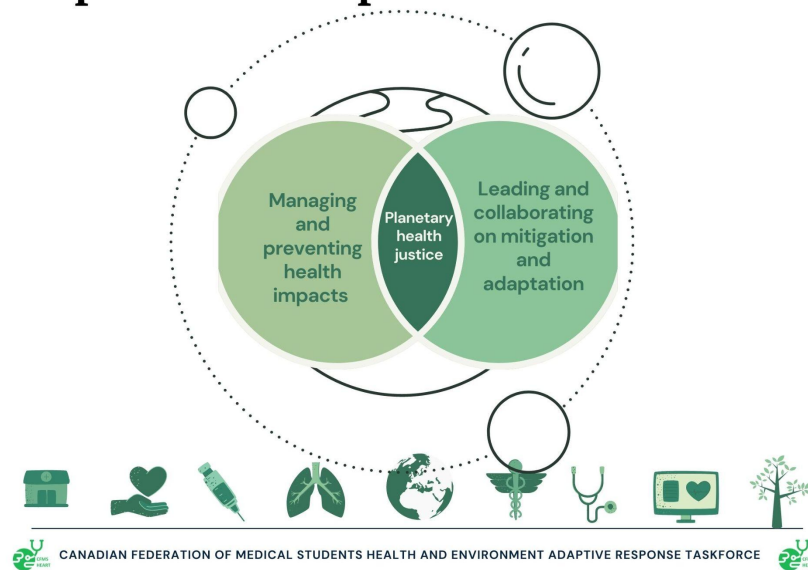


**Canadian Federation of Medical Students Health and Environment Adaptive Response Task Force (CFMS HEART)
Planetary Health Educational Competencies**
Updated December 2021

Executive summary: Climate change, air pollution and environmental degradation impacts the health of all Canadians and exacerbates existing health inequities in Canadian communities. While the pressures on the Canadian healthcare system are increasing by the growing health impacts of the climate crisis, health care delivery is also at risk of interruption from extreme weather. The Canadian healthcare system however is not only a victim and contributes a significant carbon footprint to this pressing public health crisis. It is therefore integral for medical students, residents and physicians to be educated on the causes and health impacts of climate change, and the health co-benefits of climate change adaptation and mitigation efforts in order to safeguard our healthcare system and the health of patients, communities, and our planet.

We propose an evidence-based framework of planetary health educational competencies for universal integration into medical curricula across Canada, which includes 11 competencies distributed into three foundational domains: 1) Advancing Planetary Health Justice, 2) Managing and Preventing Health Impacts, and 3) Leading and Collaborating on Mitigation and Adaptation. Medical institutions that incorporate these competencies will prepare their learners to practice planetary health care, to identify climate related etiologies and manage them appropriately, to advocate for low-carbon and climate-resilient healthcare systems, and to collaborate on transdisciplinary initiatives that draw upon diverse ways of knowing to build and maintain healthy, thriving and just environments for all.

Competent medical practice in a climate crisis





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Introduction

Climate change is described by the World Health Organization (WHO) as “the greatest threat to human health of the 21st century”. Transforming healthcare systems and practices to adapt to climate change while mitigating further warming is therefore our greatest opportunity to safeguard the health of both current and future populations. Medical professionals, by virtue of their position as front-line workers and trusted members of society, have a crucial responsibility to be well-informed about the overall causes and impacts of climate change, its disproportionate burden on marginalized communities, and how to organize equitable and quality access to healthcare in a climate emergency and reduce the environmental footprint of healthcare delivery.

National evaluations of medical curricula at all 17 Canadian medical schools demonstrate that medical students are not yet being adequately prepared to practise in a climate crisis. Below, we outline the reasons why medical students must universally receive education on climate change, planetary health, and climate justice to become competent practising physicians. Additionally, this document provides an evidence-based framework of planetary health educational competencies for integration into medical curricula across Canada.

Why do Canadian medical schools need to teach climate change, climate justice, and planetary health?

As described in the 2020 Lancet Countdown on Health and Climate Change Canadian policy brief, climate change has already contributed to a variety of health consequences for Canadians coast to coast. These range from food insecurity in the Arctic, to increased heat-related illness and respiratory disease, to stress and displacement from natural disasters such as floods and wildfires (Watts et al., 2020). These health impacts are disproportionately experienced by the elderly, children, as well as racialized and other marginalized populations, particularly in low and middle-income countries. Recognizing climate change as a health crisis, the Canadian Medical Association (CMA) has established the goal of ensuring that “climate change is understood and addressed as a challenge to the health system and a key driver of population health” in its Impact 2040 strategy (CMA, 2021). Further, the CMA has committed to work towards preventing further climate change and addressing the health consequences that are already impacting Canadians (CMA, 2021).

