A wooden slice ornament, cut from a log, hangs from a snow-covered evergreen branch. The ornament is light-colored wood with a rough bark edge. The background is a soft-focus winter scene with snow on branches and a hint of a blue sky.

Environmental Sustainability in Primary Care

Dr. Nicole Redvers, ND, MPH

Associate Professor, Schulich School of Medicine & Dentistry

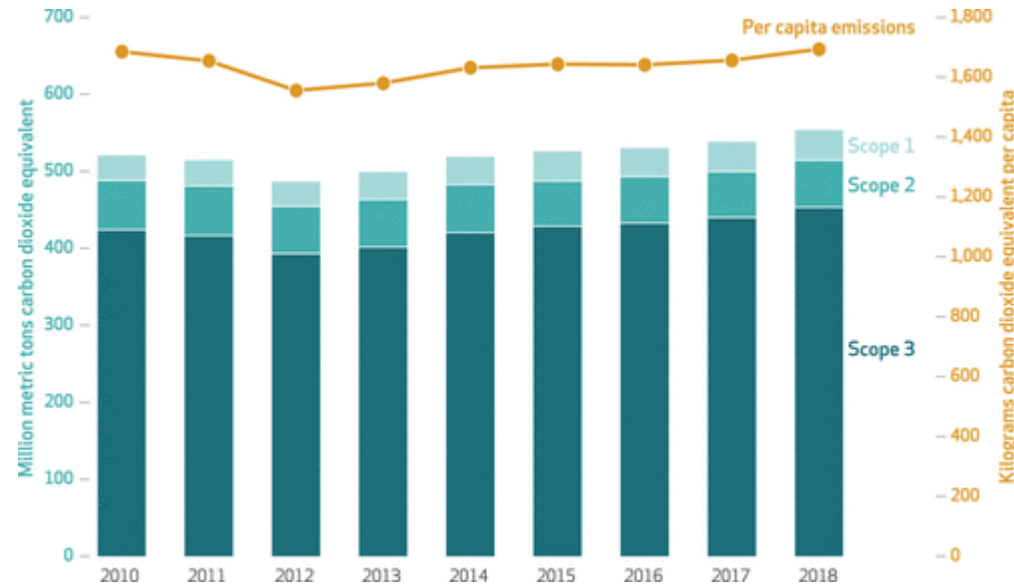
Adjunct Professor, Department of Indigenous Health, University of North Dakota

**No conflicts of interest to declare*

Role of the US Health Sector: Need for Accountability & Action

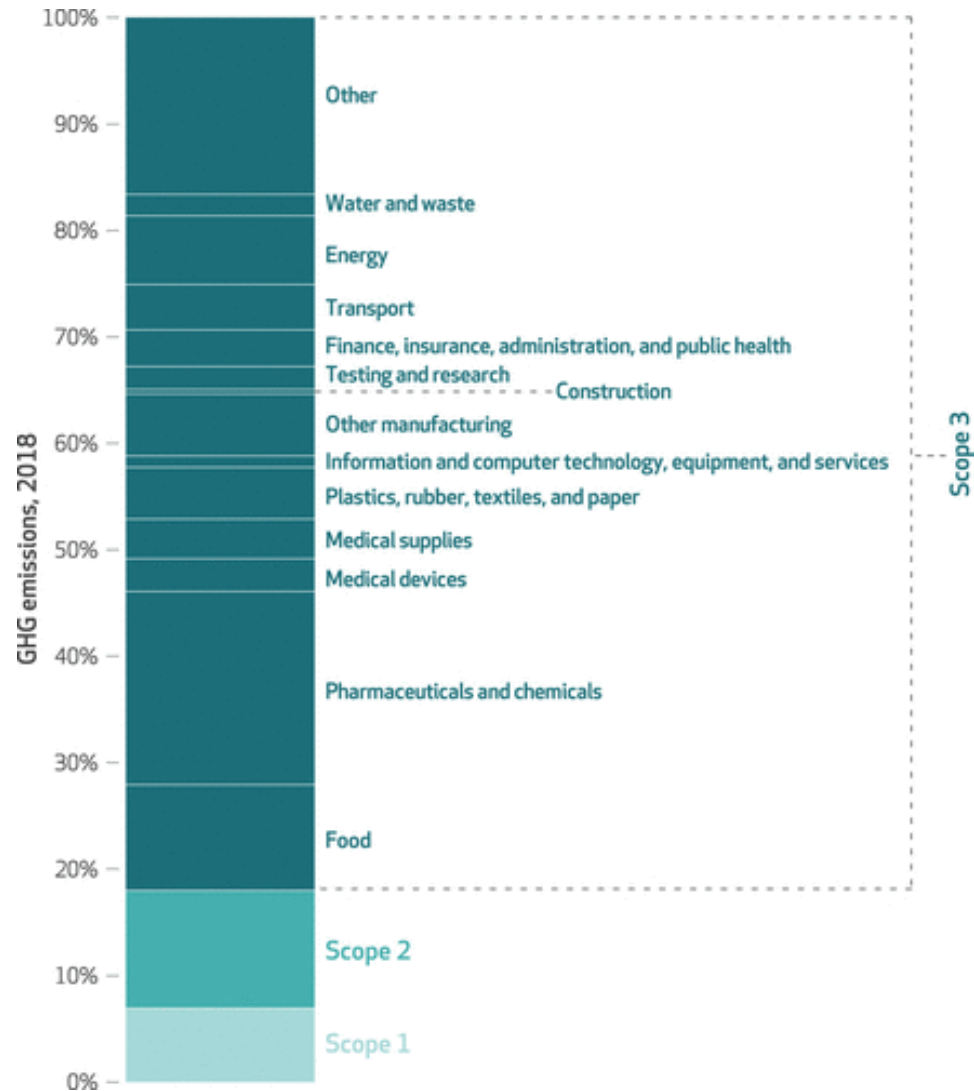
- US health sector is responsible for ~10% of US carbon emission
- Hospitals and health system contributions to global green house gas emissions is ~5% (more than double the entire aviation industry!).
- If the global healthcare sector were its own country, it would be the 5th largest greenhouse gas emitter on the planet.

