


# Planetary Health-informed health systems change: A Circumpolar-based multi-methods approach

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**Abstract**

Health systems are underprepared for the effects of an increasingly stressed planet. In this dissertation, I used a multi-methods, pragmatist approach to identify influences on planetary health-informed health systems change in a Circumpolar and diverse healthcare setting, and to explore transferable knowledge for other contexts. Through a mixed-methods systemic review, I identified factors that influence adaptation of patient-planetary health (P-PH) co-benefit prescribing using content analysis. Barriers included a lack of knowledge and time; facilitators included policy statements and guidelines from respected associations. Informed by this review, I then conducted interviews exploring physician perspectives around P-PH co-benefit prescribing in a Circumpolar region. Using reflexive thematic analysis, I found the current healthcare system does not support planetary health, with many physicians discussing difficulties. I then held a sharing circle with Indigenous Elders from the same area, and inductively coded the data to generate key themes and a systems map. Findings included four interconnected themes: the past and how we got here; where we are now; where we need to go in the future; and reflections. Overall, health systems were viewed as devoid of any

environmental context or consideration. I then carried out reflexive thematic analysis regarding nature prescriptions in the context of Indigenous Peoples. Findings included the need for things to be done "in the right way", and the sentiment that the Land is not just an experience but a way of life. Lastly, I carried out a scoping review to identify current planetary health frameworks for health systems. Using content analysis to identify the different domains, I described six overarching categories including, as examples: key structural components for environmentally sustainable health systems; climate resilient and sustainable technologies and infrastructure; and evaluation and accountability mechanisms. By triangulating data across these studies, I identified common elements, including an implicit focus and understanding that some level of the status quo (i.e., Nature disconnection) is still being perpetuated within research and discourse around planetary health-related health systems change.

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## Statement of contribution

The studies, analyses, and interpretation of the results are all the original work of the author, completed under the supervision of Professors Sarah Tonkin-Crine and Jamie Hartmann-Boyce, both at the Nuffield Department of Primary Care Health Sciences, University of Oxford (Dr Hartmann-Boyce is now primarily based at the University of Massachusetts, Amherst). As the author, I led all aspects of the thesis, including design, conduct, and analyses of the studies presented in the subsequent chapters, as well as writing the included chapters and resulting journal articles. All tables and figures contained within this thesis are my own creation. I hereby declare that no part of this thesis has been submitted for any other degree at this or any other university.

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# Chapter 1: Introduction

## 1.1 Summary

Within this dissertation, I aimed to identify the influences on planetary health-informed health systems change in a Circumpolar and racially diverse healthcare clinical setting while attempting to also identify transferable elements and knowledge for other contexts. Most of the work was carried out in a region of the world that is in the midst of ongoing climate change. This chapter presents the context and rationale behind my dissertation objective, and outlines how existing work has informed the shape of this dissertation. First, it discusses planetary health, defining the scope and nature of the problem while providing an overview of the existing landscape, key terminologies, Indigenous perspectives, and how these elements relate to health systems. It then goes on to outline the context relevant to the Circumpolar North, including climate change and Indigenous Peoples in the region. Framed against this background I then provide a positionality statement as well as a brief overview of the theoretical positioning of the dissertation. The chapter concludes by restating the aims and objectives as they relate to the context outlined, and by providing a brief introduction to the subsequent chapters.

**Note:** Some of my dissertation chapters (as noted in the *Discussion* section of this dissertation) have been published in peer review journals. To avoid duplication in my introduction sections of my dissertation chapters, given the consistent framing of the context of my research (e.g., geographic setting), and the realities of the climate emergency (e.g., general data on climate change and health systems), I have amalgamated these sections into my introduction chapter here. Given this, some content I wrote for this chapter has been published by the journals *Frontiers in Public Health*,[1] *BMJ Open*,[2] *Lancet Planetary Health*,[3]

and the *International Journal of Environmental Research and Public Health*[4] as per the respective chapters that have been published (see *Discussion* section).

## 1.2 Planetary health

### 1.2.1 Background and key terminologies

Planetary health is a field focused on characterising the linkages between human-caused disruptions of Earth's natural systems (e.g., climate change, deforestation, pollution) and the resulting impacts on public health.[5] The field of planetary health is solutions-oriented, transdisciplinary, and promotes social movements focused on analysing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth.[6] The field of planetary health also aims to develop and evaluate evidence-based solutions to safeguard an equitable, sustainable, and healthy world.[7] Many global environmental changes (GEC) including climate change, biodiversity loss, deforestation, marine degradation, and increasing pollution affect planetary health and are therefore encompassed within the focus areas of the field of planetary health. The GECs encompassed within planetary health "affect the quality of the air we breathe and of the water we drink, the quality and quantity of food we produce, our exposure to infectious diseases, and even the habitability of the places where we live."[6] Given this, our health is intimately tied to the health of the planet, which is a key underpinning of my dissertation work.

### 1.2.2 Research, policy, and practice

From a Western-based research, policy, and practice perspective, planetary health is a relatively new field. In 2015, "The Rockefeller Foundation–Lancet Commission on planetary health" published its timely report acknowledging the growing body of evidence connecting the health of humanity to the health of the environment.[7] The commission concluded that the

continuing degradation of natural systems threatens to reverse the health gains seen over the last century, and that health professionals have an essential role in the achievement of planetary health. The Commission identified a need to work

> …across sectors to integrate policies that advance health and environmental sustainability, tackling health inequities, reducing the environmental impacts of health systems, and increasing the resilience of health systems and populations to environmental change.[7]

Since the Commission's work there has been a notable increase in planetary health–related research.[8] Additionally, in the policy space, international governance organizations, Nation States, and non-governmental organizations have been increasingly adopting planetary health-related language and initiatives. For example, in 2024 a report on planetary health and human wellbeing was produced by the United Nations Environment Programme (UNEP) in collaboration with the International Science Council, with the outcomes of the report integrated into UNEP's strategic planning.[9] In April 2022, a National Science Challenge (NSC) meeting chaired by the Prime Minister of Malaysia mandated the development of a National Planetary Health Action Plan (NPHAP), described as:[10]

> an integrated initiative to mainstream planetary health in all national policies and plans through a holistic and whole-of-nation approach towards addressing the ecosystem, biodiversity health and climate change for sustainable development.[10]

Within the implementation and practice space, there has been a notable increase in organizations platforming planetary health-related work. This includes one organization that developed an intervention aimed at expanding healthcare access and use for communities living near a national park with clinic discounts offsetting costs historically met through illegal logging.[11] The result of the community-derived planetary-heath project "simultaneously improved health care access for local and Indigenous communities and sustainably conserved carbon stocks in a protected tropical forest."[11] Despite these advances,

there are still incredible gaps within applied health system operations alignment to planetary health research, policy, and practice.