Future health practitioners will be at the front lines of managing the health consequences of climate change. In addition, healthcare service delivery produces a significant ecological footprint, with the Canadian healthcare system responsible for 4.6% of the total national emissions (Eckelman, Sherman, & MacNeill, 2018). As such, future physicians must be prepared to practise climate-smart care, and advocate for health sector sustainability. Physicians, as public health advocates, have a responsibility to understand the impacts and origins of global environmental change on their patients and integrate this knowledge into their



clinical practice. They also must learn how to collaborate with stakeholders to promote public policy that benefits the health of society and the natural systems upon which we depend.

How do Canadian medical schools currently teach planetary health?

It is clear that the collective voices of the health profession are essential in driving adaptation and mitigation efforts in response to climate and environmental change. However, medical students across Canada are not adequately taught about planetary health in order to be prepared to practise in a climate crisis. A large multinational survey found that healthcare professionals believe that climate change will harm their patients (77%) and future generations (93%) a great deal, but cited that lack of knowledge (41%) was a key barrier to their engagement in climate action (Kotcher et al., 2021). This finding aligns with national evaluations of the planetary health curricula at Canadian medical schools. In 2019, only 10 out of Canada's seventeen medical schools had any climate and health lectures (CFMS HEART, 2020). In 2021, this number increased to 16 out of 17 medical schools including lecture-based teachings on planetary health, but only seven schools assess students on this content and a mere three provide longitudinal planetary health learning opportunities throughout preclerkship and clerkship (Affleck, Roshan, Stroshein, Walker, & Luo, 2021). Despite progress made since the first national evaluation conducted in 2019 (Hackett, Got, Kitching, MacQueen & Cohen, 2020), Canadian medical students also identified key gaps in sustainable healthcare education and teaching that unravels the connections that must be made between climate change-related health impacts and the social determinants of health.

What are the planetary health competencies that need to be universally integrated into Canadian medical schools to prepare physicians to practice in a climate crisis?

Given the urgent nature of this issue, the Canadian Federation of Medical Students' Health and Environmental Adaptive Responsive Task Force has created a proposed list of climate change, climate justice, and planetary health medical educational competencies. While we recognize that some medical schools are already covering some of these topics, it is imperative that Canadian medical school faculties universally incorporate these objectives into their undergraduate medical education curricula in order to prepare all future Canadian physicians to provide low-carbon care for patients and communities increasingly impacted by the climate crisis.

The CFMS HEART Planetary Health Educational Competencies are based on the following conceptual framework:

Planetary health is a solutions-oriented, transdisciplinary field and social movement focused on analyzing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth (Planetary Health Alliance, 2021). Planetary health recognizes that the health of human communities is fundamentally dependent upon the health of the planet's ecosystems and that while human health continues to significantly progress, the depletion of our natural systems and pollution of our environment in the process threatens our ability to maintain these improvements (Whitmee et al., 2015).



It is well understood that human activity is the primary driver of climate change (IPCC, 2021). Climate change is both driven by and exacerbates social oppression, including racism, sexism, and ableism (Gaard, 2015; McGee & Greiner, 2020; The Wretched of the Earth, 2019). Marginalized communities continue to be the most impacted by climate change and environmental destruction despite having contributed the least to it, making the climate crisis inherently a justice issue (Rudolph et al., 2018; ISSC, IDS & UNESCO, 2016). It is thus critical to frame planetary health through an explicit climate justice lens. Because climate change is driven by unjust relations and continues to generate inequitable health outcomes, it is essential to ensure that voices of marginalized communities are represented in climate change adaptation and mitigation efforts. In particular, Indigenous leadership and sovereignty must be centered as since time immemorial, Indigenous communities have stewarded and defended the lands and waters of our planet (ICA, 2021). As such, recognizing the impacts of colonialism and its relationship with Indigenous sovereignty and climate change is essential to understanding the need for a decolonial approach to planetary health (ICA, 2021).

Framing planetary health education from a climate justice lens allows medical learners and practitioners to work in solidarity with communities most impacted by climate change at local and global levels (Pettit, 2009; Evans, 2010). Such an approach means prioritizing leadership from marginalized communities, confronting the prioritization of corporate entities over human communities, and re-building global structures that center the well-being of both marginalized communities and the planet (Evans, 2010). Planetary health medical education must be operationalized within the principles of climate justice.

Highlighted in red are suggested curriculum topics in which the CFMS HEART Planetary Health competencies could be incorporated, whether into pre-existing modules or as separate sessions.

Highlighted in blue are where the curriculum topics fall under the CanMEDS roles.



A. Advancing Planetary Health Justice

CanMEDS Health Advocate

(Social determinants of health, Medical ethics, Global health)

1. Planetary health justice

1. Explain the two main dimensions of justice underlying planetary health and climate action (Fisher, 2015).
 - a. Procedural justice refers to the perceived fairness of rules and decisions. In planetary health, applying concepts of procedural justice is seeking equitable inclusion and participation of marginalized (Indigenous, low- or middle-income countries, etc.) communities in climate action decision-making processes (Dreher & Voyer, 2015; Evans, 2010).
 - b. Distributive justice refers to the perceived fairness of outcomes or resource allocations. In planetary health, applying concepts of distributive justice is to recognize that those who have contributed least to climate change are often subject to the most harm due to climate change, as well as to direct harm from polluting industries situated close to and upstream from their communities (Dreher & Voyer, 2015).
2. Apply these principles of planetary health justice in all efforts to advance climate action and planetary health.

