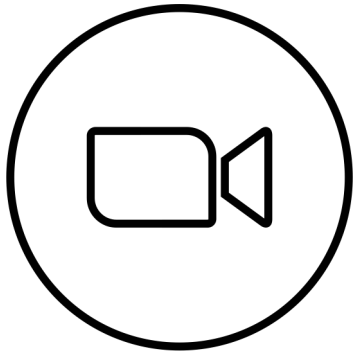
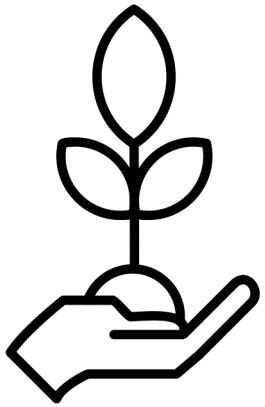
ECOLOGY OTTAWA ECOLOGIE OTTAWA

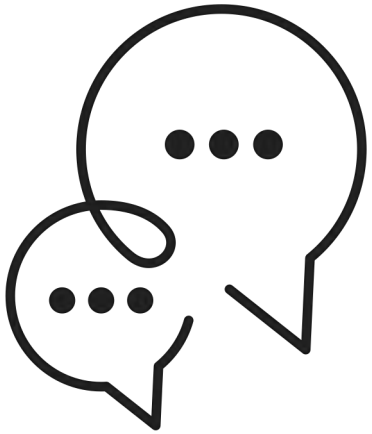
YELLOW BUSES MUST GO GREEN!

CHERYL RANDALL, CLIMATE CHANGE CAMPAIGN ORGANIZER, ECOLOGY OTTAWA

WELCOME







WELCOME

DR LAURA MINET, CLEAN AIR LAB (CLAIR), UNIVERSITY OF VICTORIA

DR EUGENIE WATERS, FAMILY PHYSICIAN, CAPE, ONTARIO REGIONAL COMMITTEE

TRANSPORTATION EMISSIONS

- AIR POLLUTION MONITORING
- URBAN SPRAWL
- 15 MINUTE NEIGHBOURHOODS
- ACTIVE TRANSPORTATION
- PUBLIC TRANSIT

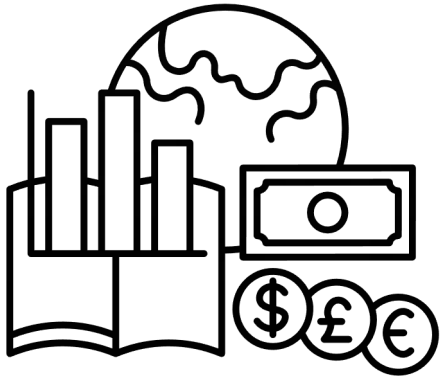
GETTING TO SCHOOL

- CYCLE, WALK, ROLL TO SCHOOL
- 80,000 STUDENTS IN OTTAWA, 833,000 IN ONTARIO TAKE THE BUS TO SCHOOL
- ONTARIO HAS 20,000+ SCHOOL BUSES, 0.1% ARE ELECTRIC

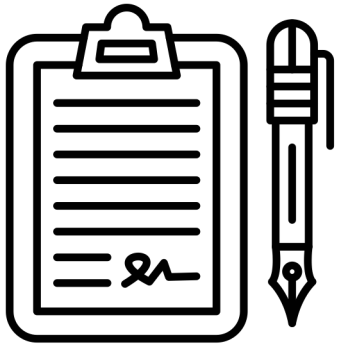
CLIMATE

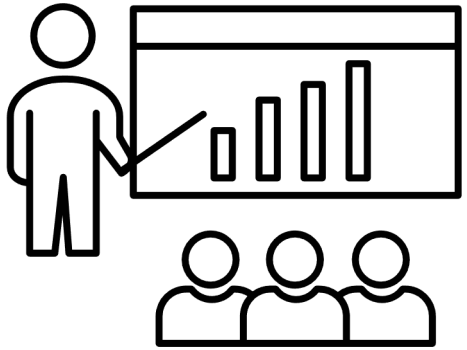
HEALTH

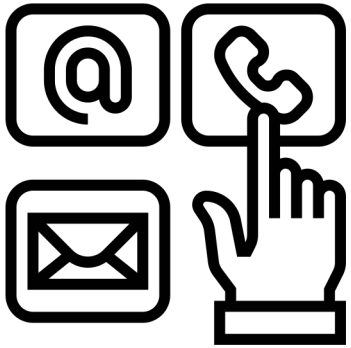
ECONOMICS



NEXT STEPS







Clean Air Lab

University of Victoria

Health and Climate Benefits of Cleaner Vehicles

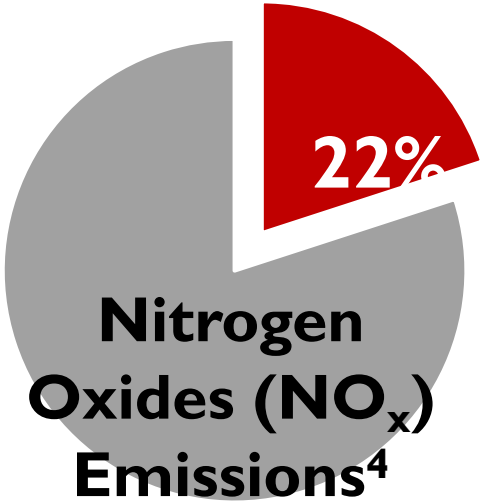
Dr. Laura Minet

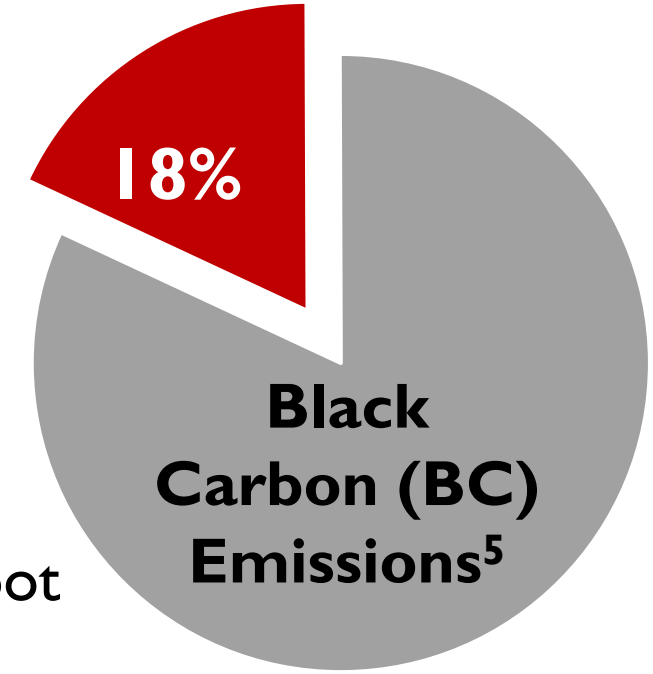
Assistant Professor - Civil Engineering

University of Victoria

On-Road Transportation: the Main Source of Emissions in Cities

On-road transportation





$NO_x = NO + NO_2$

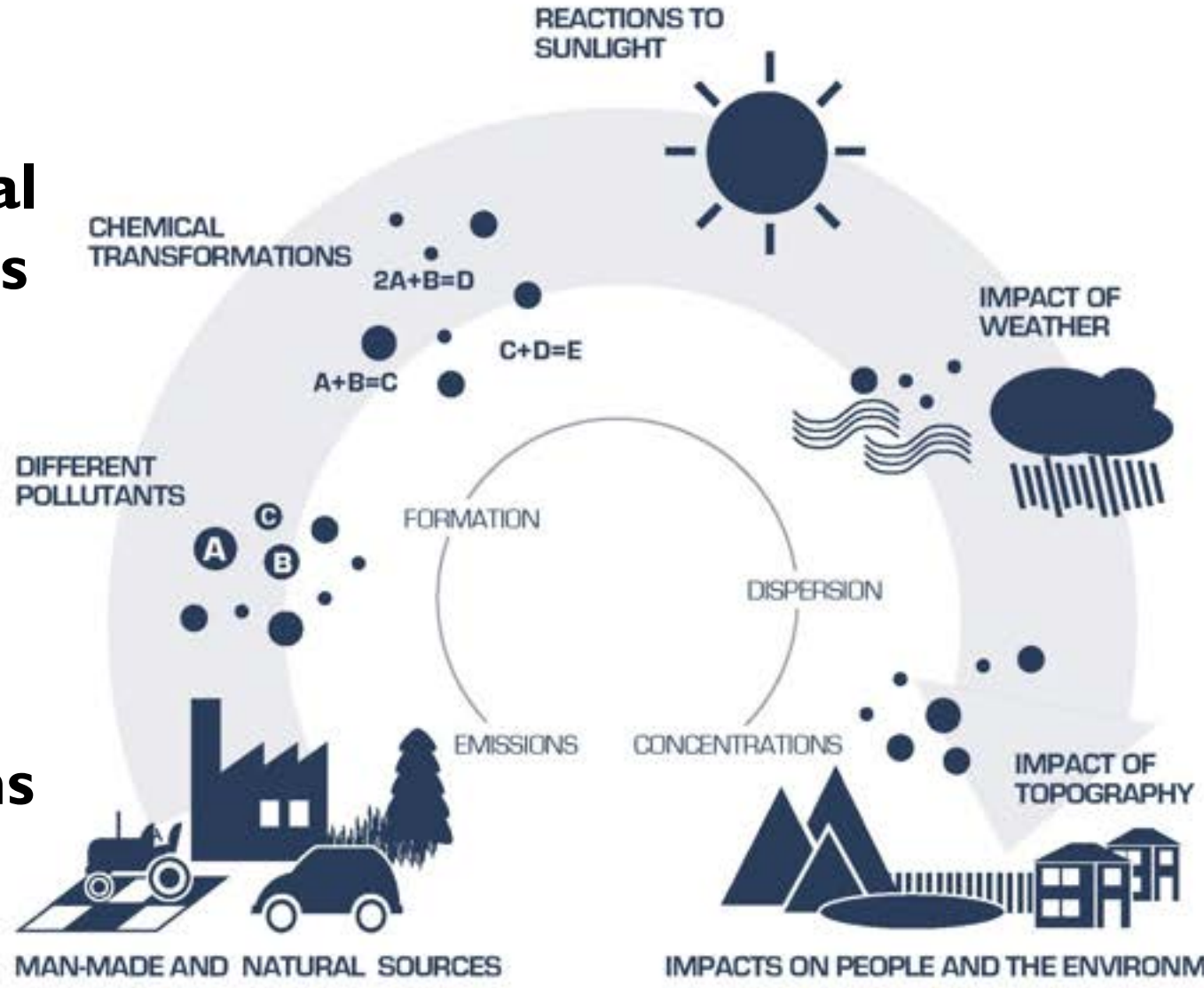
BC = Soot

Markers of traffic-related air pollution

Understanding Population Exposure Requires More than Quantifying Air Pollutant Emissions

2) Chemical reactions

3) Meteorology



1) Emissions

4) Urban design

Source: 6

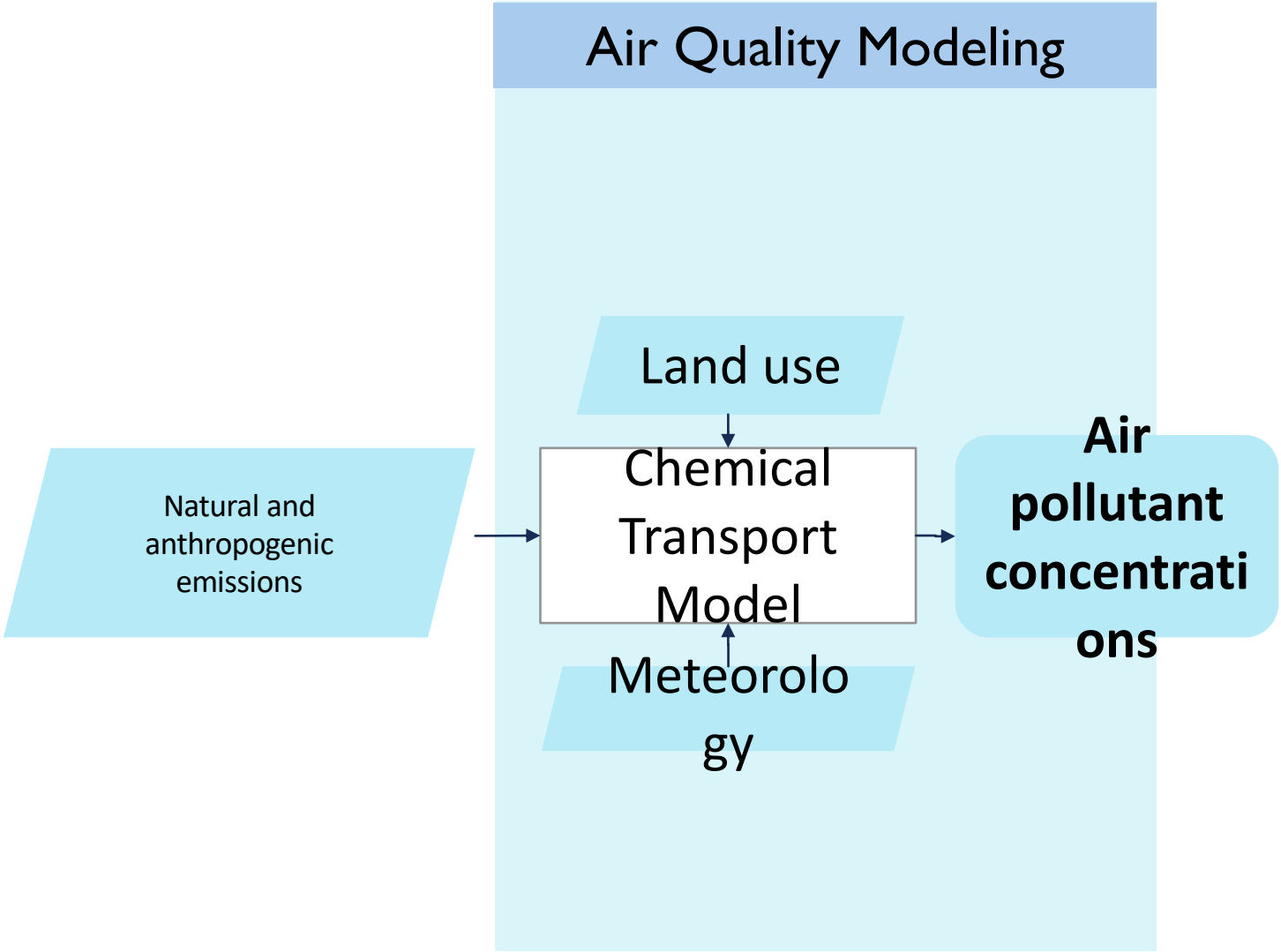
How Can we Improve Urban Air Quality with Transportation Policies?