### 1.2.3 Indigenous planetary health

From an Indigenous perspective, planetary health as an academic field is primarily a Western construct as Indigenous Traditional Knowledge systems have no clear separation between the health of the planet and the health of self, or that of the community and the ecosystem at large.[1,12] This means that the meaning and applications of planetary health are directly rooted in community values based on protocols for living in harmony with all that have existed for thousands of years.[1,13] With this,

> …despite modern movements towards a framing that understands the interconnectedness of all systems and elements on Earth, planetary health is not a new concept. The knowledge and applied practices of planetary health have been around in Indigenous Nations for millennia—it was just not termed 'planetary health.'[14]

These existing Indigenous knowledges, however, have had little overarching applied exposure within national and international climate change and planetary health spaces despite an increasing interest in how to include Indigenous knowledges within research, policy, and practice. With this, there is increasing interest in Indigenous knowledges, however, action is still sparse from a global perspective.

For the purposes of this dissertation, Indigenous knowledges (interchangeably used with Indigenous traditional knowledges, traditional knowledges, Indigenous knowledge systems) is a term that represents: the understanding and information unique to Indigenous Peoples; information collected by generations of Indigenous Peoples; and holistic, cumulative and dynamic knowledge systems built on the historic experiences of a people. Indigenous knowledges are: adaptive to social, economic, environmental, spiritual and political change; inclusive of the physical and metaphysical world linked to moral code; and the practical

application of skills and knowledge. They embody trust for inherited wisdom and a respect for all things, include practical experimentation, are usually a qualitative oral record, can be a communication of metaphor and story connected to life, values and culturally appropriate behaviour, and are integrated and applied to daily living.[15] Indigenous knowledges is specifically noted in plural form to recognize the diversity of Indigenous Peoples and their knowledges around the globe. Additionally, for the purpose of this dissertation,

> Indigenous communities, peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal system.[16]

## 1.3 Planetary health and health systems

### *1.3.1 Health system considerations*

The UN Secretary-General António Guterres has called climate change "a code red for humanity,"[17] modeling the 'code red' terminology used within health systems for emergencies. Acknowledging the clear impacts between various interconnected global environmental changes (i.e., global warming, pollution, biodiversity loss) in the health of humans and other species, the current Director General of the World Health Organization, Tedros Adhanom Ghebreyesus, stated that, "Health sector facilities are the operational heart of service delivery, protecting health, treating patients, and saving lives. Yet health sector facilities are also a source of carbon emissions, contributing to climate change. Places of healing should be leading the way, not contributing to the burden of disease."[18] If the global healthcare sector were its own country, it would be the 5th largest greenhouse gas emitter on the planet, equivalent to the annual greenhouse gas emissions from 514 coal-fired power

plants.[18] With this, the path towards net zero greenhouse gas emissions within healthcare needs to align with current planetary health and sustainability targets globally. More specifically, there is a need to centre climate mitigation and adaptation planning, preparedness, and action within health systems globally while considering other health system impacts on such things as biodiversity loss, as well as addressing the ongoing contributions towards the global burden of pollution. If no action is taken, the impacts of climate change on health systems will be in the tune of billions of dollars.[19,20]

It wasn't until the 26th United Nations Climate Change Conference (COP26) in 2021 that a health programme was promoted. COP28 held in 2023, was the very first time that there was a dedicated health day to highlight the impact of climate change on health. Progress is being made, however, with a recent World Health Organization (WHO) review of all 193 national climate plans (Nationally Determined Contributions [NDCs]) showing that most (91%) now include health considerations at some level.[21] Many NDCs also now formally recognize the health co-benefits that come with climate mitigation actions in various sectors, including from reduced air pollution, healthier diets, and active transport.[21] The effects of climate change on health and health systems, however, will not be felt equally, with underserved and marginalized communities disproportionately impacted and least able to "prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts."[22]

### *1.3.2 Health professional considerations*

Health professionals are increasingly called to become partners in planetary health,[23-26] yet have varied exposure and awareness to these calls around the globe.[27-29] Despite these health professionals' calls to action on planetary health, there has been little to no consistency in the development of clear clinical recommendations or guidelines. With this, health professionals

and health systems are currently underprepared for the effects of an increasingly stressed planet, due to this scarcity of clear and ubiquitous clinical recommendations, educational training efforts, political will, and policy guidelines across nation states. With expected and continued amplification of climate-related health ailments, physicians and health systems will shoulder the burden of patient care on already stressed health-care systems without further planning and action.[30,31] Additionally, health professionals and health systems have a moral responsibility to deeply consider their "professional role to promote public health and address threats to psychological and physical welfare" with the climate and biodiversity-loss crisis lying "within the moral remit of medicine".[32]

### *1.3.3 Patient-planetary health co-benefit prescribing*

The term "co-benefits" has increasingly been used in climate change and planetary health discourse. Instead of considering climate change specifically in isolation for example, a co-benefit approach considers how climate change mitigation initiatives can also advance other policy goals[33] while also leading to improvements in health[34] (e.g., movement away from gas powered vehicles to active transport [bicycles] reduces air pollution, and therefore asthma exacerbations in urban areas). Operationalized clinically, a co-benefit approach would seek to consider both the individual's and the planet's health in the context of the medical advice given.[5] What is not explicit in the co-benefit framing however is the often nuanced uneven prioritization of people over planet in policy and implementation. In considering a new framework for defining co-benefits, while taking into consideration the multiple evolving terminologies and practice areas that seek to improve the health of people and planet (see *Figure 1*), a synergistic and interconnected perspective is needed that highlights healthy patients and a healthy planet without hierarchy, and while avoiding terminology dissonance.

Lessons can be gleaned in this regard from Indigenous Knowledge systems as presented below.




**Figure 1.** Examples of the multiple and often independently evolving prescribing terminologies and practice areas that seek to improve the health of people and planet (adapted from *Redvers, 2021*).[1]

Indigenous languages worldwide are based and rooted within relationships to the Land.[35] The process of putting words and terminologies together is not without careful thought to their relationships with each other, and the symbolisms, interpretations, and actions that could come from their use. This is exemplified by the tight connection between language and Indigenous Knowledges as it relates to biodiversity.[36] In considering this, how we use language can be a powerful tool for both awareness and implementation processes within and outside of healthcare.[37]

In the current effort to orient clinical care with climate change in mind, health systems are automatically framing the work through the lens of an issue or a 'problem' to be solved outside of the system (i.e., climate change). This is in direct opposition to the Indigenous worldview in which everything is entirely interconnected,[38] and demonstrated additionally by the Indigenous conceptualization of planetary health (see section *1.2.3* above). With environmentally sustainable clinical practices developing in response to a "state" (i.e., the climate crisis), as opposed to the focused recognition of the need for "ongoing" interconnected relationship building between patient and planet (i.e., ongoing stewardship vs. a situation-based action), we mechanize our process of clinical delivery against a deficit state (i.e., climate change). Therefore, from an Indigenous knowledges perspective, patient-planetary health considerations and therefore discourse should be framed in perpetuity from a strengths-based perspective regardless of the state of the world's environment and climate. Given this, my dissertation work has been framed explicitly through a 'planetary health' lens (i.e., the health and wellbeing of the planet) as opposed to 'climate change' (i.e., the problem).

