Ontario Health Study
Étude sur la santé Ontario

The Ontario Health Study:

A resource for cancer, disease and health research in Ontario and Canada

ICES Research Forum, Strength of Numbers: Partnering for Impact

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What is the Ontario Health Study (OHS)?

The OHS is a **longitudinal cohort study,** sampling a group of study participants over time via questionnaires, biological samples, and other forms of data collection.
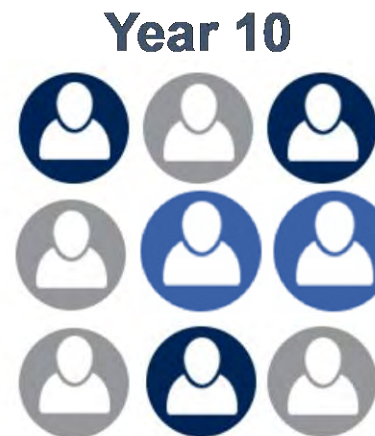
The Study examines how **lifestyle, the environment and genetics** interact to affect people's health.

The OHS makes the data and biosamples of its **225,000 participants** available to researchers investigating cancer and other conditions.

What is the OHS?

Today

Large-scale population health cohorts help assess disease risks.
As cohorts collect data on participants over time,
- some **develop diseases**,
- **some die** and
- some **remain disease free**.

Population laboratories are "invaluable for understanding gene-environment interactions in complex human disease."*

Year 5

Year 10

Year 15

Genes, environment and the value of prospective cohort studies, Manolio TA, 2006

Value of linked OHS-ICES data

- Greatly expands the amount of data available about an individual by **combining multiple sources of data**

- Data from **83%** of OHS participants have been successfully linked to administrative health records

- **Ongoing data and biosample collection** from OHS participants

- Allows for **future passive data collection** if contact is lost with participants, including health outcomes

Why is the OHS important?

- **3 in 5** adult Canadians have a chronic disease[1]
    - Major chronic diseases cause **two-thirds** of all deaths annually in Canada[2]

- Chronic disease treatment consumes **67%** of direct health care costs[3]
    - Costs the Canadian economy **$190 billion** annually[3]

- **1 in 2.2** Canadians will develop cancer in their lifetime[4]
    - **1 in 4.5** will die of the disease[4]

[1]Elmslie, K (2016). Against the Growing Burden of Disease. Public Health Agency of Canada. Retrieved from https://cagh-acsm.org/sites/default/files/resources/2016/10/elmslie.pdf. Accessed 25 September 2023.

[2]Public Health Agency of Canada (2017). How Healthy Are Canadians? Retrieved from https://www.canada.ca/en/public-health/services/publications/healthy-living/how-healthy-canadians.html. Accessed 25 September 2023.

[3]Public Health Agency of Canada. Retrieved from https://cagh-acsm.org/sites/default/files/resources/2016/10/elmslie.pdf. Accessed 25 September ber 2023

[4]Canadian Cancer Statistics 2023. Retrieved from: http://www.cancer.ca/Canadian-Cancer-Statistics-2023-EN. Accessed 19 April 2024.

What does the OHS have available?

~225,000 participants, of which **>181,600** are part of CanPath

>188,000 participants linked with administrative databases

>40,000 non-fasting blood samples (plasma, serum, RBC, buffy coat)