2. Marginalized and at-risk populations

CanMEDS Manager, Health Advocate

- a. Distinguish between concepts of vulnerability and marginalization, and understand the importance of using the latter term in the context of planetary health. Marginalization recognizes the socio-political context that puts people in situations of vulnerability (Sapkota et al., 2016; Walker & Fox, 2018). (Population health, Global health)
- b. Elderly and children (Family medicine, Geriatrics, Pediatrics)
 - i. Identify that children and elderly are at increased risk of climate-related illness and injury. Both populations are more susceptible to the extremes in temperature (Balbus & Malina, 2009), and environmental pollutants, due to increased exposure, reduced elimination of particulate matter, and the increased presence of existing comorbidities (Sacks et al., 2011).
 - ii. Explain how children are at increased risk of respiratory disease due to exposure to air pollution, severe forms of infectious diseases, undernutrition due to food insecurity, and disrupted access to essential services, such as water and sanitation, healthcare and education, with nearly half of the world's children living at "extremely high-risk" of climate health impacts (United Nations Children's Fund (UNICEF), 2021).

- iii. Explain how elderly are at increased risk during extreme events, such as heat waves or floods, as they are often more socially isolated, less mobile, have less access to heat-resilient housing, and less able to respond to environmental stressors due to a decreased ability to regulate body temperature, medication use, and an increased prevalence of comorbid conditions (IPCC, 2014, Chapter 11.3).
- c. Climate migration (**Global health, Refugee health, Population health, Psychiatry, Infectious diseases, Health systems, Ethics**)
 - i. Illustrate how changes in environmental conditions, such as land loss due to extreme events, drives population displacement. By 2050, anywhere between 50 and 200 million people are predicted to move (permanently or temporarily), within or out of their countries (UNHCR, 2018).
 - ii. Manage health risks for displaced and refugee populations, including: infectious diseases (such as malaria, water-borne illnesses, and sexually transmitted infections), dehydration and heat stress, malnutrition, injuries, and mental health challenges (such as post-traumatic stress disorder) (IPCC, 2014, Chapter 11.8.4; McMichael et al, 2012).
 - iii. Explain how newcomer populations experience a unique set of barriers that expose them disproportionately to climate-related health risks, such as language barriers in risk communication during episodes of extreme weather. These barriers often intersect with lower socioeconomic status, housing insecurity, and racialization. (Varickanickal & Newbold, 2021)
- d. Populations experiencing poverty and housing insecurity (**Population health, Social determinants of health, Poverty, Inner city health, Global health**)
 - i. Describe how those living unhoused are amongst the most structurally marginalized in high-income countries and are some of the first to experience the effects of climate change. Increased air pollution, severity of floods and storms, frequency of heat waves and changing distributions of vector-borne infectious diseases (e.g. West Nile Virus) will impact housing insecure populations disproportionately.
 - ii. Advocate for the co-creation of health promotion strategies with those who are unhoused due to environmental changes, including a housing- first approach, with consideration of urban planning frameworks and public health adaptive responses (Ramin et al., 2011).
 - iii. Explain how national, community and individual poverty mediate the health risks of environmental change. Low-/middle-income countries, which have been overexploited due to colonialism and imperialism, are made to be most vulnerable to climate change. Within a country, populations and regions of lower socioeconomic status are at risk, due to both poorer baseline health status and reduced access to both preventive and adaptive resources fueled by reduced decision-making power (IPCC, 2014, Chapter 11.3).
 - iv. Illustrate that patients experiencing poverty are the most vulnerable to potential losses of private insurance coverage or increased private insurance premiums, which are critical for many Canadians to access health services including

medications, dental care, physical therapy, occupational therapy, and psychology services, related to climate change-associated risks to the health insurance sector (Sarra, 2021).

- e. Incarcerated populations (**Social determinants of health, Global health, Population health, Social determinants of health**)
 - i. Explain how current jails and prisons are inadequately prepared to adapt to extreme heat events. Increasing extreme heat events subject incarcerated people to heat stress, which has physical and mental health impacts (Holt, 2015).
- f. Populations marginalized by racism (**Social determinants of health, Indigenous health, Population health, Social determinants of health, Global health**)
 - i. Articulate that environmental racism is a form of structural racism that disproportionately subjects Black, Indigenous and People of Colour communities to air, water, and soil pollution and toxins, and systematically undermines the capacity of these communities to politically and legally oppose these pollutants, throughout history and continuing today (Waldron, 2018).
 - ii. Explain how patients of colour are more likely to be exposed to urban heat islands, with built infrastructure and lack of tree cover and green spaces that promotes heat production, absorption and retention, increasing their risk of heat-related illness (Hsu et al., 2021).
 - iii. Describe how Indigenous communities disproportionately experience the burden of industrial developments on their lands (Huseman & Short, 2012; Booth & Skelton, 2010) and thereby are disproportionately exposed to water contamination, waste disposal, toxins and pollutants from these heavily polluting industries (Waldron, 2018; Philibert, Fillion, & Mergler, 2020). In many cases, Indigenous communities have been relegated to live on neglected to undesirable land with restricted access to environmental resources and necessary infrastructure. This, along with other colonial policies of cultural genocide, has resulted in limited access to economic, social, and cultural activities that are critical for the good health of Indigenous communities (Richmond et al, 2005; Huseman & Short, 2012).

