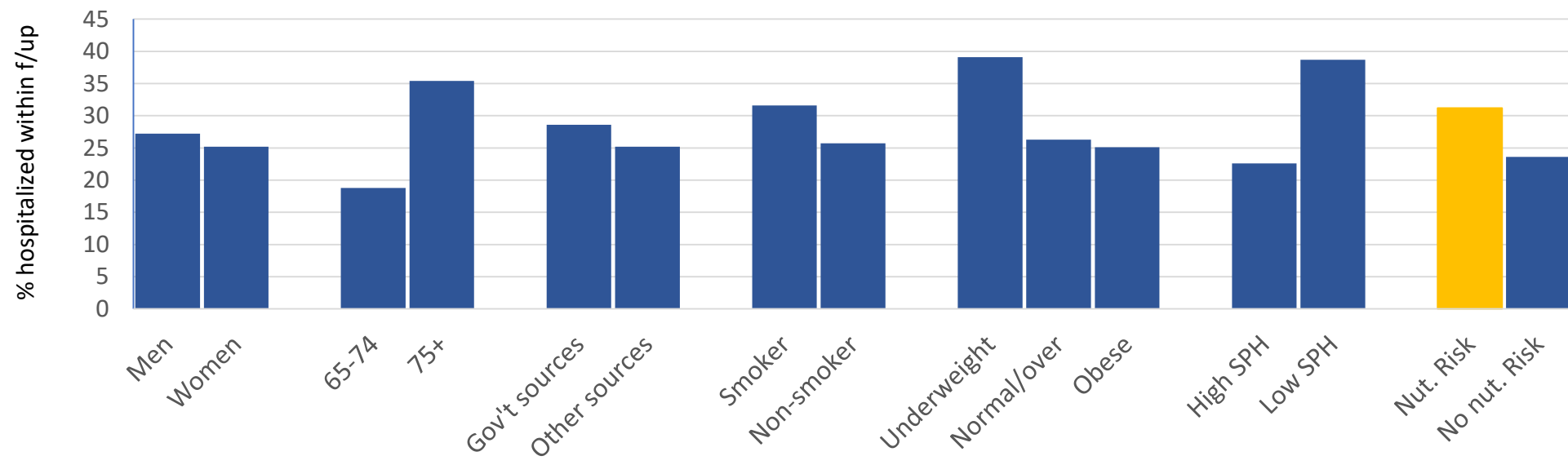
- 34% of seniors at nutritional risk 2008/2009
- Negative health outcomes of nutritional risk – functional limitations, declines in quality of life, longer hospital stays, death
- Previous studies investigating association between nutritional risk and hospitalization or mortality – small non-representative samples

CCHS-Health Aging Survey (2008) linked to hospital and death data:

- Is nutritional risk associated with increased risk of *acute care hospitalization or death*?