>12,800 physical assessments
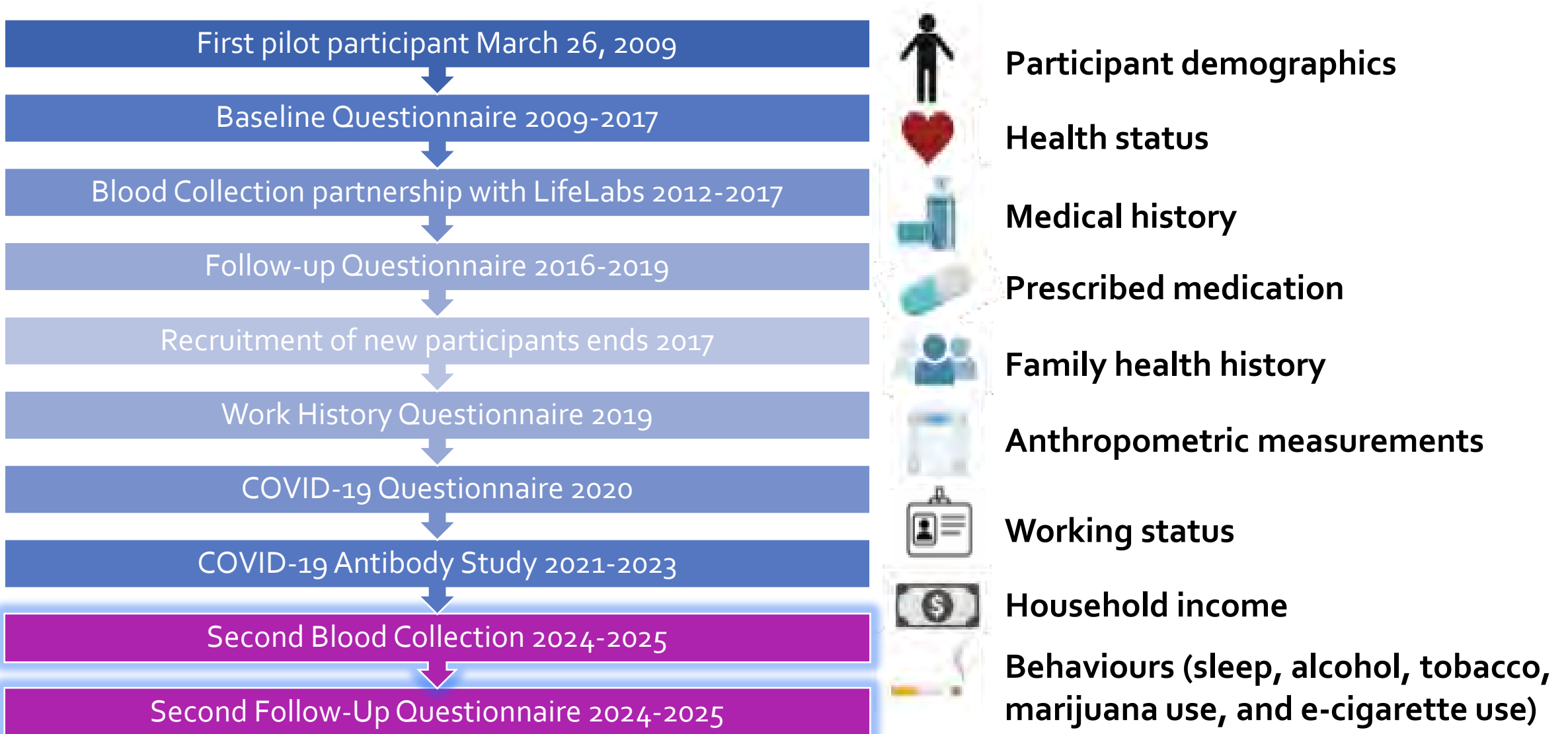
~12,600 urine samples