US national health care GHG emissions, 2010-2018



- 554 MMT in 2018, or ~10% of national GHG emissions
- Emissions rose 6% from 2010 to 2018, highest rate among OECD nations
- Public health damages from US health sector pollution, 388,000 DALYs (especially from particulate matter)

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



- Scope 1 is direct emissions from health care facilities
- Scope 2 is emissions from direct purchases of energy
- Scope 3 is all other supply-chain emissions

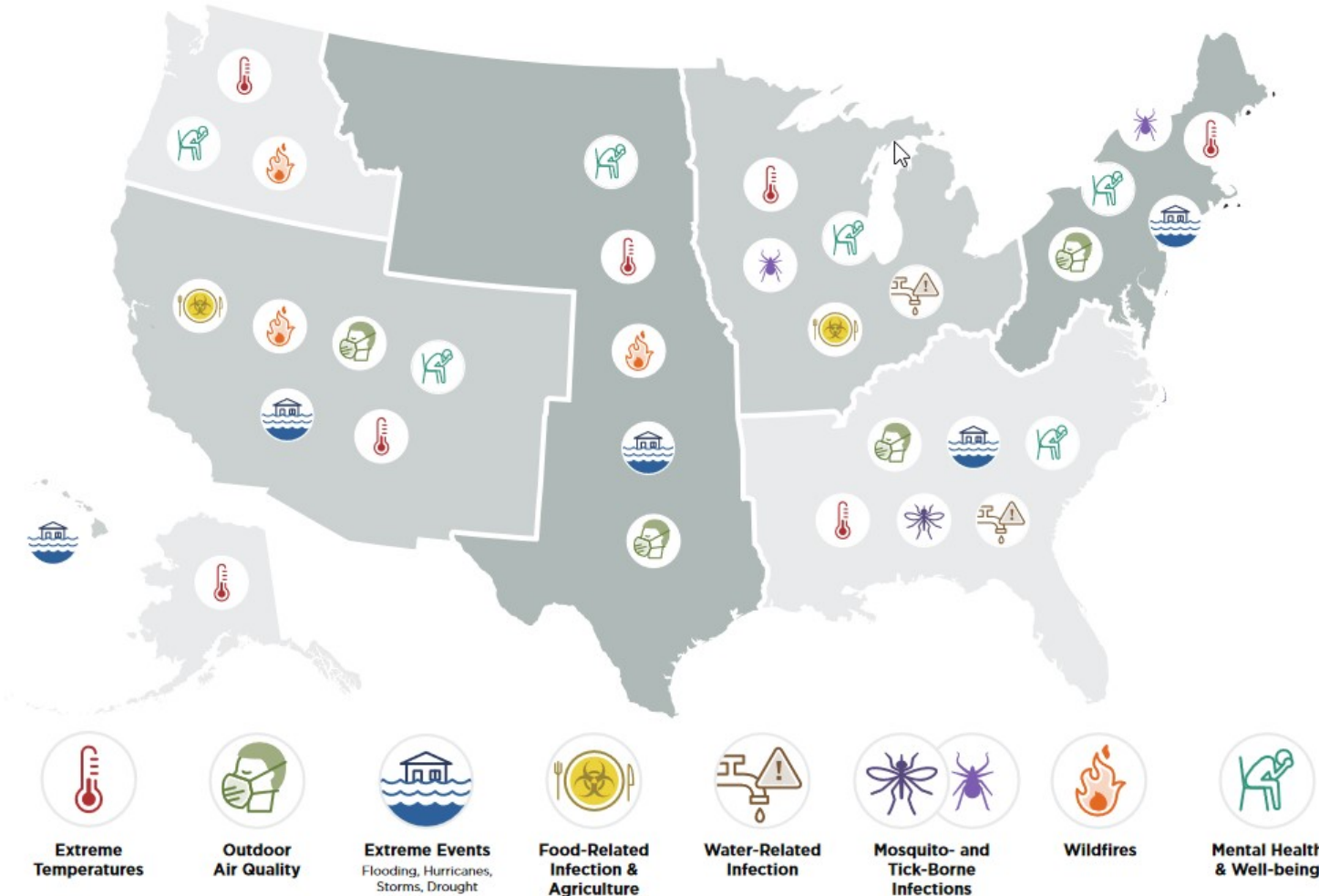
The Climate Crisis is a Public Health Crisis

