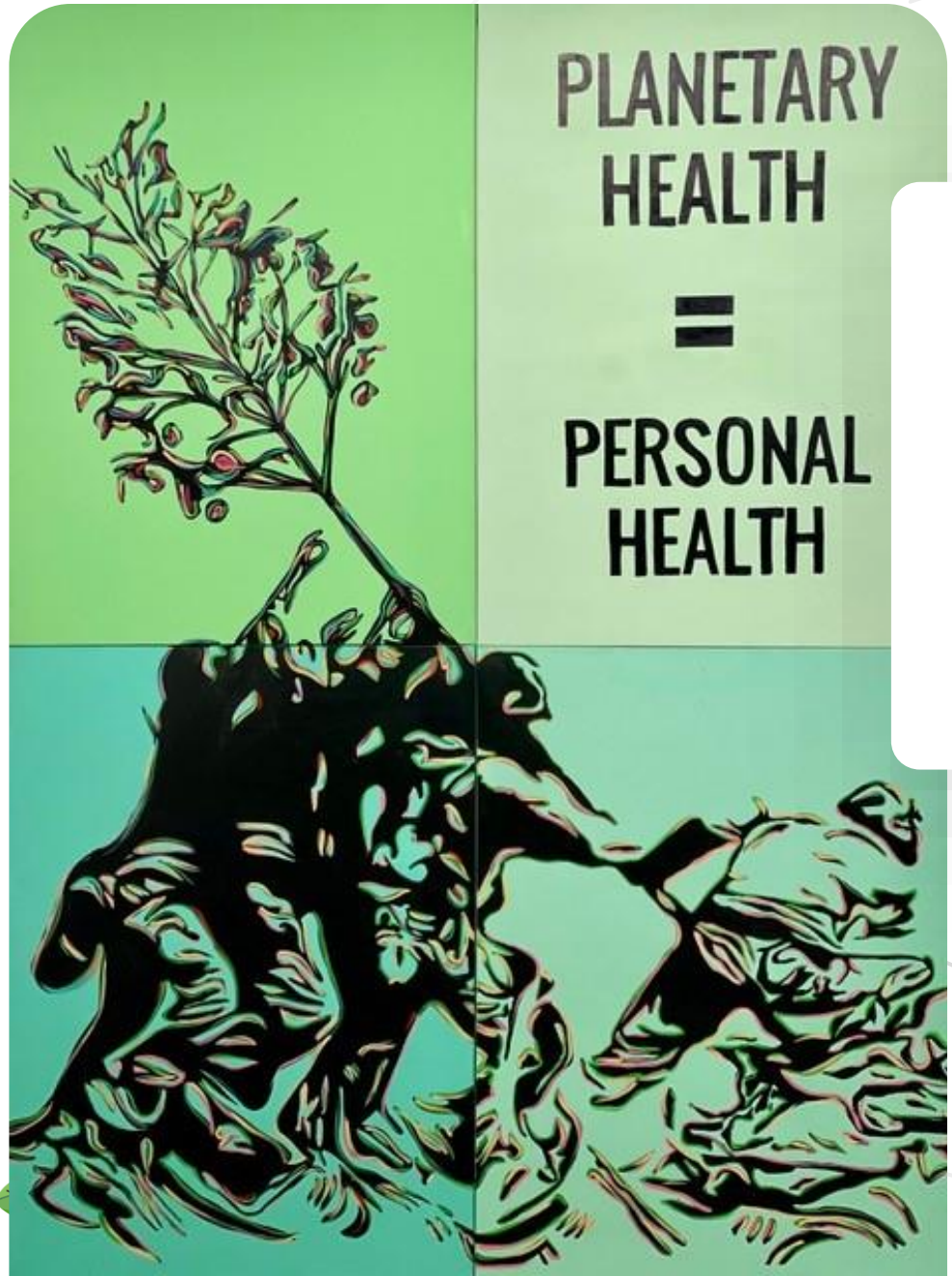
Credit: Jessica Gorlicky, the Mural Campaign



UBC Family & Community Practice Grand Rounds

An Introduction to Planetary Healthcare

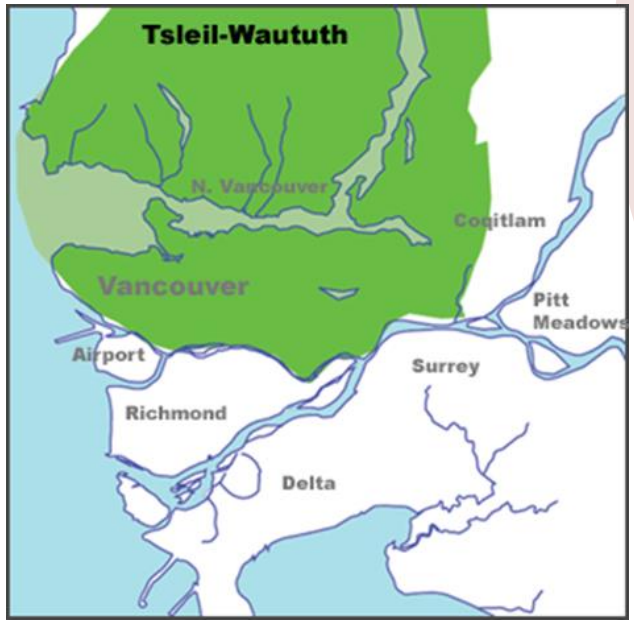
Andrea MacNeill, MD MSc FRCSC

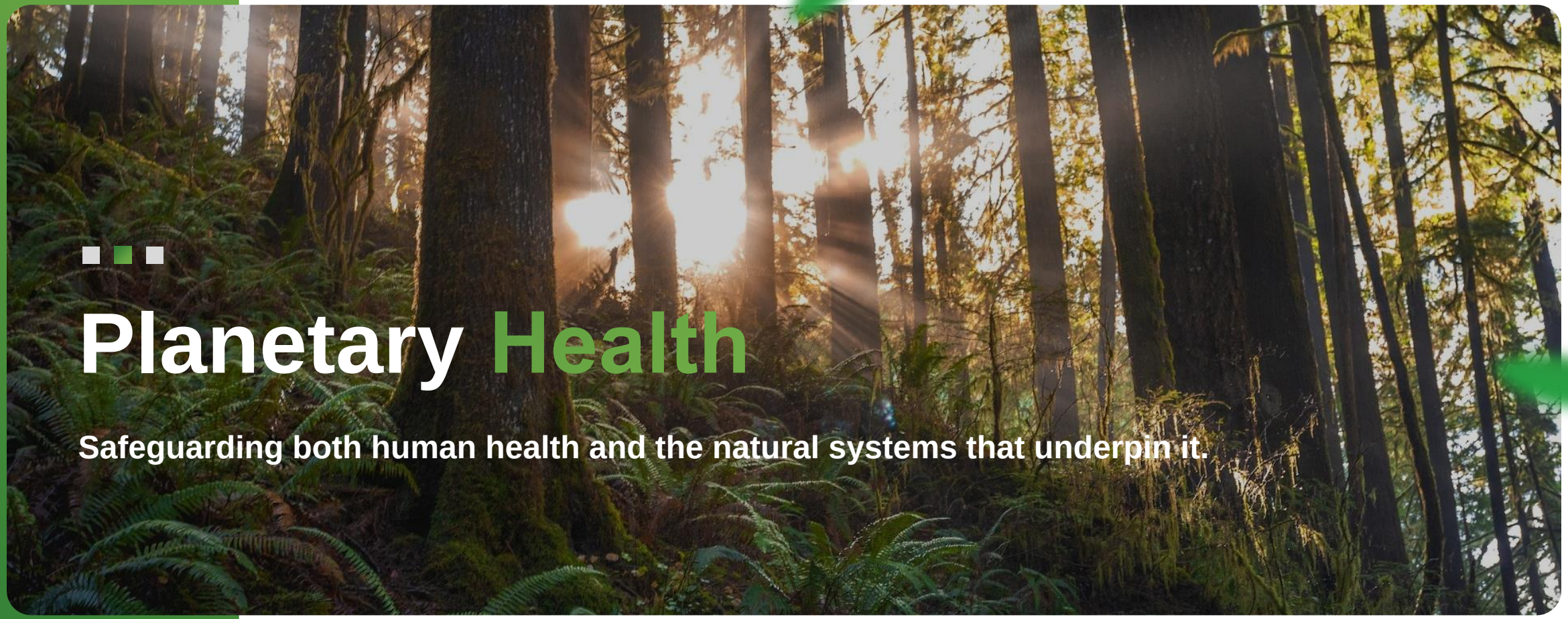
@ecosurgeon

28 February, 2023

We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.

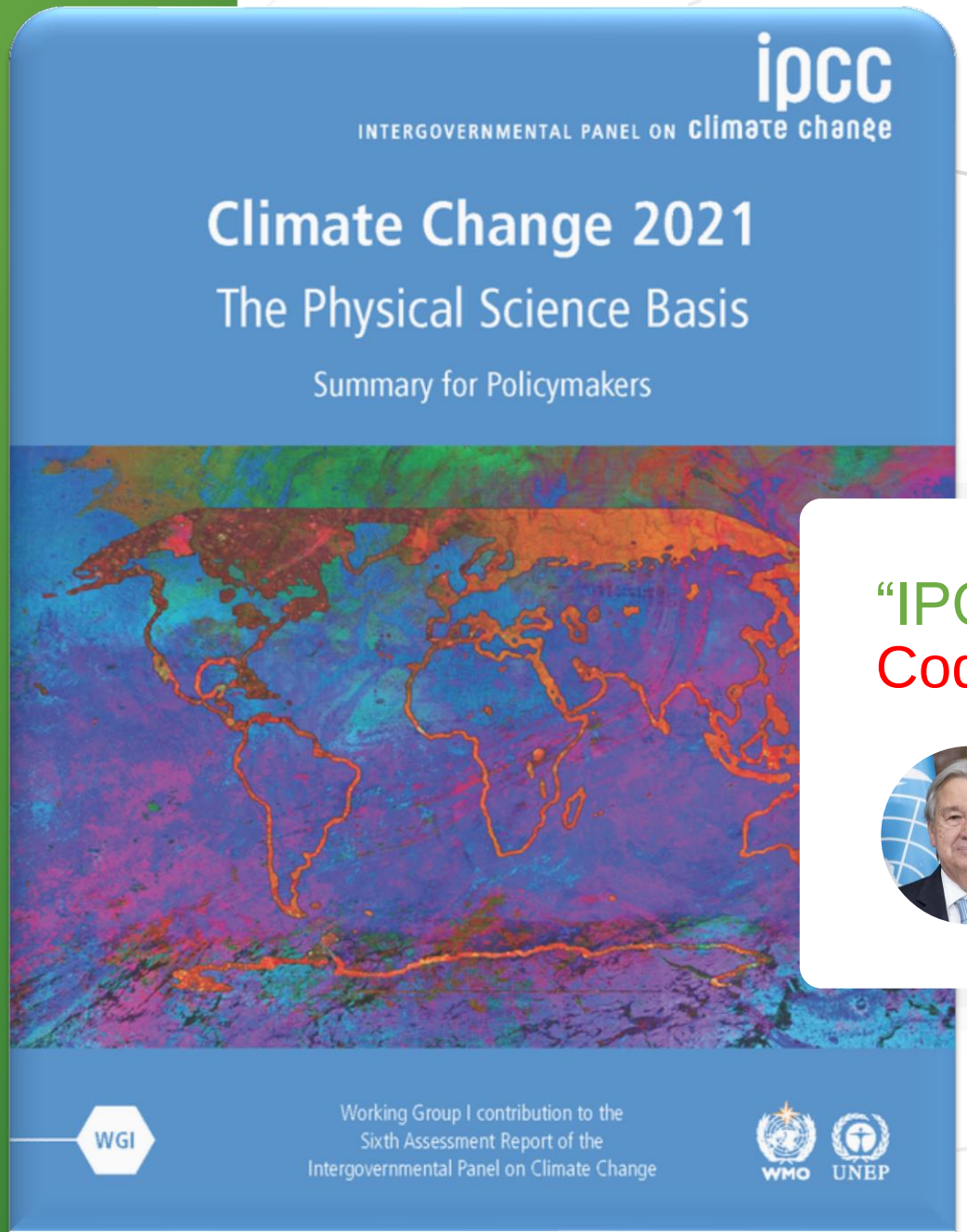
Source: www.johomaps.net/na/canada/bc/vancouver/firstnations/firstnations.html





Planetary Health

Safeguarding both human health and the natural systems that underpin it.



"IPCC Working Group I Report Is A Code Red For Humanity"

- Antonio Guterres

United Nations Secretary General

Climate Impacts on Health and the Health System

Extreme Weather

Rising Temps

Extreme Heat

- Heat-related mortality
- Heat-realted illnesses and hospital visits
- Mental health effects
- Overheating in facilities

Poor Air Quality & Wildfires

- Premature mortality, respiratory and cardiovascular disease, allergies
- Mental health effects
- Poor air quality in facilities
- Closures and evacuations

Storms, Flooding, Power Outages & Landslides

- Injuries and mortality
- Damage to facilities and infrastrucure
- Health service disruptions
- Impacts to water quality

Storm Surge & Sea Level Rise

- Damage to facilities and infrastrucure
- Salination of groundwater sources
- Coastal erosion, loss of ecosystems and cultural sites
- Displacement during flood events

Infectious Diseases

- Increasing exposure to Legionella and Enterovirus
- Increasing local risk of vector-borne diseases like Lyme Disease
- Increased risk of exposure when travelling to tropical locations

Changes To Ecosystems

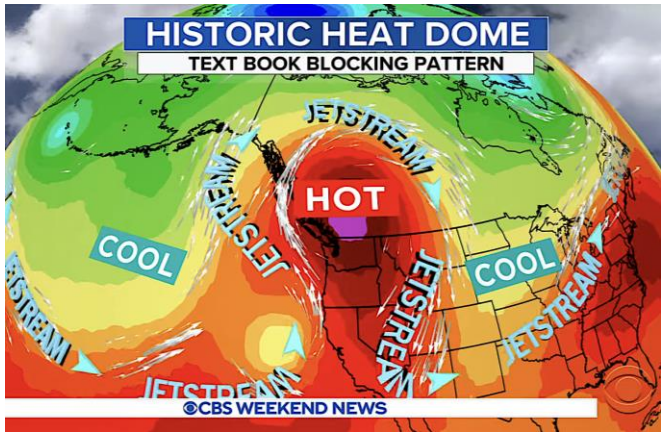
- Longer droughts, warmer rivers, ocean acidification and warming
- Food and water quality, safety and security (e. g. shellfish poisoning)
- Decreasing access to traditional foods for Indigenous communities, as well as cultural impacts

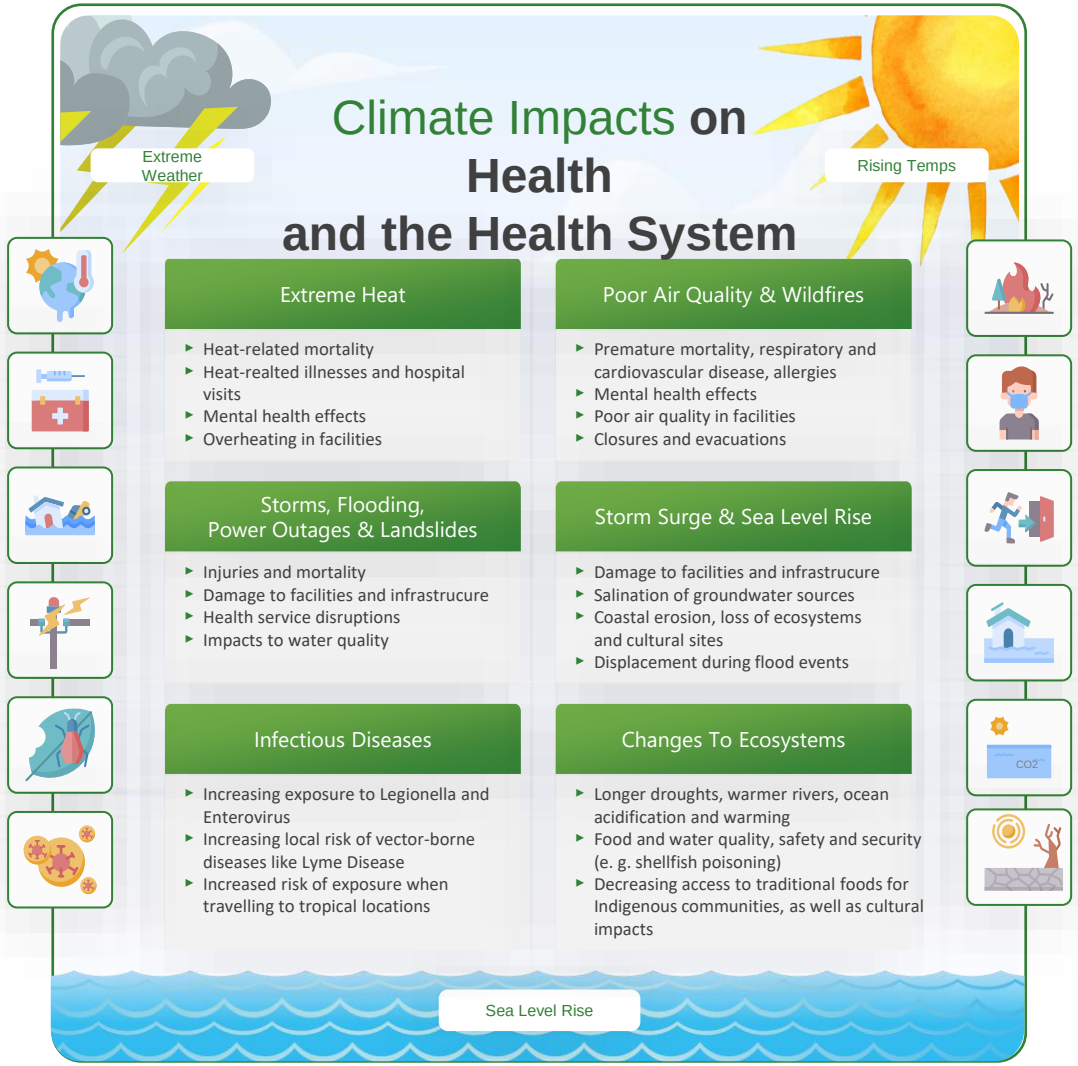
Sea Level Rise

vch.ca/climatechange

Adaptation:

Health system disruption





vch.ca/climatechange

Mitigation:

Low-carbon health systems

THE LANCET
Planetary Health

5.2%
Of Global Emissions (2.4Gt CO2e)

Equivalent to

5th
Highest Emitting Country

Life Cycle Environmental Emissions and Health Damages From the Canadian Healthcare System:

An Economic-Environmental-Epidemiological Analysis

Matthew J. Eckelman

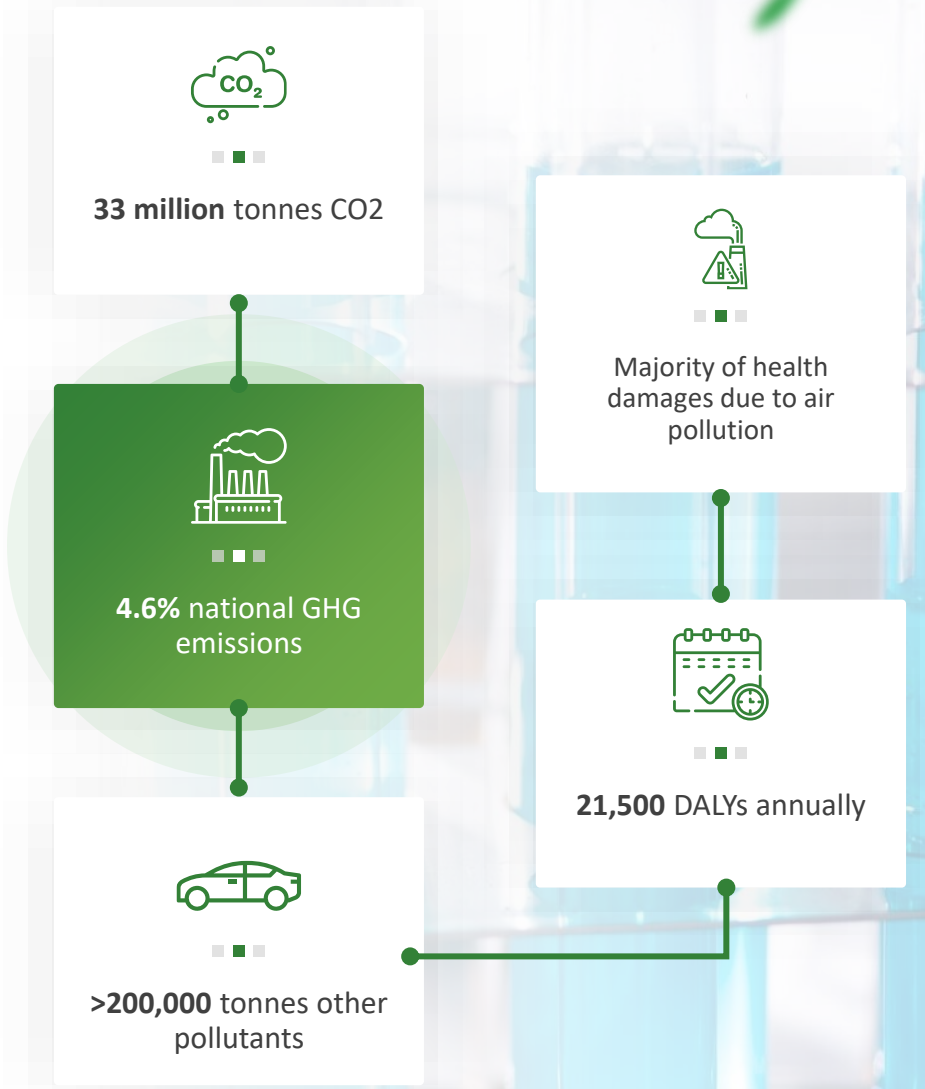
Department of Civil and Environmental Engineering, Northeastern University, Boston, Massachusetts

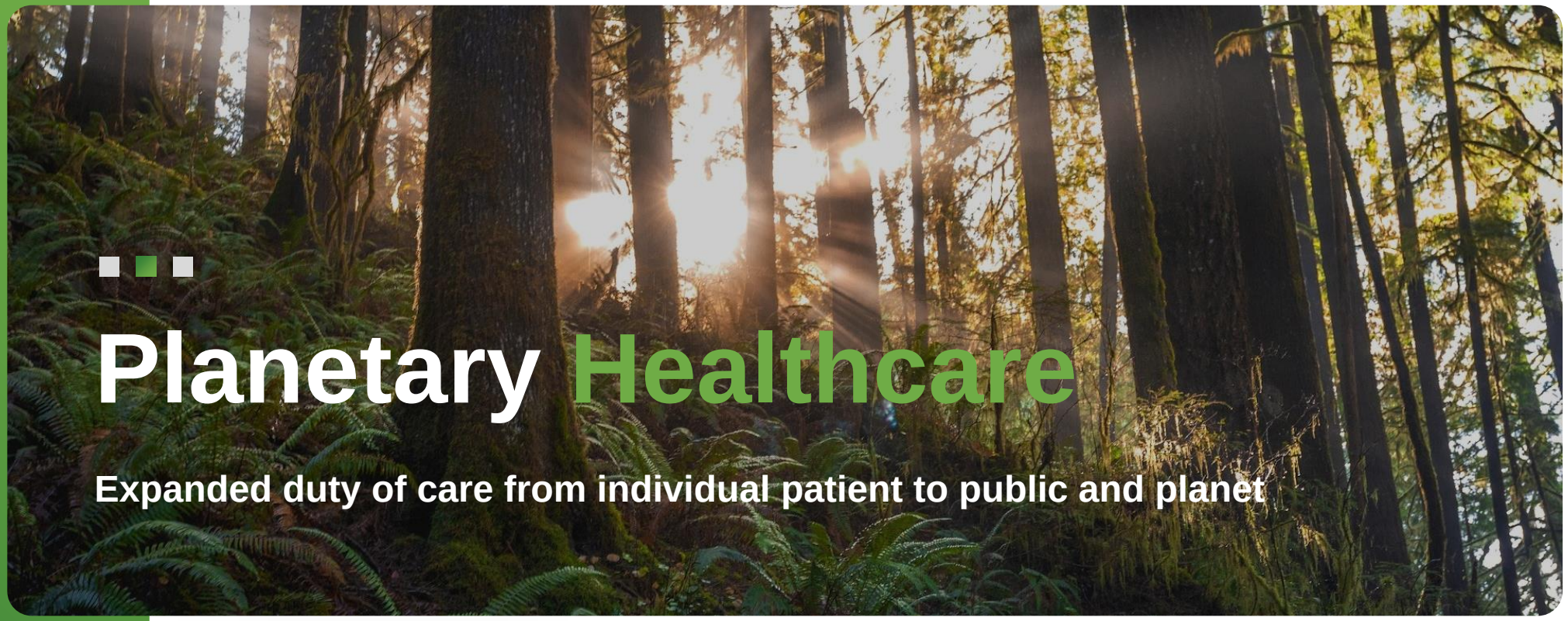
Jodi Sherman

Department of Anesthesiology, Yale School of Medicine, New Haven, Connecticut

Andrea J. MacNeill

Department of Surgery, University of British Columbia, Vancouver, British Columbia





Planetary Healthcare

Expanded duty of care from individual patient to public and planet

THE LANCET

A Pledge For Planetary Health To Unite Health Professionals In The Anthropocene

Katharina-Jaqueline Wabnitz. Sabine Gabrysch. Renzo Guinto. Andy Haines. Martin Hermann. Courtney Howard

Published: September 30,2020.

BILL C-12 NET-ZERO EMISSIONS ACCOUNTABILITY ACT

Five pillars of Canadian Climate Accountability Act

Pillar 1 **Long-term (2050 8: 2030) GHG reduction targets** that are ambitious and move

Pillar 2 **Five-year carbon budget:** that cap total GHG emissions and fairly distribute emissions reductions across the country. Carbon budgets are the basis for mitigation planning.

Pillar 3 **Five-year impact reports** tabled before Parliament that assess the risks of current and predicted climate impacts in Canada. Impact reports are the basis for adaptation planning.

Pillar 4 **Planning and reporting requirements** to achieve carbon budgets and guide adaptation. Plans, progress reports on their implementation. and the government's response to progress reports must be tabled before Parliament.

Pillar 5 **Arm's-length expert climate advisory committee** to advise on long-term targets, five-year carbon budgets, climate impact reports and policy solutions, and independently monitor and report on implementation progress. The expert committee is central to the accountability framework and has a key role in each of the preceding pillars.

UN CLIMATE CHANGE CONFERENCE UK 2021

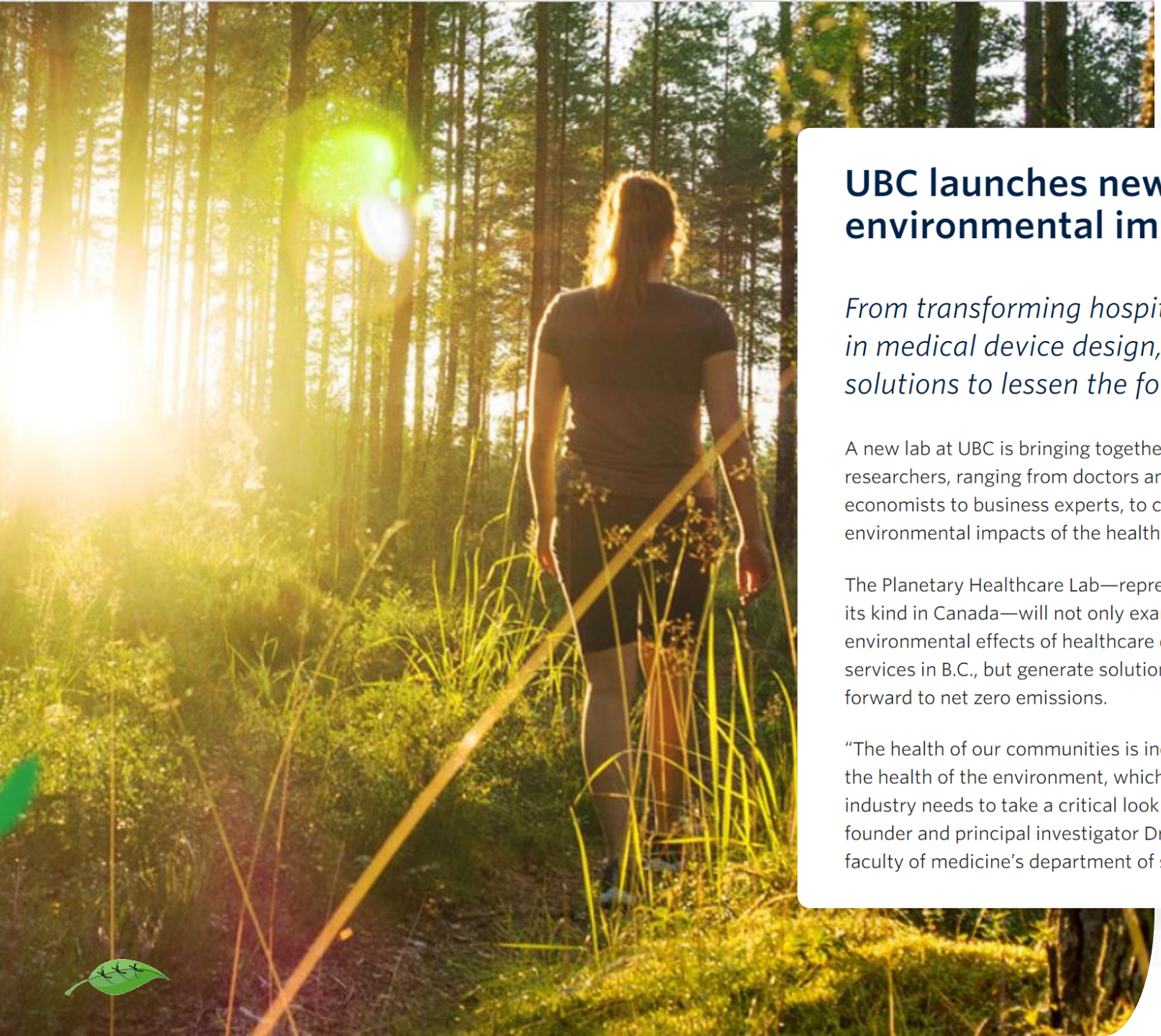
World Health Organization

Steven Guilbeault ✓
@s_guilbeault

Canada has signed onto the @WHO #COP26 initiative on resilient, low-carbon health systems. #climatechange poses significant public health risks & decarbonizing our healthcare systems is an important step on the path to net-zero.

@jyduclos @courtghoward

3:06 PM · Nov 9, 2021 · Twitter for iPhone



UBC launches new lab to combat healthcare's environmental impact

From transforming hospital food systems to driving innovation in medical device design, a team of researchers will generate solutions to lessen the footprint of healthcare in B.C.

A new lab at UBC is bringing together a team of researchers, ranging from doctors and health economists to business experts, to combat the growing environmental impacts of the healthcare industry.

Dr. Andrea MacNeill

The Planetary Healthcare Lab—representing the first of its kind in Canada—will not only examine the environmental effects of healthcare delivery and services in B.C., but generate solutions to chart a path forward to net zero emissions.

"The health of our communities is inextricably linked to the health of the environment, which is why every industry needs to take a critical look at its activities, including healthcare," says the lab's founder and principal investigator Dr. Andrea MacNeill, a clinical associate professor in UBC faculty of medicine's department of surgery.

PLANETARY HEALTHCARE LAB

THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Medicine

Health Economics


Clinical


Public Health


Behavioral Sciences


Environmental Engineering


Vancouver Coastal Health


VCH Foundational Pillars

Indigenous Cultural Safety

Delivering culturally safe care to Indigenous Peoples every day in every way.

Diversity, Equity and Inclusion

Celebrating each person and distinct experiences so we bring our whole selves to work

Anti-Racism

Creating a community where we dismantle attitudes, practices and processes that treat people differently because of their race or ethnicity.