My joining of "patient-planetary health" therefore is purposeful in that the grammatical hyphen itself is connecting the two words, subtly elucidating their direct interconnection. The joining of the terms also seeks to remove any hierarchical inclination of one focus over the other, instead ensuring the view is always on both elements equitably in considering a co-benefit perspective. I therefore use the term "patient-planetary health co-benefit prescribing" to denote any and all prescribing practices or medical advice given that have co-benefits for both patient and planetary health.

## 1.4 Circumpolar North and climate change

### 1.4.1 Circumpolar context and climate impacts

The Circumpolar North includes the sub-Arctic and Arctic regions of the globe spread across eight countries including: Canada, Finland, Denmark (including Greenland and the Faroe Islands), Iceland, Norway, Russia, Sweden, and the United States (Alaska).[39] The region is warming at 3 to 4 times the global rate,[20] with climate change impacts already having been felt for decades. The region is said to be a ground zero for climate change, amplifying already existing socioeconomic barriers and health inequities, with particular amplified effects for the substantial Indigenous population in the area.[40] Despite the Circumpolar region often being associated within the 'Global North,' many of the Circumpolar regions are more attuned with the global health concerns more often associated with the 'Global South' (e.g., socioeconomic marginalisation, high rates of poverty, and health inequities).[40] The region has been very much overlooked in the context of global health policy and practice.[40]

### 1.4.2 Northwest Territories (NWT) region and health system

A large portion of my research was carried out in the Northwest Territories (NWT), Canada, which has a majority Indigenous population (First Nations, Inuit, Métis) and a land mass of 1,171,918 square km[41] (approximate equivalent to the land mass of Spain, Portugal, and France combined), yet has a population of around 45,000 people. The NWT is one of the ground zeros for climate change in the Circumpolar North. In the last 10 years, there have been numerous climate change–related events that have stressed hospital systems and patient health in the NWT. For example, 2023 was the worst wildfire season on record with 68% of the population having to evacuate the region to escape the wildfires. This included evacuating numerous community health centres as well as a 100-bed hospital within a short period of

time, with the closest evacuation centre being 1000 km by air.[42,43] Despite current and ongoing experiences of climate change in the region, no research has been carried out within local health systems to gain a better understanding of climate mitigation or adaptation responses through a planetary health lens.

The NWT is split into seven publicly funded unique healthcare delivery regions, with one 100-bed tertiary care hospital, the Stanton Territorial Hospital located in Yellowknife, serving the entire NWT in addition to the Kitikmeot region of the neighbouring territory Nunavut. Smaller community hospitals and clinics with limited services as well as small community nursing stations serve the rest of the population across the seven regions. This means that the NWT relies heavily on medical travel to get patients to their medical appointments with many one-way trips in the order of 1000+ km. Physicians based in the NWT are usually based either in Yellowknife, or less commonly with ongoing physicians' shortages in the area, in the smaller community centres; however, many provide rotational clinics to the smaller communities spread across the north. There are generally around a total of 50 physicians serving the region (specialists and family physicians); however, this number is constantly in flux. Despite the majority Indigenous population in the region, there is a lack of Indigenous physicians in the region with most practising physicians not being originally from the NWT.

### 1.4.3 The context of Indigenous Peoples in the region

As noted in section 1.4.2, the NWT has a majority Indigenous population represented by diverse First Nations, Inuit, and Métis Peoples. There are eleven official languages in the region, including Dene Kədǝ, Dëne Sųłiné, Dene Zhatıé, Dinjii Zhu' Ginjik, English, French, Inuinnaqtun, Inuktitut, Inuvialuktun, nēhiyawēwin, and Tłı̨chǫ. The region is inclusive of

Treaty 8 and Treaty 11, as well as the Inuvialuit Settlement Region (ISR) which sets out the relationship between the Federal government and Indigenous Nations in the region, including provisions for healthcare. Other First Nation specific self-governing agreements are in place or are in process. Indigenous Peoples in the region experience the ongoing effects from colonisation and the residential school legacy which impacts their health status contributing to substantial health inequities compared to the non-Indigenous population in the region.[40]

## 1.5 Positionality

It is expected with any research or inquiry involving Indigenous Peoples that the author positions themselves in the context of the work ("nothing about us, without us").[44,45] Although positionality is a common feature of many qualitative approaches, positionality from an Indigenous methodological approach is inherently relational and Land-based. I therefore orient this positionality statement from an Indigenous methodological approach that is expected from the region I grew up in, and where the majority of my dissertation work has taken place (i.e., in the NWT, Canada).

My traditional name is *Nadloghaze* (little laughing one), and I am a member of the Deninu K'ue First Nation. I was born and raised in my First Nation as well as on Kátł'odeeche First Nation territory and the Ts'ueh Nda community (West Point First Nation)—all located within Treaty 8 Territory. My great, great grandfather Beniah was a signatory with the British crown for Treaty 8, and many of my family members, including my mother and grandmother were forcibly removed by the federal government to attend "Indian boarding schools" where the purpose was to "kill the Indian and save the child." I am also a relative of Louis Riel, a Métis leader, and a central figure in the Red River and North-West resistance that fought the federal government (British loyalists) setting the stage for complicated Indigenous relations

that continue today. I additionally have ancestors from Ireland, Italy, and England, with some of my relatives on my father's side fighting directly against the resistance of the Métis led by Louis Riel.

My Indigenous Elders have told me that one of the reasons I can do the work that I do is that I have inside of me many different perspectives from the soul lineages (i.e., ancestral relations) I carry with me—embodying both the strengths and the intergenerational traumas. The bird perspective that I also carry helps me see things from a good vantage point, viewing what is behind, what is in front, sideways, up and down, and within (the seven directions). I am a traditional faster (i.e., practice our ceremonies), a mother of two strong-willed daughters, an auntie, a sister, and a relation from the north to all our Indigenous relatives. These collective relationships set out the responsibilities I carry with me in my life and in my work. Our Indigenous positionalities are set even before we come earth-side; however, they become a direct and absolute responsibility once here to formally realize. With this, due to the lived experience of being raised within sub-Arctic Indigenous communities, having worked professionally with Indigenous Peoples my entire career (first as a clinician and then as an Indigenous scholar), my responsibility is therefore to remain true to my positioning throughout my research work while acknowledging my role and direct accountabilities within Indigenous communities. This I believe brings strength and credibility to the work from an Indigenous perspective. I have to be continually mindful that Indigenous researchers are

> ...accountable not only to their academic institutions but also their Indigenous communities and their ancestors, Elders both past and present. This is partially defined as Indigenous capital, and distinguished from social capital. From an Indigenous epistemological standpoint, it is culturally appropriate that Indigenous…[Peoples]…speak through their Indigenous researchers.[46]