2 Case Studies:

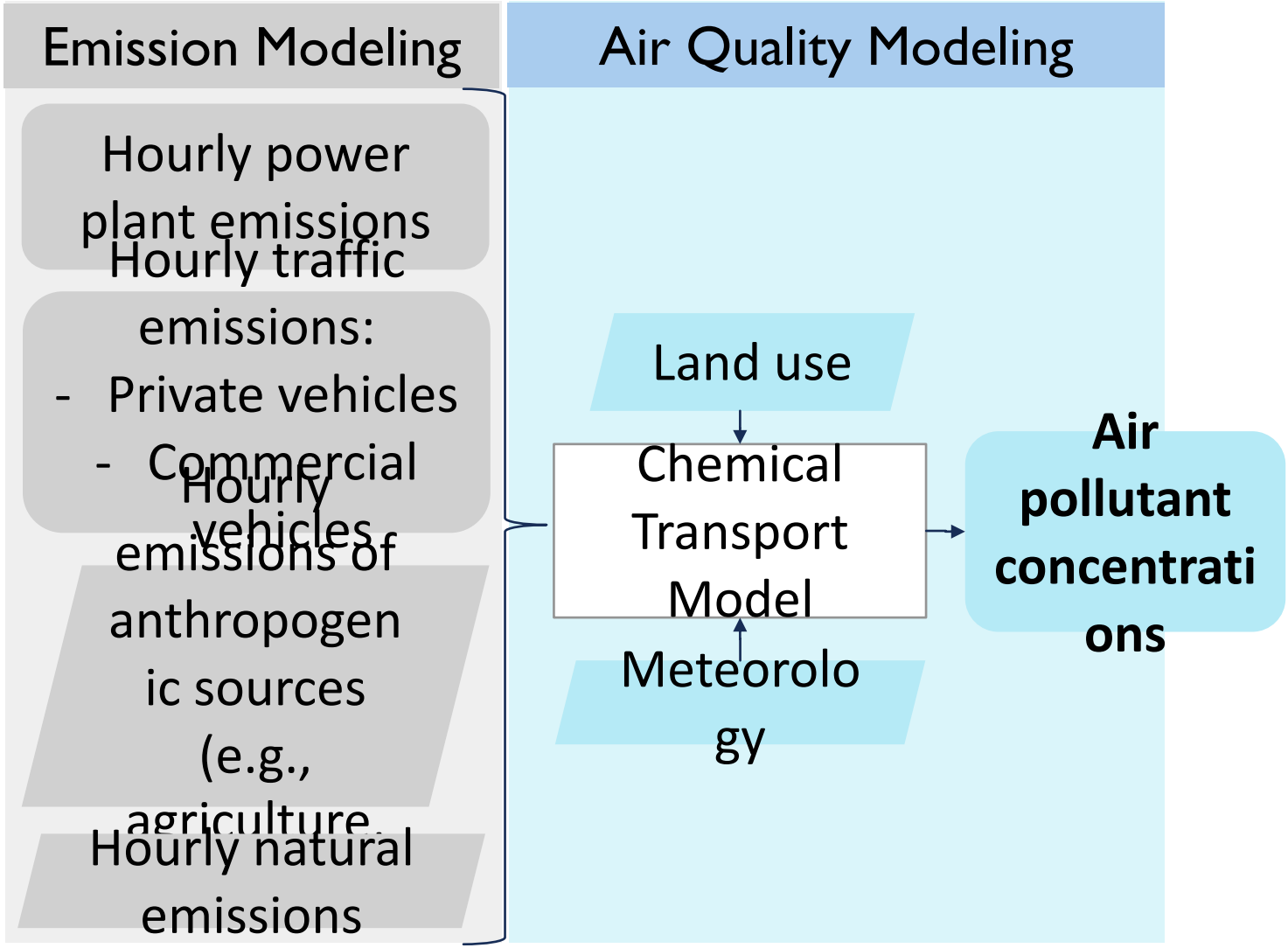
- What are the health burdens of on-road vehicles in the Greater Toronto and Hamilton Area (GTHA)?
- What are the climate and health benefits of getting cleaner vehicles on the roads in the GTHA?

Minet, L., Chowdhury, T., Wang, A., Gai, Y., Posen, I.D., Roorda, M. and Hatzopoulou, M., 2020. Quantifying the air quality and health benefits of greening freight movements. *Environmental Research*, 183, p.109193.
Gai, Y., Minet, L., Wang, A., Posen, I. D., Smargiassi, A., Tétreault, L.-F., Hatzopoulou, M. 2020. Health and climate benefits of electric vehicle deployment in the Greater Toronto and Hamilton Area. *Environmental Pollution*, 114983
Minet, L., Wang, A., Hatzopoulou, M. 2021. Health and Climate Incentives for the Deployment of Cleaner On-Road Vehicle Technologies. *Environmental Science & Technology. 55, 10, 6602–6612*

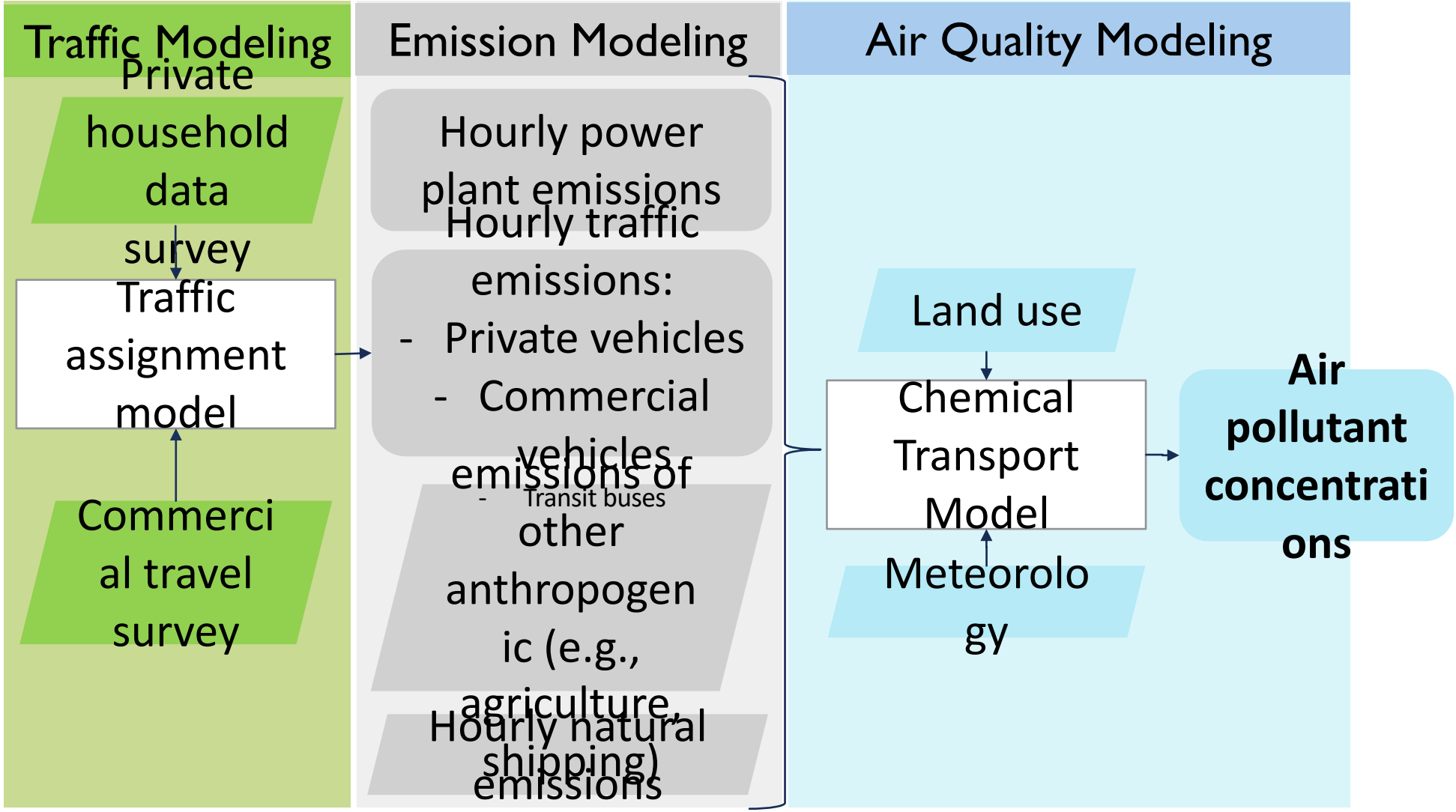
Modeling Framework



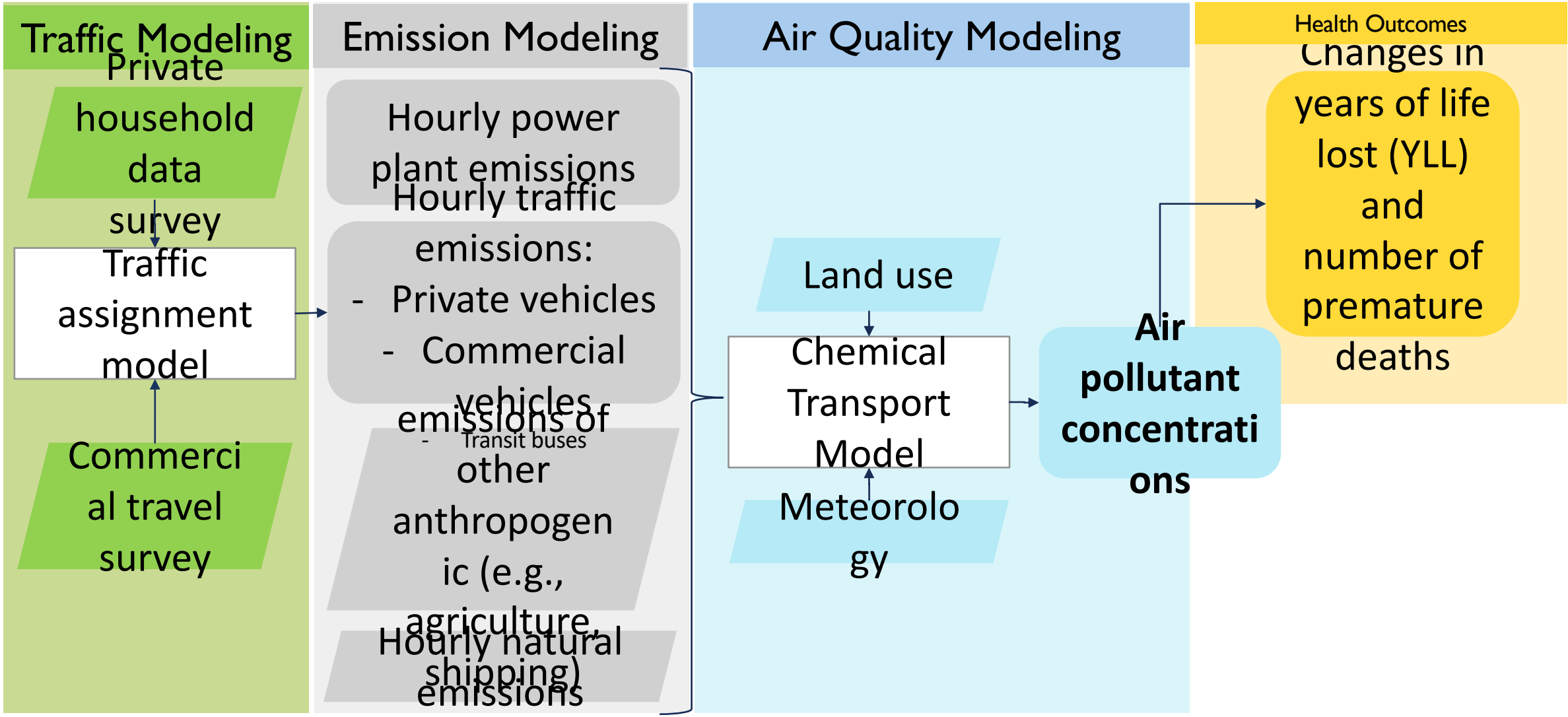
Modeling Framework



Modeling Framework



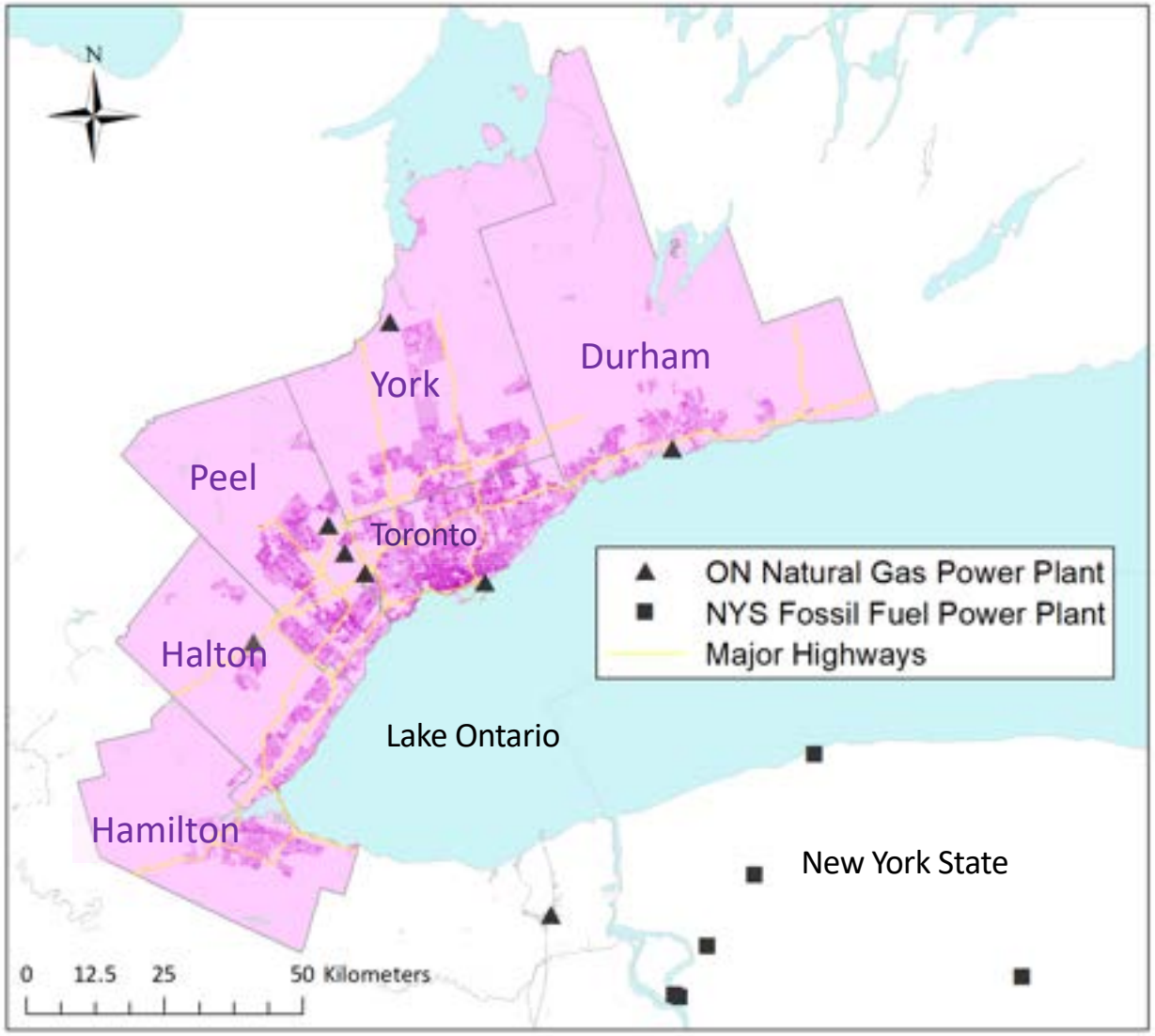
Modeling Framework



Concentration Response Functions (CRFs) Define the Relationship Between Exposure and Increased Risk of Disease