Planetary Health

Inspiring people to create, restore, steward and conserve healthy ecosystems

Vancouver CoastalHealth

VCH Goals and Strategies

Exceptional Care

1. Provide effective population and public health
2. Embed cultural safety and humility
3. Expand team-based primary and community care
4. Expand access to specialized community services for vulnerable populations
5. Increase access to surgical services and medical imaging
6. Provide high quality community and hospital services
7. Build an integrated strategy and plan for Planetary Health

Innovation for Impact

1. Enhance clinical information systems and technologies
2. Expand virtual health
3. Translate research into practice

Great Place to Work

1. Unite VCH under one strategic plan and shared values
2. Transform our organizational health to drive sustainable performance


Quality and Patient Safety
01
Quality
02
Safety
03
Infection Prevention and Control (IPAC)
04
Risk Management
05
Experience
06
Quality Analytics and Systems Strategy
07
Planetary Health

CASCADES

CREATING A SUSTAINABLE HEALTHCARE SYSTEM IN A CLIMATE CRISIS

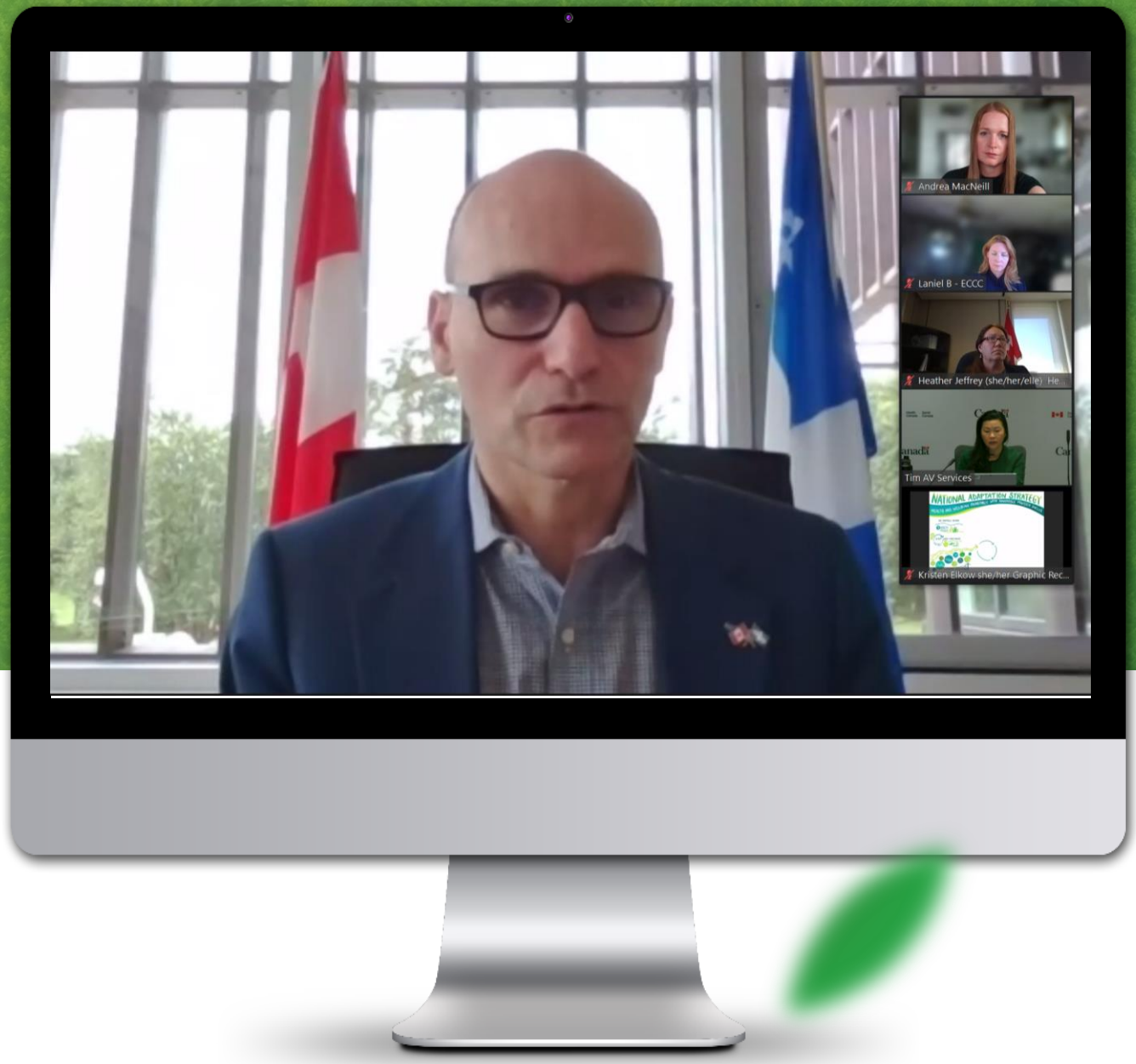
THE UNIVERSITY OF BRITISH COLUMBIA

The Canadian Coalition for Green Health Care

Coalition canadienne pour un système de santé écologie

UNIVERSITY OF TORONTO

DALHOUSIE UNIVERSITY



CASCADES

CREATING A SUSTAINABLE HEALTHCARE SYSTEM IN A CLIMATE CRISIS

Framework for Planetary Healthcare

MacNeill A, McGain F, Sherman J.
Lancet Planet Health 2021

Ladder of Engagement

Buchman et al. *Practising social accountability*. Can Fam Phys 2016

Framework for Planetary Healthcare

Net zero healthcare: a call for clinician action

Health professionals are well positioned to effect change by reshaping individual practice, influencing healthcare organisations, and setting clinical standards, argue **Jodi Sherman and colleagues**

Achieving net zero emissions in healthcare will be possible only with radical and immediate engagement of the clinical community. The covid-19 pandemic has served as a wake-up call for high income health systems that resources are finite and globally interdependent, vulnerable to massive surges in demands and simultaneous infrastructure disruption, and that inequities in access to care threaten health and wellbeing for everyone.

During the first months of the pandemic, the medical community united at a historic pace, rapidly sharing information, redesigning models of care, conserving and innovating resources, and moving towards a circular economy. In comparison, the task of transforming healthcare culture and practice to halve healthcare emissions by 2030 as recommended by the Intergovernmental Panel on Climate Change[1] seems entirely feasible.

health and wellbeing depend.[2] This planetary health lens acknowledges crucial links between ecological change, human health, and our ability to thrive.[2]

Planetary accountability encompasses actions taken by individual health professionals within the clinical setting, collective actions of clinicians in healthcare organisations with the communities they serve, and interactions of individuals and collectives in professional societies with regulatory and oversight bodies.

For clinicians, this means recognising that healthcare consumes finite resources and produces harmful pollution, accepting that environmental stewardship is integral to our fundamental duty of care, and that we are quickly approaching a climate tipping point.

Healthcare is one of the largest polluting industries, responsible for nearly 5% of total global greenhouse gases.[3] Like all industries, healthcare must rapidly and substantially reduce its greenhouse gas

strands of action: reducing emissions from healthcare services, matching supply and demand, and reducing demand for healthcare.[4] Here we provide practical suggestions to help clinicians enact that framework (table 1).

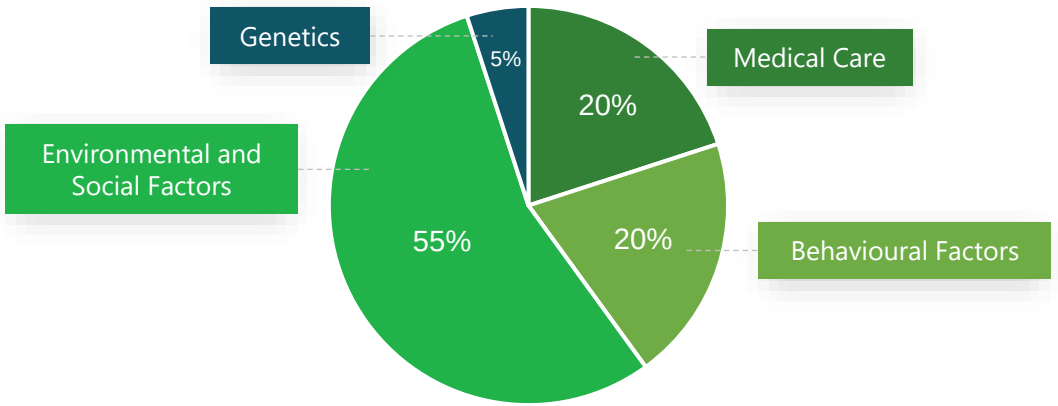
Reducing emissions from supply of health services

Reducing emissions from healthcare services encompasses all activities that consume materials and energy. Most healthcare sustainability initiatives focus on large scale facility operations, such as improving hospital energy performance and sourcing renewable electricity, which typically are not under the control of clinicians. However, clinicians influence building use through decisions on care settings—for example, whether to administer monitoring or treatment in the home, clinic, or hospital (which has the highest resource and emissions intensity).[5] Virtual care for patient-provider interactions that do not

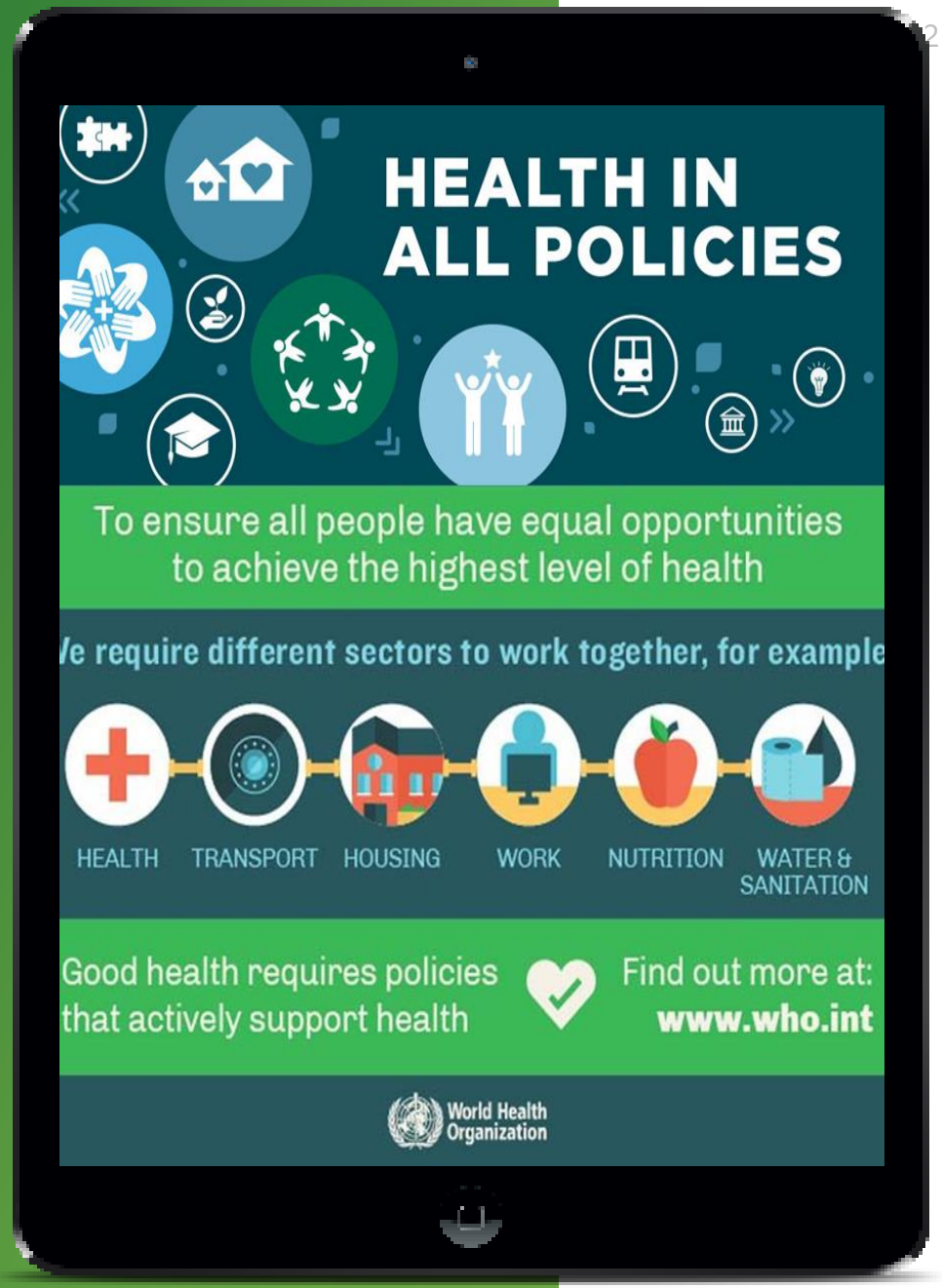
MacNeill A, McGain F and Sherman J.
Planetary Health Care: A Framework for Sustainable Health Systems, Lancet Planetary Health 2021

World Health Organization

Determinants of Health



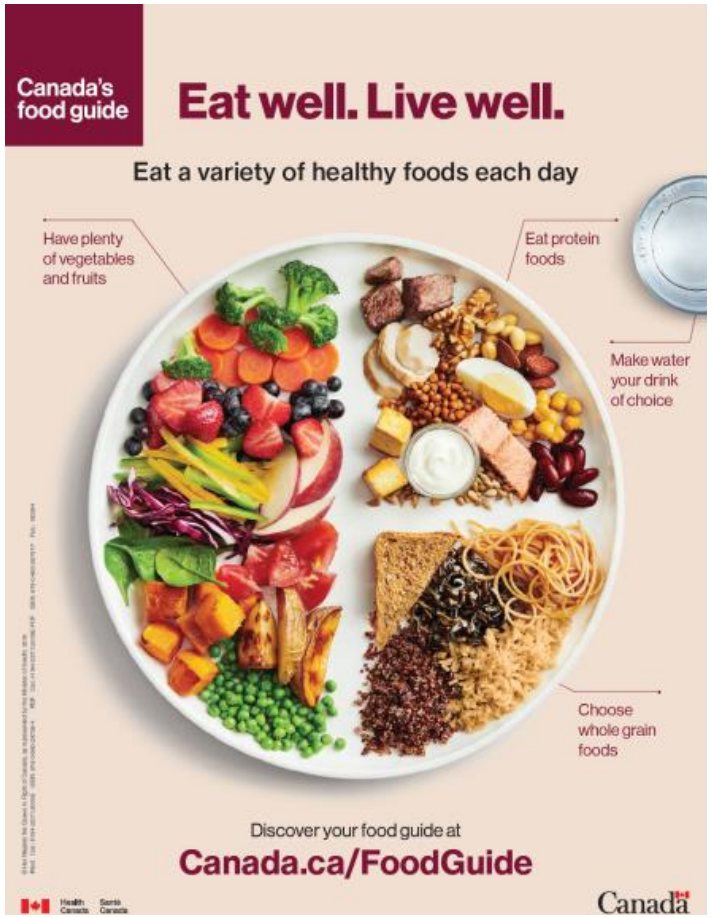
University of Wisconsin Population Health Institute