B. Managing and Preventing Health Impacts

3. Food and water insecurity

CanMEDS Medical Expert, Scholar, Health Advocate

- a. Explain how climate change and ecosystem degradation lead to multiple impacts on food security, nutrition and health, including: (**Nutrition, Refugee health, Social determinants of health, Indigenous health, Poverty, Global health**)
 - i. Explain how reductions in global food availability and quality are in part due to unfavourable weather conditions for agriculture, soil degradation from conventional agricultural practices, food supply chain disruptions, and price instability (IPCC, 2014, Chapter 7; Wheeler & von Braun, 2013). This results in

an increased risk of mortality associated with both reduced fruit and vegetable consumption and an increased prevalence of malnutrition, which will disproportionately impact communities experiencing pre-existing malnutrition (Springmann et al, 2016; IPCC, 2014, Chapter 11.6).

- ii. Articulate how changes in the land and ability to access traditional food will further exacerbate pre-existing food insecurity in remote regions of Canada such as the circumpolar Arctic (Beaumier & Ford, 2010).
- b. Explain how large scale agriculture of mono-crops and the overuse of fertilizers and pesticides are contributing to soil degradation and water pollution (Sanaullah et al., 2020), and that practices like regenerative farming and ecosystem restoration can promote diverse diets, create community food sovereignty, and improve climate resilience (Anderson & Rivera-Ferre, 2021). **(Nutrition)**
- c. Articulate that stresses on global water supply will be exacerbated by extreme weather events associated with climate change (e.g. drought and floods). The increasing frequency of droughts and floods will reduce freshwater resource quality and quantity, posing risks to safe drinking water and adequate hydration (IPCC, 2014, Chapter 3; Levy et al, 2016; Cann et al, 2013). **(Refugee health, Waterborne illnesses, Nutrition)**
- d. Illustrate how marginalized communities are most impacted by food and water insecurity. These are often the same communities that face the brunt of various forms of oppression, including racism and classism (Holt-Giménez, 2015). **(Indigenous health, Social determinants of health, Nutrition, Population health)**
 - i. Describe that many Indigenous communities experience long-term Drinking Water Advisories (DWAs) and that the number of DWAs in Canada has increased over the past decade (Thompson, Post & McBean, 2017). Know that Indigenous households face a high prevalence of food insecurity (Skinner, Hanning & Tsuji, 2012), a challenge that is greatly exacerbated by environmental factors including weather (for air/road transport of food) and changing hunting conditions (Beaumier & Ford, 2010).

4. Changing infectious disease burdens

CanMEDS Medical Expert, Scholar, Health Advocate

- a. Explain how climate change contributes significantly to the emergence and spread of infectious disease threats due to the expansion of geographic areas that are suitable for a wide range of vector-borne diseases. (Watts et al, 2017 [section 1.6]; IPCC, 2014, Chapter 11.5; Patz et al, 2005; Daszak et al, 2013) **(Infectious diseases, Outbreak management, Global burden of disease, Global health)**
- b. Illustrate how rising global temperatures and increasing frequencies of heavy rain, flooding and drought associated with climate change are impacting the prevalence and incidence of food- and water-borne infections including *Vibrio cholera*, *Campylobacter spp.*, *pathogenic Escherichia coli*, and *Salmonella spp.*, norovirus and *B. cereus* (Escobar et al., 2015; Smith & Fazil, 2019) **(Infectious diseases, Global health)**

- c. Articulate how habitat destruction and increased human activity in dwindling natural areas result in increased animal-human interactions that thereby increase the risk of known zoonotic infections such as SARS and Ebola as well as drive the emergence of novel diseases such as COVID-19 (Gibb et al., 2020). (Infectious diseases, Outbreak management, Global burden of disease, Global health)
- d. Explain the connection between expanded tick habitation due to increasing average temperatures and the spread of Lyme disease and other tick-borne illnesses including Anaplasmosis, Babesiosis, and Powassan virus in Canada (Ogden et al, 2006; Uminski et al, 2018) (Infectious diseases, Family medicine, Preventative medicine, Emergency medicine, Dermatology)
- e. Illustrate how climate change-related factors on average global temperatures are expanding the range of West Nile virus, Dengue, Zika and Chikungunya and other mosquito-borne illnesses (Paz, 2015; Doughty, 2017). (Infectious diseases, Dermatology, Outbreak management, Global burden of disease, Global health)
- f. Describe how changes in infectious disease burdens due to increased temperatures and the expanded range of insect, food and water-borne infective agents will disproportionately affect Indigenous communities and rural and remote communities. Understand how this relates to the continued gaps in water treatment infrastructure in Indigenous communities and traditional food storage and preparation practices (Ford, 2010, Wright et al., 2018). (Indigenous health, Social determinants of health, Rural healthcare)