# *Nutritional risk, hospitalization and mortality among community-dwelling Canadians aged 65 or older*

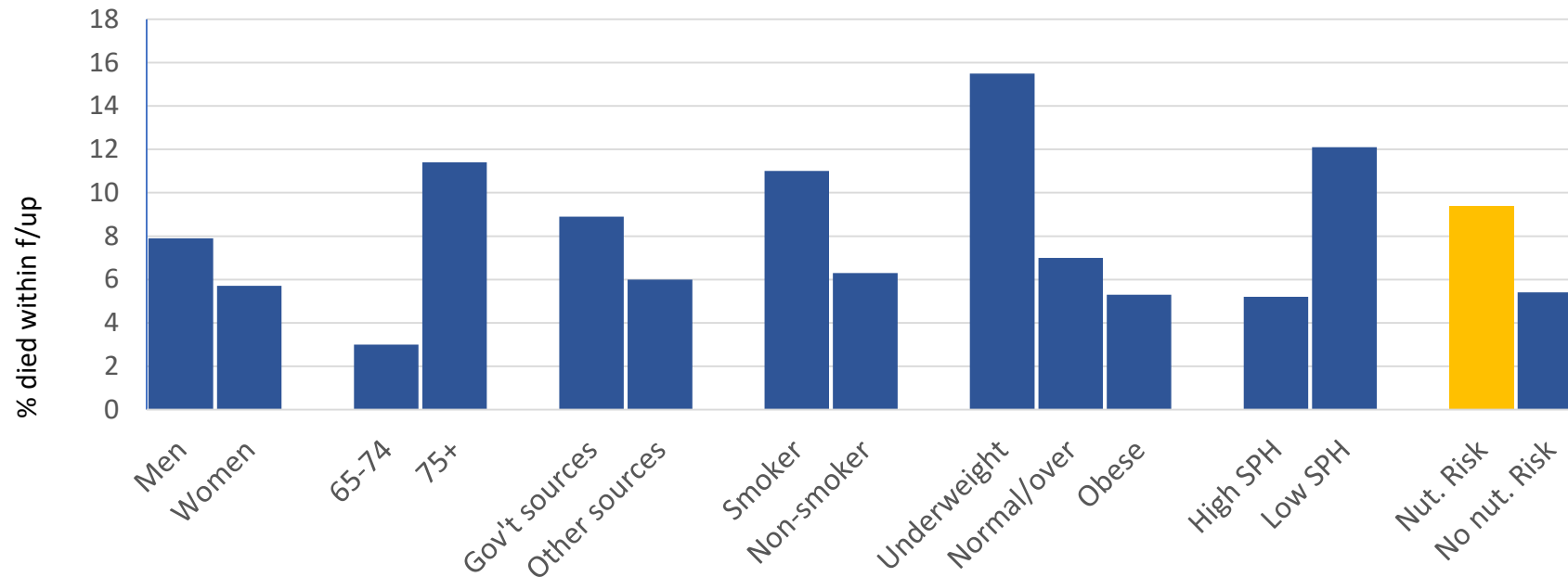
## **Acute care hospitalization**





# *Nutritional risk, hospitalization and mortality among community-dwelling Canadians aged 65 or older*

## Death



\* p<0.05

*After adjusting for demographic, health and socio-economic factors, seniors 65 years of age and older who reported being at nutritional risk were at increased risk for both hospitalization and death within follow-up....*

1.2

Hazard ratio for  
hospitalization

1.6

Hazard ratio for death

## How *have* linked CCHS to DAD been used?

### Population groups

Immigrant  
First Nations,  
Métis, Inuit  
Visible  
minority



### **Using linked data to estimate excess days in acute-care hospitals for smokers**

by Kathryn Wilkins, Margot Shields and Michelle Rotermann

### Socioeconomic status

Education  
Income  
Occupation  
Housing



Hospitalization



### Health determinant behaviours

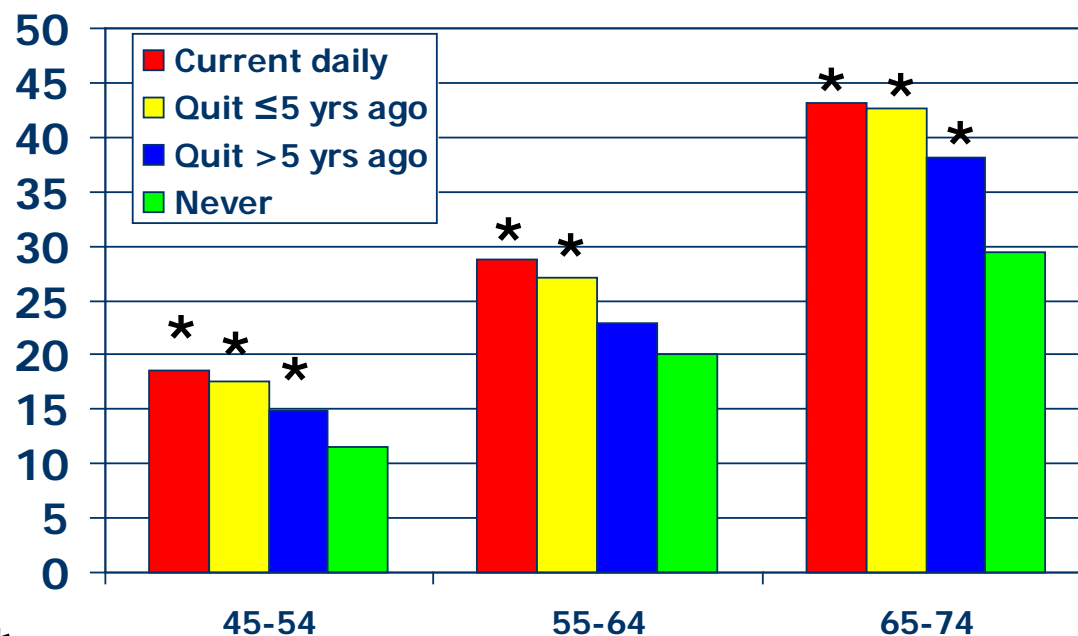
Daily smoking  
Physical activity  
Visits to physicians