## 1.6 Theoretical positioning of the dissertation

Indigenous research differs substantially from non-Indigenous research. For example,

> Indigenous research is ultimately about reciprocal relationships between the researcher and the researched, which may be defined by the researcher's Indigenous understanding, their 'ways of knowing' and their assumptions about reality, that are not Eurocentric in nature and origin.[46]

The University of Oxford, like many universities, can be seen by Indigenous Peoples as being a colonial, Euro-Western-based institution that is based in a country that colonized our Lands, our political systems, and our healthcare systems. Throughout my dissertation work, I therefore had to think very deeply on the theoretical underpinnings of my work, wanting to initially avoid setting up my "Indigenous" ways of knowing and being up for an academic theoretical debate. I grappled with the decision on whether to "focus" and "learn" Western academic systems to better support my work, and therefore not needing to defend who we are as Indigenous Peoples in a university setting that has little experience with Indigenous ontologies, axiologies, epistemologies, and methodologies. I realized as I initially progressed through my DPhil studies, however, that this was the opposite advice I give to my own students, and I was being theoretically lazy, missing the opportunity to more explicitly "bridge" ways of knowing. Given this, I decided to take a deep dive into theoretical orientations of Euro-Western research, giving the academic traditions some formal attention to assess whether there was any connectivity to Indigenous worldviews. There was not, and I was not comfortable utilizing a theoretical orientation for my qualitative work that did not allow me to be my Indigenous self, forcing me into a box of seeing the world through a Euro-Western derived reality.

On further exploration, I did, however, identify a more flexible theoretical orientation that although was not perfectly aligned, didn't have the need for my work to be put in a box—pragmatism.

> …[P]ragmatism is about pluralistic social science, in which scholars forgo debates about matters of social theory in favour of applied research, and about reflexive awareness of the position of the enquirer as a socially situated and politically empowered subject. Theories are meant to be instruments, and enquiry is meant to be problem-driven. Theories may be modular, and an analytically promiscuous eclecticism is preferable to more systematic and methodologically immanent procedures of investigation. Fundamental ontological questions of social theory, such as the nature of action, experience, agency, structure, or mind, are too abstract and need not be answered anyway to permit fruitful enquiry.[47]

Pragmatism embodies a commitment to "collapsing epistemology and ontology,"[47] which allows for Indigenous ways of being (ontology) and knowing (epistemology) to remain innately interconnected. A pragmatist approach also allows research to not only be an activity alone, but can also be seen in and of itself "as a community of practitioners embedded within a society," with these community practitioners also treated "as actors who themselves constitute a political force in society."[48] This allows space for Indigenous worldviews to continue to be inherently relational, non-hierarchical, and rights-based. Additionally, given the urgency of the planetary crises, the pragmatic approach allowed me to be solutions-orientated and action-based[49] in my approach to the research. Indigenous ways of knowing and being are also embodied through "action." Many Indigenous languages are even verb-based seeing the world only through action processes. A pragmatic approach therefore is not directly oppositional to the needs of Indigenous ways of knowing. For example,

> [a]t the beginning of an action process [from a pragmatic perspective], goals are frequently unspecific and only vaguely understood. They become clearer once the actor has a better understanding of the possible means to achieve the ends…This reciprocal process between means and ends structures action…This allows one to perceive perception and cognition not as acts preceding action but as part of the action process that is inherently to the situational context.[50]

Further to this viewpoint, an Elder named Francois Paulette from my home region describes *Dene Ch'anie* which encapsulates my Dene Peoples way of life. The *Dene Ch'anie* philosophy emphasizes an ecological perspective rather than one of only humans. Elder Francois explains that each living being has an ephemeral flow of existence, a spirit, and our spirits take form from the "action trails" they leave behind, and their beliefs create projections into the future (i.e., it is our actions that create who we are).[51] Although our *Dene Ch'anie* philosophy would take a full dissertation in itself to describe, these brief teachings give preliminary insights into the bridging thought process that went into considering the theoretical orientation of my work. Bringing things together from a pragmatic approach, the ability to see ourselves as actors with political force to create change, to be solutions-orientated and action-based, and not to get stuck in debates on social theory in favour of applied research allowed me to not sacrifice any Indigenous approaches or worldviews in my work.

Decolonial research paradigms allow for Indigenous scholars to see what works best in what instance for their research. With this, the ability to specifically choose or to bridge my work as an Indigenous scholar with Euro-Western-derived descriptions (i.e., pragmatism) or varied research methods (e.g., Indigenous research methods and Western research methods) fits within a decolonized research paradigm. Decolonial research paradigms themselves embed a "collaborative process of naturalizing Indigenous intent, interactions, and processes…making them evident to transform spaces, places, and hearts."[52] A decolonial approach also allows for Indigenous "traditional protocols"[13] to be respected, honoured, and followed while ensuring that research is able to be experienced as "ceremony,"[53] which is in and of itself a critical action in reciprocity (i.e., a cyclical obligation[54]) within many

Indigenous communities. Ultimately, a pragmatic approach seen to be encapsulated within a decolonial research paradigm does not create any barriers that would prevent my work from being carried out meaningfully and hence the choice of orientation for my research work.

## 1.7 Aims of the Dissertation

As noted in section 1.1., the aim of this dissertation was to identify the influences on planetary health-informed health systems change in a Circumpolar and racially diverse healthcare clinical setting while also exploring transferable elements and knowledge for other contexts. The research also bridges both Western and Indigenous perspectives from a region in the Circumpolar North currently experiencing substantial climate change. Eventually, I hope the findings gleaned from this research could be used by health systems and health professionals to inform the development of interventions, organizational change processes, and policy-making efforts as they move towards planetary health-informed healthcare. Additionally, I also hope that this research will inspire health systems to avoid the continued perpetuation of the disconnect between individual, communities, and the planet, while looking to Indigenous Peoples and their knowledges for urgent, impactful, and meaningful change.

The chapters contained in this thesis all directly map on to the aim set out above, and are summarized briefly below:

- Chapter 2 presents a mixed methods systematic review of physicians' views of patient-planetary health (P-PH) co-benefit prescribing. More specifically, the review identified the barriers and facilitators to adopting P–PH co-benefit prescribing by physicians, and mapped these barriers and facilitators onto the Capability, Opportunity, Motivation, and Behaviour (COM-B) model and the Theoretical Domains Framework (TDF).

- Chapter 3 presents a qualitative interview study in which I explored the perspectives of physicians around P-PH co-benefit prescribing in a Circumpolar region in the NWT.
- Chapter 4 presents a qualitative sharing circle study in which I explored the views of planetary health-informed health system changes within the Circumpolar North from the perspective of Indigenous Elders.
- Chapter 5 presents the results from asking a unique research question from the interview and sharing circle data collected in Chapters 3 and 4. I carried out reflexive thematic analysis to generate key themes, and present separate findings on Circumpolar-based physicians' and Indigenous Elders' views on nature prescribing in the NWT.
- Chapter 6 presents a scoping review that identified current planetary health frameworks that have been developed for health systems. I describe the content of these frameworks, their stage of implementation, and any accountability mechanisms noted. I also present the framework elements commonly considered as critical to the development and functioning of environmentally sustainable healthcare systems.
- Chapter 7 is the discussion chapter of this dissertation that provides a synthesis of the findings from the previous chapters while reflecting on areas for future research.