5. Air pollution and health

CanMEDS Medical Expert, Scholar

- a. Describe how air pollution (both household/indoor and ambient/outdoor) causes more deaths than any other environmental pollutant, and that it is most strongly linked to cardiorespiratory diseases, such as: atherosclerosis, hypertension, coronary artery disease, congestive heart failure, arrhythmias, myocardial infarctions, asthma, COPD, and lung cancer (Al-Kindi et al., 2020; Forouzanfar et al, 2016; Government of Canada, 2017). (Respiratory health, Cardiovascular health)
- b. Illustrate how air pollution also has mental health impacts, and has been associated with increased mental health service use among people recently diagnosed with psychotic and mood disorders (Newbury et al., 2021). (Psychiatry)
- c. Explain how climate change increases the amount, distribution and temporal patterns of pollen and other allergens, which have been associated with increased incidence of asthma diagnoses and exacerbations (D'Amato et al., 2020). (Respiratory health)
- d. Describe how stratospheric ozone depletion from air pollution is associated with increasing ultraviolet radiation on the Earth's surface and an increasing incidence of melanoma and non-melanoma skin cancers worldwide (Parker, 2021). (Dermatology)
- e. Articulate how air pollution disproportionately affects low-income communities and those who are unhoused (Hajat, Hsia, & O'Neill, 2015). Low-income communities are more likely to reside in high-traffic corridors and are thus more exposed to air pollution from

vehicle exhaust (Houston, Wu, Ong, & Winer, 2004). The vast majority of deaths due to air pollution occur in low- and middle-income countries, which includes increased exposure to outdoor air pollution from industrial sites and indoor air pollution from traditional stoves (Landrigan et al, 2018). A climate justice lens recognizes that low-income communities face procedural injustice, subjecting them to the brunt of the consequences of air pollution. (Respiratory health, poverty, social determinants of health, women's health, pediatrics)

- f. Identify patients more susceptible to the health impacts of air pollution and screen for patient exposure to air pollution. This can include asking about living and working situations in terms of proximity to green spaces, high-traffic roads, and industrial environments and the use of solid fuels at home for cooking, lighting and other purposes (Hadley, Baumgartner, & Vedanthan, 2018). (Respiratory health, Cardiovascular health, Preventative health, Family medicine)
- g. Counsel at-risk patients, including those with asthma, chronic obstructive pulmonary disease or heart failure, to reduce their exposure to outdoor air pollution. This can include advising these patients to review the Air Quality Health Index (AQHI) to plan their outdoor activities, and to avoid exercising near high-traffic areas (Abelsohn, & Stieb, 2011). (Respiratory health, Cardiovascular health, Preventative health, Family medicine)

6. Mental health

CanMEDS Scholar, Health Advocate, Medical Expert

- a. Explain how climate change-related extreme weather events, which result in the destruction of homes and communities, as well as the degradation of landscapes and ecosystems directly contribute to mental health consequences such as post-traumatic stress disorder, major depressive disorder, anxiety including eco-anxiety, ecological grief, solastalgia, substance use, and suicidal ideation (Berry, Bowen, & Kjellstrom, 2010; Cunsolo Willox et al., 2013; Hayes, Blashki, Wiseman, Burke, & Reifels, 2018). (Psychiatry, Public health, Population health, Global health)
- b. Illustrate the links between extreme heat events and insomnia, higher suicide rates and increased number of mental health-related emergency department visits (Burke et al., 2018; Obradovich et al., 2019; Wang et al., 2014). (Psychiatry, Emergency medicine, Family medicine, Public health)
- c. Articulate how climate change compounds the known impacts of social determinants on mental health issues. This includes people who are unhoused, those with pre-existing mental illness, those of lower socioeconomic status, and other marginalized populations in Canada (Berry et al., 2010; Doherty & Clayton, 2011; Hayes et al., 2018). (Psychiatry, Occupational health, Social determinants of health, Indigenous health)
- d. Highlight how the health and wellness of Indigenous communities are deeply tied to the land and thus resource extraction, land exploitation, natural disasters, and habitat degradation result in profound mental health challenges and stresses in Indigenous communities (Middleton et al., 2020; Dodd et al., 2018). (Psychiatry, Social determinants of health, Indigenous health, Global Health, Population health)



- e. Make use of an empathetic and action-oriented approach to discussions with patients experiencing eco-anxiety, ecological grief, and solastalgia (Albrecht et al., 2007; Doherty & Clayton, 2011; Clayton, 2020; Cunsolo Willox et al., 2020). (Psychiatry, Family medicine, Pediatrics, Communication)