~3,100 MRIs, cognitive assessments

~22,000 participants genotyped

>23,600 participants diagnosed with cancer
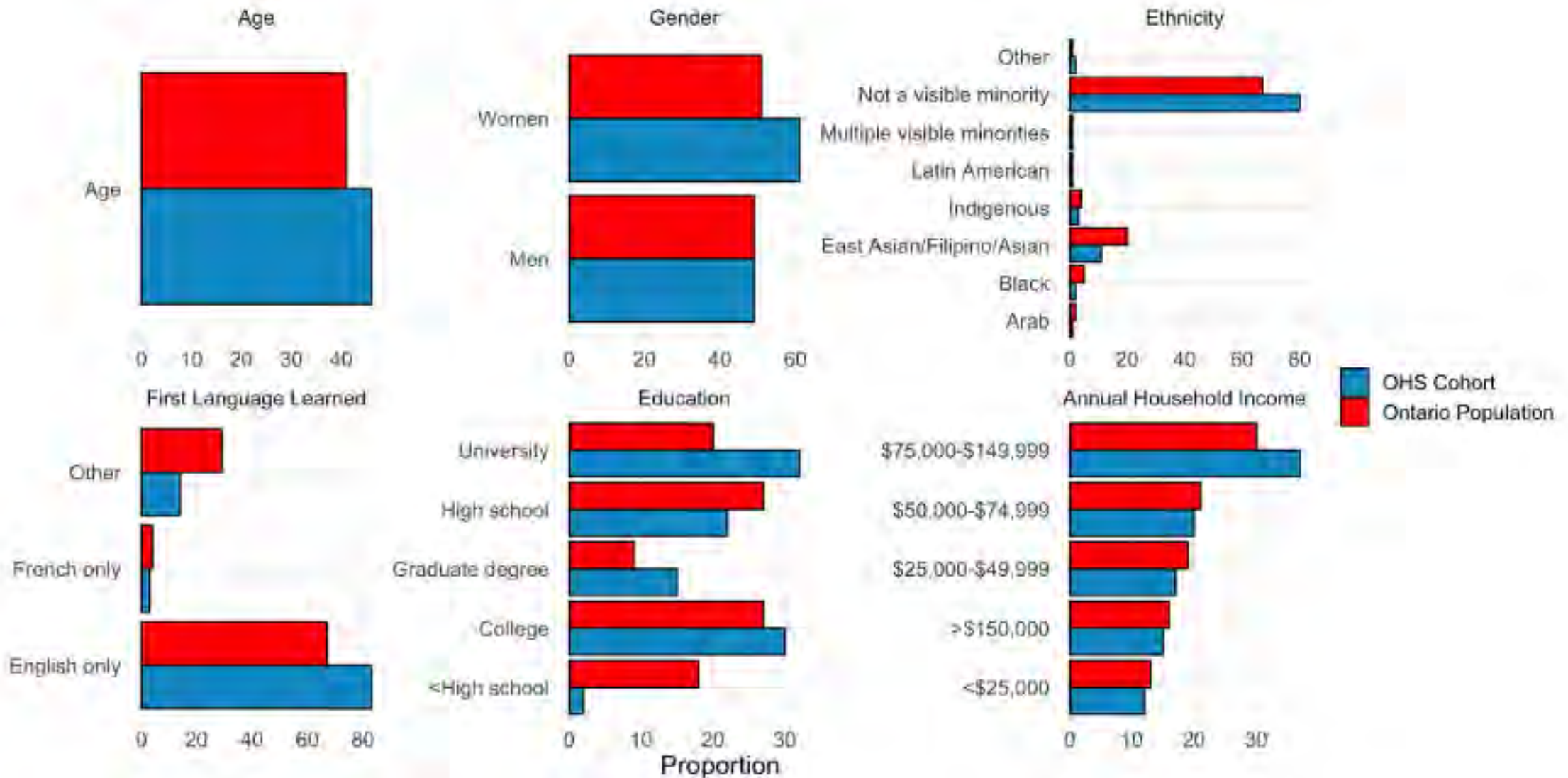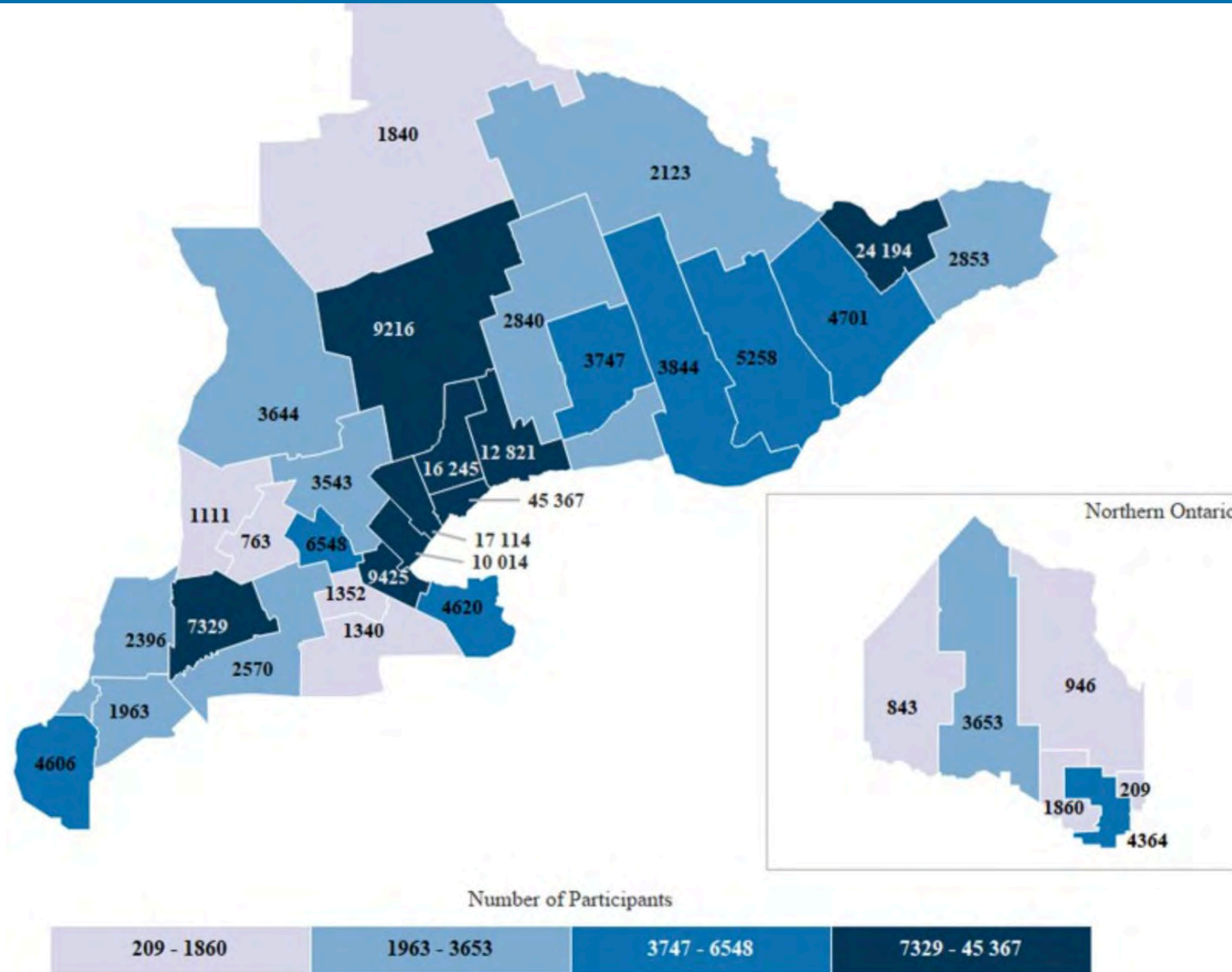
Ongoing data and biospecimen collection