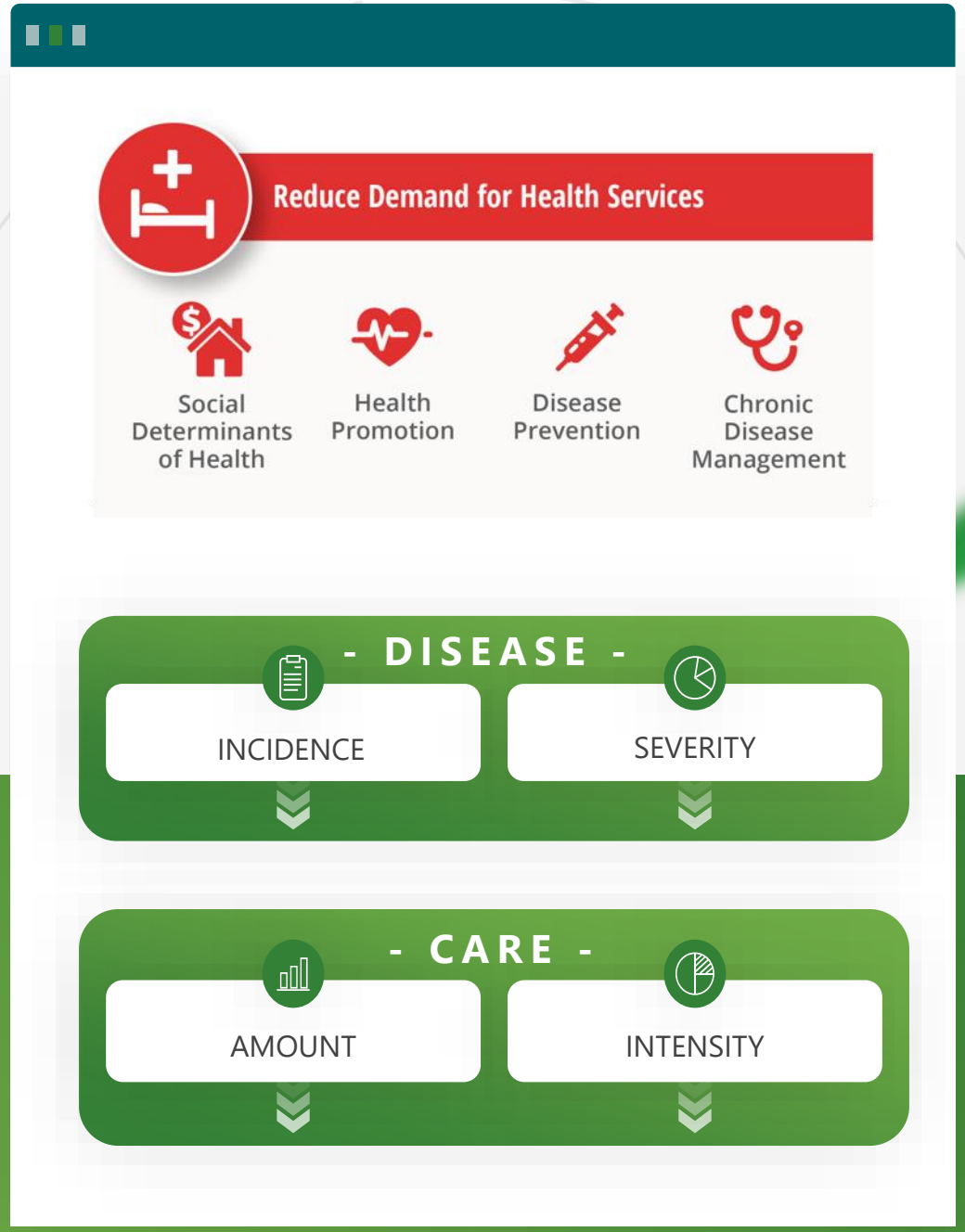
Health Promotion:
Active Transport

cycling centre
VANCOUVER GENERAL HOSPITAL

Health Promotion:
Healthy food systems



Framework for Planetary Healthcare

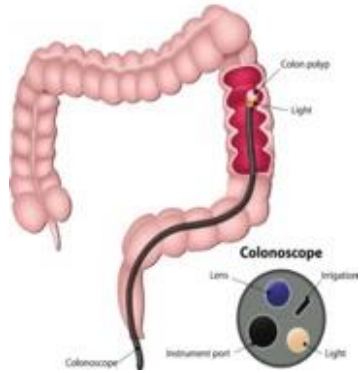


MacNeill A, McGain F, Sherman J.
Lancet Planet Health 2021

1º and 2º Prevention Opportunities

Vaccinations

Smoking Cessation



Cancer Screening

Chronic disease management

Prevention

Blood Pressure Control

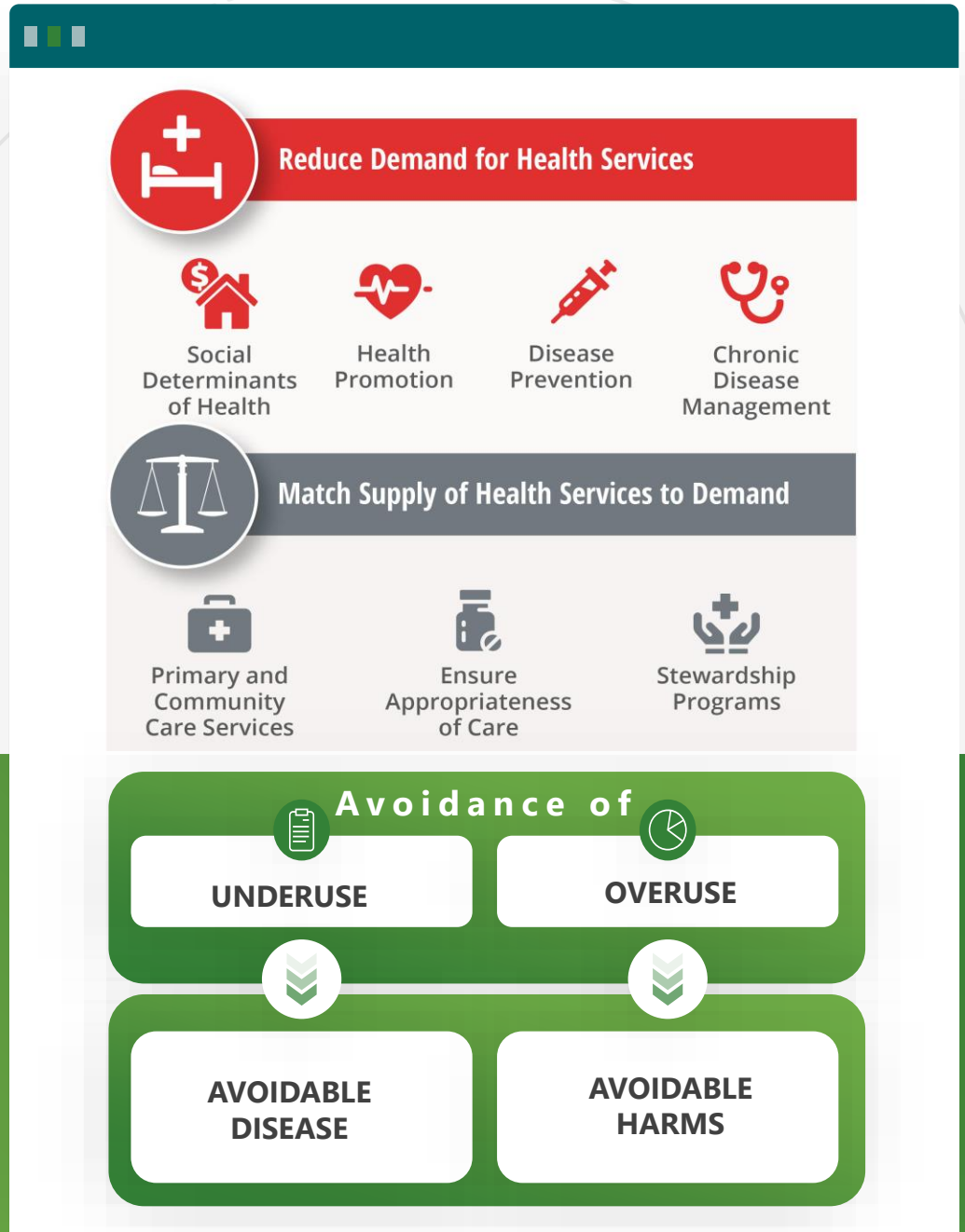
Diabetes Management

Hemodialysis

$60,000
Annually

3.8-7.2 TCO2e
Annually

Framework for Planetary Healthcare



MacNeill A, McGain F, Sherman J.
Lancet Planet Health 2021

Inappropriate Care

Unnecessary Investigations & Interventions

25% of care

$100 billion/y (US)

Dimension of **quality**

Arises from **system** structure/funding and **clinician** and **patient** behaviours

The Burden Of Unnecessary Bloodwork

Unnecessary Bloodwork

Patient

Hospital

Environment

Discomfort

Blood loss

Equipment cost

Personnel cost

Delays in urgent processes

Resource creation & transport

Waste management

Social + Financial + Environmental

Consensus Process

Recommendation 1

For all patients: Order a maximum of three consecutive days of daily blood work at a time. Reassess the need for ongoing laboratory investigations daily.

Recommendation 2

For **stable patients** with **acute uncomplicated appendicitis** who are **discharged** on **post-operative day 1** after undergoing an **uncomplicated laparoscopic appendectomy,** do not order post-operative blood work.

Recommendation 3

For **stable patients** with **biliary colic** or **acute uncomplicated cholecystitis** and **no evidence of choledocholithiasis** who are **discharged on post-operative day 1** after undergoing an **uncomplicated laparoscopic cholecystectomy**, do not order post-operative blood work.

Recommendation 4

For **stable patients** with **acute gallstone pancreatitis:**

1. Use lipase as the preferred test to evaluate for pancreatitis
2. Do not trend lipase or amylase

Recommendation 5

For **stable** patients with **acute choledocholithiasis** or **gallstone pancreatitis** who have demonstrated **biochemical or mechanical common bile duct clearance*** and are awaiting same admission cholecystectomy:

1. Stop trending liver enzymes once a clear downward trend has been established, then stop all routine blood work once patient is booked for surgery**
2. Do not order post-operative blood work after uncomplicated same-admission laparoscopic cholecystectomy.

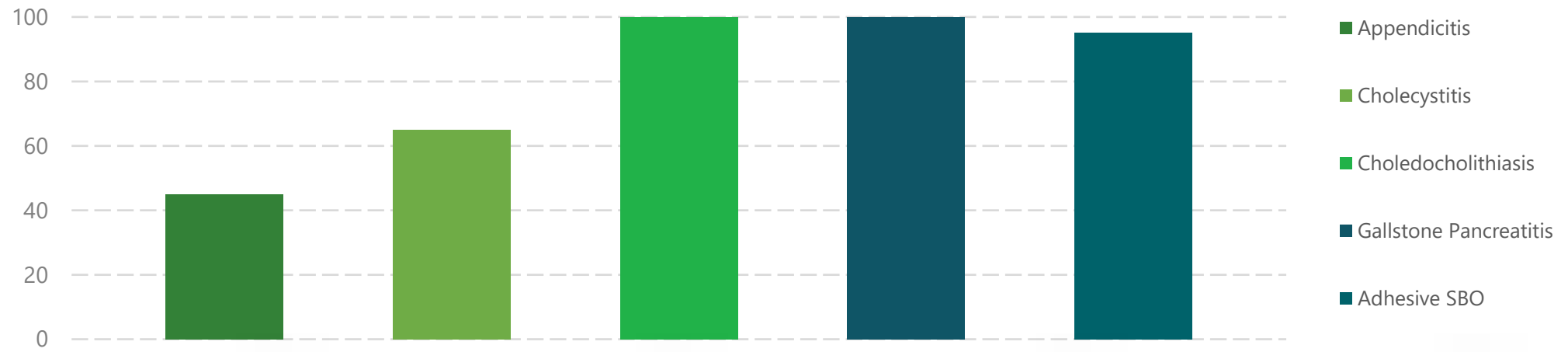
Recommendation 6

For **stable patients** with an **uncomplicated adhesive small bowel obstruction:**

1. Stop routine blood work once the nasogastric tube has been removed and the patient is tolerating a fluid diet.
2. Continue to re-assess patients intake and fluid status, and order blood work as clinically indicated.

**Common bile duct clearance includes both spontaneous clearance (as demonstrated biochemically with a normalization of bilirubin or radiologically with MRCP or EUS) as well as therapeutic clearance using ERCP.*
***Lab work may be repeated every 72 hours if the surgery is significantly delayed or sooner if the patient's clinical status changes*

Patients Receiving Unnecessary Bloodwork



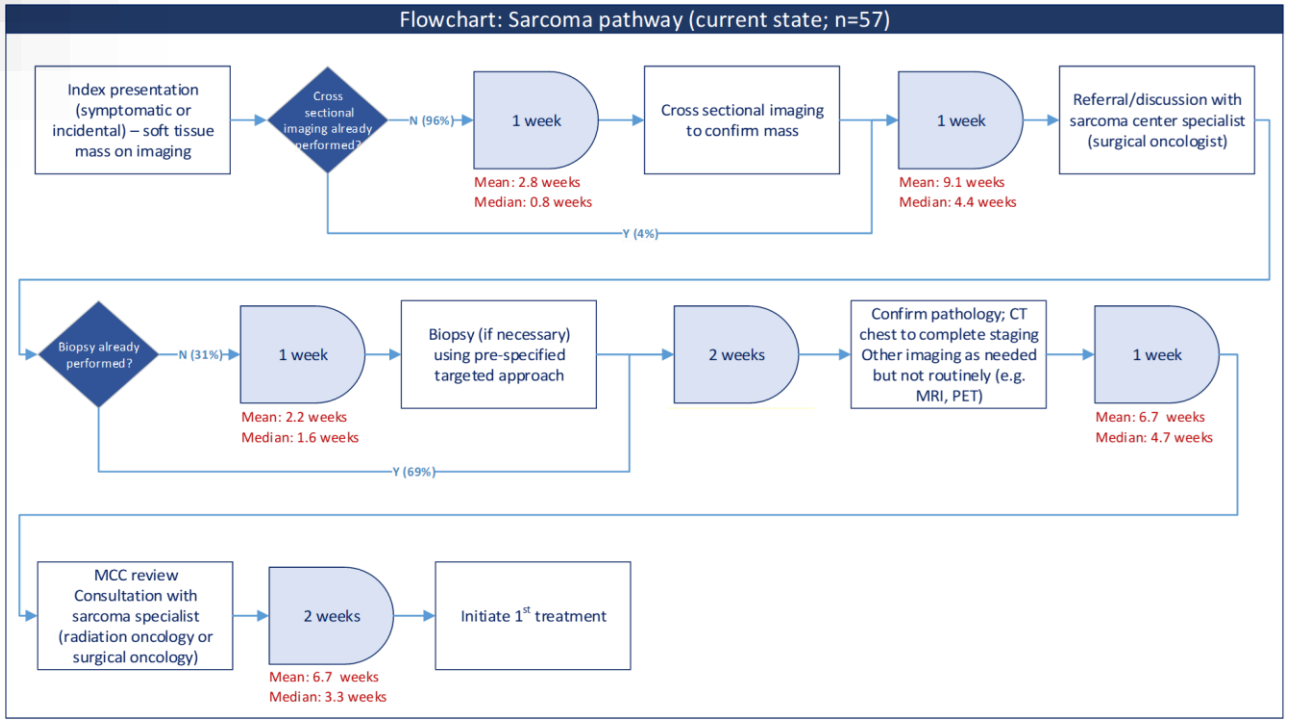
01
76%
Of Patients

02
4.4 excess vials/patient

03
$10,158

04
61 kg CO_2e

Health System Design



Retroperitoneal sarcoma in BC 2016-2018

N=55

Up to **7** Specialists

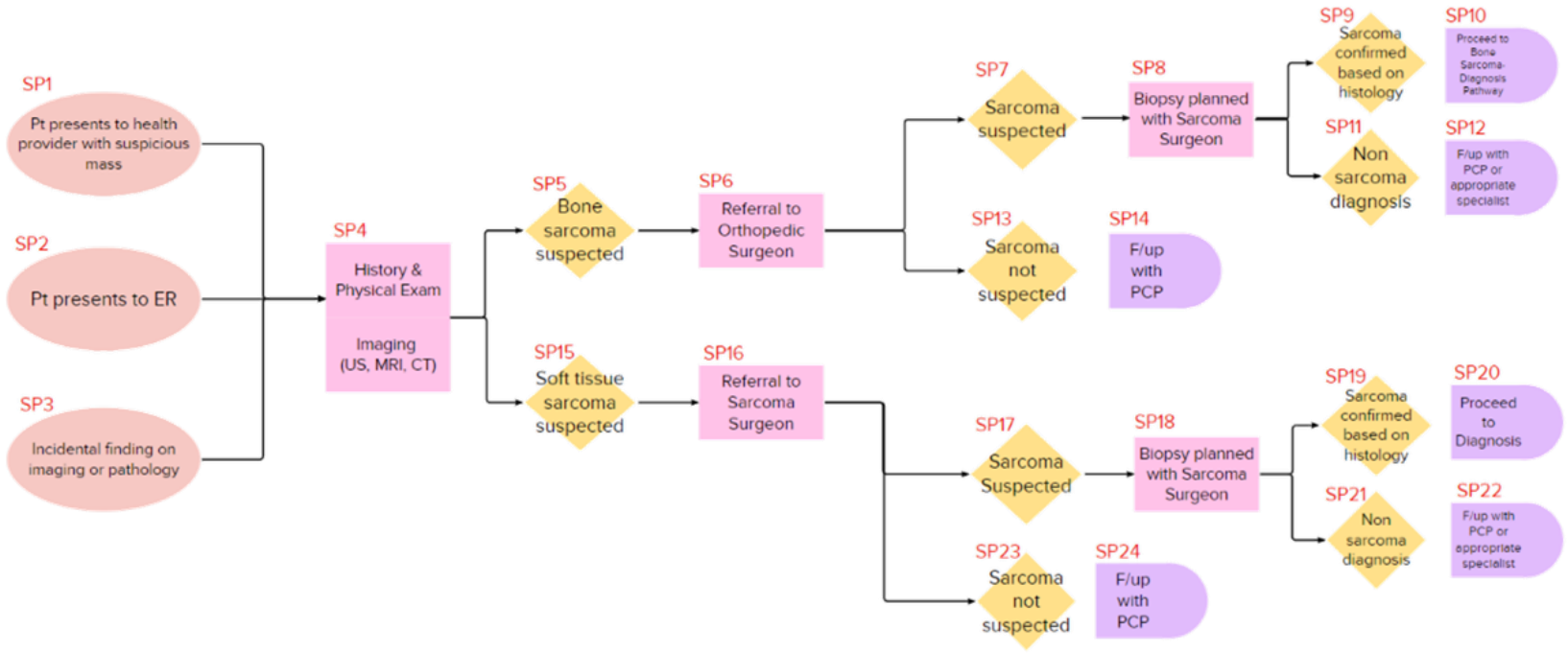
27%
unnecessary surgery

$20,000
Median excess cost

14 weeks
Median time to definitive treatment

BC Cancer Clinical Pathways

Pre-Diagnosis



Ensuring Appropriate Care

Micro

- Adherence to evidence-based best practices
- Avoidance of technology/indication creep
- Shared decision-making

Meso

- Care coordination to avoid duplication
- Institutional structures to promote best practices
- Protocols for de-adoption of low-value care

Macro

- Universal access to healthcare
- Clinical practice guidelines/standards
- Payment models that discourage low-value care

Framework for Planetary Healthcare

MacNeill A, McGain F, Sherman J.
Lancet Planet Health 2021

Low-carbon clinical services

www.thelancet.com

The impact of surgery on global climate: a carbon footprinting study of operating theatres in three health systems

Andrea J MacNeill, Robert Lillywhite, Carl J Brown

Summary

Background Climate change is a major global public health priority. The delivery of health-care services generates considerable greenhouse gas emissions. Operating theatres are a resource-intensive subsector of health care, with high energy demands, consumable throughput, and waste volumes. The environmental impacts of these activities are generally accepted as necessary for the provision of quality care, but have not been examined in detail. In this study, we estimate the carbon footprint of operating theatres in hospitals in three health systems.

Methods Surgical suites at three academic quaternary-care hospitals were studied over a 1-year period in Canada (Vancouver General Hospital, VGH), the USA (University of Minnesota Medical Center, UMMC), and the UK (John Radcliffe Hospital, JRH). Greenhouse gas emissions were estimated using primary activity data and applicable emissions factors, and reported according to the Greenhouse Gas Protocol.

Findings Site greenhouse gas evaluations were done between Jan 1 and Dec 31, 2011. The surgical suites studied were found to have annual carbon footprints of 5 187 936 kg of CO_2 equivalents (CO_2e) at JRH, 4 181 864 kg of CO_2e at UMMC, and 3 218 907 kg of CO_2e at VGH. On a per unit area basis, JRH had the lowest carbon intensity at 1702 kg CO_2e/m^2, compared with 1951 kg CO_2e/m^2 at VGH and 2284 kg CO_2e/m^2 at UMMC. Based on case volumes at all three sites, VGH had the lowest carbon intensity per operation at 146 kg CO_2e per case compared with 173 kg CO_2e per case at JRH and 232 kg CO_2e per case at UMMC. Anaesthetic gases and energy consumption were the largest sources of greenhouse gas emissions. Preferential use of desflurane resulted in a ten-fold difference in anaesthetic gas emissions between hospitals. Theatres were found to be three to six times more energy-intense than the hospital as a whole, primarily due to heating, ventilation, and air conditioning requirements. Overall, the carbon footprint of surgery in the three countries studied is estimated to be 9·7 million tonnes of CO_2e per year.

Interpretation Operating theatres are an appreciable source of greenhouse gas emissions. Emissions reduction strategies including avoidance of desflurane and occupancy-based ventilation have the potential to lessen the climate impact of surgical services without compromising patient safety.