Source	Pollutant	Cause	RR (10µg/m³)
Crouse et al. 2012	$PM_{2.5}$	All Causes	1.100 (1.050 - 1.150)
Crouse et al. 2015	NO_2	All Causes	1.053 (1.032 - 1.075)
Jerrett et al. 2009	O_3	Respiratory Disease	1.020 (1.007 - 1.033)
Cao et al. 2011	SO_2	All Causes	1.018 (1.013 - 1.023)

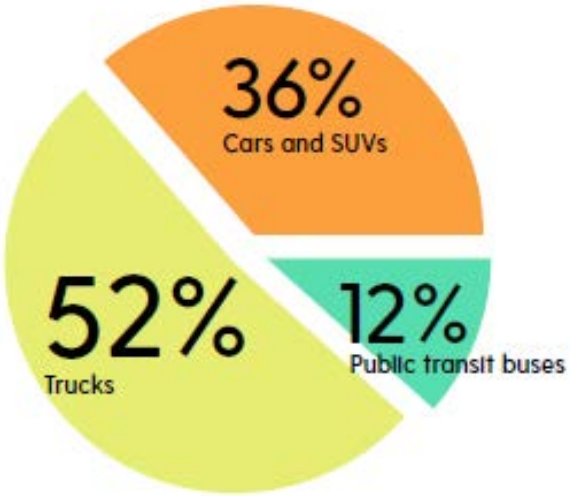
Study Area - The Greater Toronto and Hamilton Area (GTHA)



Trucks are the Largest Emitters of Traffic-Related NO_x and BC Emissions

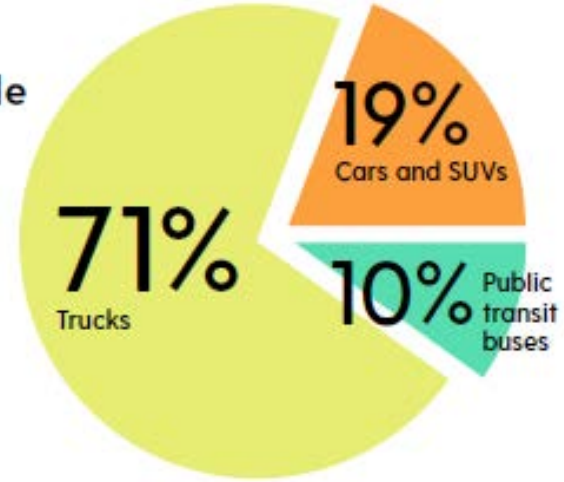
Traffic-related nitrogen oxides (NO_x) emissions by vehicle type in the GTHA

30 tonnes NO_x/day



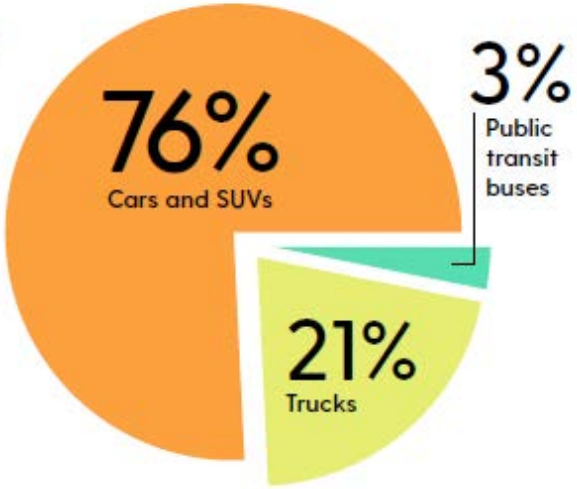
Traffic-related black carbon (BC) emissions by vehicle type in the GTHA

0.54 tonnes BC/day



Traffic-related greenhouse gas (GHG) emissions by vehicle type in the GTHA

34,340 tonnes CO_2 eq./day



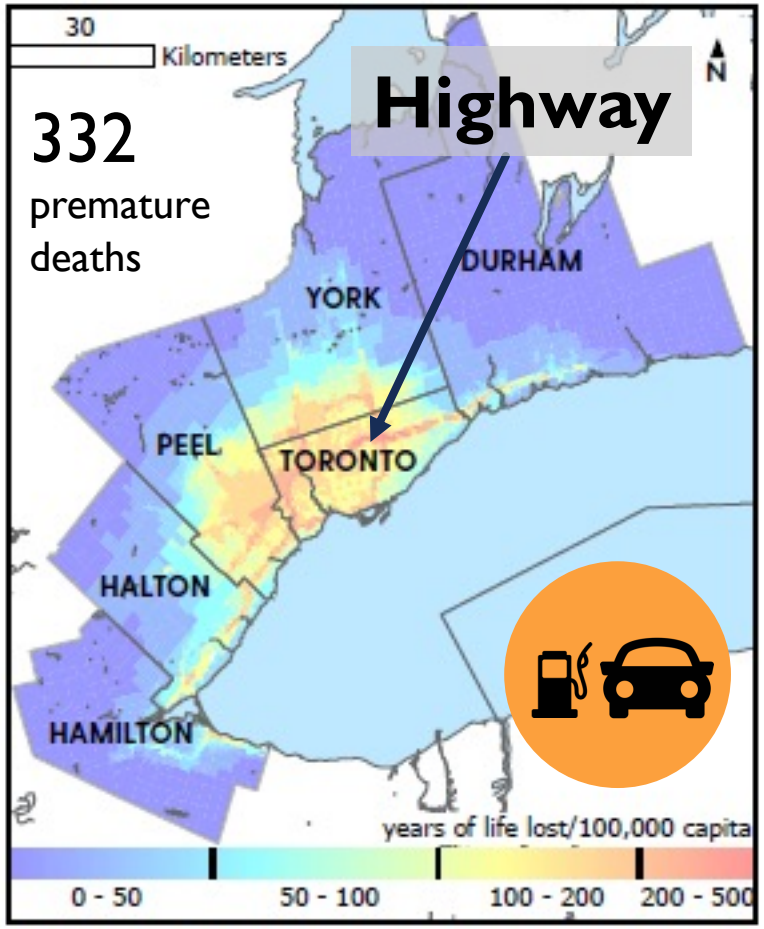
WHAT ARE THE HEALTH BURDENS OF DIFFERENT VEHICLE CATEGORIES?

Study Cases

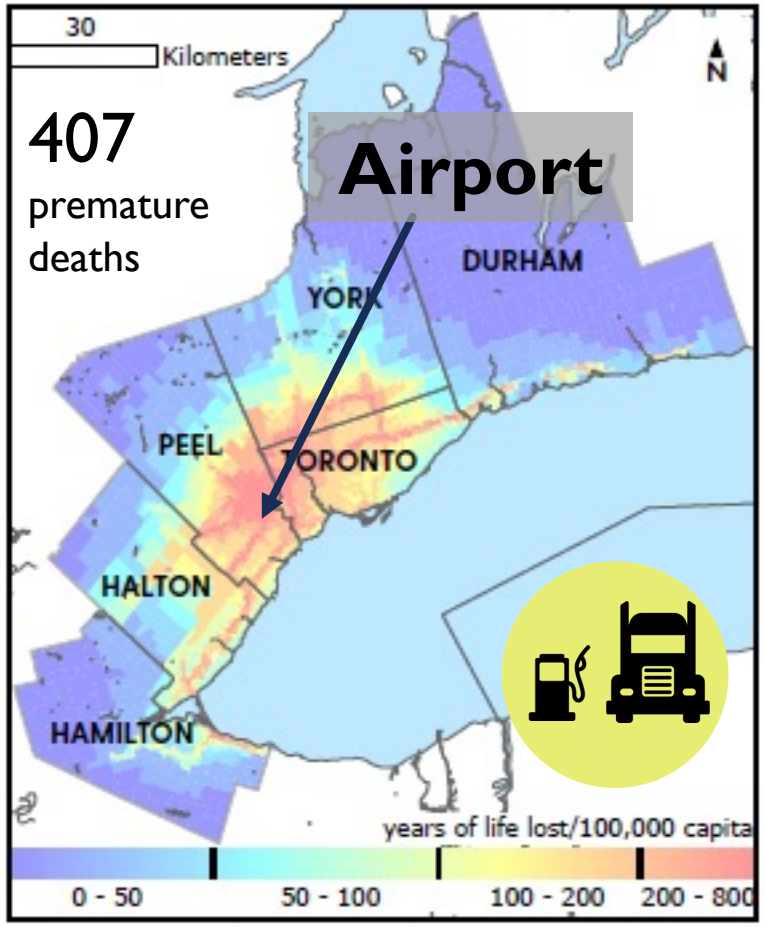
Base case	No private passenger vehicles	No commercial vehicles	No transit buses
			
			
			

Freight Transport Has the Greatest Health Burden

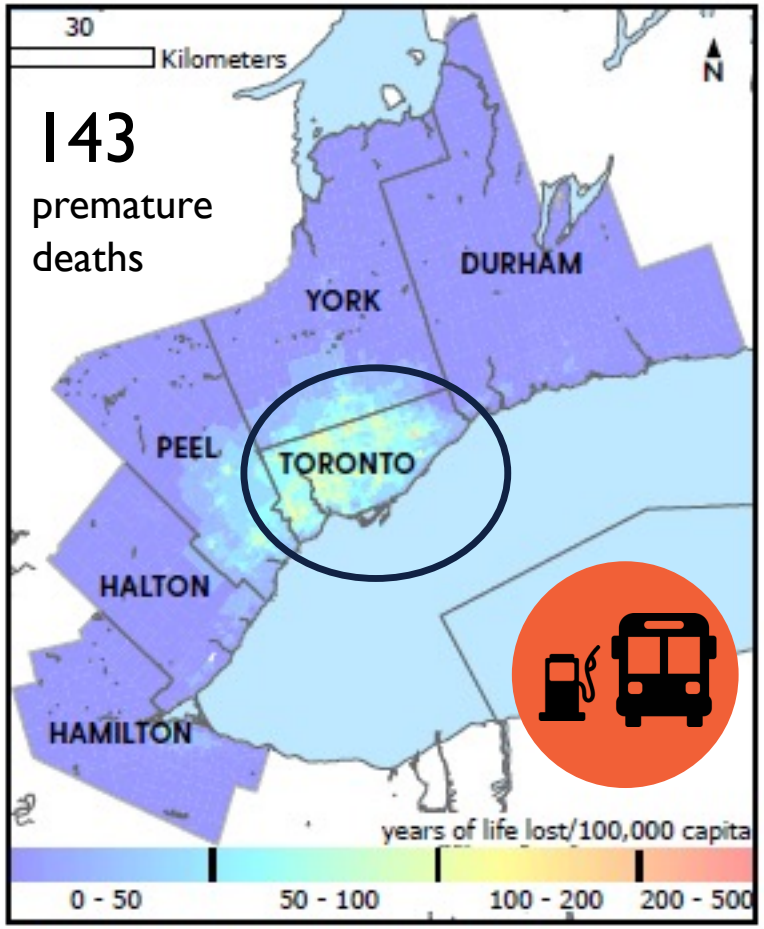
Annual number of years of life lost per 100,000 capita attributed to each mode



PRIVATE PASSENGER VEHICLES



COMMERCIAL VEHICLES



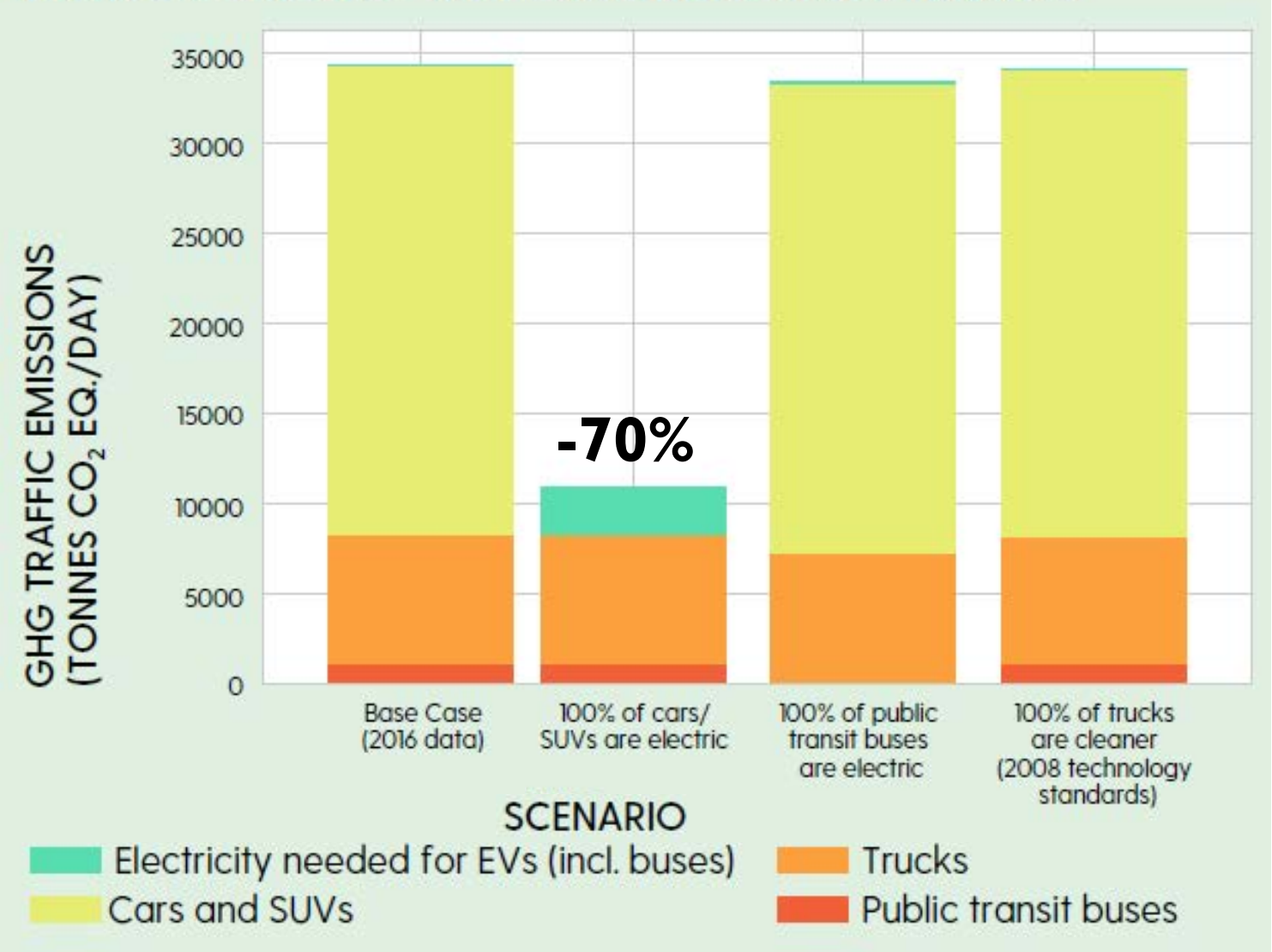
PUBLIC TRANSIT BUSES

WHAT ARE THE CLIMATE AND HEALTH BENEFITS OF GETTING CLEANER VEHICLES ON THE ROADS?