# Chapter 2 Physicians' views of patient-planetary health co-benefit prescribing: A mixed methods systematic review

## 2.1 Summary

This chapter presents a mixed methods systematic review which set out to identify barriers and facilitators to adopting P-PH co-benefit prescribing by physicians and mapped these onto the Capability, Opportunity, Motivation, and Behaviour (COM-B) model and Theoretical Domains Framework (TDF). I searched electronic databases from inception until October, 2022, and did a content analysis of the included articles ($n$ = 12). Relevant categories were matched to items in the COM-B model and TDF. Nine barriers and eight facilitators were identified. Barriers included an absence of, or little, knowledge of how to change practice and time to implement change; facilitators included having policy statements and guidelines from respected associations. Findings were limited by a heightened risk of non-response bias and therefore selection bias. I determined that diverse study designs that include health professionals, patients, and health-care system stakeholders are needed to ensure a more holistic understanding of the individual, system, and policy levers involved in implementing clinical work informed by planetary health.

**Note:** A version of this research has been published by the journal *Lancet Planetary Health*.[3]

## 2.2 Introduction

As discussed in Chapter 1, health professionals, as well as the medical organisations they work within, have increasingly been called to become partners in climate-change mitigation efforts.[5,30,55,56] Despite this, I noted in Chapter 1 that there has been a lack of consistency in the development of clear clinical recommendations or guidelines, and that with expected and

continued amplification of climate-related health ailments, physicians and health systems will shoulder the burden of patient care on already stressed healthcare systems.[30,31] With this, health professionals and health systems are currently underprepared for the effects of an increasingly stressed planet.

In 2015, the World Health Organization's (WHO) operational framework for building climate-resilient health[57] sparked a catalyst on the increasing need to consider adaptation measures within health systems globally. Despite this increasing attention on the need for climate adaptation within health systems, clinical practice is still often grounded in climate-reactive medical practice based on acute events (e.g., heat events, floods, etc.). Few overarching policy, planning, and applied interventions have focused on long-term mitigation activities within the patient-facing clinical exam room.

Most clinically orientated mitigation efforts and activities currently focus on waste reduction and recycling,[58-60] general supply chain decarbonization and life-cycle assessments,[60-63] the promotion of planet-friendly diets,[64-66] and greater divestment from fossil fuels within health systems[67-70]–all urgently needed changes. There has also been an increase in the re-framing of some existing patient-facing efforts, such as the Choosing Wisely initiative,[71] through an environmental stewardship lens (i.e., a reduction in inefficient care reduces impact on the environment[72,73]). Isolated higher carbon footprint patient treatment strategies have also been gaining greater awareness amongst some physicians including the use of metered dose inhalers (MDIs)[74,75] and anesthetic gases (e.g., desflurane).[76-78] Despite these initial dialogues on certain prescribing practices, there has been little to no focus on day-to-day prescribing considerations for more wide-ranging planetary health-informed implementation efforts outside of calls for broad transformational change.[26,72,79-84]

As further movements focus on considering how the clinical advice given to patients can be implemented through a planetary health lens,[1,5] new opportunities exist to develop standards of practice that have co-benefits for both patients and the planet.[72] The question then becomes: How can we deliver ongoing and sustainable medical care to patients that considers both the patients' and the planet's health? With more evidenced-based literature developed in this regard, physicians may be better positioned to adopt clinical approaches that seek to provide benefit to both the patient and the planet. As noted in Chapter 1, "patient-planetary health co-benefit prescribing (P-PH co-benefit prescribing)" is a framing that has been defined to denote all prescribing habits and clinical advice given to patients that *explicitly* consider both the patients' and the planet's health in the action of prescribing.[1] Yet, despite the P-PH co-benefit prescribing framing denoting a "behavior" engaged by physicians or other medical prescribers, there has been no amalgamated research on the potential application of behavioural theory on this topic.

Behavioural approaches may serve as a leverage point for thinking through necessary implementation needs for planetary health–informed clinical practice. Behavioural frameworks can help to identify and address key determinants of prescribing behaviour across health systems and can consider how interventions may be needed at an individual, organizational, or systems level. One behavioural framework of potential interest for climate-change mitigation efforts within prescribing practice is the COM-B model.[85,86] The COM-B model is made up of three overarching domains further sub-divided into six key elements thought to influence behaviour (see *Figure 2*).[85,86] The COM-B model has been used in other healthcare contexts to characterize elements of physician behavior[87-89] and as a foundation for intervention development.[90]