Lancet Planet Health 2017; 1: e381–88

See Comment page e357

Division of General Surgery, University of British Columbia, Vancouver, Canada (A J MacNeill MD, Prof C J Brown MD); Environmental Change Institute, School of Geography and the Environment, University of Oxford, Oxford, UK (A J MacNeill); and School of Life Sciences, University of Warwick, Warwick, UK (R Lillywhite)

Correspondence to: Dr Andrea J MacNeill, Division of General Surgery, Vancouver General Hospital, 950 West 10th Avenue, Vancouver, BC, V5Z 1M9, Canada andrea.macneill@vch.ca

Inhaled Anesthetics

	Sevoflurane	Isoflurane	Desflurane
GWP_{100}	130	**510**	2450

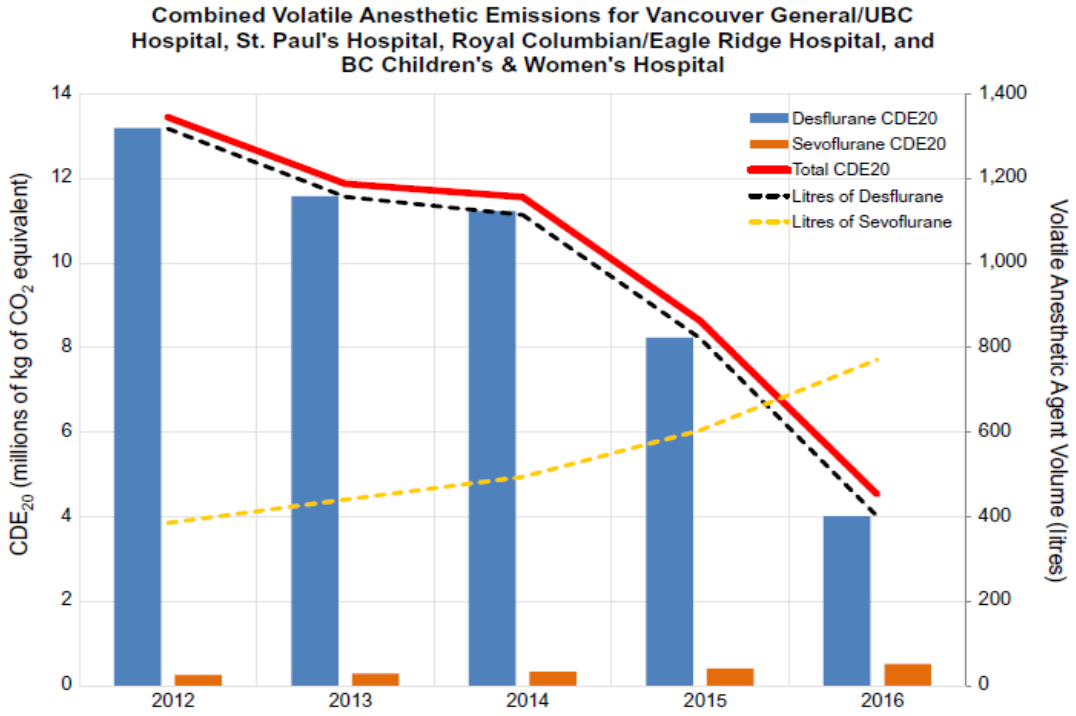
	Volume Purchased (L/y)			CO_2e (kg/y)		
	VGH	UMMC	JRH	VGH	UMMC	JRH
Sevoflurane	132	116	217	24,907	21,793	40,898
Isoflurane	34	176	222	26,297	135,636	170,314
Desflurane	536	533	0	1,983,073	1,972,412	0
Totals				**2,898,500**	**3,051,500**	**211,212**

Can J Anesth/J Can Anesth (2018) 65:221–222
DOI 10.1007/s12630-017-1006-x

CORRESPONDENCE

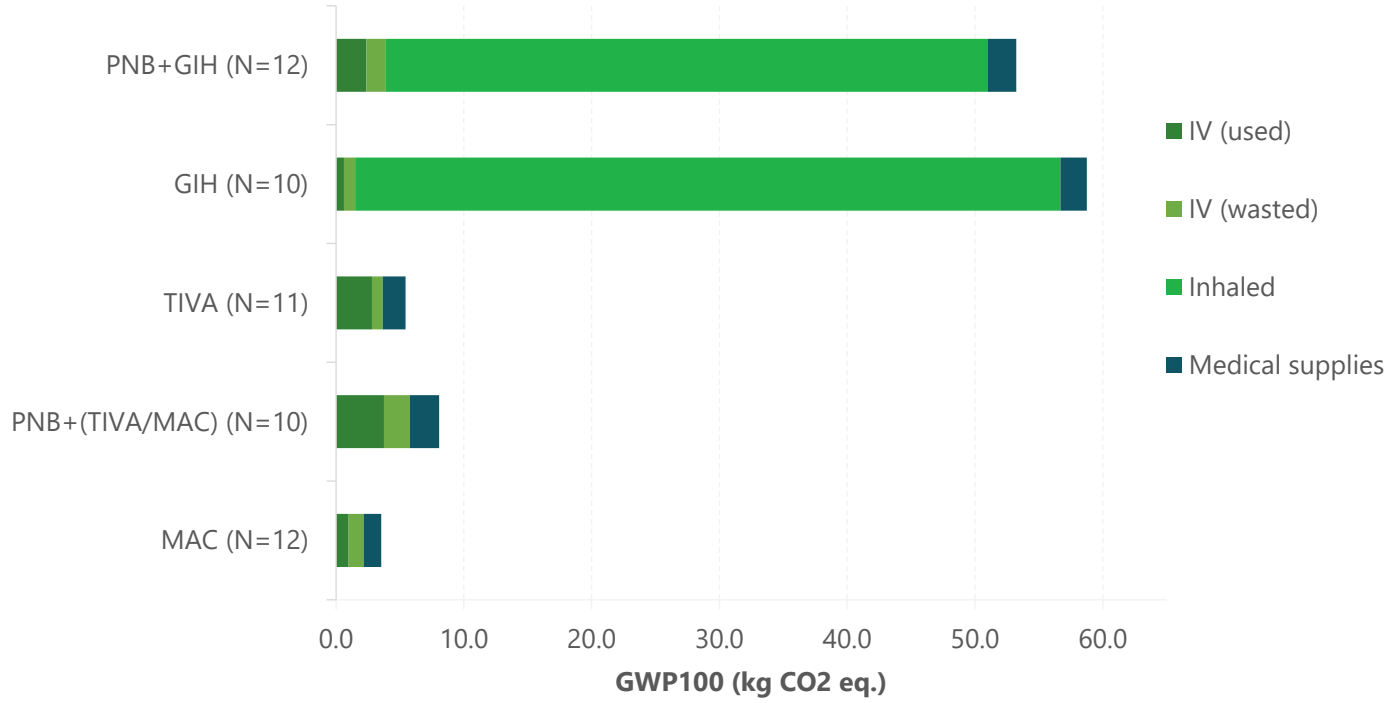
Greenhouse gases: the choice of volatile anesthetic *does* matter

Richard Alexander, MD, BSc · Andrew Poznikoff, BSc · Stephan Malherbe, MBChB, MMed, FRCPC



13.4 million $kgCO_2e$

4.5 million $kgCO_2e$



Global Warming Potential of Anesthetic Techniques

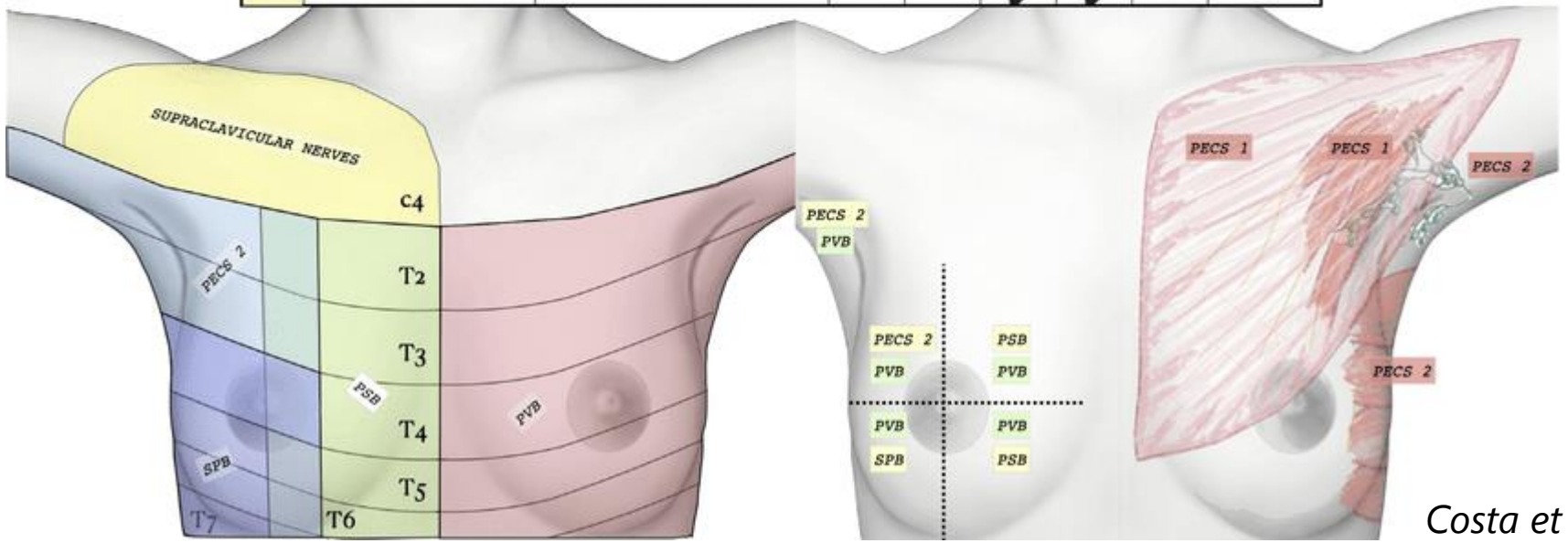
Sherman, Tunceroglu, Parvatker, Sukumar, Dai, Eckelman

PNB=peripheral nerve block, **TIVA=** total intravenous anesthetic,

GIH=general inhaled, **MAC=** monitored anesthesia care

Breast Regional Anesthesia

	Anatomical involvement	Innervation	PVB	PECS 1	PECS 2	SPB	PSB	Local infiltration
	Lumpectomy							✔
	Axillary skin	Intercostobrachial nerve (T1-T2)	✔		✔			✔
	Deep axillary structures				✔			
	Skin and gland							
Mastectomy	Infraclavicular region	Supraclavicular nerves (C3-C4)						✔
Mastectomy	Upper outer quadrant	Lateral cutaneous branches T2-T4	✔		✔			✔
Mastectomy	Lower outer quadrant	Lateral cutaneous branches T4-T6	✔			✔		✔
Mastectomy	Upper inner quadrant	Anterior cutaneous branches T2-T4	✔				✔	✔
Mastectomy	Lower inner quadrant	Anterior cutaneous branches T4-T6	✔				✔	✔
	Muscles							
Implants	Pectoralis major muscle	Lateral and medial pectoral nerves		✔	✔			
Implants	Pectoralis minor muscle	Medial pectoral nerves		✔	✔			
Implants	Serratus anterior	Long thoracic nerves			✔	✔		



Costa et al. Anaesthesia 2020.

Benefits of Breast Regional Anesthesia

Patient

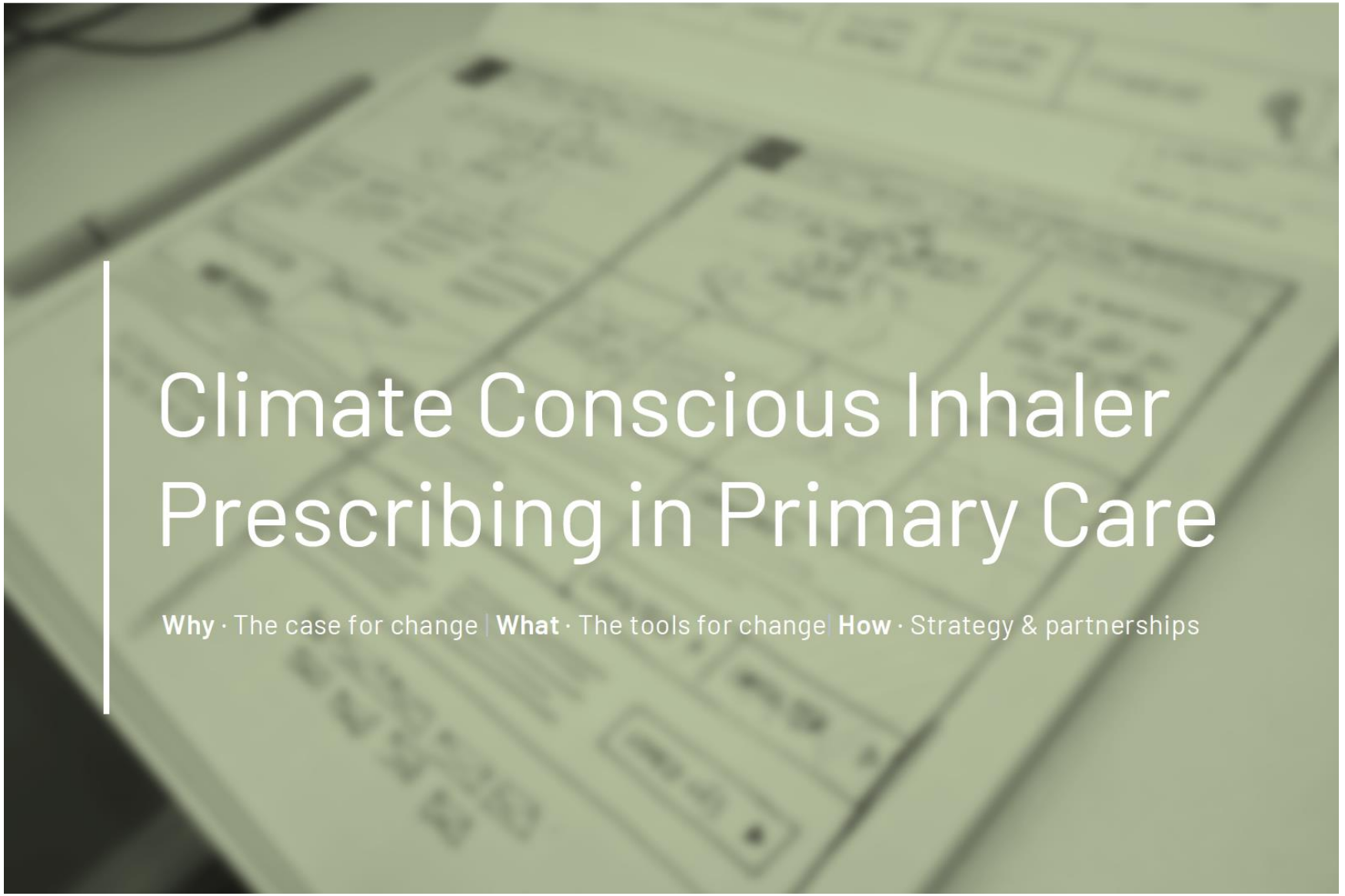
- No PONV
- Excellent analgesia
- Early mobilization
- +++ Satisfaction

System

- Avoidance of aerosols
- Higher throughput
- Conversion of inpatient cases to ambulatory

Society

- Reduced greenhouse gas emissions
- Reduced opioid prescribing



Climate Conscious Inhaler Prescribing in Primary Care

Why · The case for change | **What** · The tools for change | **How** · Strategy & partnerships

CASCADES

SUSTAINABLE HEALTH SYSTEM COMMUNITY of PRACTICE

TAHSN

This project was undertaken with the financial support of the Government of Canada.

Ce projet a été réalisé avec l'appui financier du gouvernement du Canada.

Canada

CASCADES

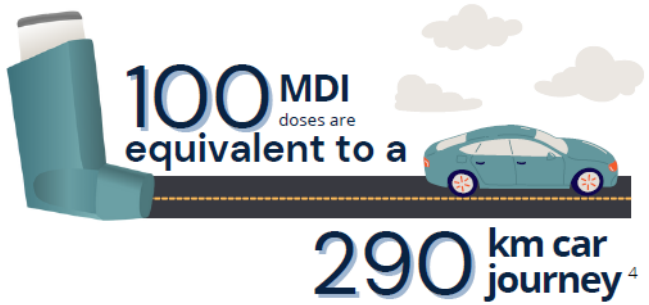
Environmentally Sustainable Opportunities for Health Systems

Metered Dose Inhalers (MDIs)

MDIs are common medical devices used to deliver inhaled medication. They are typically used in the treatment of asthma and chronic obstructive pulmonary disorder. [1]

MDIs use HFC propellants to deliver medication. [3]

HFCs are artificial fluorinated gases that act as potent greenhouse gases (GHGs) when released into the atmosphere. These gases are widely used in industry, including the healthcare sector.



Hydrofluorocarbons (HFCs)

Common HFC propellants used in MDIs include:

HFC 134a	HFC 227ea**
370 GWP* [2]	3350 GWP*

*100 year time horizon
**Used to a lesser extent

Global Warming Potential (GWP)

Global Warming Potential (GWP) is a standardization tool used to compare the global warming impact of different types of GHGs over a fixed time period (usually 100 years). It measures the amount of energy a given gas will absorb compared to the equivalent mass of carbon dioxide (CO_2), which has a standardized GWP of 1.

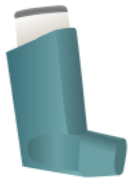
HFCs are "high-GWP gases" as they trap substantially more heat than CO2 per unit mass.