- 20 million deaths each year globally due to key factors linked to climate change, e.g.,
 - Air pollution: 7 million deaths globally, 100,000+ deaths in US
 - Vector-borne diseases: Rises in malaria and dengue fever, ~700,000 deaths each year; rise in new pandemics
 - Water and food supply: 500,000+ children die because of no access to safe drinking water
 - Climate-fueled disasters: 475,000 deaths, 2000-2019
- Forced migration by 2030, ~700 million “climate refugees”

How are health is harmed by climate change-Impacts differ by geographic region

HOW OUR HEALTH IS HARMED BY CLIMATE CHANGE

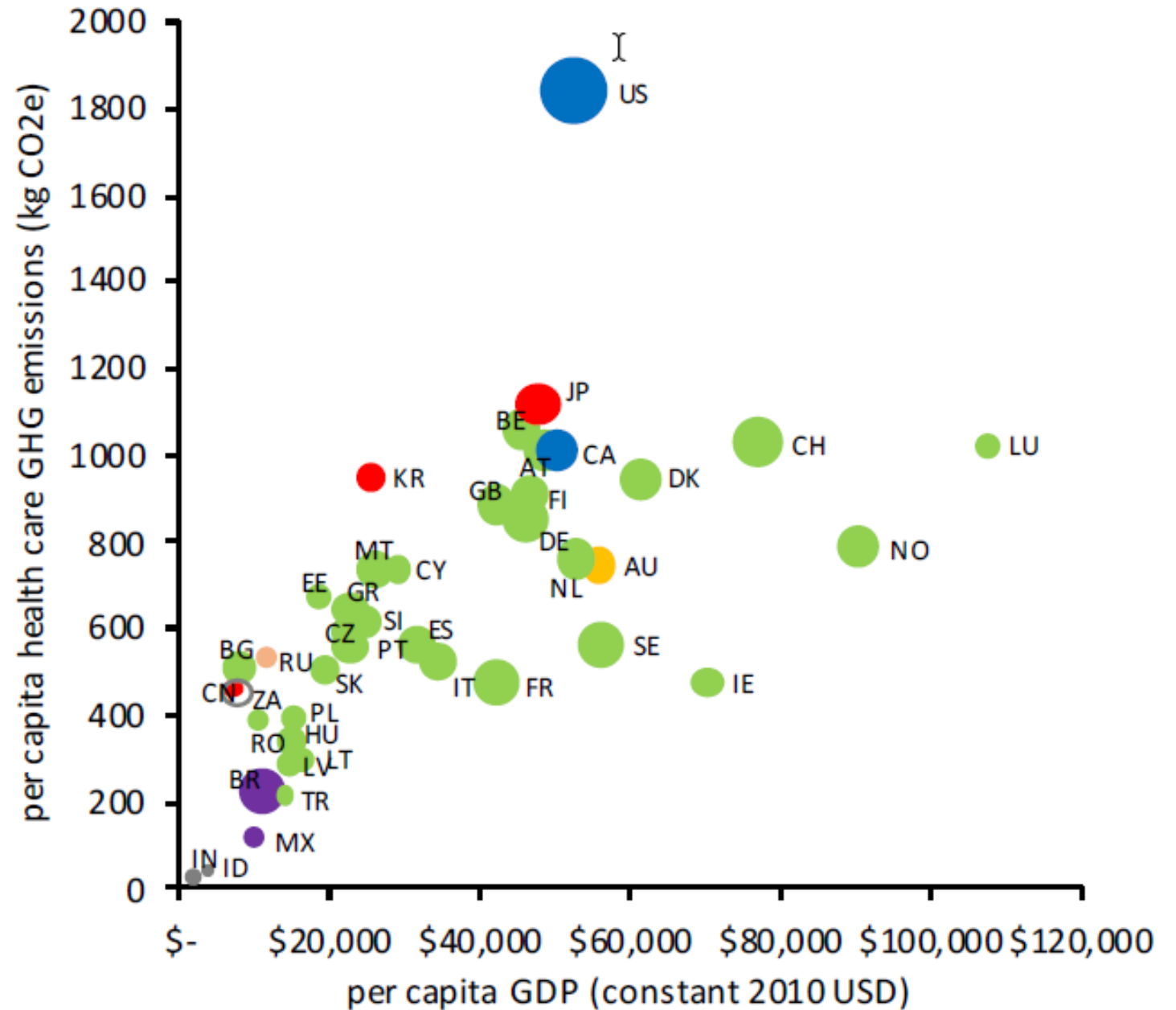
Impacts Differ by Geographic Region



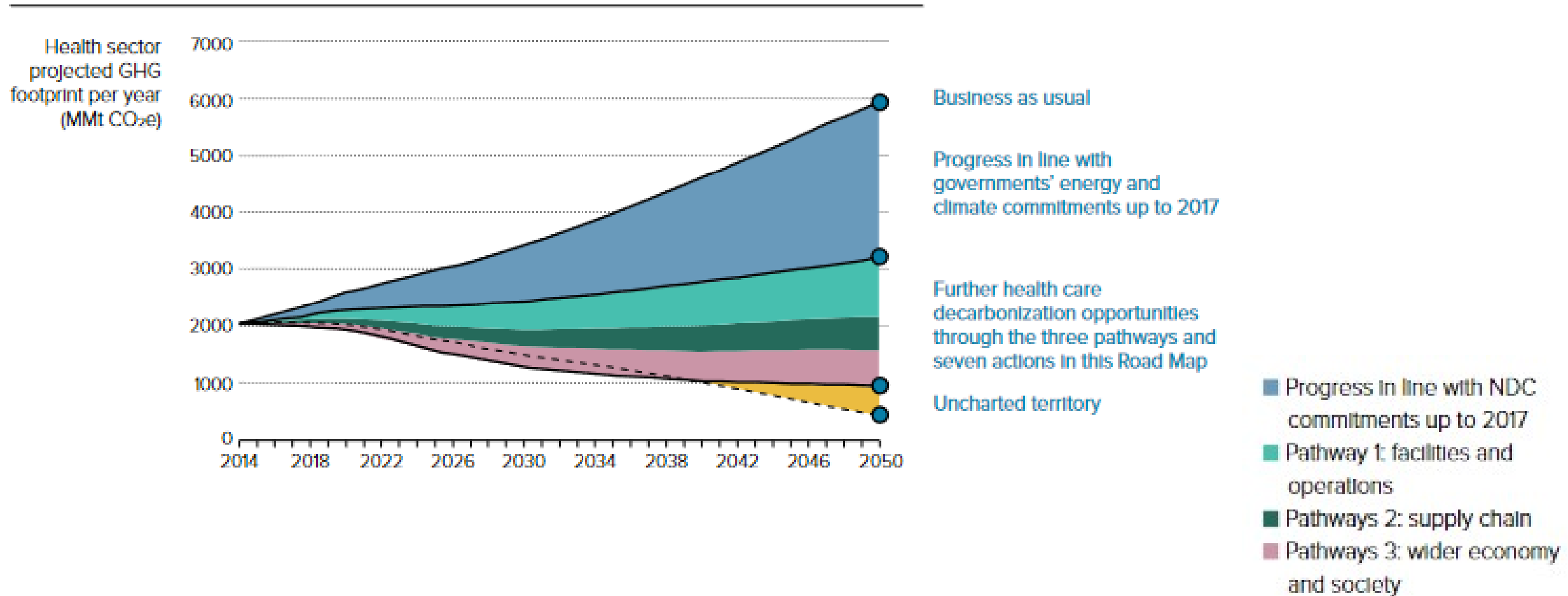
- Asthma and other respiratory diseases due to air pollution
- Heat-related illness and death, cardiovascular failure due to extreme temperatures/ heat.
- Injuries, fatalities, mental health effects due to extreme weather events.
- Infections/ infections disease
- Mental health and wellbeing

Per capita healthcare GHG emissions by country: as a function of GDP per capita

(Watts et al., Lancet. 2019,
394(10211):1836-1878.)



Health sector projected GHG footprint per year (MMt CO₂e)



Role of the Health Sector: An Obligation to Act

National Academy of Medicine, 2021

- We must treat climate change as a public health crisis.
- As some of society's most trusted professionals, we can and should help raise the alarm and communicate about these threats.
- We have a duty to advocate for health and equity to be at the center of climate change planning and policy.
- We need to hold ourselves accountable and be part of the solution.

Clinical Considerations

- Heat stroke (thermal stress)
 - higher effects in urban areas
 - pre-existing respiratory and cardiovascular disease at higher risk
- Increase spread and transmission rates of vector-borne and rodent-borne diseases (i.e., Lyme), impacts for clinical diagnostic work ups (i.e., symptoms, lab access etc.).
- Higher rates of drought
 - increased food insecurity (food price increases with lower yields), compounded by other extreme weather events (floods etc.), lower nutritional density
 - decreases in available drinking water compounded by continued high industrial use (water quality?)

(Costello et al., 2009)