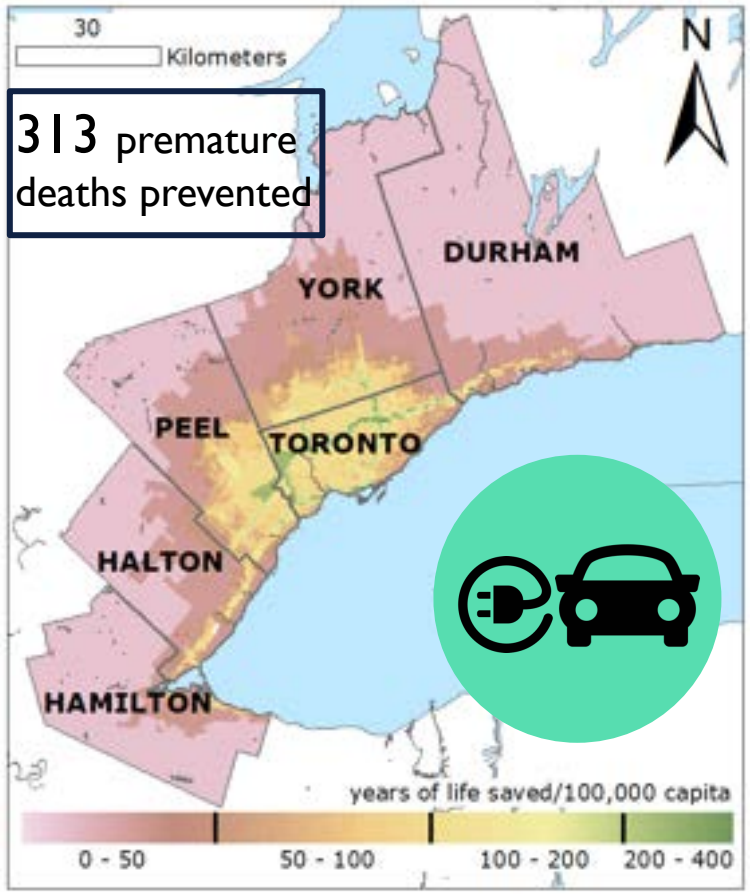
Scenarios

Base Case			
Scenario 1 : cars and SUVs are 100% electric			
Scenario 2 : transit buses are 100% electric			
Scenario 3 : cleaner trucks (2008 technology standards)			

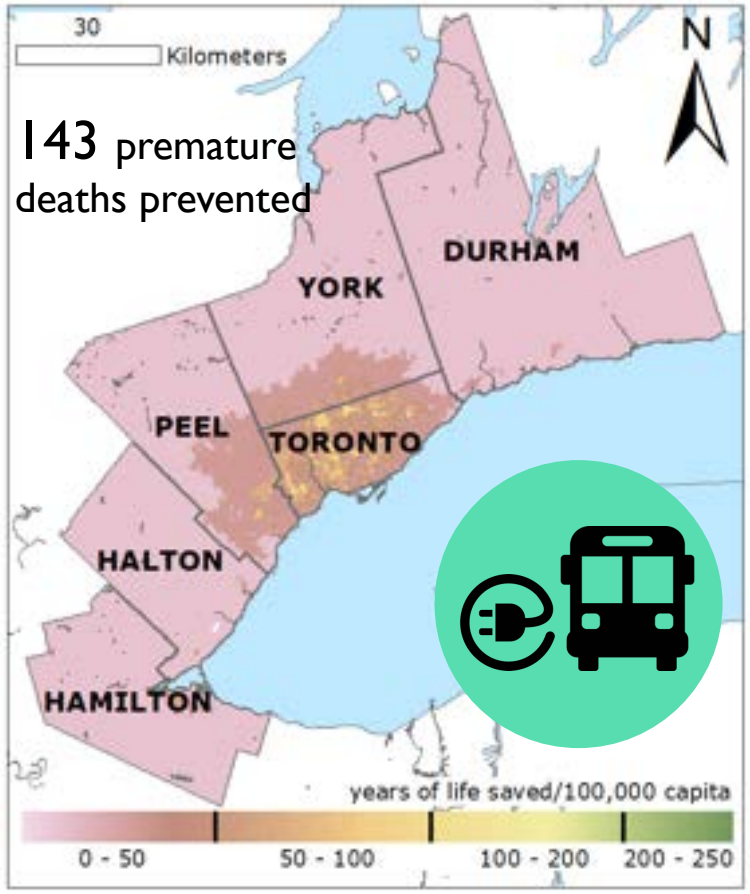
Electrifying all Private Passenger Vehicles Would Reduce GHG Emissions by 70%



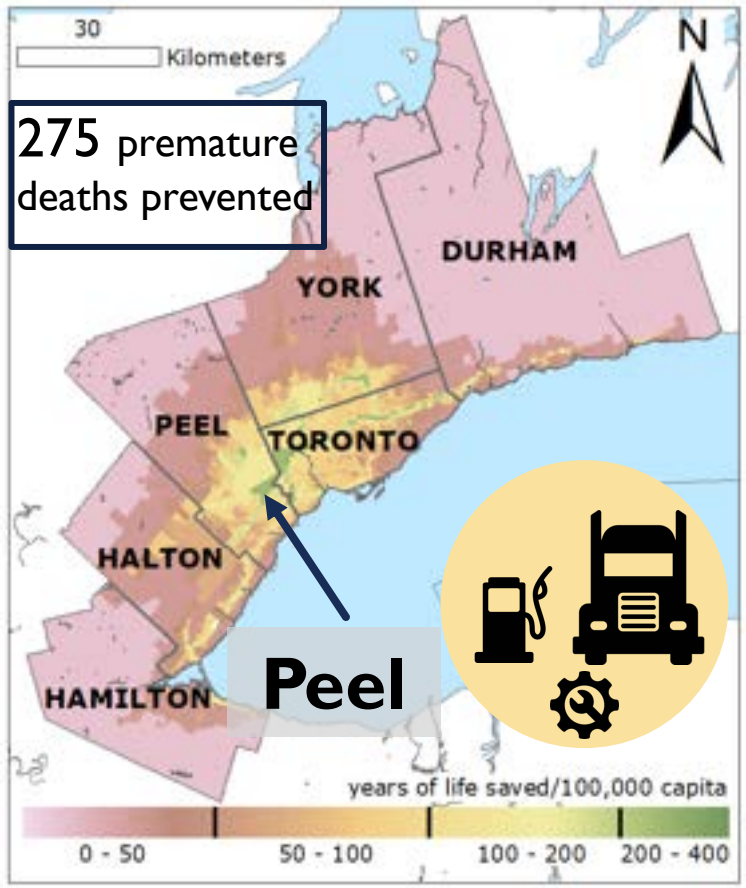
Cleaner Vehicles Prevent Premature Deaths and Reduce GHG Emissions



23,640



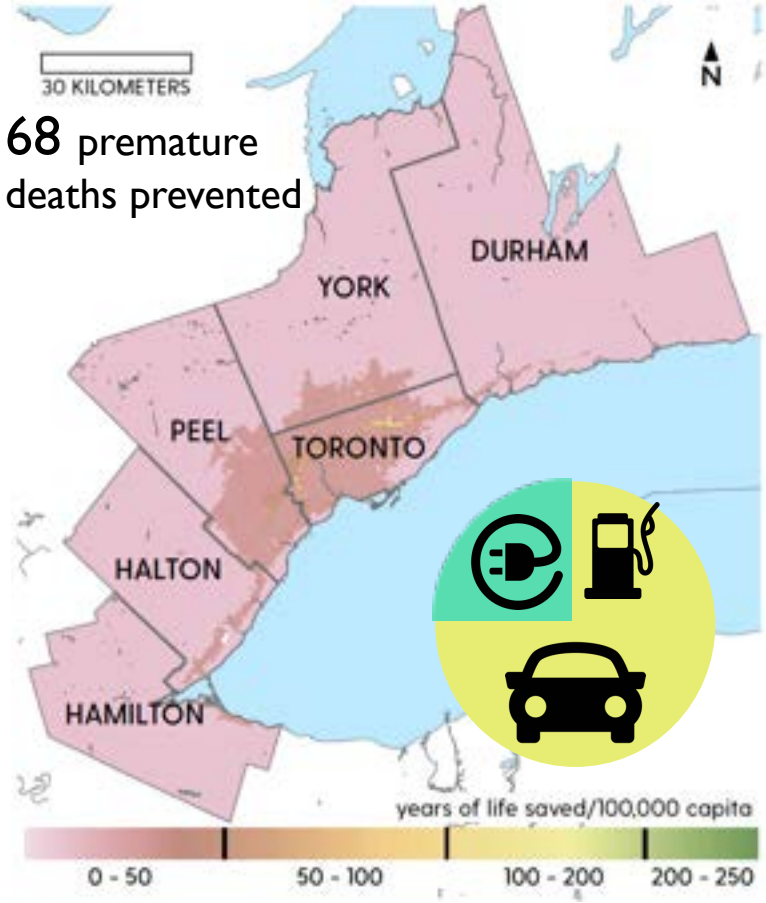
970



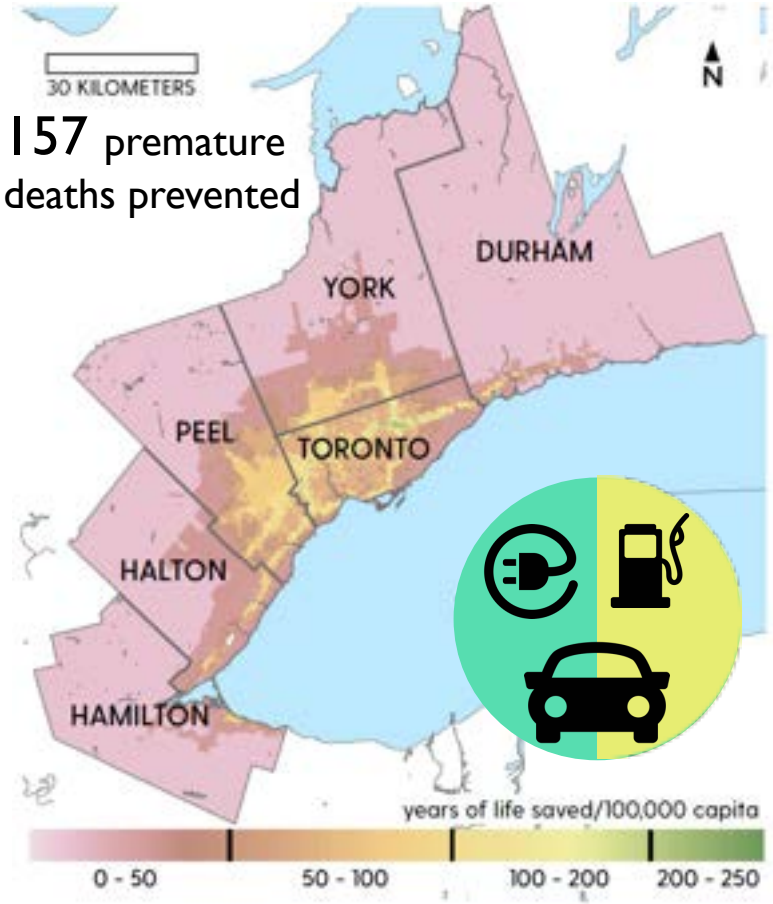
185

GHG emissions saved (tonnes CO_2 eq./day)

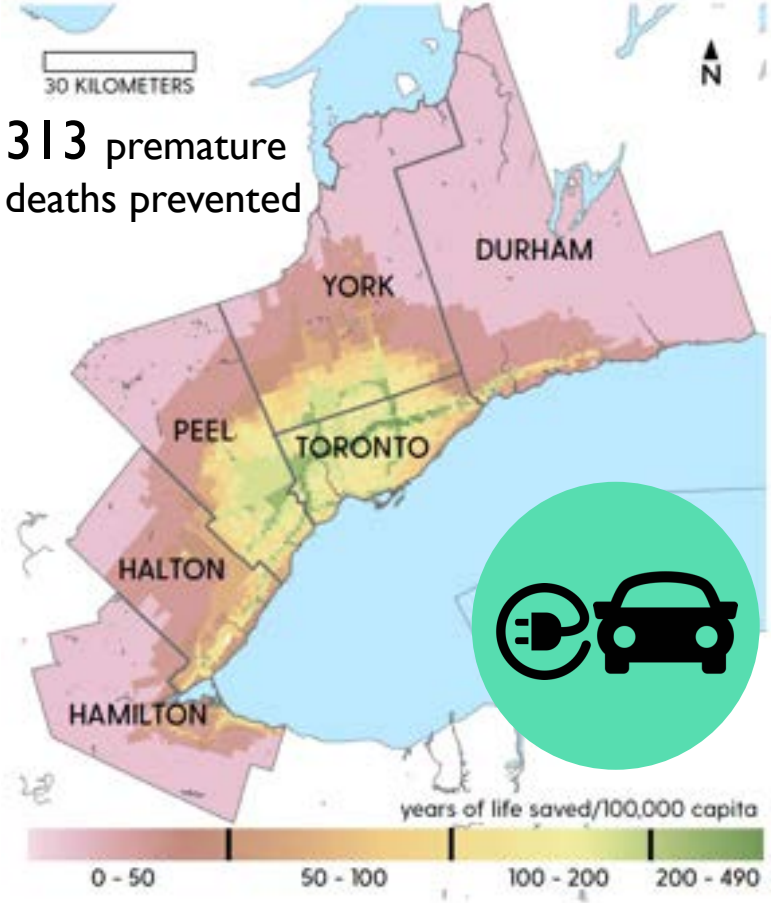
Partial and Total Electrifications of Private Passenger Vehicles Bring Similar Social Benefits



4,545



11,660



23,640

GHG emissions saved (tonnes CO_2 eq./day)

Acknowledgements

Funding sources:

NSERC CRSNG

Health Canada

Environment and Climate Change Canada
Environnement et Changement climatique Canada

TORONTO ATMOSPHERIC FUND

environmental defence
INSPIRING CHANGE

Environnement et Lutte contre les changements climatiques
Québec

Co-authors:

Marianne Hatzopoulou, Yijun Gai, Daniel Posen, Tufayel Chowdhury, An Wang, Anna Kramer, Alexandre Milovanoff, Sara Torbatian, Sham Gamage, Shoma Yamanouchi, Arman Ganji

QUESTIONS?