Sociodemographic characteristics of the OHS in comparison to the Ontario Census population (2016)

Geographic Distribution of Ontario Health Study

Kirsh et al. 2023, Int. J. Epi.

Biosamples and analytic data available for access

Timepoint	Specimen Type		Maximum Amount/ Participant	Aliquots	# of Participants
Baseline (2009 – 2017)	Blood	Plasma	1.5-4.5 mL	1-3 cryovials (1.5 mL)	40,056
		Serum	1.5-4.5 mL	1-3 cryovials (1.5 mL)	
			2.4 mL	6 cryovials (0.5 mL)	
		RBCs	1.5 mL	1 cryovial (1.5 mL)	
		Buffy Coat	0.75-1.0 mL	1 cryovial (1.8 mL)	
		Lymphocytes	1.0 mL	1 cryovial (1.0 mL)	5,962
	Urine		3 mL	2 cryovials (1.5 mL)	12,600
	DNA (Buffy Coat)			Up to 1.5ug	24,563
2020 - 2023	Dried Blood Spots		Up to 3	N/A	9,956

Timepoint	Data	# of Participants
Baseline: Immediate Blood analysis	Complete Blood Count (CBC)	31,442
	Glycosylated hemoglobin (HbA1c)	
Ongoing	Genotyping (UKBIObank Affymetrix arrays)	~20,000
	Inflammatory markers (cytokines)	1,440
	scRNA Sequencing	~400
Antibody Study	Anti-N IgG levels (anti-SmT1, anti-RBD, anti-N)	9,956

Reported medication usage

- **224,771** participants completed the OHS baseline questionnaire.