Table 2. Prevalent Climate Sensitive Diseases and Impacted Medical Specialties

(Hess et al., 2009)

Disease	Epidemiology	Primary Specialties	Climate Sensitivity	Climate Change Effect(s)	Confidence in Estimates*
<ul style="list-style-type: none"> Heat illness Heat-sensitive chronic conditions 	<ul style="list-style-type: none"> 240 hyperthermia deaths annually Increased excess mortality from approximately 7%– 60% during heat waves Increased ED admissions for respiratory and renal disease 	<ul style="list-style-type: none"> EM Pediatrics 	Very high	<ul style="list-style-type: none"> Increased heat wave frequency and severity Increased incidence of heat-related illness Persistent effect modification of morbidity and mortality from heat-sensitive chronic diseases 	Very high
<ul style="list-style-type: none"> Weather-related injuries Intentional injury associated with violent crime 	<ul style="list-style-type: none"> 29.6 million nonfatal injuries requiring ED care, including 1,314,000 intentional injuries; 161,000 fatal injuries in 2002 649 weather-related deaths per year 10-year average 1997–2006 and 3,849 direct weather-related injuries in 20065 	<ul style="list-style-type: none"> EM Family practice Pediatrics 	High for injuries related to extreme weather events and for intentional violence associated with violent crime	<ul style="list-style-type: none"> Increasingly frequent and severe weather, increased incidence of weather-related injuries Increased heat wave frequency, severity and increased prevalence intentional violence 	High
Respiratory disease: <ul style="list-style-type: none"> Asthma COPD 	<ul style="list-style-type: none"> Average annual asthma prevalence 20 million (including 6.2 million children) 2001–2003 Annual asthma attack rate approximately 55% in patients with active disease 1.8 million asthma ED visits (including 0.7 million pediatric) Annual average 4,210 asthma deaths COPD prevalence 10 million in 2000 Annual average 1.5 million ED COPD visits Annual average 119,000 deaths 	<ul style="list-style-type: none"> EM Family practice Pediatrics Internal medicine Geriatrics Pulmonary 	<ul style="list-style-type: none"> Asthma: high COPD: moderate 	<ul style="list-style-type: none"> Increased aeroallergen production and higher ground-level ozone production Increasing incidence of COPD and asthma exacerbations 	High