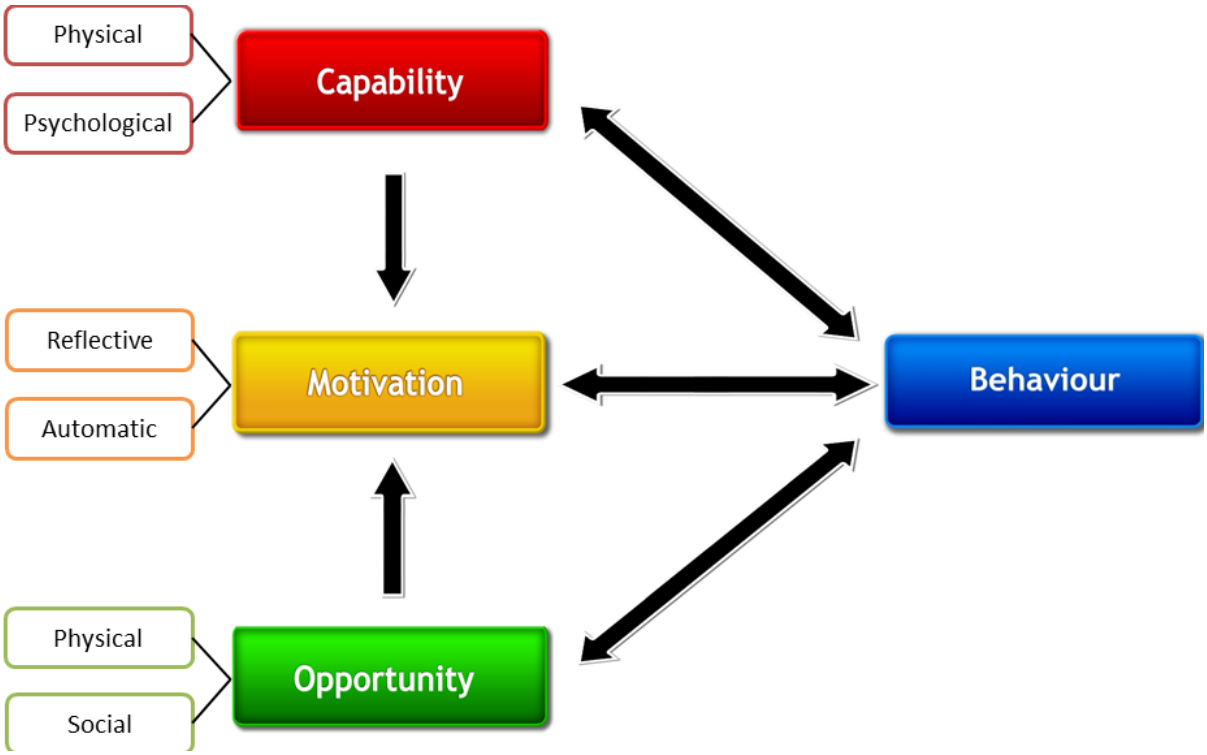



**Figure 2.** The COM-B model (adapted and reproduced from *Michie et al*[85]).

The COM-B model can also be mapped to the more detailed Theoretical Domains Framework (TDF) for implementation efforts that seek to be more refined in their understanding of the behaviours to target for change efforts.[91] Together, both the COM-B and the TDF provide an avenue for framing individual-level behavioural barriers and facilitators in a way that can be easily mapped to inform appropriate intervention design.[86,92] As my interest for this particular chapter study was to examine the individual behavioural level determinants of P-PH co-benefit prescribing, both the COM-B and the TDF provided an avenue for framing the barriers and facilitators in a way that could be easily mapped to inform intervention design. I additionally chose to use the COM-B and the TDF to get a better idea of any potential behavioural gaps, if any, within the current literature.

## 2.3 Aim and Objectives

In order to be able to explore key views and influences on the ground in the NWT (Chapter 3), it was important to first synthesise the existing literature to identify barriers and facilitators to adopting P–PH co-benefit prescribing through a behavioral lens at a broader level. At the time of initiating my dissertation research, there had been no review carried out that brought together information on the P-PH co-benefit prescribing topic, let alone through a behavioral lens. Therefore, in this systematic review I aimed to:

(1) identify the barriers and facilitators to adopting P-PH co-benefit prescribing by physicians, and

(2) to map these barriers and facilitators onto the COM-B model and the Theoretical Domains Framework (TDF).

## 2.4 Methods

I used mixed methods systematic review methodology and pre-registered the review protocol on PROSPERO (#: CRD42022301824). In addition, I used the Preferred Reporting for Systematic reviews and Meta-Analyses (PRISMA) 2020 checklist to ensure I followed best practice for reporting results of the review.[93] I used Covidence software (v2721 a9510157) for the full management of the systematic review.

### 2.4.1 Eligibility criteria, information sources, and search strategy

I included all study designs (qualitative, quantitative, mixed methods) to ensure I captured all relevant literature. I included any P-PH co-benefit prescribing-related studies that investigated physician views on medical advice or prescribing practices that considered both the patient's and the planet's health. I used P-PH co-benefit prescribing specific terminology as the framing; however, I included any studies that considered both the patient's and the planet's

health ‘explicitly’ regardless of the overarching framing of the research. I excluded publications related to medical supplies sustainability outside of direct patient engagement, Choosing Wisely, educational efforts (e.g., curriculum development), and/or dietary, reproductive, social, and exercise prescribing unless there was an explicit planetary-health focus to the analysis (also articulated through a climate-change and health lens). I excluded studies in languages other than English due to a lack of translational resources.

I developed the search strategy with advice and guidance from a University of Oxford–based medical-information specialist. Searches were executed in PubMed, Web of Science, PsycINFO, Scopus, Prospero, and Google Scholar, with the most recent search conducted on 21 October 2022. I then manually searched key journals and reference lists of relevant key articles. Additionally, I contacted two expert planetary health researchers for additional knowledge of any key studies in the field of which they may have been aware.

### 2.4.2 Selection process, data extraction, and quality appraisal

I then downloaded the search results into the Covidence software and removed duplicate articles. The titles and abstracts of all articles were assessed by two reviewers (myself and a second reviewer) using the stated inclusion criteria, with any discrepancies being resolved by discussion. Those not meeting the criteria were excluded. I then reviewed the full texts for possible inclusion, with a second reviewer assessing twenty-five percent of the articles to ensure consistency. I again resolved any discrepancies through discussion. The reasons for exclusions were documented. I then performed all data extraction (year of publication, country of study, study aim and design, recruitment and sampling method, number of participants, setting and medical specialty, eligibility, method of analysis, measurement tools

or instruments used, key conclusions, funding source) with a cross-check of ten percent of included articles completed by a second reviewer to ensure consistency.

I used the Mixed Methods Appraisal Tool (MMAT version 2018) to assess the quality of the included studies.[94] The MMAT is particularly responsive to the "appraisal stage of systematic mixed studies reviews."[94] Myself and a second reviewer performed the quality appraisal on the included articles as is recommended by the MMAT.

### 2.4.3 Data Analysis

I carried out content analysis on the included articles using a "data-based convergent synthesis design".[95] I chose this design due to its ability to be responsive to both qualitative and quantitative data with included studies being analysed using the same synthesis method.[95] (1) Firstly, I carried out open coding of the included article findings. Key quantitative findings were coded by concept narrated as opposed to by the reported numbers (e.g., "A majority of participants said they felt that health professionals have a responsibility to bring the health effects of climate change to the attention of…policy makers" would be coded versus "90% somewhat or strongly agreed"). Codes were refined to main categories representing the reported data. (2) Secondly, I classified content analysis categories into the six subcomponents of the COM-B model and the TDF domains using "best-fit synthesis framework".[96] I created a coding framework for both the COM-B and the TDF based on their components (e.g., capability, opportunity, motivation, etc.), then mapped the identified categories to this framework. I used a computer-assisted qualitative data analysis package (NVivo 12) for both content analysis coding, and the best-fit synthesis framework mapping. Within both the COM-B and the TDF, mapped categories could be a barrier as well as a facilitator depending on what participants were reporting (e.g., some clinicians say that

colleagues support P-PH co-benefit prescribing and some say that colleagues do not support P-PH co-benefit prescribing), so therefore certain categories could be framed as either a barrier or a facilitator pending the source. Given this, I reported findings based on how the results were framed within the original article source.

## 2.5 Results

### 2.5.1 Study selection and characteristics

My systematic search identified 8,909 articles for screening. Twelve articles met the inclusion criteria and were included for further analysis (see *Figure 3*). Most of the included studies were cross-sectional surveys ($n$ = 10) with a total combined global participant $n$ of 10,590. Questionnaires had between fourteen and sixty-five items, with some including both closed and open-ended questions. One qualitative study[97] and one mixed-methods study[98] were included. However, for the latter, the mixed-method qualitative arm was of non-physician participants and therefore that portion of the study was not included in the analysis. One of the cross-sectional studies included disaggregated data for non-physicians, which was also not included in the analysis. Six of the studies were based in the United States (US), and of the twelve included studies, the earliest was published in 2014. Most of the studies were published since 2016 (10/12 studies).