Health care systems can curb MDI-related HFC emissions by implementing the following strategies

1 ENCOURAGING MDI ALTERNATIVES

The carbon footprint of MDIs is much higher than that of dry powder inhalers (DPIs), which do not use a propellant to deliver the medication. Opting for alternative treatment options, such as DPIs and soft mist inhalers (SMIs), when appropriate, can help **reduce** the carbon footprint of inhalers (though all of these options have environmental impacts).[5]

CARBON FOOTPRINTS



Ventolin HFA MDI
28.26 kg CO_2e*[6]

Ventolin Diskus DPI
0.58 kg CO_2e[6]

Combivent Respimat SMI**
0.78 kg CO_2e[6,7]

*CO_2e = Carbon Dioxide equivalent
** Combivent Respimat SMI is a ipratropium/salbutamol combination, and usually replaces two inhalers. Carbon footprint estimated from other Respimat Soft Mist inhaler devices.

WHEN MDIs ARE NECESSARY...

Choose smaller volume relievers

Small volume relievers emit less propellant at each use, and therefore, have lower carbon footprints than large volume relievers.[8]

ENSURING APPROPRIATE INHALER USAGE

2

95-98% OF PROPELLANT EMISSIONS FROM MDIs OCCUR AT THE USER PHASE

This typically involves poor synchronization of actuation with inhalation. [8,10]

Adequate and ongoing patient training on inhaler technique and usage is a key part of reducing their environmental impacts.

National Institute for Health and Care Excellence: Patient Decision Aid Inhalers

Provides information to assist patients and health care professionals in discussing suitable inhaler options, appropriate usage, and the environmental impact of inhalers. [9]

Canadian Network for Respiratory Care: Certified Respiratory Educator

Health care professionals looking to enhance their skills and knowledge in respiratory care can opt to complete the certified respiratory educator exam, which trains professionals in up-to-date respiratory care guidelines and techniques. [11]

3 PRACTICING SUSTAINABLE RECOVERY AND RECYCLING OF INHALERS

THE END-OF-LIFE PHASE OF MDIs IS AN ADDITIONAL SOURCE OF PROPELLANT EMISSION

Improper MDI disposal contributes to medication wastage and increases the risk of MDI residual propellant release into the atmosphere.[8]

Once fully used, MDIs can be...

RECYCLED
Plastic and aluminum in each device can be recycled at designated pharmacies.

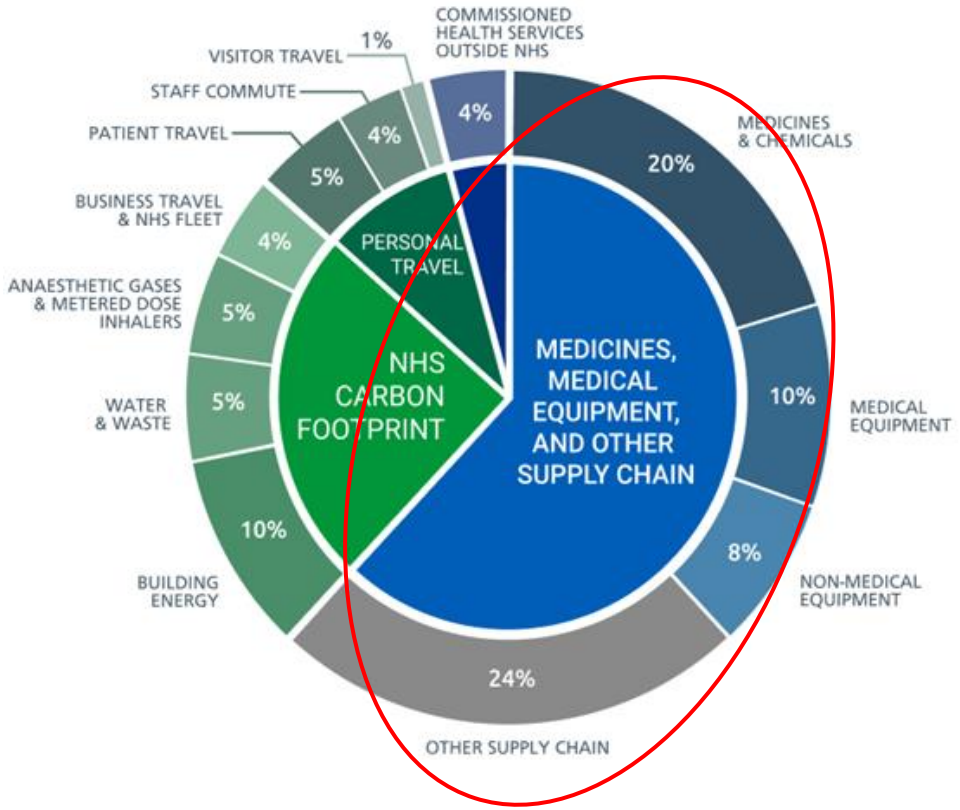
INCINERATED
MDI incineration causes the thermal degradation of HFC chemicals.

CO_2 emission
SAVINGS 4-18kg[8]
per inhaler*

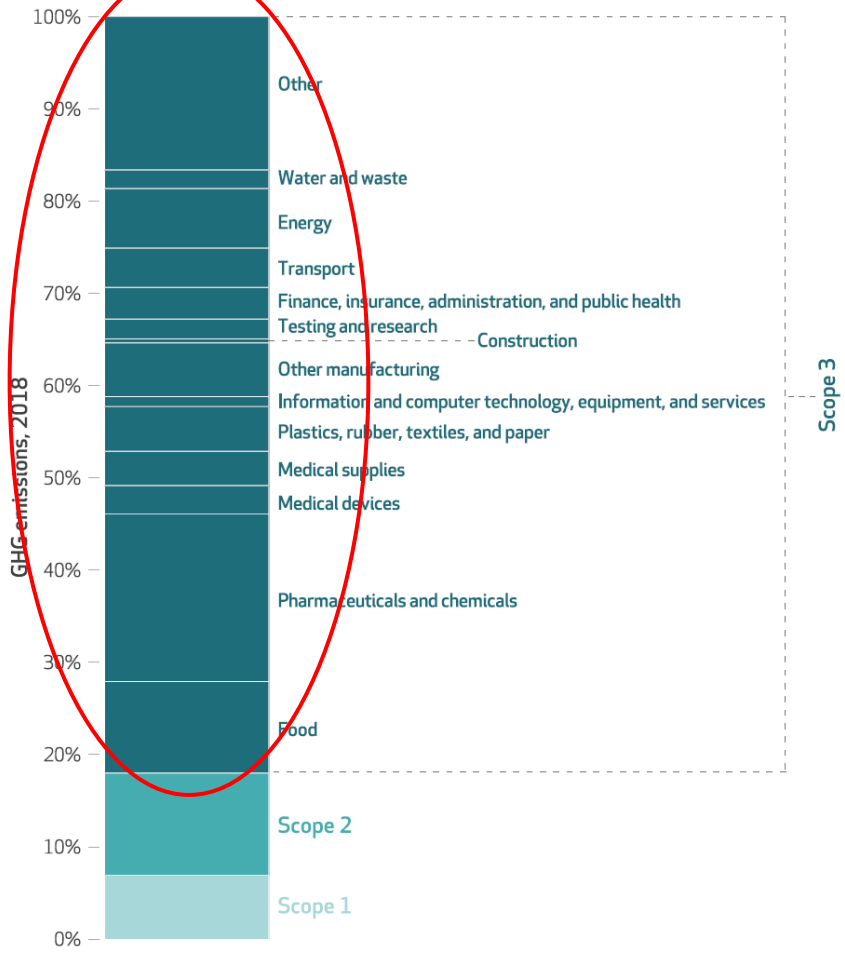
CO_2 emission
SAVINGS 3-17kg[8]
per inhaler*

*Compared to landfill disposal

Supply Chain

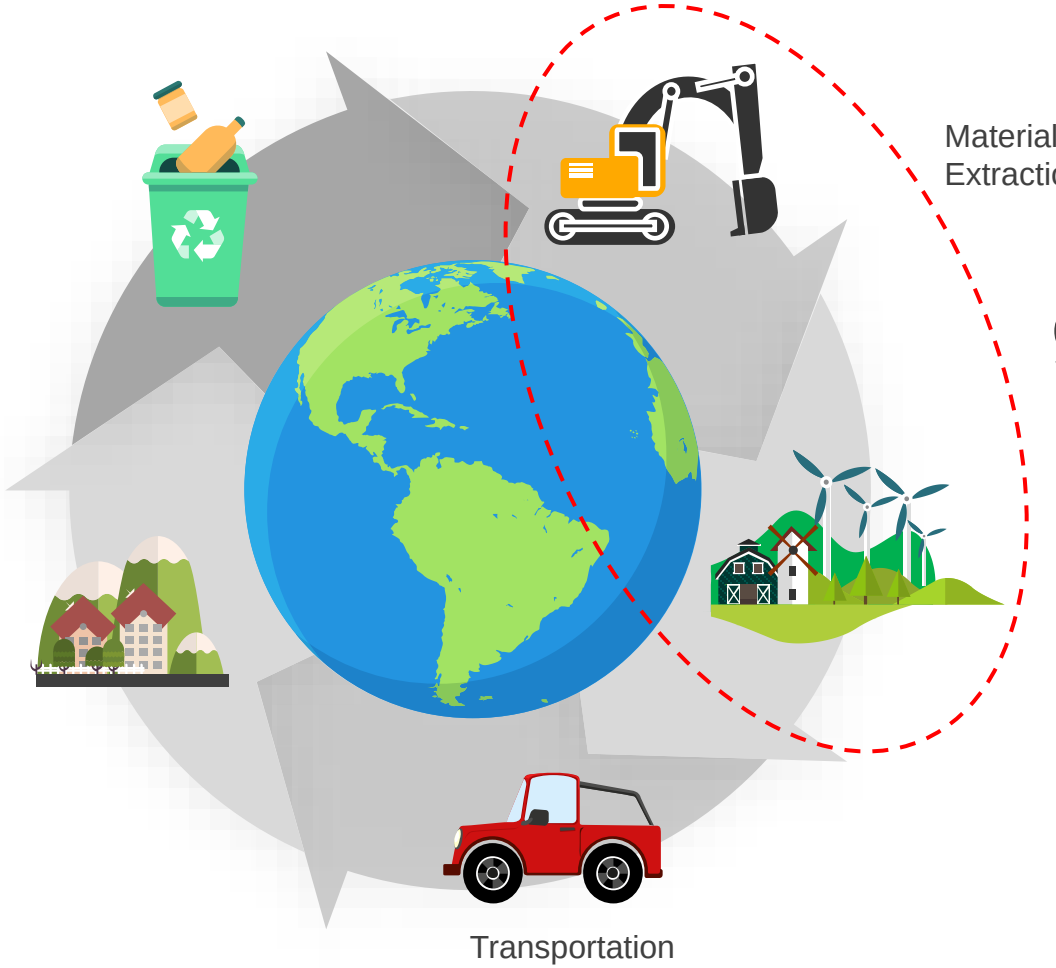


US national health care greenhouse gas emissions by GHG Protocol Scope, 2018



SOURCES See sources to exhibit 1. **NOTE** Scopes 1–3 are defined in the notes to exhibit 1.

Life-Cycle Emissions



www.healthaffairs.org

ENVIRONMENTAL HEALTH

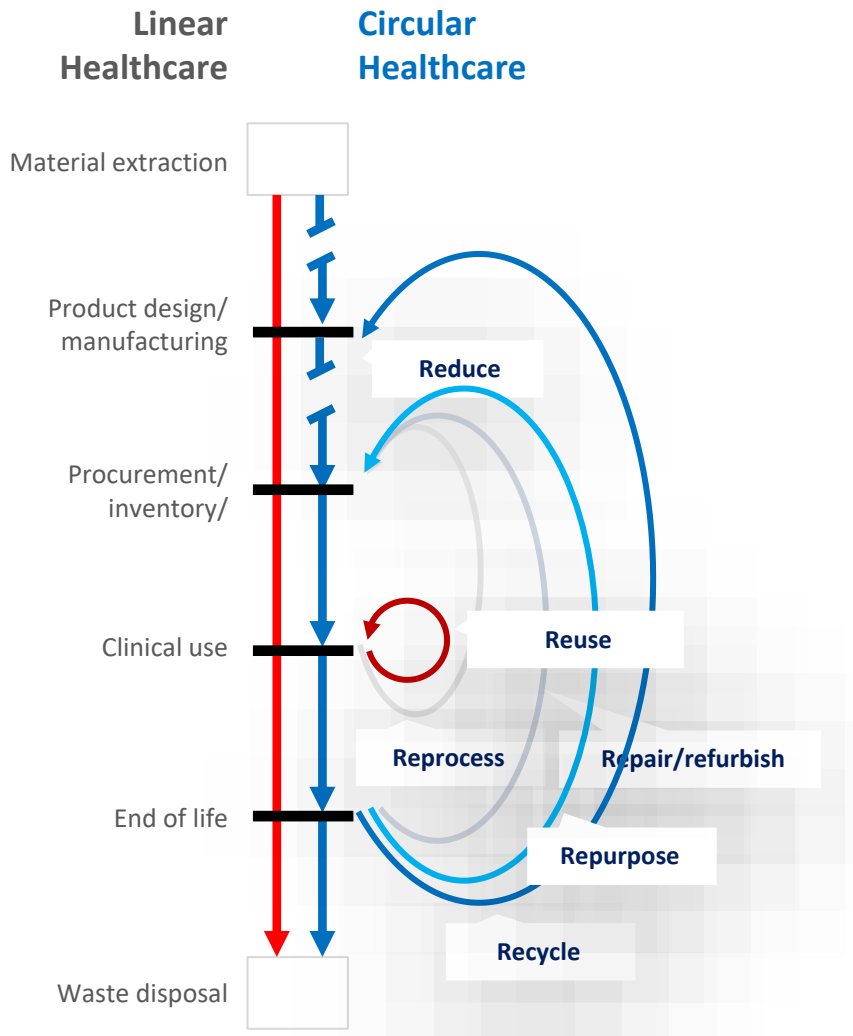
By Andrea J. MacNeill, Harriet Hopf, Aman Khanuja, Saed Alizamir, Melissa Bilec, Matthew J. Eckelman, Lyndon Hernandez, Forbes McGain, Kari Simonsen, Cassandra Thiel, Steven Young, Robert Lagasse, and Jodi D. Sherman

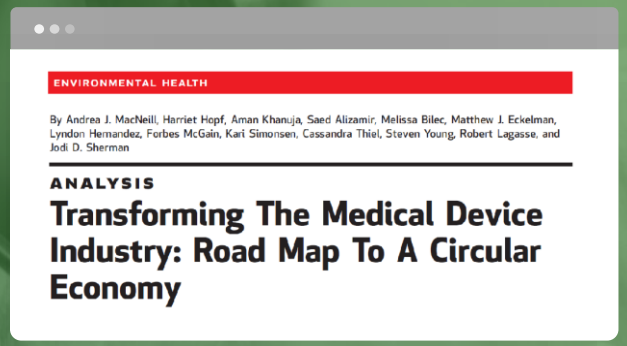
ANALYSIS

Transforming The Medical Device Industry: Road Map To A Circular Economy

ABSTRACT A circular economy involves maintaining manufactured products in circulation, distributing resource and environmental costs over time and with repeated use. In a linear supply chain, manufactured products are used once and discarded. In high-income nations, health care systems increasingly rely on linear supply chains composed of single-use disposable medical devices. This has resulted in increased health care expenditures and health care–generated waste and pollution, with associated public health damage. It has also caused the supply chain to be vulnerable to disruption and demand fluctuations. Transformation of the medical device industry to a more circular economy would advance the goal of providing increasingly complex care in a low-emissions future. Barriers to circularity include perceptions regarding infection prevention, behaviors of device consumers and manufacturers, and regulatory structures that encourage the proliferation of disposable medical devices. Complementary policy- and market-driven solutions are needed to encourage systemic transformation.

Health Affairs. 2020. 39(12):2088-97.

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ANALYSIS

Transforming The Medical Device Industry: Road Map To A Circular Economy

Drivers of a Linear Economy

Consumers

Avoidance of liability and complexity

Manufacturers

Profit maximization

Regulators

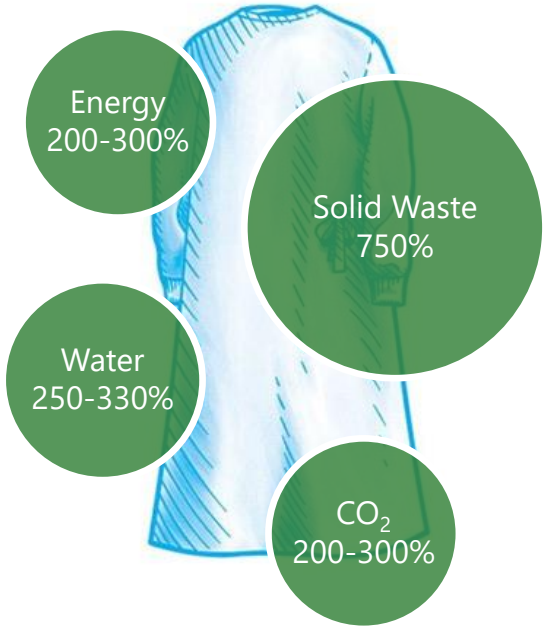
Assumptions of improved safety with single-use devices

A Comparison of Reusable and Disposable Perioperative Textiles

Overcash M. Anesth Analg 2012.