7. Reproductive health and gender equity

CanMEDS Health Advocate, Collaborator

- a. Promote voluntary contraceptive care and the education of girls and women within a rights-based, culturally appropriate framework as it can offer a cost-effective and health-promoting strategy to reduce unintended pregnancies and therefore reduce greenhouse gas emissions (Guillebaud, 2016). (Women's health, Family medicine, Gynecology, Social determinants of health, Global health, Population health)
- b. Describe how women are disproportionately impacted by land degradation, natural disasters, and environmental changes (e.g. droughts and extreme heat). Additionally, patriarchal systems result in more women being subject to poverty, amplifying their vulnerability to climate change (Israel & Sachs, 2012). (Social determinants of health, Global health, Population health)
- c. Illustrate how extreme heat events are associated with increased rates of domestic violence against women (Burke, Hsiang, & Miguel, 2015) and birth complications including low birthweight, premature births, and stillbirths (Chersich et al., 2020). (Emergency medicine, Obstetrics, Pediatrics, Social determinants of health)

C. Leading and Collaborating on Mitigation and Adaptation

8. Ecological health promotion

CanMEDS Health Advocate, Professional, Collaborator, Leader, Communicator, Scholar

- a. Describe how human health is dependent on the well-being of natural systems and the world's ecosystems. (Public health, Global health, Population health)
- b. Counsel patients on climate change and health links and how to adapt to and mitigate their climate change-related health risks (Senay, Safarty, & Rice, 2021), in recognition that patients and families value counselling on climate change (Lewandowski et al., 2021). (Family medicine, Pediatrics, Internal Medicine)
 - i. Take an exposure history in order to make the connection between your patient's symptoms and pathology and environmental risks in their home and community (Marshall et al., 2002).
- c. Delineate how the health professional role for patient and community health extends to climate and environmental advocacy by leading by example and by motivating their surrounding communities (Rudolph & Harrison, 2016; Crowley, 2016; CMA, 2010) (Public health, Health advocacy)

- i. Encourage and model pro-environmental behaviours to one's patients and local community to live in a more sustainable and healthy manner, such as using active transport.
- d. Communicate the urgency of climate change, and the critical need to advocate for evidence-based policies to limit global warming to 1.5°C above pre-industrial levels and protect and restore nature. (Public health, Health advocacy, Global health, Population health)
 - i. Frame climate change as a health issue, given that it is shown to be an effective way to garner public support for climate change policy and action (Dasandi et al., 2021). Importantly, it is essential to demonstrate the health co-benefits of climate change adaptation and mitigation in interdisciplinary fields including transport, food production, energy and urban planning. (Ambasta & Buonocore, 2018; Edger et al., 2020; Watts et al., 2017, 2015; Whitmee et al., 2015). (Public health, Global health, Population health, Social determinants of health)
 - 1. Collaborate with other fields of practice and sectors outside of healthcare in order to advance sustainable development and protect natural spaces.
 - 2. Illustrate how sustainable developments across societal sectors are necessary to promote planetary health and provide substantial population health co-benefits. Examples include:
 - a. Phasing out coal, gas and fossil fuel exploration and extraction;
 - b. Carbon pricing;
 - c. Promoting access to sustainable, affordable, and healthy plant-rich, low commercial meat diets while continuing to respect Indigenous traditional diets;
 - d. Active and public transport;
 - e. Embedding circular economies in the supply chain;
 - f. Decarbonization of energy, transportation, buildings, and healthcare;
 - g. Urban sprawl mitigation;
 - h. Retrofitting of buildings to be more energy-efficient.
 - 3. Articulate the critical importance of nature-based solutions, including the protection of natural spaces and biodiversity and the expansion of green spaces in urban areas. These approaches promote climate change adaptation and mitigation through reducing urban heat islands, flood prevention, and storing carbon (Seddon et al, 2020). These are particularly important in low-income neighbourhoods to reduce the burden of illness and health inequities (WHO, 2017; Crause et al., 2017).
 - 4. Explain how transitioning to a low-carbon economy could result in socio-economic dislocation for certain regions and sectors with concurrent impacts on livelihoods and health, which could be prevented by support and retraining for these impacted workers (Spencer et al., 2018; Pollin and Callaci, 2016).
- e. Engage with research, leadership and advocacy led by marginalized communities, especially Indigenous Peoples, when addressing and advocating for climate and



environmental action (ICA, 2021). Appreciate the importance of centering climate action on Indigenous traditional knowledge and ways of being, as Indigenous stewardship has been shown to protect forests, store carbon, and avoid land-use emissions from deforestation and degradation (Alejo et al., 2021). (Indigenous health, Health advocacy, Health systems and policy, Global health, Population health)