- **89,637 (39.9%)** listed at least one medication in response to question "*Are you <u>currently</u> taking any medications prescribed by a doctor and dispensed by a pharmacist?*"

- Top **10** frequently-prescribed medications:

| Rank	Medication	Indicated Use
1	Synthroid	Hypothyroidism
2	Apo-Atorvastatin	Statin (CVD, blood pressure)
3	Crestor 10 mg	Statin (Rosuvastatin)
4	Eltroxin	Hypothyroidism
5	Coversyl	ACE inhibitor (CVD, blood pressure)
6	Crestor 20 mg	Statin (Rosuvastatin)
7	Apo-hydro	Anti-hypertensive; diuretic
8	Teva-hydrochlorothiazide	Anti-hypertensive; diuretic
9	Celebrex	COX2-Inhibitor NSAID
10	Apo-salvent	Bronchodilator (Asthma)

Linkages with OHS Data

188,000+ OHS participants recruited between 2009 and 2017 have been linked to Ontario Health and ICES data holdings

- Data sets available through ICES include:
  - Hospital Discharge Abstract Database (DAD)
  - National Ambulatory Care Reporting System (NACRS)
  - Continuing Care Reporting System (CCRS)
  - Ontario Drug Benefit Claims (ODB)
  - Ontario Health Insurance Plan Claims Database (OHIP)
  - Registered Persons Database (RPDB)
  - Ontario Cancer Registry (OCR)
  - Ontario Laboratory Information System (OLIS)

Common diseases and conditions identified through ICES

Source: Incident, Prevalent
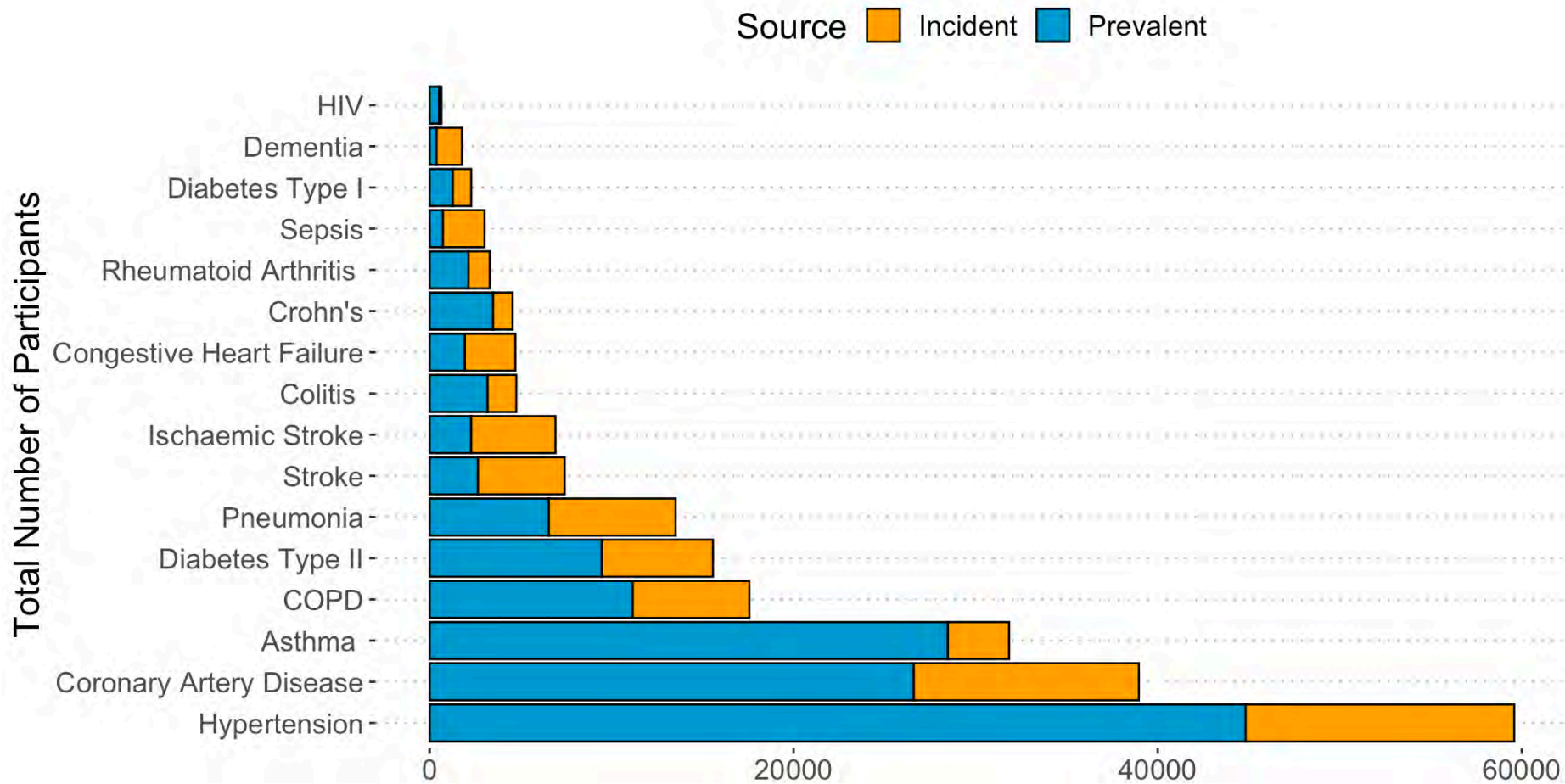
Total Number of Participants:
225,000