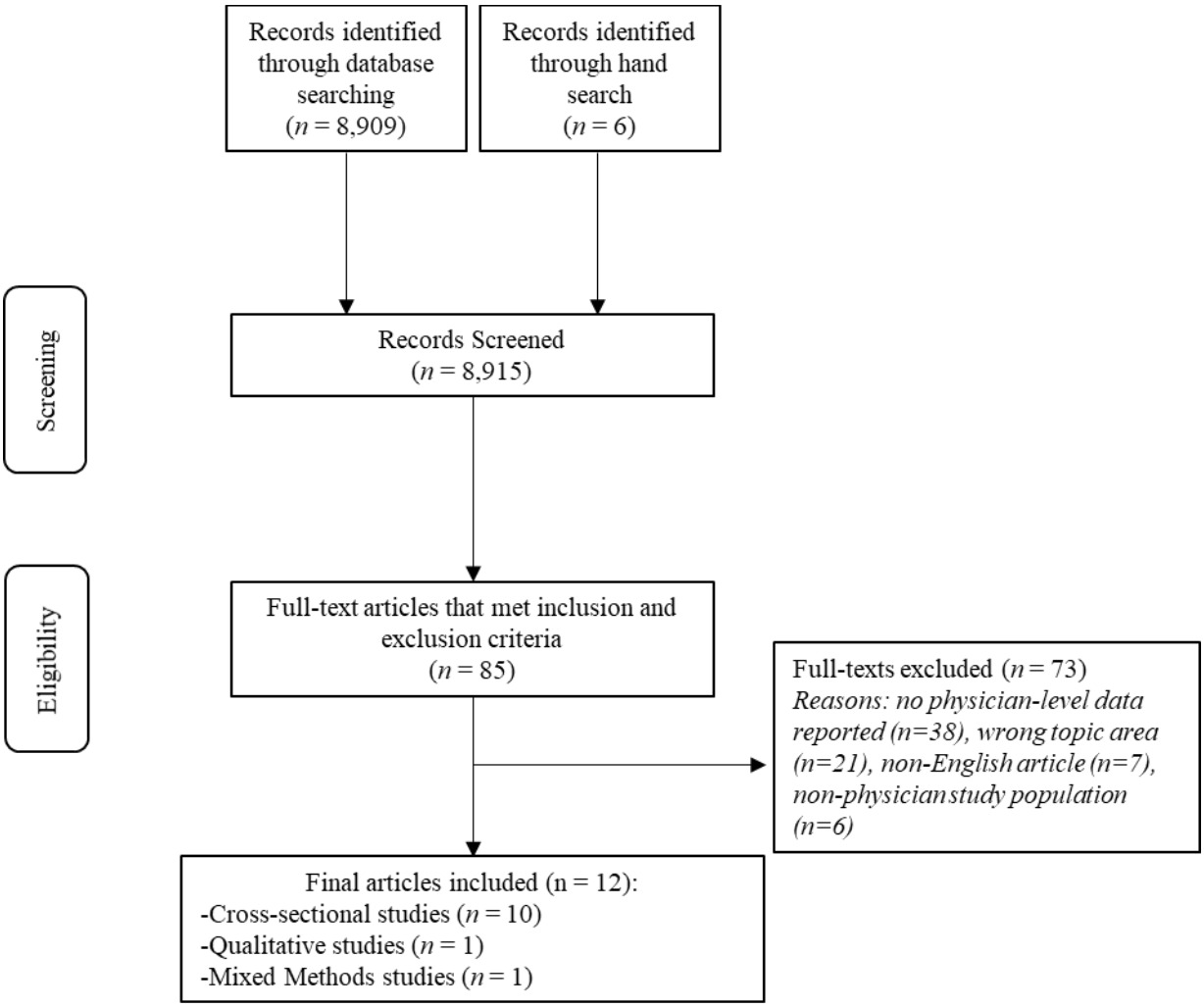



**Figure 3.** Adapted PRISMA diagram

Authorship overlap was noted within some of the included studies, with a few authors being present on several of the included articles (including, in some cases, overlapping funding sources between studies). Five of the included studies had either physician specialists as the population of interest (e.g., anesthesiologists) or key organizational groups. Many of the physician specialist–focused studies often utilized professional organizations to support recruitment efforts by email and used convenience sampling. See *Table 1* for study characteristics.

**Table 1.** Characteristics of included studies.

| | Region | Study design | *n* | Sampling | Medical Specialty or Organizational membership | Study Aims |
|---|---|---|---|---|---|---|
| *André et al, 2022*[99] | Switzerland | Cross-Sectional | 497 | Convenience | Family medicine | To determine the level of knowledge of general practitioners (GPs) regarding health impacts of climate change and of concepts such as planetary health and co-benefit interventions, as well as their willingness to address climate change with patients. |
| *Ard et al, 2016*[100] | US | Cross-sectional | 2189 | Random | Anesthesiologist members of the American Society of Anesthesiologists | To understand the current state of environmental practice, attitudes, and knowledge among anesthesiologists in the United States. |
| *den Boer et al, 2021*[97] | US | Qualitative | 18 | Purposive | Mixed | To determine patients' and physicians' perceived impact of climate change on patient health in the family-medicine setting. |
| *Boland & Temte, 2019*[101] | US | Cross-sectional | 180 | Convenience | Family medicine | To explore the viewpoints among U.S. physicians who are concerned about the health effects of GEC. |
| *Kotcher et al, 2021*[102] | Jamaica, UK, Canada, India, Kuwait, New Zealand, Australia, South Africa, Chile, Columbia, Uruguay, World | Cross-sectional | 3977 | Convenience | Mixed | To assess physician views about climate change as a human health issue. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Medical Association members (countries unknown) | | | | | |
| *Petre et al, 2019*[103] | Canada | Cross-sectional | 426 | Convenience | The Canadian Anesthesiologists Society | To document Canadian anesthesiologists' current practice, attitudes towards, and perceived barriers regarding recycling of OR waste and environmental sustainability efforts. |
| *Sarfaty et al, 2014*[104] | US | Cross-sectional | 284 | Convenience | National Medical Association | To assess physicians' experiences with climate change, particularly whether they were witnessing health effects in their own patients. |
| *Sarfaty et al, 2015*[105] | US | Cross-sectional | 915 | Random | Physician members of the American Thoracic Society | To assess attitudes on the existence of and drivers of climate change, the witnessing of the health effects of climate change in practice, and suggestions on what actions, if any, should be taken by members of the American Thoracic Society (ATS), |
| *Sarfaty et al, 2016*[106] | 25% Asia, 25% Europe, 18% South America, 18% North America, 9% Australia or New Zealand, 6% Africa | Cross-sectional | 474 | Convenience | International members of the American Thoracic Society | To assess perceptions, clinical experiences, and preferred policy responses related to global climate change of international members of the American Thoracic Society (ATS). |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Sarfaty et al, 2016*[107] | US | Cross-sectional | 1184 | Convenience | American Academy of Allergy Asthma and Immunology | To assesses the American Academy of Allergy Asthma and Immunology (AAAAI) members knowledge, attitudes, and experiences with climate change and health. |
| *Völker et al, 2018*[98] | Thailand | Mixed Methods | Survey:184 | Survey: convenience | Mixed | To investigate the association between different hypothesized determinants of physicians' engagement in addressing environmental health issues and physicians' likelihood to take their patients' history on environmental exposures and to counsel their patients on environmental health risks. |
| *Wang et al, 2020*[108] | China | Cross-sectional | 262 | Random | Mixed | To assess the attitudes of physicians prescribing medicines regarding Eco-directed sustainable prescribing (EDSP) from the perspective of ecopharmacovigilance (EPV). |