9. Disaster preparedness

CanMEDS Manager, Medical Expert, Health Advocate

- a. Distinguish the health care professional's role in disaster management, the burden of disasters on the health system, and the impacts of extreme events on physical and mental health from other professions. Health systems play a part in early-disaster warning systems and in responding to climate-related disasters, such as wildfires or flooding. Extreme weather events fueled by climate change are occurring at a greater frequency in Canada causing more devastating and more costly disasters. (Watts et al, 2017, Maclean et al. 2016, Goldmann and Galea 2014, Gillett et al. 2004) (Refugee health, Wilderness medicine, Psychiatry, Emergency medicine, Psychiatry)
- b. Explain the importance of embedding climate resilience into health systems, due to the risks of health care provision interruptions due to damaged infrastructure and interrupted supply chains during episodes of extreme weather (The Canadian Coalition for Green Healthcare, 2017). Approaches to promoting health system climate resiliency include securing back-up suppliers for critical health supplies, climate-proofing buildings to protect critical assets, and diversifying energy sources. (Health systems, Disaster preparedness, Emergency medicine)
- c. Articulate how extreme heat events increase the incidence of asthma exacerbations (Shoraka et al., 2019), ischemic heart disease (Lin et al., 2009), acute kidney injury (McTavish et al., 2018), nephrolithiasis (Tasian et al., 2014), mental health issues (Thompson, Hornigold, Page & Waite, 2018), flares of inflammatory dermatoses such as atopic dermatitis and pemphigus (Kim, Kim, Han, Jeon, Cheong, & Ahn, 2017; Ren, Hsu, Brieva, & Silverberg, 2019), and have been associated with increased emergency department presentations and length of stay in both adult and pediatric care settings (Kegel, Luo, & Richer, 2021; Hofer & Saurenmann, 2017). (Emergency medicine, Respiriology, Cardiology, Nephrology, Urology, Dermatology, Geriatrics)
- d. Diagnose and manage extreme temperature risks (e.g. hyperthermia, hypothermia, heat stroke and exhaustion) and understand the importance of heat-related risk warning systems (Canadian Environmental Health Atlas, 2017) (Geriatrics, Pediatrics, Family medicine, Emergency medicine)
- e. Illustrate how the lack of adequate 911 and emergency response services leaves many Indigenous communities in Canada poorly equipped to handle climate-related weather disasters —like wildfires and floods— and prolonging community recovery times (Collier 2015, Mew et al., 2017). (Indigenous health)
- f. Explain how outdoor workers, including those working in construction, agriculture, service and manufacturing, are disproportionately impacted by extreme heat events and



require targeted counselling on cooling methods during heat waves including reducing outdoor exposure, and frequent hydration (Xiang, Bi, Pisaniello, & Hansen, 2014).

(Occupational health)

- g. Describe why people living with disability are among those most vulnerable to impacts from natural disasters and other climate change consequences (Bell et al., 2020; Vasquez, 2021). (Health of people with disabilities)

10. Context-specific practice

CanMEDS Medical Expert, Manager, Collaborator, Health Advocate

- a. Integrate multidisciplinary information to manage complex climate-related conditions specific to a variety of contexts. (Community health, Family medicine, Emergency medicine, Geriatrics, Indigenous health, Preparation for rural/northern medicine electives, Social determinants of health)
 - i. In urban areas, promote awareness of respiratory health risks related to air pollutants, or advise patients on how to prevent heat stress or illness exacerbations during heat waves (Government of Canada, 2021; Maxwell and Blashki, 2016). This includes identifying patients who may be living in and near urban heat islands, with built infrastructure that promotes heat production, absorption and retention (Kalnay & Cai, 2003).
 - ii. In isolated and remote contexts, address mental health challenges related to disruption in land-based activities and traditional ways of living. In the Canadian North, climate change has already shown a negative influence on Inuit peoples' mental health (PHAC, 2014). Additionally, physicians working with remote Indigenous communities should be aware that these populations are also more at risk of food insecurity. Changes in sea-levels and permafrost/ice stability/animal migration patterns threaten traditional ways of living and access to culturally appropriate food forcing individuals to access less nutrient dense food sources (Furgal & Seguin 2006, Romero Manrique et al., 2018).
 - iii. In rural communities, recognize that rural Canadian populations tend to be older, have a higher burden of chronic diseases, and report less availability of health resources and increased travel time to access them, which increases their risk of heat-related illnesses and exacerbations of underlying chronic conditions during heatwaves (Canadian Institute for Health Information, 2012; Liang & Kosatsky, 2020). Thus, rural practitioners need to know how to identify patients who are vulnerable to the health impacts of heat and how to counsel these patients on preventative efforts such as cooling centers, frequent rehydration, and taking breaks during outdoor work or physical activity (Jay et al., 2021).