Mean age at recruitment:
46.4 years
(SD = +/-15.0)

*Linkages reflect diagnoses captured up until March 2020 through Institute for Clinical and Evaluative Sciences (ICES)

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COVID-19 cases identified through linkage to the Ontario Laboratory Information Systems (OLIS)

PCR-confirmed SARS-CoV-2 infections :
3,813

RT-PCR-based COVID-19 tests performed :
229,167

Legend: New tests/week — New cases/week
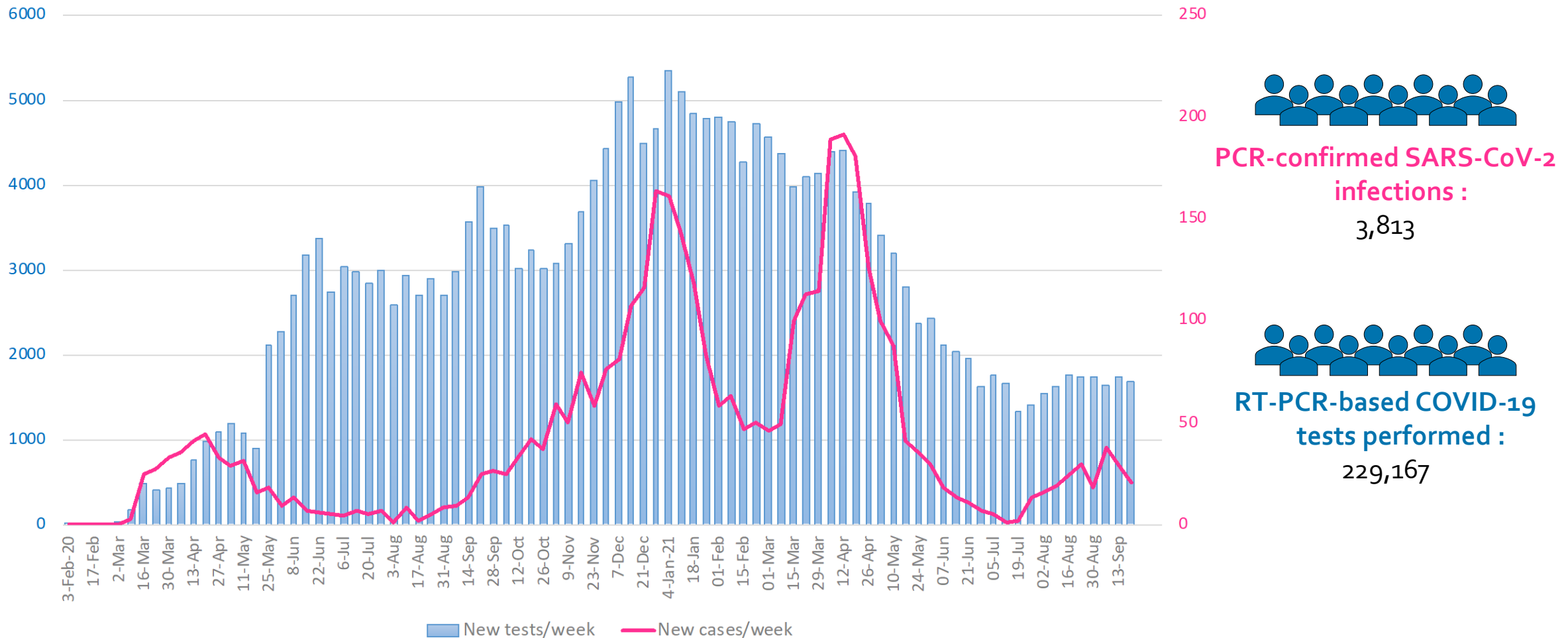
*Linkages reflect diagnoses captured from January 25, 2020 to September 20, 2021 through Institute for Clinical and Evaluative Sciences (ICES)