Dr. Laura Minet

lauraminet@uvic.ca

http://cleanairlab.ca/

Clean Air Lab

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1: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

2: https://www.canada.ca/en/health-canada/services/air-quality/health-effects-indoor-air-pollution.html

3: https://www.peelregion.ca/health/resources/healthbydesign/pdf/moh-report.pdf

4: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollutant-emissions.html

5: https://www.canada.ca/en/environment-climate-change/services/air-pollution/publications/black-carbon-inventory-emissions-2020/chapter-2.html

6: https://www.eea.europa.eu/media/infographics/many-factors-contribute-to-air-1/view

Health Impacts of Diesel Exhaust and Traffic-related Air Pollution

Bring on the Electric School Buses!

Eugenie Waters, MD CCFP
Family Physician, General Practitioner in Oncology

- Background information
- Health impacts of diesel exhaust
- Benefits of a transition to electric school buses

Healthcare in Ontario is in a state of ongoing crisis

CBC

Ontario pediatric hospitals ask for help to deal with backlog… surgeries

A surge of viral respiratory illnesses, driven by a particularly bad ... Centre and CHEO, a health care and research facility in Ottawa.

4 weeks ago

Macleans.ca

An impossible job: What it's like to work in a pediatric ICU

... critical care at the Children's Hospital of Eastern Ontario, or CHEO. ... crisis in hospitals caused by the surge in respiratory viruses...

2 days ago

CHEO

CHEO opens a second Intensive Care Unit. You can help ...

... driven by acute viral respiratory infections including RSV, flu, ... To address this crisis, CHEO has been taking a series of measures...

Nov 9, 2022

Ottawa Citizen

Children's health crisis: 7 kids resuscitated at CHEO; Ford … called out for not wearing masks

Article content. The president of CHEO has issued another plea for the public to help prevent the spread of respiratory viruses after hospital...

Nov 15, 2022

Ottawa Citizen

Up to 150,000 Ottawa residents don't have access to primary care: Ott… Health

An estimated 1.8 million Ontario residents are in need of a family doctor but determining exactly how big the primary health-care gap is in...

3 weeks ago

Capital Current

Primary care crisis sparks urgent push for solutions locally ...

The issue of Canadians' access to primary health care — in short, a family doctor — was also at the forefront of a Jan. 30 Ottawa Board of...

4 days ago

CTV News Winnipeg

Health-care deal: Ottawa and Manitoba meet to negotiate ...

The 10-year, $196 billion deal offered by Ottawa included $25 billion ... primary health-care, and having the feds improve the credentials...

19 hours ago

The Globe and Mail

Ontario announces $30-million for new primary care teams ...

The Ontario government says it supports Ottawa's call for health care data reporting as part of a funding deal with the provinces and...

2 weeks ago

CLIMATE CHANGES HEALTH IN CANADA

Climate change is the biggest global health threat of the 21st century.
— Lancet[1]

IMPACTS ON AVAILABILITY OF TRADITIONAL FOODS[2] AND MENTAL HEALTH[3] IN THE NORTH

Due to arctic warming (3x Global Rate)[4].

DISPLACEMENT

Climate change-exacerbated drought and famine was one factor in Syrian refugee crisis.[24]

WILDFIRE-RELATED ASTHMA[5] & EVACUATION

Healthcare facilities evacuated:
- Fort McMurray: 105 patients[6,7]
- Interior BC 2017: 880 patients[8,9]

Anxiety & PTSD following evacuation.[10]

FLOOD-RELATED DEATHS AND DAMAGE

2013 Alberta flood[11]:
- 5 deaths[12]
- Healthcare facilities closed due to flooding.[13]

DROUGHTS[14,15]

Uneven impact on crops.[16]
Socioeconomic stress.[17]

ALLERGIES

Increased severity & duration of pollen seasons.[18]

TICK-BORNE DISEASE

2017: 3x higher rate Lyme Disease in Ontario than 2012-2016 average.[19]

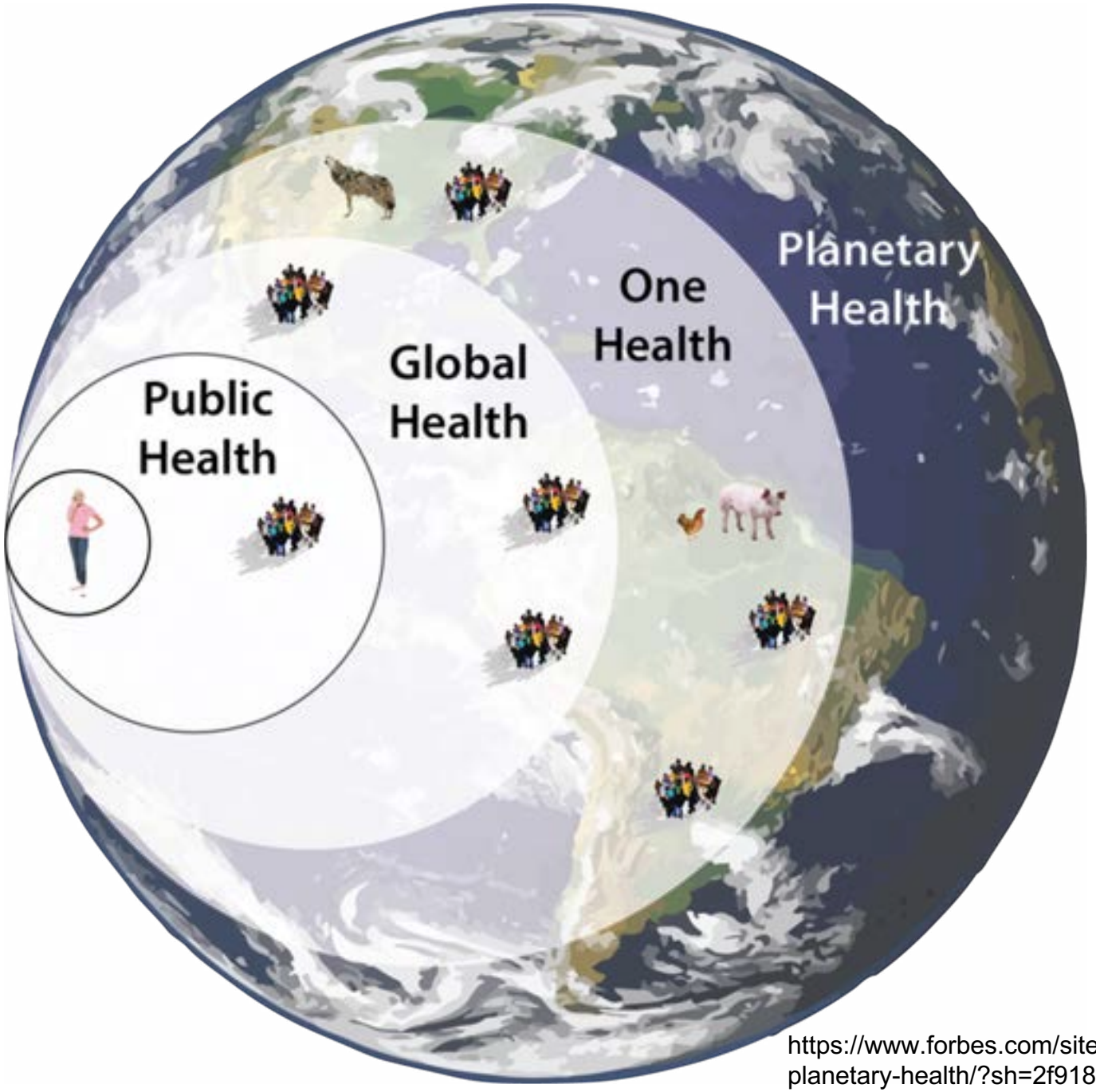
HEAT-RELATED ILLNESS[20]

66 people died in Montreal during 2018 heat wave.[21,22]

RELOCATION & STRESS FROM COASTAL EROSION

P.E.I. homes at risk.[23]

1-Costello, The Lancet, 2009; 2-Rosol R, IJCH, 2016; 3-Cunsolo A, Ellis N, Nature CC 2018; 4-Canada's Changing Climate 2019; 5-Yao J et al, 2016; 6-Hampshire, G, CBC 2016; 7-Kirchmeier-Young M 2017; 8-BC Int Health 2017; 9-Kirchmeier-Young M et al, Am Geo Un; 2018; 10-Alberta Health, 2016; 11-Teufel B et al 2017; 12-CBC Alberta Flood 2013; 13-United Nurses of Alberta 2013; 14-Yusa A, et al, Int J Env Res P H; 2015; 15- Smoyer-Tomic KE, et al. Ecohealth 2004; 16- Agriculture and Agri-Food Canada, 2015; 17-Cryderman K, 2018; 18- Ziska LH, The Lancet PH 2019; 19- Naidei MP, 2018; 20-Howard, C et al. The Lancet Countdown Policy Brief for Canada 2018; 21-Montreal PH, 2019; 22- Vogel MM et al, Am Geo Union, 2019; 23-Fenech, A, 2014; 24-Kelleya, C, et al, 2015

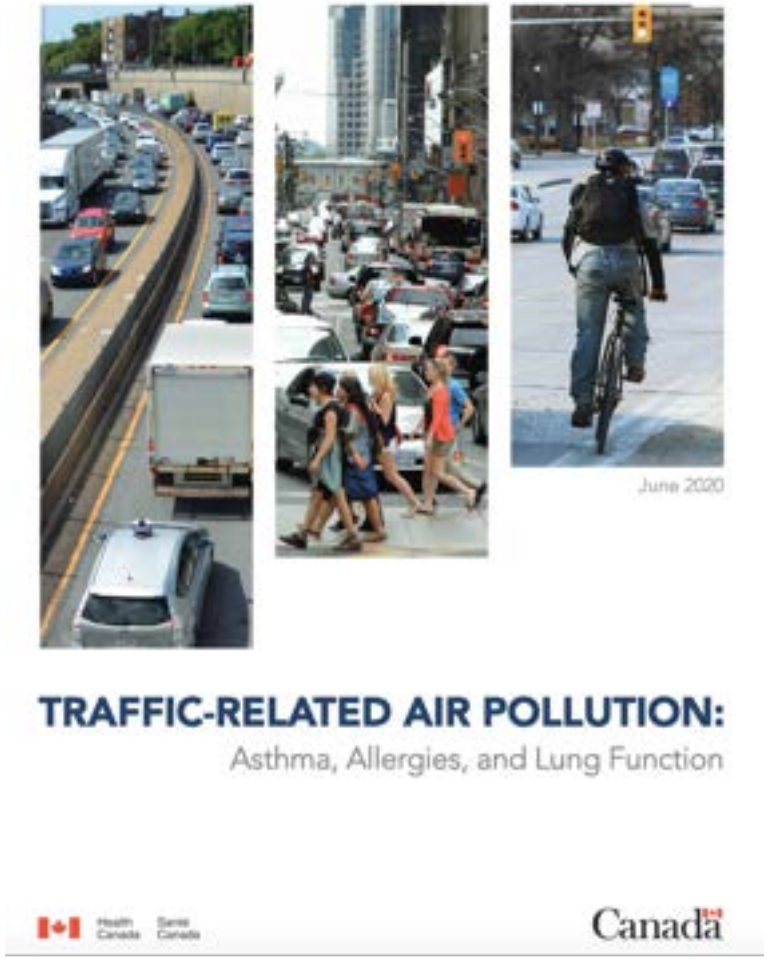


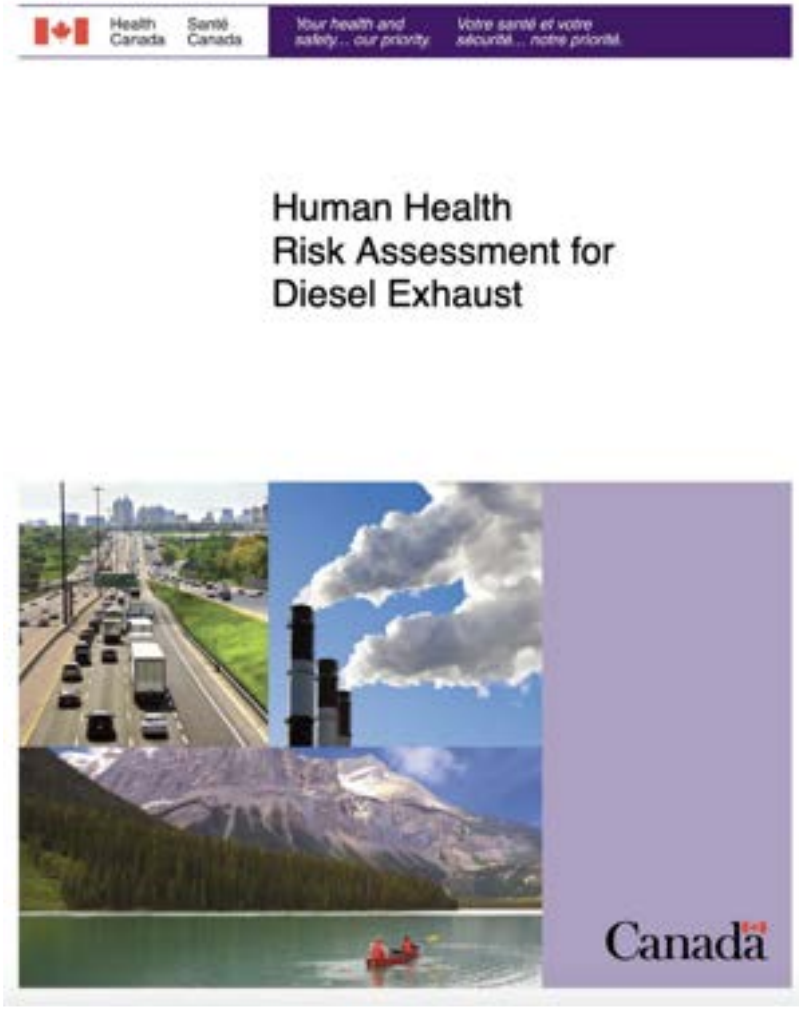
https://www.forbes.com/sites/johndrake/2021/04/22/what-is-planetary-health/?sh=2f9187372998