Available at: <https://www150.statcan.gc.ca/n1/pub/82-003-x/2009004/article/11033-eng.htm>

*How did the likelihood of hospitalization in acute-care hospitals over the next 4 years differ by smoking status?*

Percentage hospitalized in four-year period following interview, by age group and smoking status

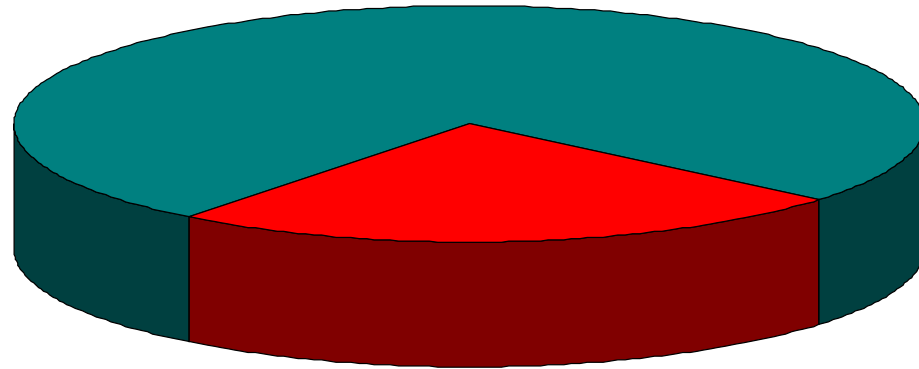


\*

Statistically higher than age-group estimate for “Never” ( $p < 0.05$ )

Source: Linked 2000/01 Canadian Community Health Survey (CCHS) and Health Person Oriented Information (HPOI) (excludes Québec)

Estimated excess days for smokers and former smokers account for nearly one-third of all hospital days used by people aged 45-74



**Excess days for smokers, former smokers  
= 7.1 million days**

# Considerations when using linked CCHS

## Population out of scope :

- Persons living in institutions, on Indian reserves
- Quebec not available in DAD

Survey collection redesigns in 2007, 2015; changes over time to sample frame, target age, core content

Sample size of linked outcome

Respondent information available at baseline only

Cross-sectional survey

# Linked Health Data available @ StatCan

Canadian Birth Census Cohort (CanBCC) (1996 and 2006 )

Canadian Cancer Registry (CCR) (diagnosis years 1992 to 2014) linked to 1992-2014 files: Canadian Vital Statistics Death Database (CVSD) and T1 Personal Master File (1992 to 2014).

Canadian Community Health Survey (CCHS) linked to the Longitudinal Immigration Database (IMDB):  
CCHS – Annual cycles (2.1, 3.1, 4.1, 2008-2014) linked to IMDB ; CCHS – Focus content cycles (1.2, 5.2) linked to IMDB

Canadian Vital Statistics Death Database (CVSD) 2008-2014 linked to the Discharge Abstract Database (DAD) and the National Ambulatory Care Reporting System (NACRS) (2004/05 to 2014/15)

Longitudinal Immigration Database (IMDB) 1980-2013 linked to the Discharge Abstract Database (DAD) 2000/01-2013/2014

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# Where are the CanCHECs and linked CCHS data?