Reusable Textiles

Disposable Textiles



Comparative Life Cycle Assessment of Disposable and Reusable Laryngeal Mask Airways

Eckelman M, Mosher M, Gonzalez A and Sherman J. Anesth Analg 2012.

7.4 kgCO2e

11.3 kgCO2e

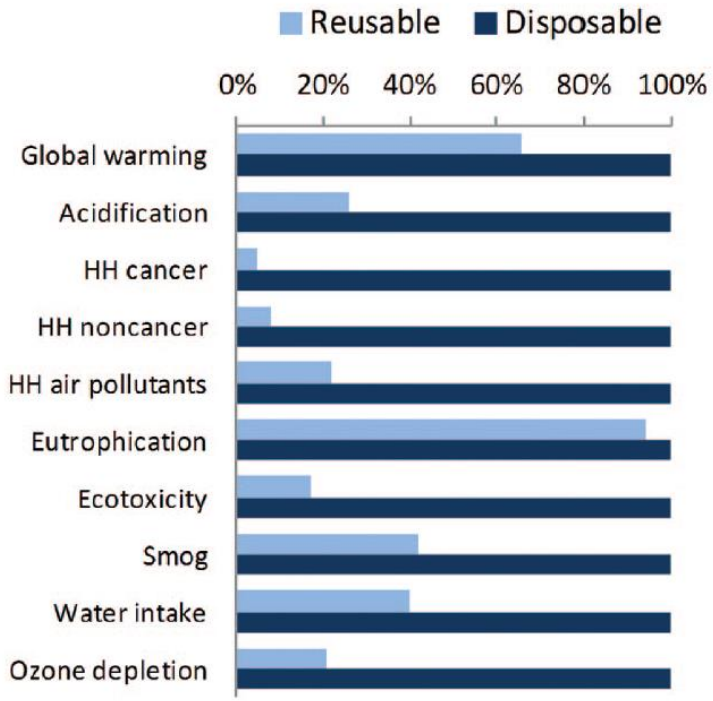


Figure 2. Comparative environmental and human health (HH) impacts for disposable and reusable laryngeal mask airways (LMA), Building for Environmental and Economic Sustainability (BEES) impact assessment method.

Supply chain resilience

VS

Circular Healthcare Strategy

Micro

- Reduce material consumption
- Select low-carbon drug or reusable device where choice exists
- Innovate toward lower carbon design

Meso

- Environmentally preferable procurement policies
- Evidence-based infection control practices
- Policies for rational use of single-use devices

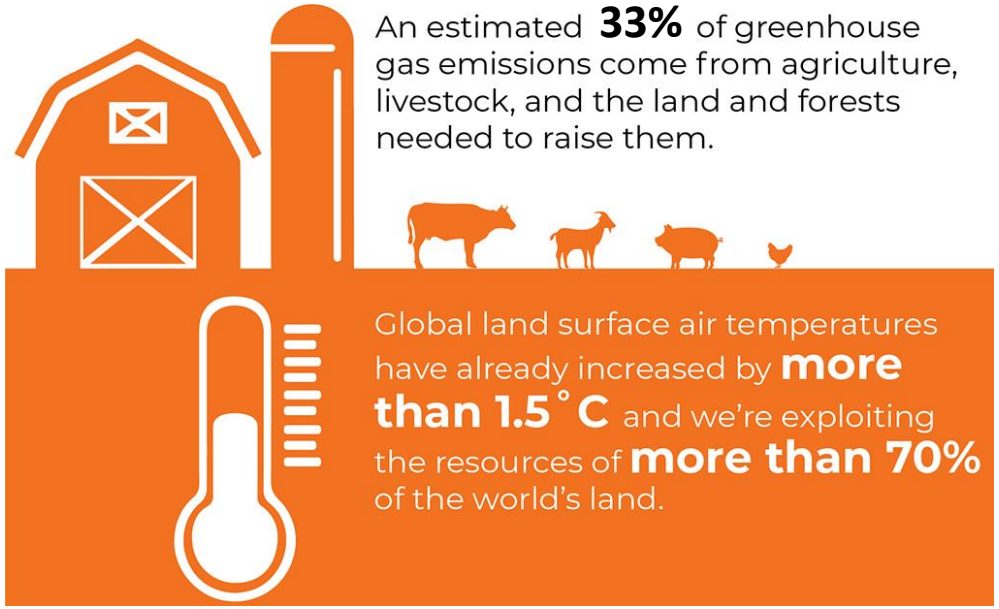
Macro

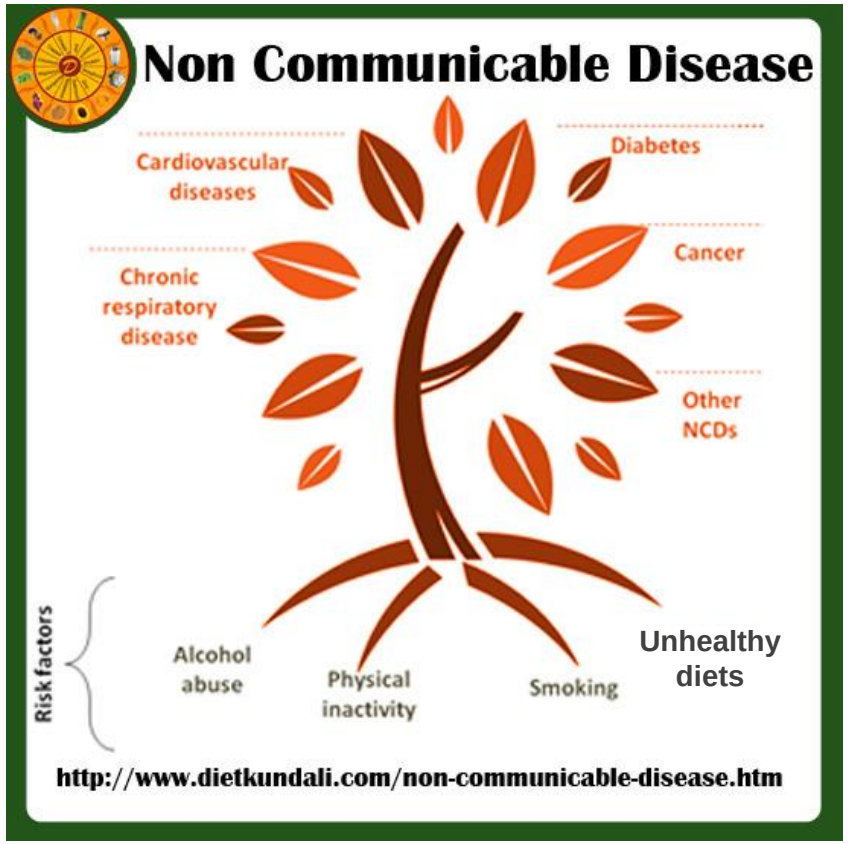
- Professional guidelines to support low-carbon treatments (e.g. inhalers, anesthesia)
- Extended producer responsibility
- Accreditation policies to promote environmental stewardship

Food as Medicine

UN Climate Change Report

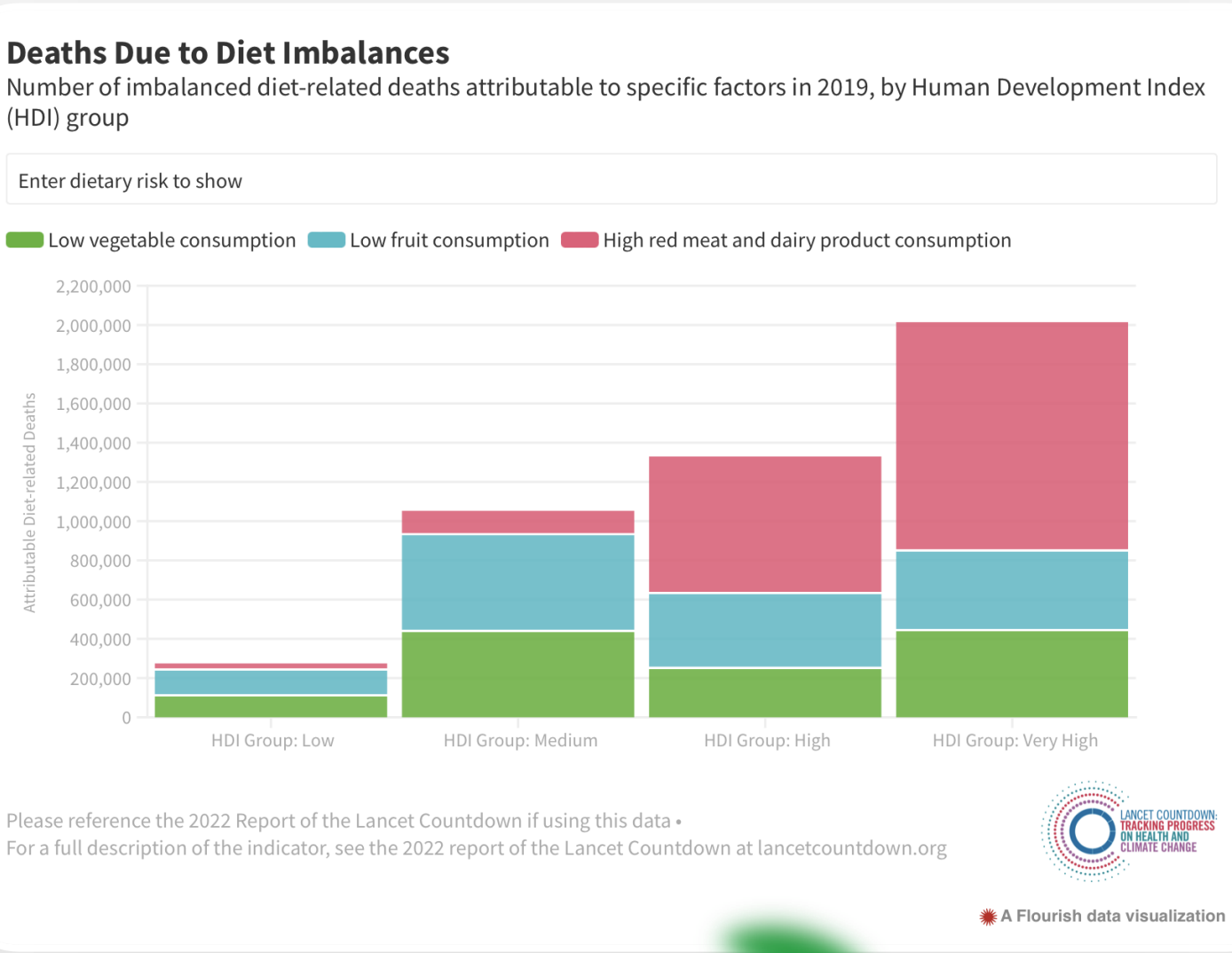
Food and Land





Individual Health

Romanello et al. Lancet Countdown. 2022



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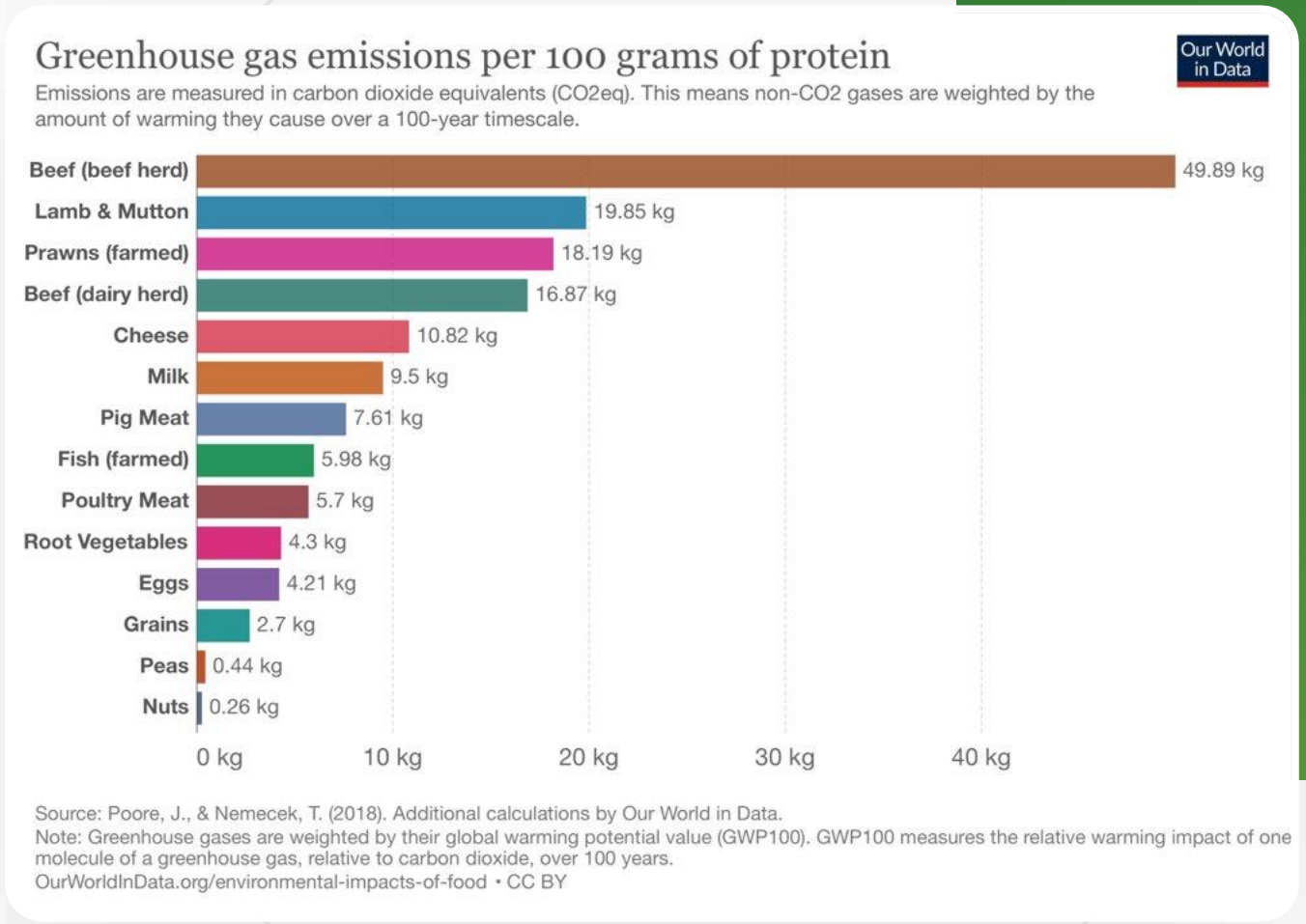

Environmental Impacts Of Food

Scarborough 2014

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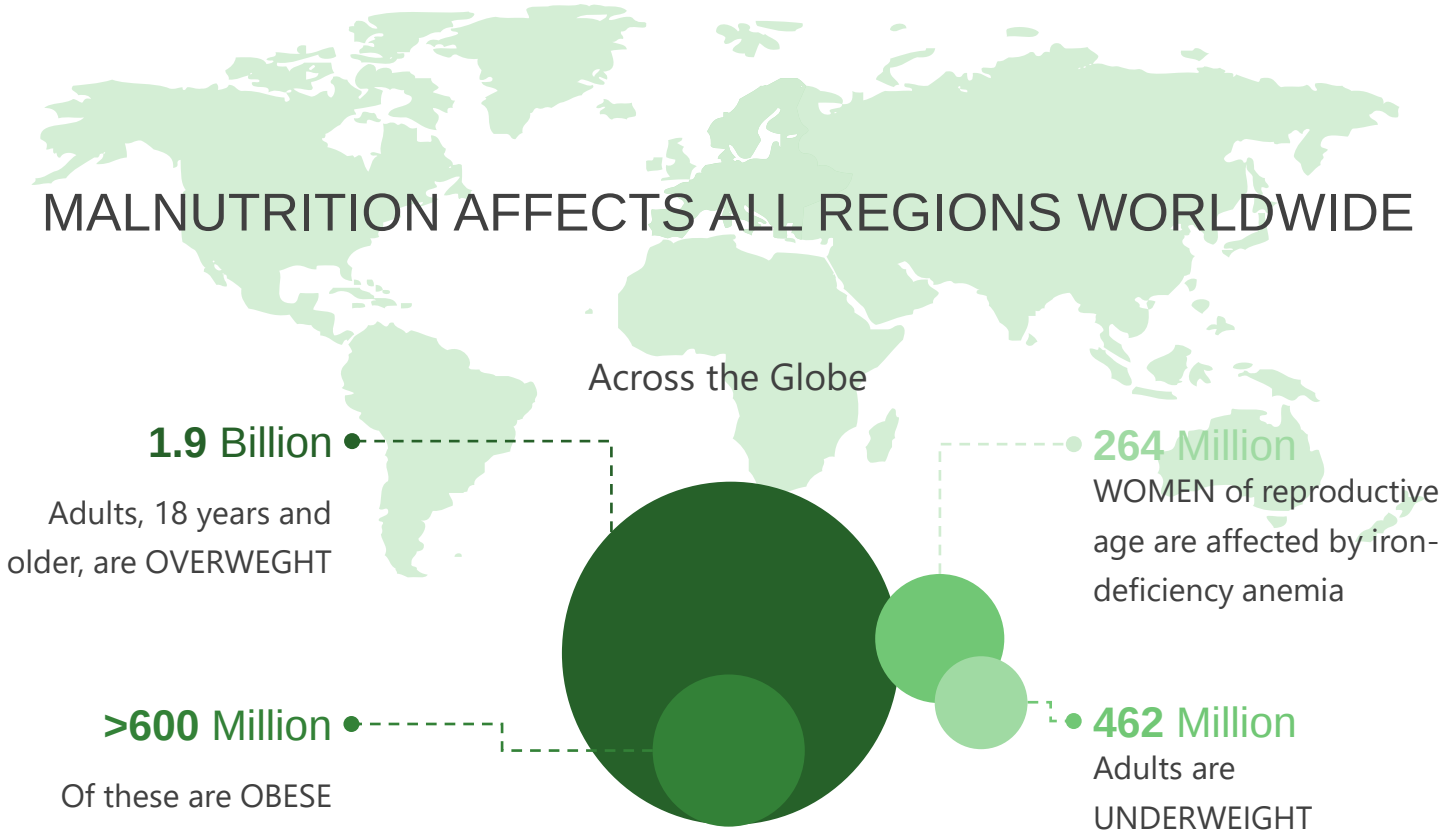
Food as Medicine