SCHOOL BUS
447D

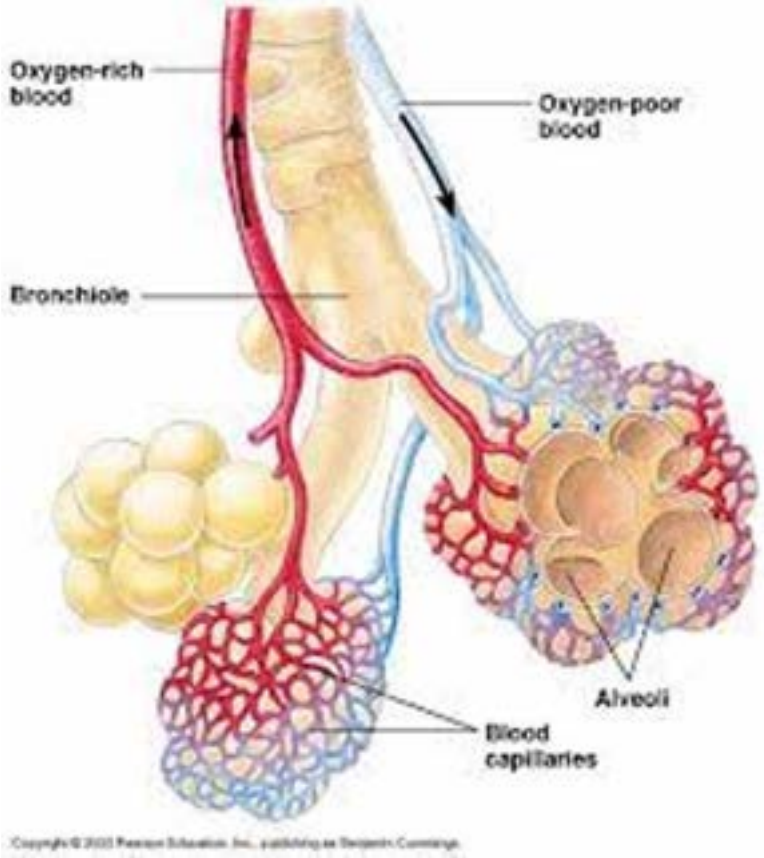

SCHOOL BUS
LION C

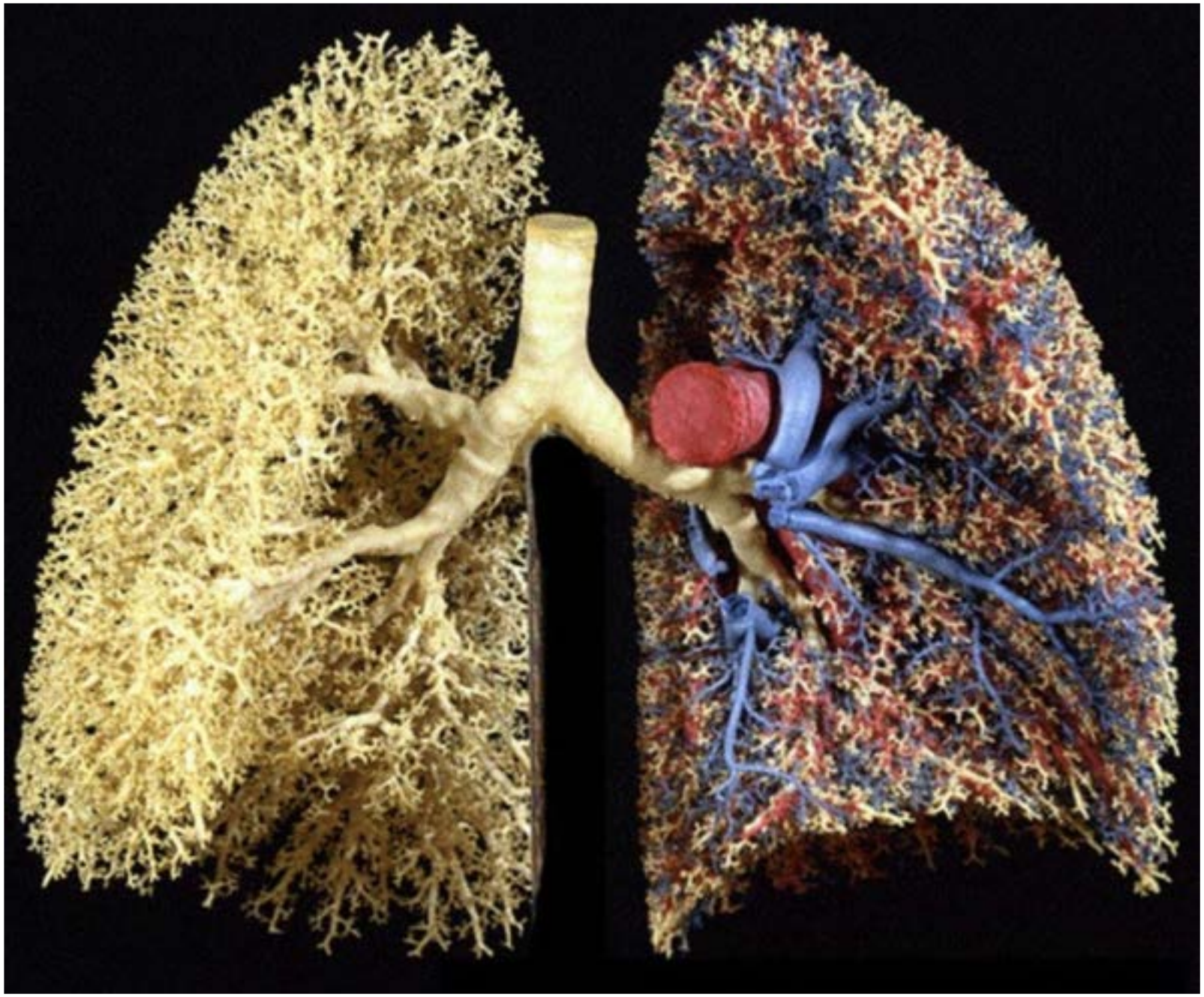

CAPE
Canadian Association of Physicians for the Environment
Association canadienne des médecins pour l'environnement
ACME
Mobilizing Evidence
ACTIVATING CHANGE ON TRAFFIC-RELATED AIR POLLUTION (TRAP) HEALTH IMPACTS
APRIL 2022


June 2020
TRAFFIC-RELATED AIR POLLUTION:
Asthma, Allergies, and Lung Function
Health Canada
Santé Canada
Canada


Health Canada
Santé Canada
Your health and safety... our priority.
Votre santé et votre sécurité... notre priorité.
Human Health
Risk Assessment for
Diesel Exhaust
Canada

https://www.canada.ca/en/health-canada/services/publications/healthy-living/traffic-related-air-pollution-asthma-allergies-lung-function.





Model of human lungs - Dr. Robb Glenny

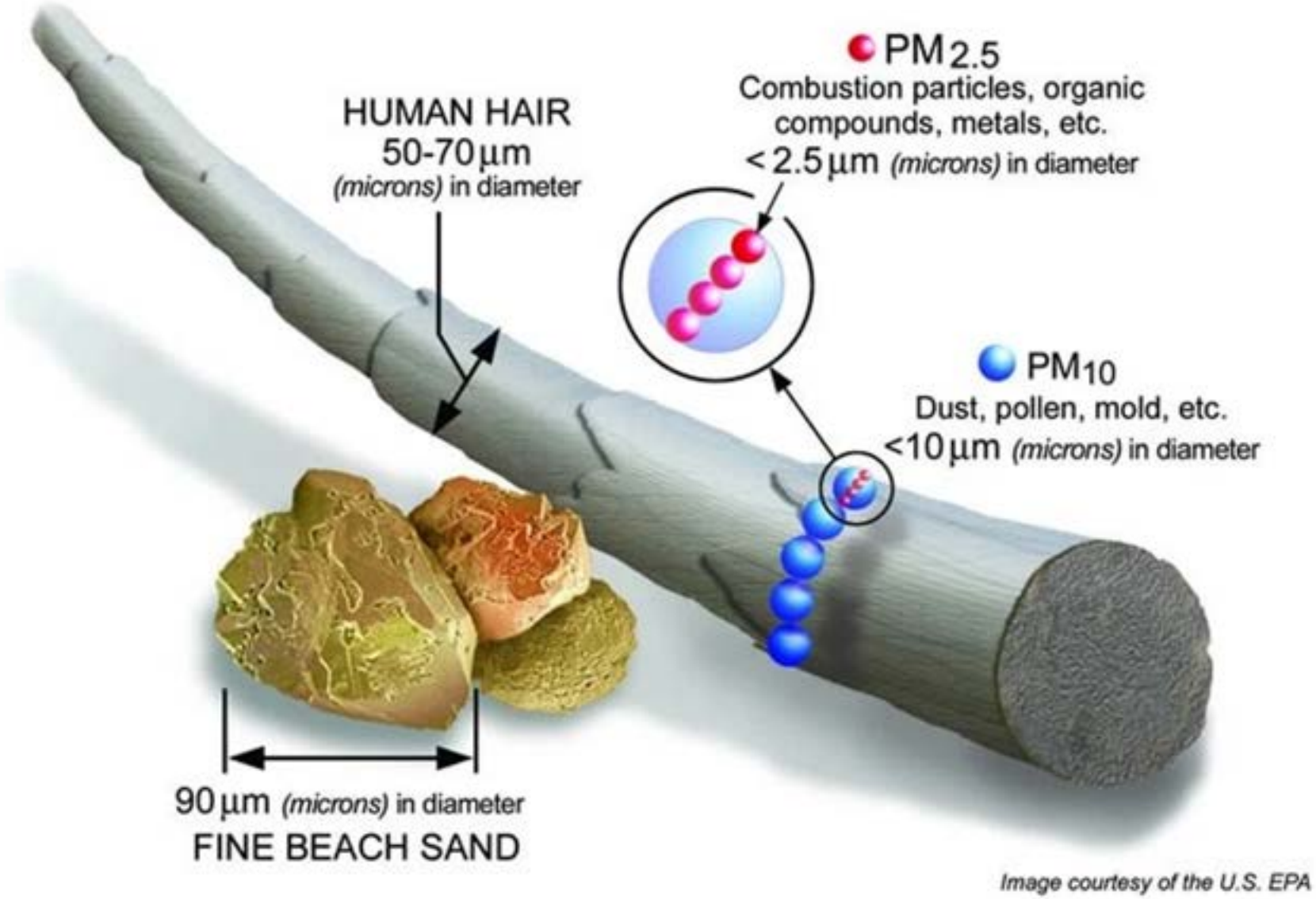
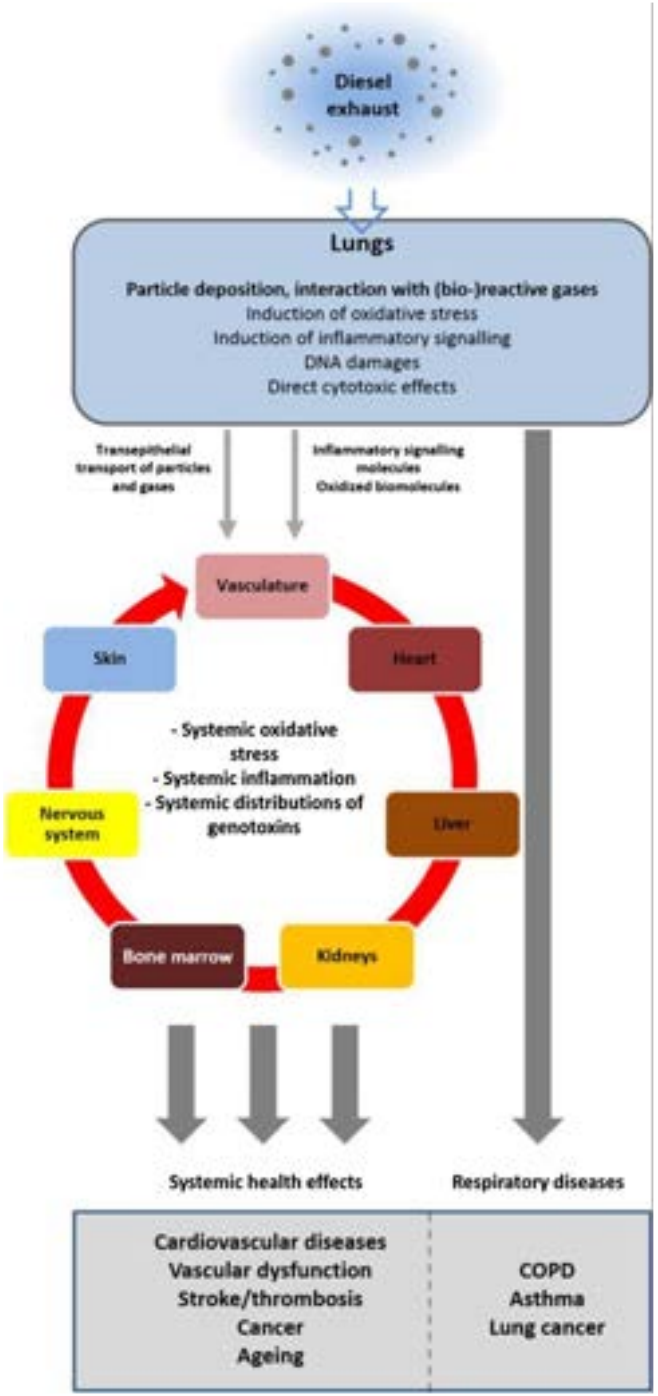