Statistics Canada / Statistique Canada

Search website

Subjects | Data | Analysis | Reference | Geography | Census | Surveys and statistical programs | About StatCan

Home → The Research Data Centres Program → Data available in the RDCs

## The Research Data Centres (RDC) Program

- The RDC network
- The FRDC
- Application process and guidelines
- Data available in the RDCs**
- RDC projects and publications
- FAQ

### Data available in the RDCs

The following data sets are available at the RDCs.

If data you are seeking for your RDC project is not listed, please contact [STATCAN.de-mad-rdcdata.STATCAN@canada.ca](mailto:STATCAN.de-mad-rdcdata.STATCAN@canada.ca) to enquire about its availability.

Filter items:  Showing 1 to 1 of 1 entries (filtered from 163 total entries) | Show 10 entries

Record number	Survey name	Acronym
3901	<a href="#">Canadian Census Health and Environment Cohort</a>	CanCHEC

CanCHEC 1991  
CanCHEC 1996  
CanCHEC 2001  
CanCHEC 2006

<https://www.statcan.gc.ca/eng/rdc/data>

CRDCN Canadian Research Data Centre Network

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## Data

Research Data Centres offer a secure access to detailed microdata from Statistics Canada's surveys, and to Canadian censuses' data, as well as to an increasing number of administrative data sets. The search engine below was designed to help you find out more easily which dataset among all the surveys available in the RDCs best suits your research needs. You can search by theme (based on past publications) or subject (based on Statistics Canada's classification), by type of survey (including pilot projects) or by its name.

Refer to our [research page](#) to learn more about the application procedure for accessing these data.

Search for a dataset:

Search for a dataset by name

<https://crdcn.org/data>

# Who is using the CanCHECs and linked CCHS data?

[Home](#) → List of all RDC projects within the last 12 months

## The Research Data Centres (RDC) Program

The RDC network

The FRDC

Application process and guidelines

Data available in the RDCs

RDC projects and publications

FAQ

## Other Microdata Access Programs

Biobank

Data Liberation Initiative (DLI)




The Real Time Remote Access (RTRA) system

## Research Tools

## List of all RDC projects within the last 12 months

Filter items  Showing 1 to 10 of 406 entries | Show  entries

RDC projects from April 2018 - March 2019 inclusively

Contract Title 	Principal Investigator 	Data Cycle 
<b>A 10-year retrospective study of predictors of fatal opioid overdoses in Canada</b>	Anees Bahji	CCHS
<b>A between-country dietary analysis and policy scan: Leveraging population-level dietary intake data to inform policy</b>	Jennifer Vena	CCHS, Other-Non-StatCan
<b>A comparison of datasets to study mobility in New Brunswick</b>	Michael Haan	CEN, IMDB, LAD
<b>A decomposition of changes in Canadian wealth inequality</b>	Brant Malcolm Abbott	SFS
<b>A profile of immigrant health in Calgary using the Canadian Community Health Survey</b>	Naomi Anna Lightman	CCHS
<b>A re-examination of incentives and retirement</b>	Kevin Scott Milligan	CIS, LAD, LFS, SLID, Other-Non-StatCan
<b>A spatial-temporal analysis of migration patterns of Sudbury, Thunder Bay, Sault St. Marie, North Bay Ontario, and Timmins</b>	Sean O'Hagan	CEN, NHS
<b>A study of depression and suicidal ideation among the aboriginal Canadian population</b>	Rasha Mohamed Shehatta Amer Elamoshy	APS, CCHS

<https://www.statcan.gc.ca/eng/rdc/rdc>

Contacts for questions regarding the U of C RDC can be directed to:

- RDC Analysts: Dina Lavorato, Stephanie Cantlay
- Email: [rdc@ucalgary.ca](mailto:rdc@ucalgary.ca)
- Website: <https://crdcn.org/prairie-regional-rdc>

*Thank you!*

[statcan.had-das-das-had.statcan@canada.ca](mailto:statcan.had-das-das-had.statcan@canada.ca)