Table 2. Prevalent Climate Sensitive Diseases and Impacted Medical Specialties

Disease	Epidemiology	Primary Specialties	Climate Sensitivity	Climate Change Effect(s)	Confidence in Estimates*
Gastroenteritis	<ul style="list-style-type: none"> Highly underreported Estimated annual incidence 210 million cases Estimated 900,000 hospitalizations annually Estimated 6,000 annual deaths 	<ul style="list-style-type: none"> EM Family practice Pediatrics Internal Medicine 	<ul style="list-style-type: none"> Depends on pathogen High for bacteria Moderate for parasites Relatively low for viruses 	<ul style="list-style-type: none"> Increased incidence of water- and food-borne bacterial and parasitic gastrointestinal infection Possible decrease viral infection incidence 	Moderate
Urolithiasis	<ul style="list-style-type: none"> Lifetime prevalence of 12% in men Lifetime prevalence 7% in women Approximately 1% of ED visits Total 1,140,000 ED visits in 2000 	<ul style="list-style-type: none"> EM Urology Family practice Internal medicine 	Moderate	<ul style="list-style-type: none"> Increased ambient temperature associated with dehydration and decreased urine volume Higher stone incidence in populations not previously at risk 	Moderate
Vector-borne and zoonotic disease	<ul style="list-style-type: none"> Widely variable depending on disease Lyme disease average annual prevalence 21,460 from 2003–20056 	<ul style="list-style-type: none"> EM Family practice Pediatrics Internal medicine Infectious disease 	<ul style="list-style-type: none"> Depends on pathogen Moderately high for vectors of: <ul style="list-style-type: none"> —Lyme disease —West Nile virus Western Equine encephalitis —Eastern Equine encephalitis —Bluetongue virus 	<ul style="list-style-type: none"> Increased ambient temperatures and northward ecosystem migration associated with northward range expansion for <i>I. scapularis</i> 	Moderate

Climate Change and the Microbiome

“We have to be aware that climate change and biodiversity loss are stress factors for ecosystems, for humans, for animals, and for the microbiome. Our research shows that if the different axes of the disease pyramid are destabilized, new infectious diseases can be expected, including for humans.”

~Prof. Dirk Schmeller, Université de Toulouse

“We must learn not just how microorganisms affect climate change (including production and consumption of greenhouse gases) but also how they will be affected by climate change and other human activities. This Consensus Statement documents the central role and global importance of microorganisms in climate change biology. It also puts humanity on notice that the impact of climate change will depend heavily on responses of microorganisms, which are essential for achieving an environmentally sustainable future” (Cavicchioli et al, 2019).



Eco-anxiety

- Eco-anxiety refers to a fear of environmental damage or ecological disaster. This sense of anxiety is largely based on the current and predicted future state of the environment and human-induced climate change (Huizen, 2019).

Presentations:

- trauma and shock
- post-traumatic stress disorder (PTSD)
- anxiety
- depression
- substance abuse
- aggression
- reduced feelings of autonomy and control
- feelings of helplessness, fatalism, and fear

+

●

○

Ecological grief

- The grief felt in relation to experienced or anticipated ecological losses, including the loss of species, ecosystems and meaningful landscapes due to acute or chronic environmental change. “...we argue that ecological grief is an important emergent area for psychological and geographical inquiry that has potential to shed light on personal and collective responses to ecological loss...” (Cunsolo & Ellis. 2018).



Readiness

- Despite the call to action for health-professional involvement in mitigation efforts, there is evidence demonstrating that in some regions clinicians may not actually feel comfortable counseling patients specifically around climate change impacts and health.
- 64% percent of primary care physicians in one US state believe climate change was affecting their patients' health, whereas only 17% were comfortable counseling patients about climate change and health.

Patient-Planetary Health Co-benefit Prescribing


Co-benefits	Description
Food Choices	A transition to a more sustainable plant-based diet — rich in fruits, vegetables, nuts, and legumes — can reduce the environmental footprint of agriculture, as recently highlighted by the EAT-Lancet Commission.
Active Transport	Forms of transport that involve physical activity, such as cycling and walking, have the dual benefit of reducing emissions and protecting against multiple diseases.
Reproductive Health	Ensuring universal access to reproductive healthcare can improve both maternal and child health.
Connecting within Nature	Finding ways to spend more time outside in nature—including in green space in cities—can have benefits for physical and mental health and increase a sense of stewardship for our natural environment.
Engaging in community	Fostering social connectedness through community building not only results in mental-health benefits but can also help build the social capital necessary for collective action. Connecting with those around us is thought to be particularly effective for planetary health when mobilizing around a common goal, such as bringing more green space, bike lanes, composting services, or farmers' markets to our communities.
Sustainable Drug Prescribing	Eco-directed Sustainable Drug Prescribing (EDSP) has been proposed to prevent the adverse effects of some active pharmaceutical ingredients (APIs) in the environment resulting from certain medical prescriptions. Other medications have been highlighted for their global warming potential (GWP) with statements being issued to inform clinicians on potential alternatives.
Preventative Medicine	With an increase in global population as well as that of the aged, the carbon footprint of healthcare is not improving, and the complexity of diagnostic and treatment methods used is increasing. Disease prevention strategies are important for patients as well as for reducing the intensity of the high carbon care required.