Image courtesy of the U.S. EPA



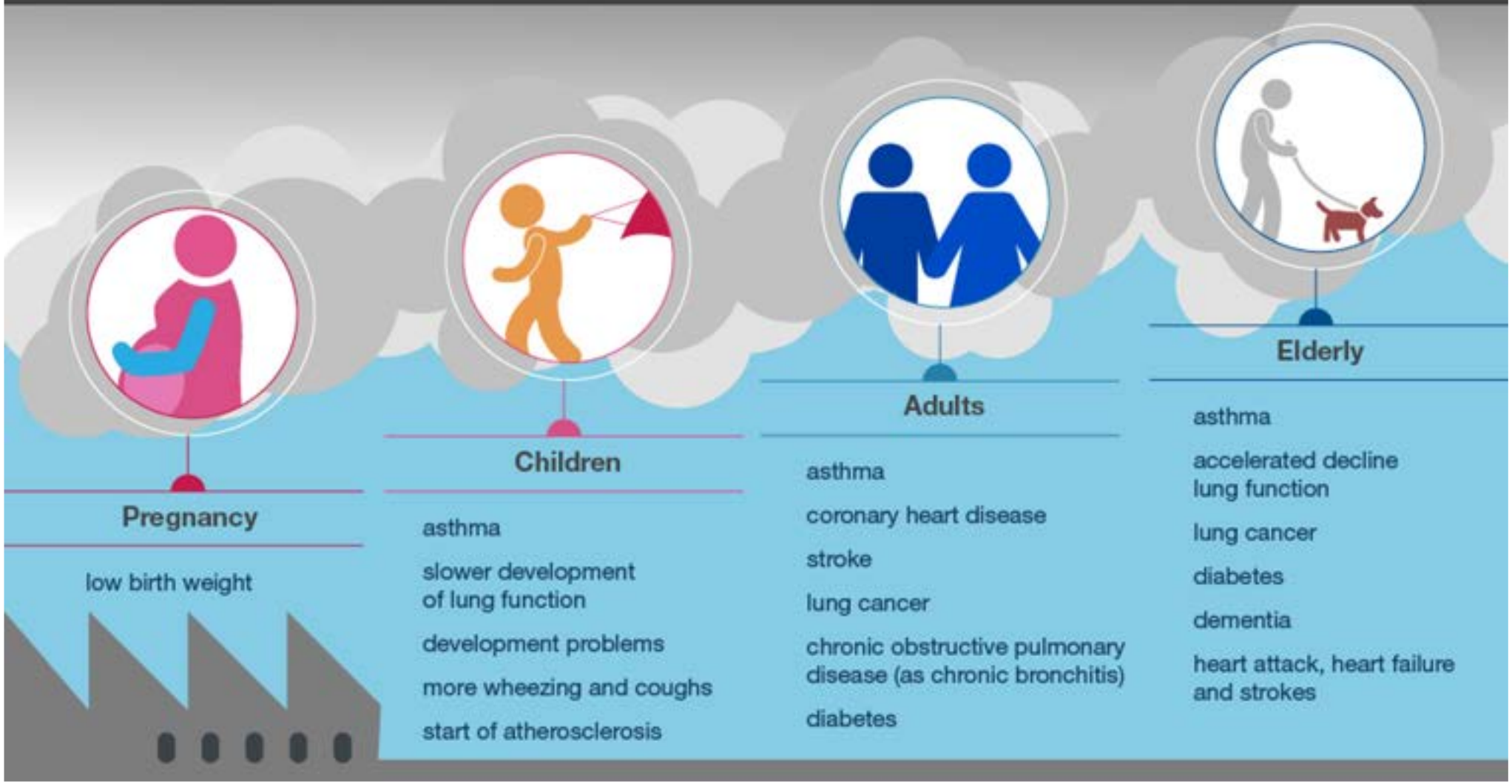
Diesel exhaust: current knowledge of adverse effects and underlying cellular mechanisms. Arch. Toxicol. 2016

Who is at risk from TRAP?

About 1/3 of all Canadians live in elevated TRAP exposure zones (within 500 m of highways or 100 m of major urban roads)

https://www.canada.ca/en/health-canada/services/publications/healthy-living/traffic-related-air-pollution-asthma-allergies-lung-function.

Air pollution affects people throughout their lifetime



Children are especially Vulnerable to TRAP

“Children are NOT little adults!”

Children are more likely to be at risk from environmental hazards than adults because of:

- Unique activity patterns and behavior
- Physiological differences
- Windows of susceptibility during early life stages including fetal development and puberty

Children are also dependent upon adults to ensure that their environment is safe.

https://www.epa.gov/children/children-are-not-little-adults

↓ Reduced Lung Function

-Spirometry
-Symptoms of cough or wheeze

↑ Respiratory-related ER visits

Asthma - Inflamed Bronchial Tube

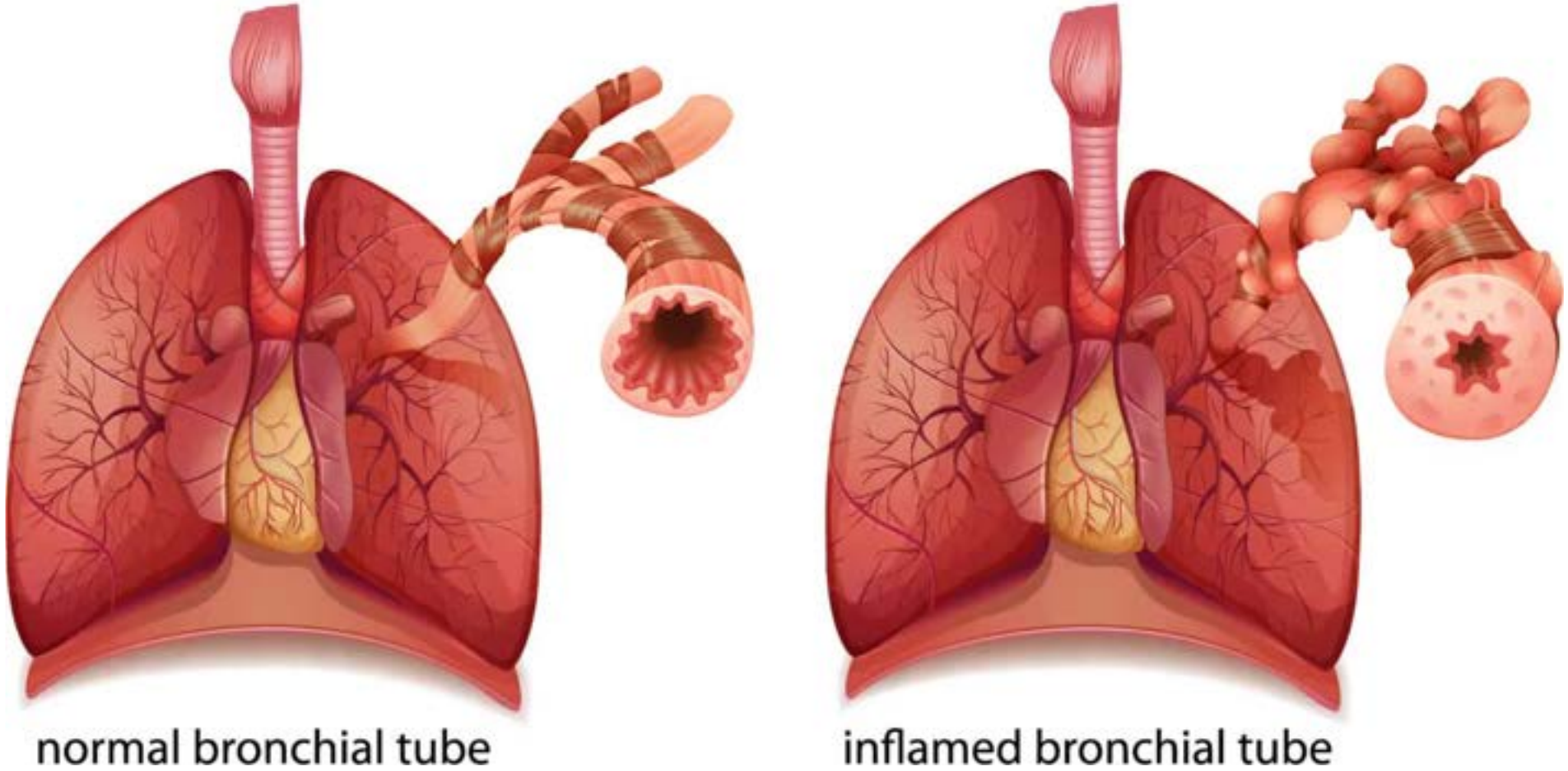
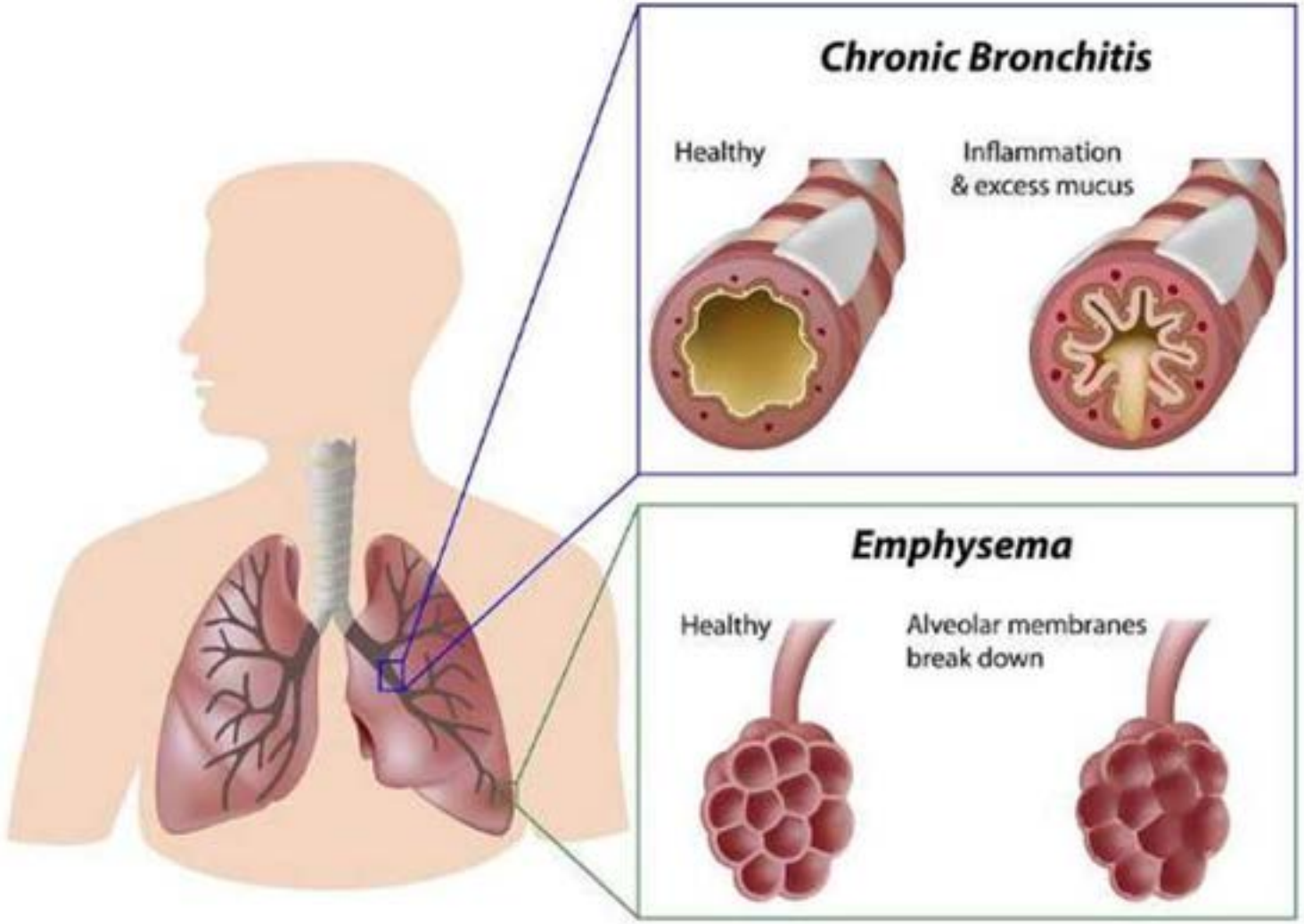


Image: https://asthma.ca/get-help/understanding-asthma/

↑ Childhood asthma

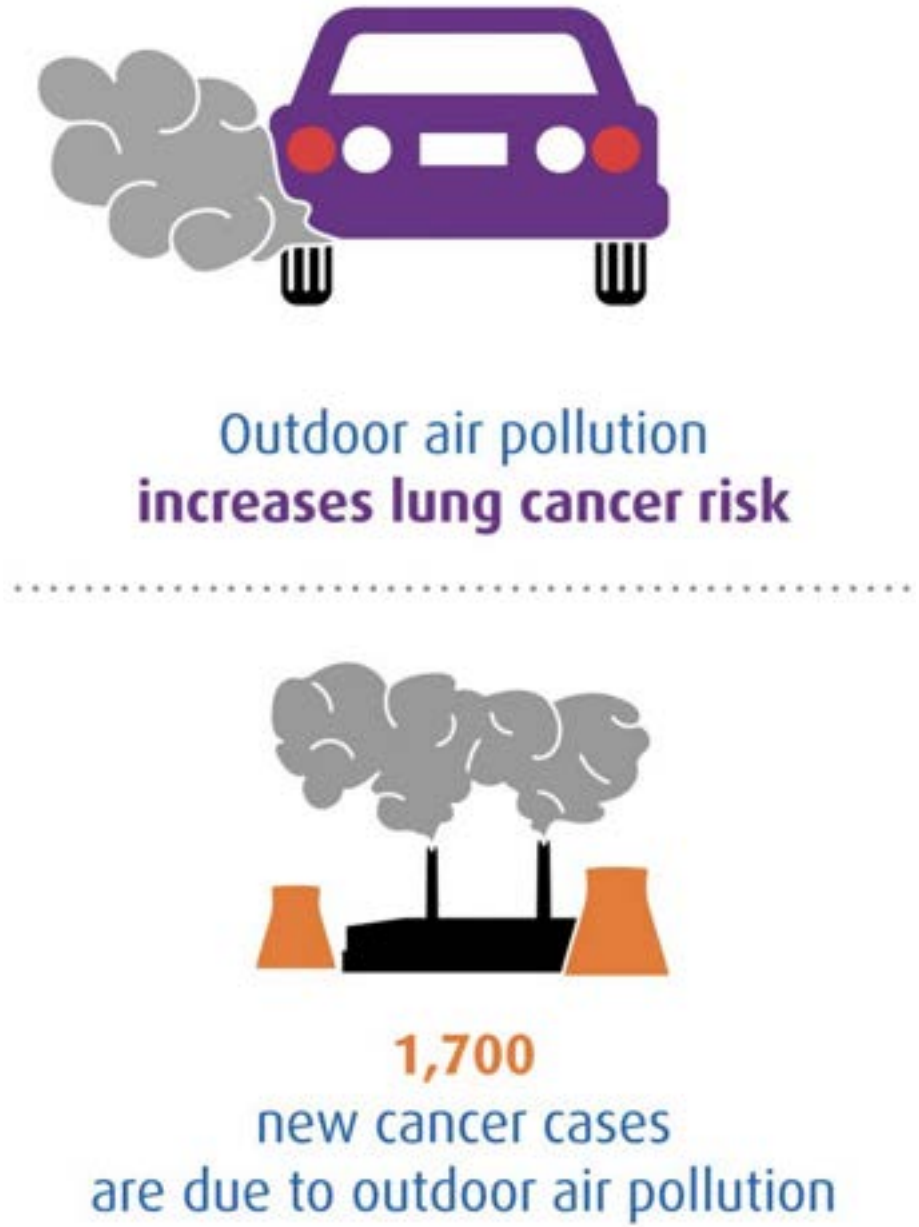
↑ Adult asthma

Chronic Obstructive Pulmonary Disease (COPD)