Most commonly-diagnosed cancers in cohort

Cancer Type	Total (N=188,351)[a]			Provided blood (N=38,799)		
	Prevalence[b]	Incidence[c,d]		Prevalence[b]	Incidence[c,d]	
	n	n	Per 100,000 person-years	n	n	Per 100,000 person-years
Breast (female)	2535	1870	190.2	926	415	263.3
Prostate	2194	1699	266.3	683	456	441.9
Skin (melanoma)	972	834	50.1	315	204	74.9
Colorectal	960	969	58.2	275	167	61.2
Thyroid and other endocrinal	829	522	31.3	285	93	34.1
Lymph node	653	335	20.1	191	77	28.1
Haemotologic	469	956	57.2	139	217	79.3
Uterine	468	540	53.6	176	134	81.8
Bladder	321	580	34.7	97	126	46
Renal	312	357	21.3	104	73	26.6

a Includes participants who consented to administrative linkages; mean (SD) age in years is 47 (15) overall and 57 (10) among those who provided a blood sample.
b Ascertained through linkage with the Ontario Cancer Registry from 1 January 1964 through to date of enrolment; self-reported cancer history is also available.
c Ascertained through linkage with the Ontario Cancer Registry covering the period from baseline to 31 March 2021.
d Average follow-up time is 8.7 years; 1,634,839 total person-years of observation.

Applying for access to linked OHS-ICES data

Process for ICES Scientists:

1. Complete the OHS-ICES Application Form, available internally.
2. The completed form is sent to the OHS Access Office via ICES Compliance, along with:
   - the project protocol,
   - proof of funding (if available),
   - 2-page CV, and
   - REB approval letter for the project.
3. The OHS Access Committee reviews the application and notifies ICES Compliance and the Scientist of approval.
4. The Scientist submits their OHS approval notice with their Privacy Impact Assessment (PIA)/PAW to ICES Privacy.

Linkages to The Canadian Urban Environmental Health Research Consortium (CANUE)

- All OHS participants have been linked to CANUE environmental exposures

- CANUE has built a database of environmental factors (e.g., **local air quality, amount of nearby traffic, access to greenspaces, walkability, social deprivation, climate, and weather**) dating back to the 1980s for each postal code in Canada

- Through Statistics Canada's Social Data Linkage Environment (SDLE) program, OHS participants' previous residences have identified through a residence reconstruction initiative using data from federal documents

- A platform to study climate change impact on the health

Part of Canada's largest population health research platform

The Ontario Health Study is the largest contributing member of **CanPath**, the Canadian Partnership for Tomorrow's Health.

CanPath is the sole Canadian representative of the **International Health Cohorts Consortium**, an association of large cohort studies.

What's next?

- **Research community engagement**

- **More blood collection**

- **Ancillary Studies (chronic fatigue study, Canadian Alliance for Healthy Hearts and Minds)**

- **Second Health Status Follow-Up Questionnaire**

- **Diet and Physical Activity Questionnaire**

The OHS is made possible through:

Funders

Participants

The OHS thanks all its participants for generously donating their time, energy and data to make this research possible.

Learn more about the Study

Read the OHS cohort profile paper in the
International Journal of Epidemiology
(Volume 52, Issue 2, April 2023)

Visit the OHS website at
www.OntarioHealthStudy.ca

Contact the OHS Access Officer at
access@ontariohealthstudy.ca

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