Planetary Health Clinical Practice

- Nature connectedness
- Diet (i.e., plant-forward)
- Transport (↑ exercise)
- Choosing Wisely®
- Consumption



Nature Connectedness

- In a study of 20,000 people, it was found that people who spent two hours a week in green spaces — local parks or other natural environments, either all at once or spaced over several visits — were substantially more likely to report good health and psychological well-being than those who don't. 
- Two hours was a hard boundary (*i.e., it showed there were no benefits for people who didn't meet that threshold*).
- The effects were robust, cutting across different occupations, ethnic groups, people from rich and poor areas, and people with chronic illnesses and disabilities.

Nature Connectedness

- What does this look like on a prescription pad?

e.g.:

- 4 x 30 minutes of green exercise per week
- 120 minutes leisure time in nature per week
- 10 plants of different sizes and varieties in the house.
- Place pictures of nature around your home.
- Spend some time sitting under a tree.



Planetary Health Practice

- Nature connectedness
- **Diet (i.e., plant-based, buy local)**
- Transport (↑ exercise)
- Choosing Wisely®
- Consumption



Planetary Health Diet

- EAT-Lancet Commission presents a global planetary health diet this is healthy for both people and planet.
- It emphasizes a plant-forward diet where whole grains, fruits, vegetables, nuts and legumes comprised greater portion of foods consumed.
- Overconsumption is a waste of foods with both health and environmental costs.
- Allows for flexible application to tailor foods and amounts to different preferences and contexts to reduce the risk of poor diets and environmental degradation.



Planetary Health Practice

- Nature connectedness
- Diet (i.e., plant-based, buy local)
- **Transport (↑ exercise)**
- Choosing Wisely®
- Consumption





Transport (↑ exercise)

- Exercise is a foundation helping to pave the way to environmental change.
- When you exercise outdoors, you reduce your carbon footprint because you are minimizing the use of energy-consuming machines or vehicles.
- Plogging (Sweden fitness craze that is spreading).
- 'Purpose' in exercising?