11. Planetary health care

CanMEDS Professional, Leader, Collaborator, Medical Expert, Health Advocate, Scholar

- a. Explain that Canadian healthcare service delivery is responsible for 4.6% of the Canadian national total greenhouse gas emissions and is the third highest per-capita emitter of greenhouse gases among health systems worldwide (Eckelman, Sherman, & MacNeill, 2018; Watts et al., 2019). (Health systems, Quality improvement)
- b. Apply the social responsibility within health care to be stewards of the environment and the moral imperative of health care to be climate resilient and low-carbon (World Health Organization, 2021). (Health systems, Health advocacy)
- c. Infer that Indigenous traditional medicines represent one of the least resource-intensive avenues of healthcare delivery and that centering Indigenous voices and traditional knowledge is essential to achieve health system sustainability (Redvers et al., 2020). (Health systems, Indigenous health, Health advocacy)
- d. Facilitate and advocate for transitions to achieve a decarbonized healthcare system and practice low-carbon healthcare. These range from interventions at the individual and healthcare institution level, to healthcare systems-level transformations. Examples include: (Health systems, Quality improvement, Family Medicine, Anesthesiology, Respiriology, Pediatrics)
 - i. *Strengthening community and preventative care.* Illustrate how a strengthened primary healthcare system would reduce the need for carbon-intensive hospital-based care (Sherman et al., 2021).
 - ii. *Dietary choices* – Advocate for plant-based and plant-forward eating habits which are associated with decreased carbon footprints and improved overall health in keeping with the Canadian Food Guide’s Eat Well Plate and the EAT-Lancet Commission ‘Planetary Health Diet (Willett et al., 2019), while respecting Indigenous traditional diets. Further, advocate for hospital food systems to purchase locally-produced, plant-based, whole food as well as traditional Indigenous food and other cultural food options to serve staff and patients, while minimizing the expansive food waste currently occurring in hospitals (Sonnino & McWilliam, 2011).
 - iii. *Resource stewardship* - Incorporate evidence-informed resource stewardship guidance such as *Choosing Wisely* into day-to-day medical practices to reduce the burden of unnecessary, low-value tests and treatments, given that an estimated 6-30% of medical acts deemed potentially unnecessary worldwide (Brownlee et al., 2017).
 - iv. *Continuous quality improvement* - Leverage quality improvement to embed sustainability into healthcare systems, and expand the conception of quality improvement to evaluate patient and population outcomes against the triple bottom line of environmental, social, and financial costs (Mortimer, Isherwood, Wilkinson, & Vaux, 2018)
 - v. *Transportation* - Counsel patients on the environmental benefits of electric vehicles, public, group, and/or active transportation between healthcare facilities as well as between the community and healthcare facilities. Advocate to electrify healthcare institution vehicle fleets and expand the availability of charging points for electrical vehicles on healthcare premises. Advocate for more and continued

- virtual options for medical conferences, residency and fellowship interviews to reduce unnecessary travel (Liang et al., 2021).
- vi. *Virtual care* - Explain how telemedicine has the potential to save patient time and reduce transport-associated greenhouse gas emissions (Purohit, Smith, & Hibble, 2021). Learn about the appropriate use of telemedicine and telehealth etiquette during virtual visits (Gustin, Kott, Rutledge, 2020). Telemedicine may also improve access to care for rural communities and some people with disabilities.
 - vii. *Energy* - Advocate for healthcare institutions to transition from fossil fuel energy to renewable sources of energy (solar, wind, hydro, geothermal, biomass, etc.) for the provision of temperature regulation and electricity. In addition, advocate for healthcare institutions to increase their energy efficiency through energy-saving LED bulbs, thermal insulation, and turning off heating, ventilation and air conditioning systems during off-hours.
 - viii. *Waste reduction and management* - Advocate for proper waste disposal between biohazardous, recycling and nonrecyclable waste streams, environmentally friendly reusable materials/equipment, and resource stewardship to reduce hospital waste. Describe the consequences of improper waste management including air pollution from incineration of biohazardous waste, landfill use and subsequent natural resource contamination. Advocate for the reduction of single-use plastics, an increased representation of reusable cutlery and plates as well as composting in healthcare facility cafeterias, and installing easily-accessible water fountains to patients and staff to reduce the purchasing of bottled water.
 - ix. *Product acquisition and consumption* - Illustrate how hospitals and clinics purchase a large number of products integral to healthcare delivery and often rely on linear supply chains composed of single-use disposable healthcare items. Advocate to embed circular economies into healthcare product purchasing, utilization, and reutilization and repurposing policies (MacNeill et al., 2020).
 - x. *Patient-planetary health co-benefit prescribing* - Restrict use of desflurane and nitrous oxide anesthetic gases only to cases where they significantly benefit patients relative to more sustainable options such as isoflurane and sevoflurane (Sherman, Le, Lamers & Eckelman, 2012), and favour prescribing dry-powdered inhalers (DPIs) over metered-dose inhalers for obstructive lung disease management as MDIs produce a 20–30 times larger carbon footprint than their dry-powdered counterparts (Janson et al., 2020). Refer patients to community supports that deepen social connections and improve health, as well as mental and physical resilience to climate change. Prescribe nature immersion and land-based healing to improve patient health (Twohig-Bennett & Jones, 2018), and promote pro-environmental behaviours (Mackay & Schmitt, 2019). Counsel menstruating patients to choose reusable menstrual products to simultaneously reduce waste, address period poverty, and promote health (Luo, Huang, & Shen, 2021).



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