THE GLOBE AND MAIL

OPINION

Hospital food should be healing, not horrifying

ANDRÉ PICARD >

PUBLISHED AUGUST 6, 2019

Malnutrition in Canadian hospitals

Katherine F. Eckert RD BSc, Leah E. Cahill RD PhD

Cite as: *CMAJ* 2018 October 9;190:E1207. doi: 10.1503/cmaj.180108

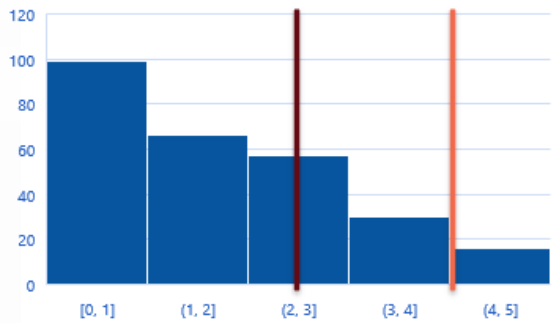
CMAJ

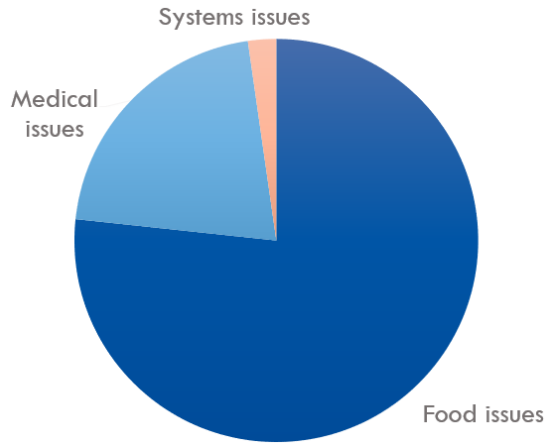
50% wasted

Impacts of Inpatient Food at Vancouver General Hospital on Patient Satisfaction, Nutrition, and Global Climate

Annie Lalande, Keiko Patterson, Stephanie Alexis, Karina Spoyalo, Navin Ramankutty, Jiaying Zhao, Andrea J. MacNeill

0.9kg of food waste per patient per day





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Food as medicine

Transforming hospital food systems for improved patient care and planetary health







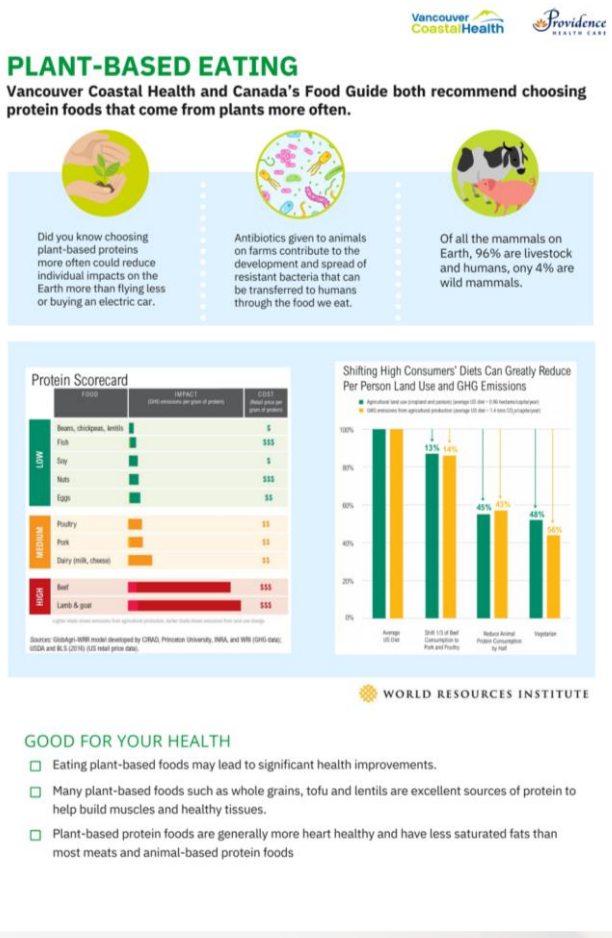




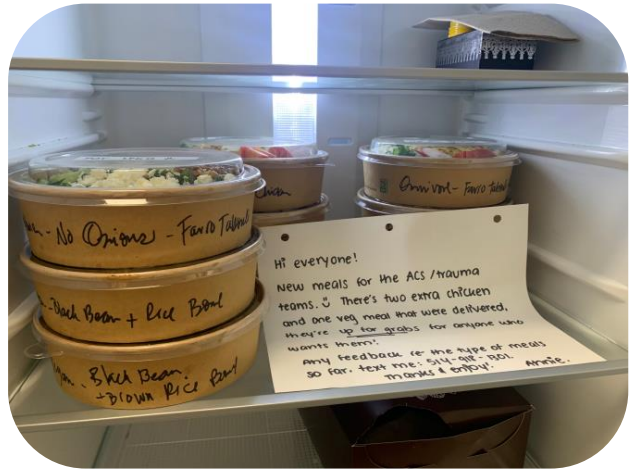

A Planetary Health Strategy

Retail Food

Catering



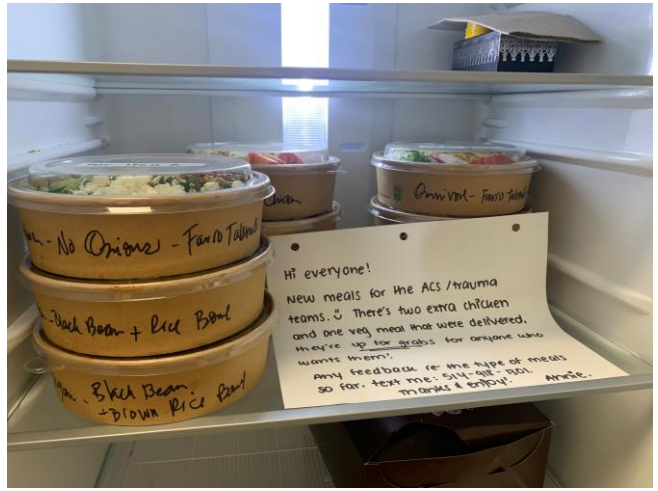
On-Call Food



CULTIVATE
By ElevATE Society

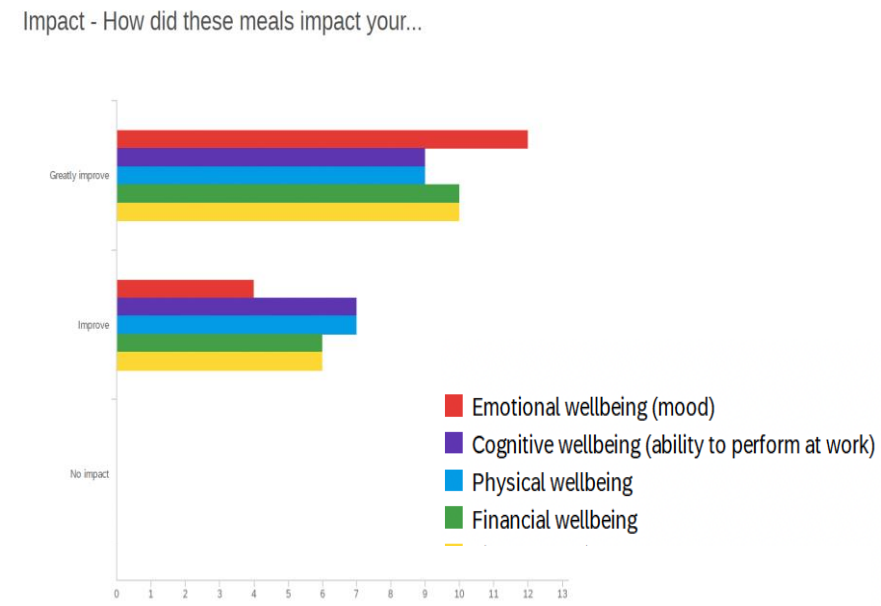
Resident Meals

The Vancouver Sun



Richmond surgeon starts food truck with profits going to local charities

Sharadh Sampath's main motivation is to create a business model that donates all profits, promotes access to employment for those facing barriers to employment, and creates healthy and diverse meal options.



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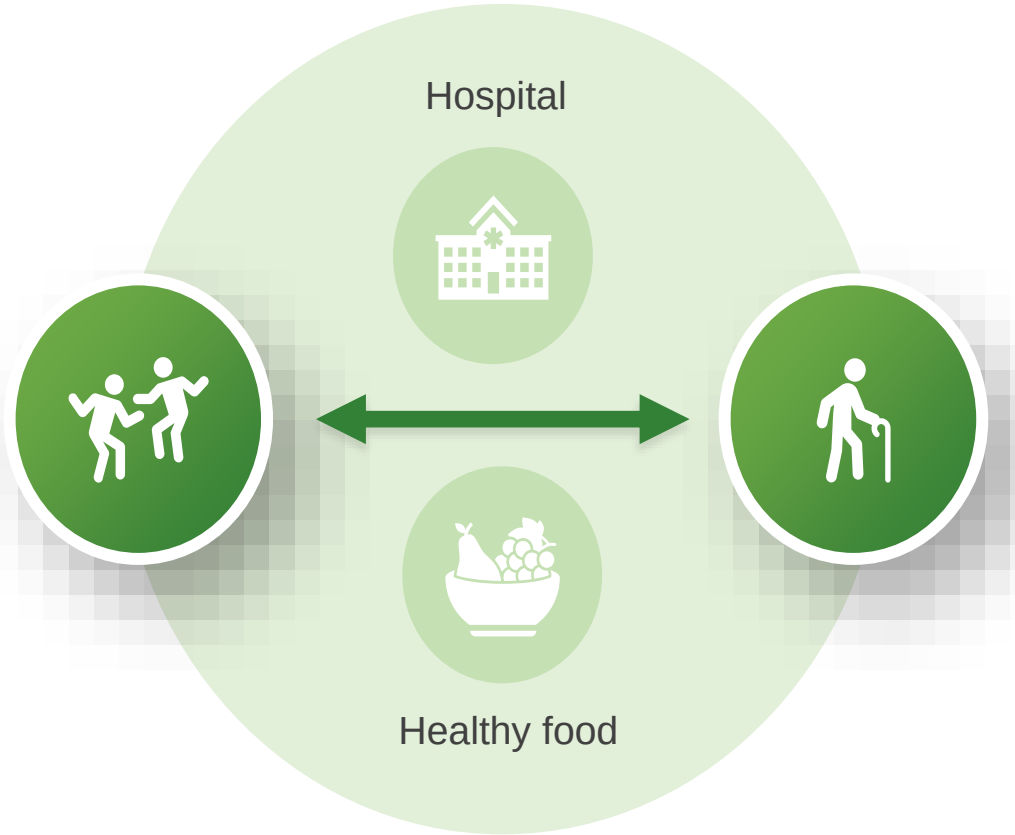
Community Wellbeing

Meals on Wheels



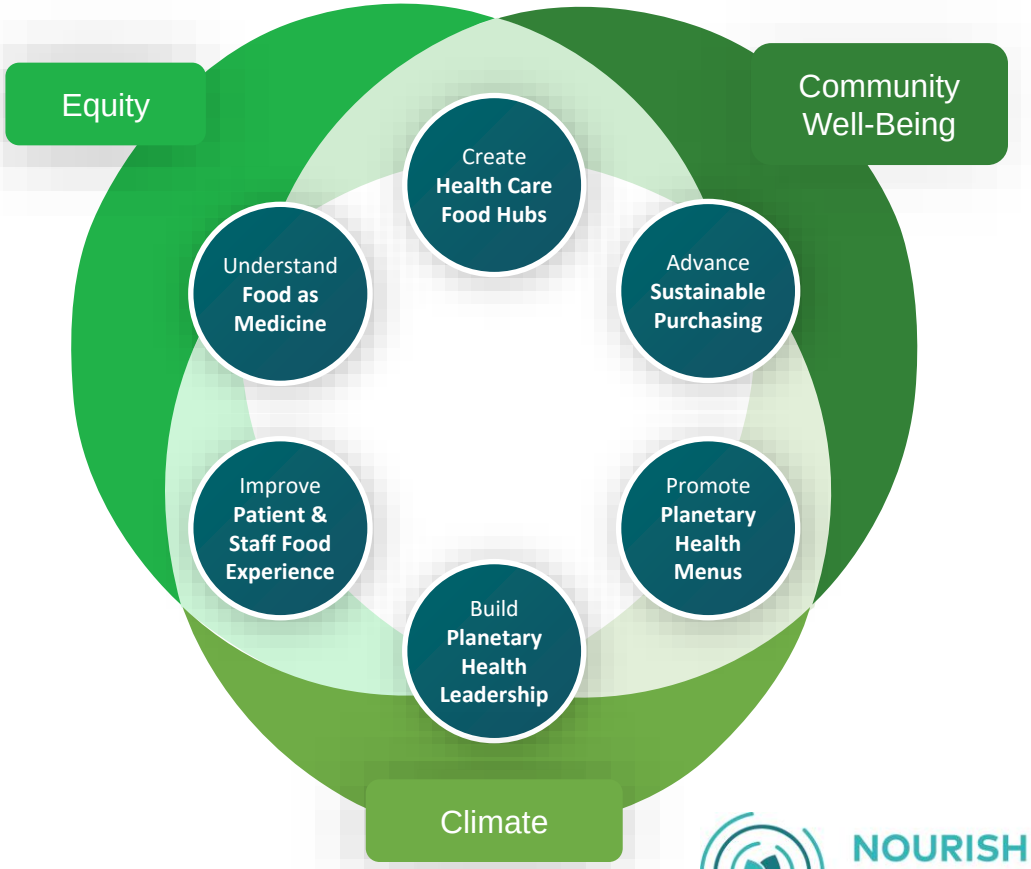
Vancouver Coastal Health

Cultural Safety

In Plain Sight

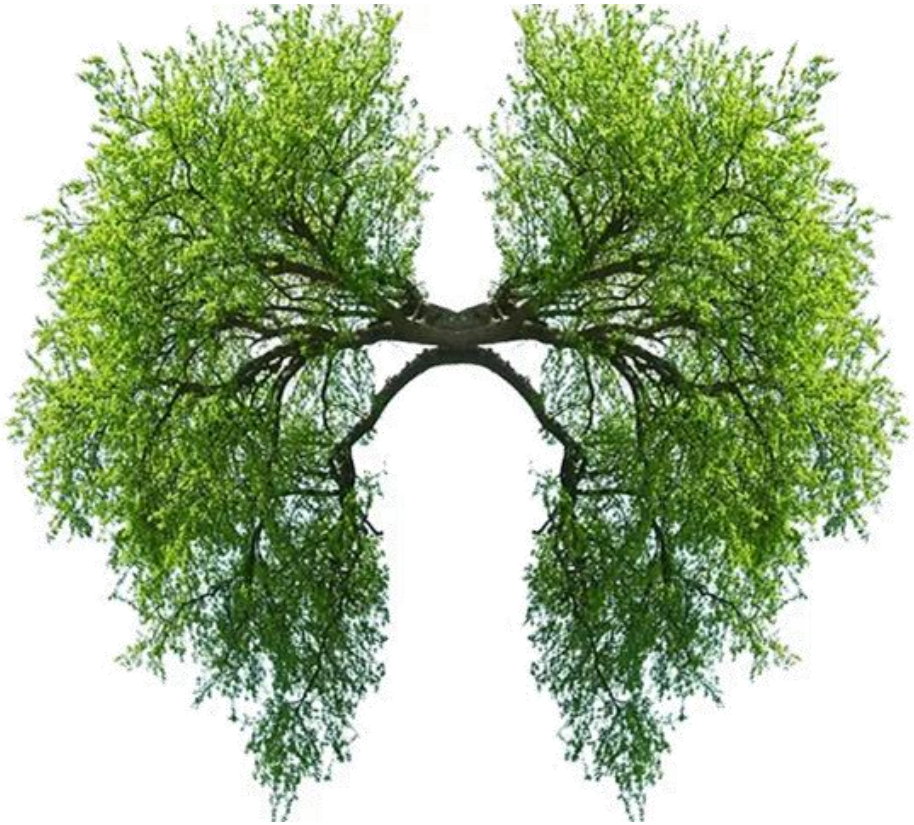
Addressing Indigenous-Specific Racism and Discrimination in BC Health Care

Addressing Racism Review
December 2020



Planetary Healthcare

Expanded duty of care from individual patient to public and planet



PLANETARY HEALTHCARE LAB

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