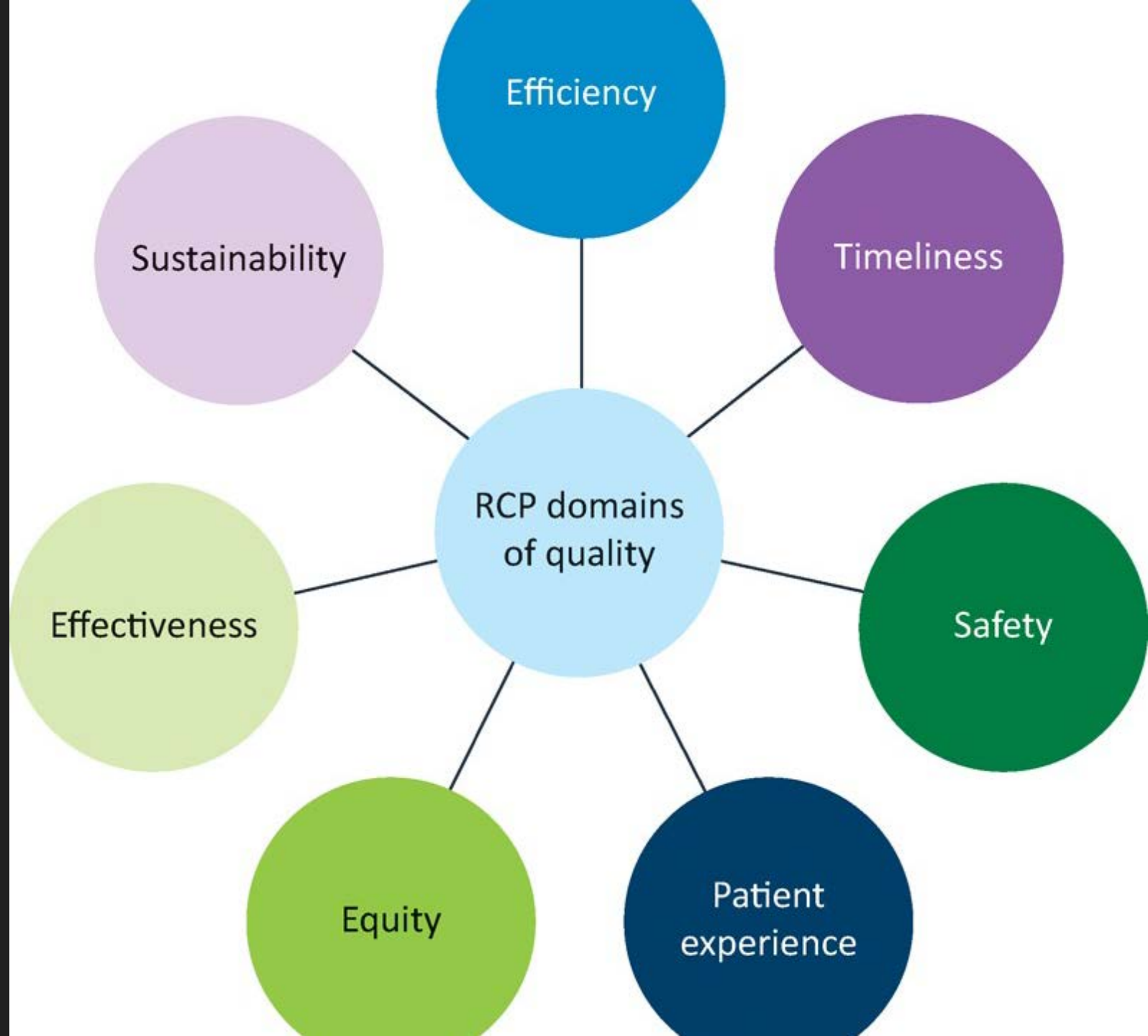
Planetary Health Practice

- Nature connectedness
- Diet (i.e., plant-based, buy local)
- Transport (↑ exercise)
- **Choosing Wisely®** (value-based care?)
- **Consumption**



Domains of quality
(adapted by the Royal
College of Physicians
from the Institute of
Medicine).

(Mortimer et al. 2018)



Education for sustainable healthcare (ESH)

The process of equipping current and future health professionals with the knowledge, attitudes, confidence and capacity to provide environmentally sustainable services through health professional education (Walpole and Mortimer 2017).

The UK's Centre for Sustainable Healthcare used a consultation process to develop three Priority Learning Outcomes (Thompson et al. 2014), which encompass ESH:



1. Describe how the environment and human health interact at different levels.
2. Demonstrate the knowledge and skills needed to improve the environmental sustainability of health systems.
3. Discuss how the duty of a doctor to protect and promote health is shaped by the dependence of human health on the local and global environment.

Sustainable Health Care-Drug Prescribing

- Active pharmaceutical ingredients (APIs)
- Eco-directed sustainable prescribing (EDSP)

(Daughton, 2014)

Sustainable Health Care-Drug Prescribing

- Patient adherence or compliance with medication regimens.
- Drug substitution, reducing dispensed drug quantity (especially amounts suitable for short-term trials). 
- Easier or better-targeted delivery systems (e.g., transdermal systems), lower doses [e.g., achieved with alternative delivery routes or personalized doses, dose timing (e.g., chronobiology), palatability (a factor that can strongly influence patient compliance and thereby raise or lower the incidence of leftovers)]. 
- Doctor medication reviews with patients (and prevention of unnecessary polypharmacy), more informative and clearer labeling (which can directly promote patient compliance), elimination of unnecessary repeat prescriptions (especially automatic refills), improved coordination among prescriber, dispenser, and patient, and alternative treatments (exercise, physical therapy, diet, etc.).
- Consideration of pharm**Eco**kinetic factors [e.g., prescribing decisions partly based on selection of drugs having lower half-lives in the environment or reduced propensity to undergo bioaccumulation].

Sustainable Health Care-Procurement

- Practice Greenhealth: Sustainable procurement directory.

PVC and DEHP Elimination Goal for Hospitals

In order to meet the goal, hospitals must eliminate PVC and DEHP from at least two product categories.

Product categories include:

1. Breast Pumps and accessories
2. Enteral Nutrition Products
3. Enteral Tubes
4. General Urological
5. Gloves
6. Parenteral Infusion Devices and Sets
7. Respiratory Therapy Products
8. Vascular Catheters

Resources

- 1) Cole J. 2019 Planetary Health-Human Health in as Era of Global Environmental Change. CAB International.
- 2) Myers S, & Frumkin H. 2020. Planetary Health-Protecting Nature to Protect Ourselves. Island Press.
- 3) Charron DF. Ecohealth Research in Practice-Innovative Applications of an Ecosystem Approach to Health. Springer.
- 4) Dakubo CY. 2010. Ecosystems and Human Health-A Critical Approach to EcoHealth Research and Practice. Springer.
- 5) Deem SL, Lane-deGraaf KE, Rayhel EA. 2019. Introduction to One Health- An interdisciplinary Approach to Planetary Health. Wiley.

Western keywords for research in this area: planetary health, one health, ecohealth, environmental health, ecological determinants of health, ecological public health, environmental justice, political ecology of health, occupational and environmental health.

Organizations Resources

- 1) Planetary Health Alliance: <https://www.planetaryhealthalliance.org/planetary-health-Clinicians-for-PH>: <https://www.planetaryhealthalliance.org/clinicians-for-planetary-health>
- 2) inVIVO Planetary Health: <https://www.invivoplanet.com/>
- 3) Centre for Sustainable Health care: <https://sustainablehealthcare.org.uk/>
- 4) The Medical Society Consortium on Climate & Health: <https://medsocietiesforclimatehealth.org/>
- 5) Health Care Without Harm (US & Canada): <https://noharm-uscanada.org/healthcareclimatechallenge>
- 6) CleanMed 2020 Virtual Series (free): <https://cleanmed.org/>
- 7) Practice Greenhealth: <https://practicegreenhealth.org/>
- 8) Community of Practice in Ecosystem Approaches to Health (COPEH-Canada): <http://www.copeh-canada.org/>
- 9) My Green Doctor: <https://www.mygreendoctor.org/>
- 10) Indigenous Environmental Network: <https://www.ienearth.org/>
- 11) Indigenous Climate Action: <https://www.indigenousclimateaction.com/>
- 12) Nature Prescriptions (PaRx): <https://www.parkprescriptions.ca/>
- 13) Yale School of Public Health-Climate Change and Health Certificate: <https://ysph.yale.edu/cchcert/>