↑ COPD Exacerbations

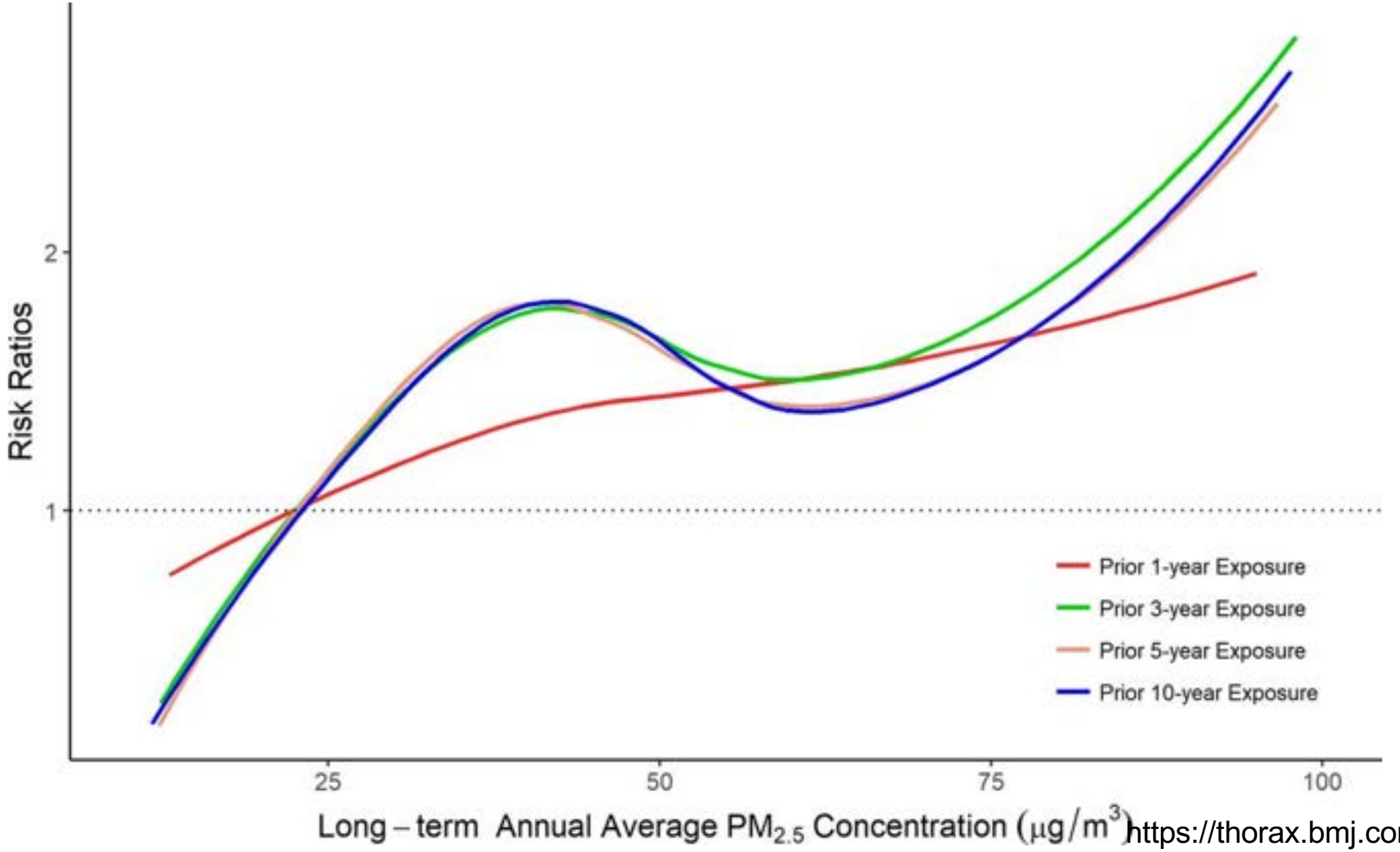
↑ Risk for lung cancer



In Canada, about 7% of lung cancer cases in 2015 were due to outdoor air pollution – that's almost 1,700 lung cancer cases

ComPARe Study (Canadian Population Attributable Risk of Cancer)

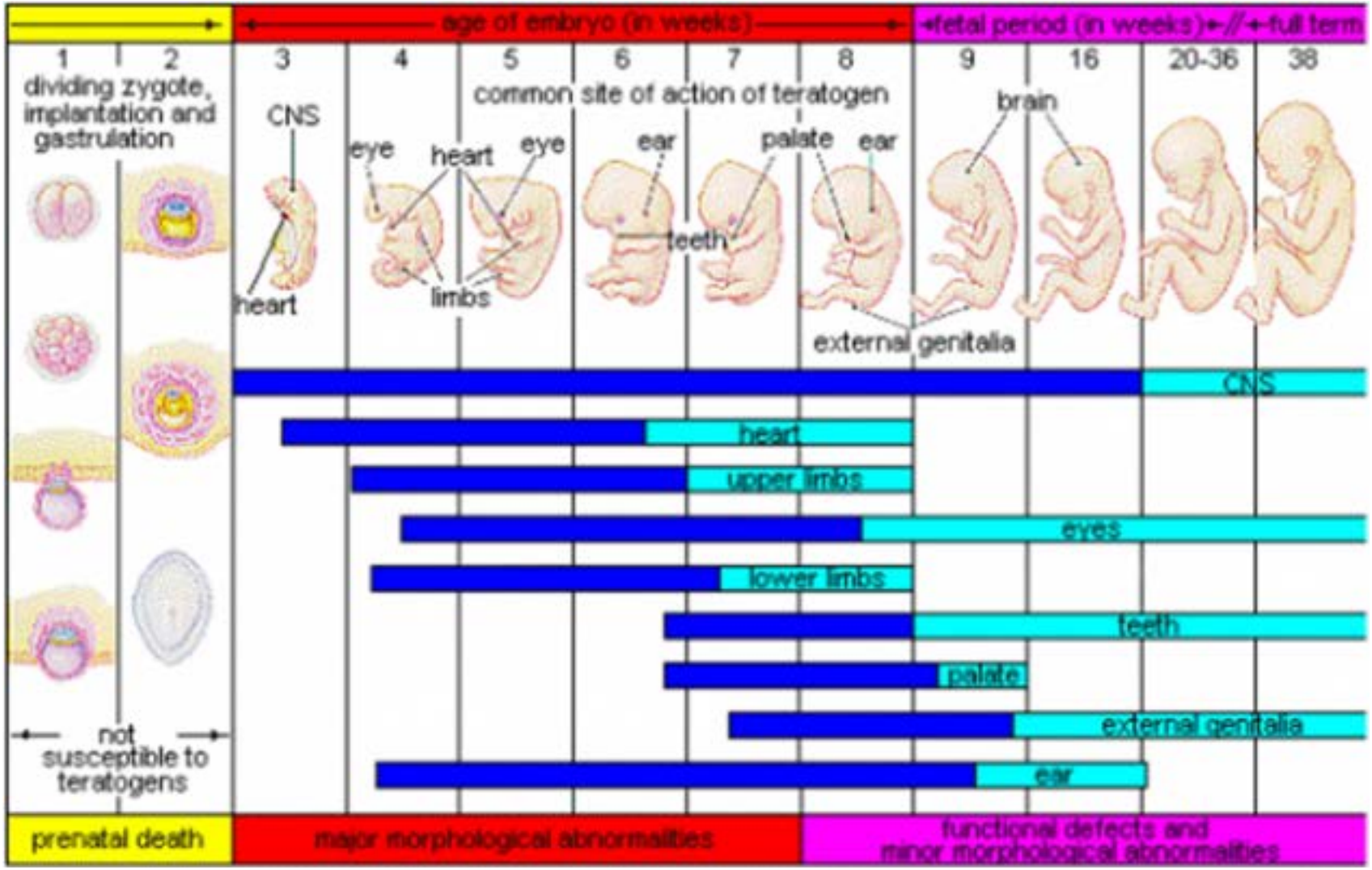
Incidence rate of lung cancer increased with increasing 1-year, 3-year, 5-year and 10-year cumulative average $PM_{2.5}$ throughout most of the distribution of $PM_{2.5}$ concentrations



https://thorax.bmj.com/content/75/1/85

↑ association with leukemia in kids & teens

Reproduction - a vulnerable time



↑ prevalence of ADHD and inattentiveness

Cardiovascular disease - TRAP **short term** exposure

- Increased risk of myocardial infarction (ie. heart attack)
- Increased mortality (ie. death!) at levels of air pollution that are lower than suggested air quality standards
- Exposure to air pollution immediately increases risk of acute coronary syndrome (ie. any condition with sudden reduced bloodflow to the heart

Cardiovascular disease - TRAP **long term** exposure

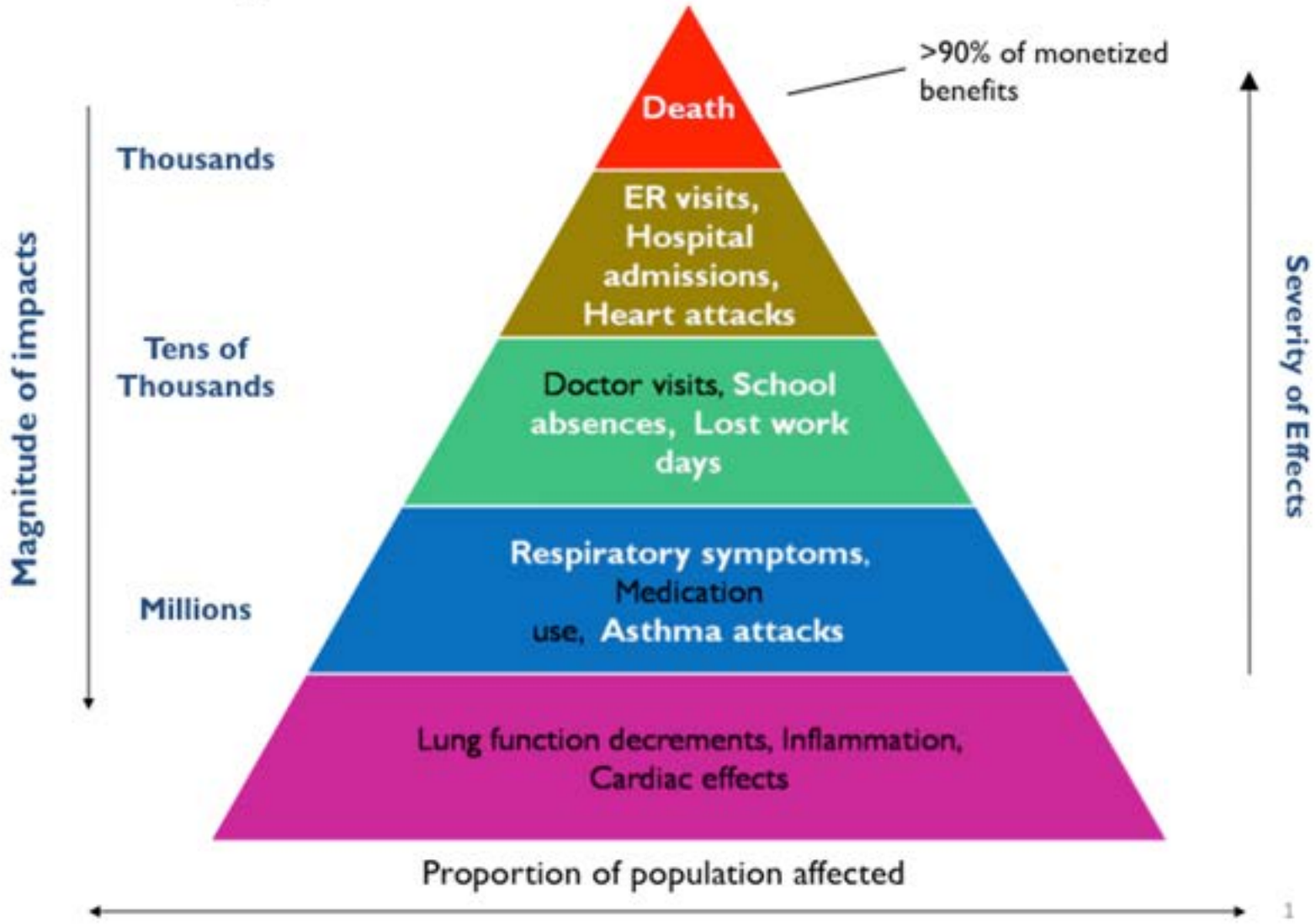
- Higher mortality from long-term exposure to air pollution
- Dose response relationship (ie. Women's Health Initiative Obs Study: ↑ air pollution concentration = ↑ CV event, ↑ death, ↑ stroke)

Health Inequities

People of low socioeconomic status often experience disproportionately high TRAP exposure risks, associated health outcomes, and barriers to healthcare access

Racialized populations tend to face disproportionately high TRAP exposure risks, associated health outcomes, and barriers to healthcare access, resulting in environmentally-driven health disparities and environmental racism

A "Pyramid of Effects" from Air Pollution



https://www.epa.gov/benmap

Prevention & Protection from TRAP

1. Adopt Pollution Prevention and Control Policies

2. Increase Active Transport

3. Ventilation Adaptations

4. Expand Urban Greenspace

5. Utilize Individual-Level Actions

Electric school buses!