Coping / Resilience



TAKING
ACTION



GETTING
EDUCATION



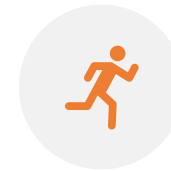
FOCUSING
ON
RESILIENCY



TRYING TO
STAY
OPTIMISTIC



FOSTERING A
STRONGER
CONNECTION WITH
NATURE



GETTING
ACTIVE



KNOWING
WHEN TO
DISENGAGE



SEEING A
DOCTOR

A pledge for planetary health to unite health professionals in the Anthropocene (*The Lancet*, 2020)

[https://www.thelancet.com/article/S0140-6736\(20\)32039-0/fulltext](https://www.thelancet.com/article/S0140-6736(20)32039-0/fulltext)



Mahsi cho

Twitter & Facebook: @DrNicoleRedvers

References (in order of presentation):

- Watts N, et al. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet*. 2019 Nov 16;394(10211):1836-1878. doi: 10.1016/S0140-6736(19)32596-6.
- Eckelman MJ et al. 2020. Health Care Pollution And Public Health Damage In The United States: An Update. *Health Affairs*. 39(12). <https://doi.org/10.1377/hlthaff.2020.01247>
- The Medical Society Consortium on Climate & Health. 2017. Report: Medical Alert! Climate Change Is Harming Our Health. Retrieved from: <https://medsocietiesforclimatehealth.org/reports/medical-alert/>
- Healthcare Without Harm. 2021. The Global Road Map for Health Care Decarbonization: a navigational tool for achieving zero emissions with climate resilience and health equity. Retrieved from: <https://www.noharm.org/healthcaredecarbroadmap>
- Costello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R, et al. 2009. Managing the health effects of climate change: Lancet and University College London Institute for Global Health Commission. *The Lancet*. 373(9676):1693-1733. [https://doi.org/10.1016/S0140-6736\(09\)60935-1](https://doi.org/10.1016/S0140-6736(09)60935-1).
- Hess, J.J., Heilpern, K.L., Davis, T.E. and Frumkin, H. (2009), Climate Change and Emergency Medicine: Impacts and Opportunities. *Academic Emergency Medicine*, 16: 782-794. doi:10.1111/j.1553-2712.2009.00469.x
- Cavicchioli, R., Ripple, W.J., Timmis, K.N. et al. Scientists' warning to humanity: microorganisms and climate change. *Nat Rev Microbiol* 17, 569–586 (2019). <https://doi.org/10.1038/s41579-019-0222-5>
- Huizen J. 2019. What to know about eco-anxiety. *Medical News Today*. Accessed from: <https://www.medicalnewstoday.com/articles/327354>
- Cunsolo, A., Ellis, N.R. Ecological grief as a mental health response to climate change-related loss. *Nature Clim Change* 8, 275–281 (2018). <https://doi.org/10.1038/s41558-018-0092-2>
- Boland TM, Temte JL. Family Medicine Patient and Physician Attitudes Toward Climate Change and Health in Wisconsin. *Wilderness Environ Med*. 2019 Dec;30(4):386-393. doi: 10.1016/j.wem.2019.08.005.
- Redvers N. 2021. Patient-Planetary Health Co-benefit Prescribing: Emerging Considerations for Health Policy and Health Professional Practice. *Front. Public Health*. <https://doi.org/10.3389/fpubh.2021.678545>.
- White, M.P., Alcock, I., Grellier, J. et al. Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Sci Rep* 9, 7730 (2019). <https://doi.org/10.1038/s41598-019-44097-3>
- Mortimer F, Isherwood J, Wilkinson A, Vaux E. Sustainability in quality improvement: redefining value. *Future Healthc J*. 2018;5(2):88-93. doi:10.7861/futurehosp.5-2-88
- Walpole SC, Mortimer F. 2017. Evaluation of a collaborative project to develop sustainable healthcare education in eight UK medical schools. *Pub Health*.150:134–148. <https://www.sciencedirect.com/science/article/pii/S0033350617301944>
- Thompson T, Walpole S, Braithwaite I, Inman A, Barna S, Mortimer F. 2014. Learning objectives for sustainable health care. *Lancet*. 384:1924-1925.
- Daughton CG. 2014. Eco-directed sustainable prescribing: feasibility for reducing water contamination by drugs. *Science of the Total Environment*. 493(15): 392-404. <https://doi.org/10.1016/j.scitotenv.2014.06.013>
- Wabnitz KJ, Gabrysch S, Guinto R, Haines A, Herrmann M, Howard C, Potter T, Prescott SL, Redvers N. A pledge for planetary health to unite health professionals in the Anthropocene. *Lancet*. 2020 Nov 7;396(10261):1471-1473. doi: 10.1016/S0140-6736(20)32039-0.