### 2.5.2 Quality appraisal and risk of bias

The MMAT assessments flagged issues with the majority of included studies (see *Appendix 1*). As most included studies in the review were cross-sectional convenience samples ($n$ = 8), the risk of non-response bias and therefore selection bias for all is heightened. Non-response bias was also a potential issue for the cross-sectional random samples ($n$ = 3) based on the response rates. Most of the studies reported descriptive statistics; however, a few carried out inferential processes on convenience samples without a clear delineation of statistical assumptions that made me question their validity.

### 2.5.3 Physician-specific barriers and facilitators of P-PH co-benefit prescribing

Through content analysis, I identified nine overarching barriers and eight facilitators under the P-PH co-benefit prescribing framing by physicians (see *Table 2*). The most noted barrier across all included articles was a lack of resources, with a particular focus on the perceived lack of knowledge and education on the topic ($n$ = 12). With this, all twelve included articles supported the need for more education and training of physicians through various mediums. The most cited facilitator across the article base was having policy statements and/or guidelines from relevant medical associations available on P-PH co-benefit prescribing parameters ($n$ = 10). Barrier 7 (i.e., B7) was represented within only one United States (US) based study (see *Table 2*). All other barriers and facilitators were represented in more than one country. The barriers and facilitators were cross-cutting across specialty and sample groups with no specific behavioural influences being exclusive to one sample population.

**Table 2.** Physician-specific barriers and facilitators identified in the included articles.

| **Barriers** | **Relevant Articles** |
|---|---|
| B1. Lack of Resources (including): | |
| B1a. Lack of, or limited, knowledge and education | *André et al*,[99] *Ard et al*,[100] *Boland & Temte*,[101] *den Boer et al*,[97] *Kotcher et al*,[102] *Petre et al*,[103] *Sarfaty et al*,[104] *Sarfaty et al*,[105] *Sarfaty et al*,[106] *Sarfaty et al*,[107] *Völker et al*,[98] *Wang et al*[108] |
| B1b. Lack of time | *André et al*,[99] *den Boer et al*,[97] *Kotcher et al*,[102] *Petre et al*, *Sarfaty et al*,[104] *Sarfaty et al*,[106] *Völker et al*[98] |
| B1c. Lack of financial resources | *Petre et al*,[103] *Völker at al*[98] |
| B2. Lack of positive institutional culture and leadership | *Ard et al*,[100] *Den Boer et al*,[97] *Petre et al*,[103] *Völker et al*[98] |
| B3. Physicians uncomfortable, unsure, or don't think it is their role | *André et al*,[99] *Boland & Temte*,[101] *den Boer et al*,[97] *Volker et al,*[98] *Wang et al*[108] |
| B4. Topic may be too controversial or risky to engage in with patients (e.g., political differences) | *Boland & Temte*,[101] *den Boer et al*,[97] *Kotcher et al*,[102] *Sarfaty et al*[104] |

| | |
|---|---|
| B5. Concerns over patient safety or lack of well-accepted guidelines to make informed and safe decisions | *André et al*,[99] *Petre et al*,[103] *Wang et al*[108] |
| B6. Lack of peer support and networks | *Kotcher et al*,[102] *Völker et al*[98] |
| B7. Patient seen as priority in clinical encounter over environmental concerns | *den Boer et al*[97] |
| B8. Perceived patient disinterest | *André et al,*[99] *Sarfaty et al*[104] |
| B9. Unable to bill for time | *André et al*,[99] *Sarfaty et al*[104] |
| **Facilitators** | **Relevant Articles** |
| F1. Having policy statements and guidelines from Associations | *André et al*,[99] *Boland & Temte*,[101] *den Boer et al*,[97] *Kotcher et al*,[102] *Petre et al*,[103] *Sarfaty et al*,[104] S*arfaty et al*,[105] *Sarfaty et al*,[106] *Sarfaty et al*[107] |
| F2. Belief that environmental impact is important to consider with patients | *André et al*,[99] *Boland & Temte*,[101] *den Boer et al*,[97] *Petre et al*,[103] *Sarfaty et al*,[104] *Sarfaty et al*,[105] Sarfaty et al,[107] *Völker et al*,[98] *Wang et al*[108] |
| F3. Available patient education materials and resources | *André et al*,[99] den Boer et al,[97] Kotcher et al,[102] *Sarfaty et al*,[104] *Sarfaty et al*[106] |
| F4. Effective leadership, peer support, and collaborations | *den Boer et al*,[97] *Kotcher et al*,[102] *Petre et al*,[103] *Völker et al*[98] |
| F5. Existing knowledge | *André et al*,[99] *Petre et al*,[103] *Völker et al*[98] |
| F6. Medical specialty tailored education and implementation approach | *den Boer et al*,[97] *Wang et al*[108] |
| F7. Health system and hospital level environmental metrics, support, funding, and buy-in | *Petre et al*[103] |
| F8. Using a personalized communication style and approach with patients | *den Boer et a*l[97] |

*Numbered barriers and facilitators are for mapping purposes only and do not denote any hierarchy of presence within the literature in the listed order. Sub-categories were numbered to allow them to be mapped to the COM-B and TDF independently.

### 2.5.4 Most common behavioural influences

I then mapped the barriers and facilitators to the COM-B model and TDF and identified the most common behavioural influences within the literature base. The most common behavioural influences I identified in terms of TDF domains in the included articles were (see *Table 3*): (1) environmental context and resources (76 mentions), (2) knowledge (57 mentions), (3) beliefs about consequences (49 mentions), and (4) social influences (44

mentions). The TDF domain "environmental context and resources" included such barriers as lack of time, financial resources, and ability to bill for time, as well as facilitators including having patient education materials and resources available. A barrier in the TDF domain "beliefs about consequences" included the concern for patient safety or the lack of well-accepted guidelines to make informed and safe decisions. Additionally, one barrier in the TDF domain "social influences" was that the topic may be too controversial or risky to engage in with patients (e.g., political differences).

**Table 3.** The behavioural influences identified in the included articles, including example statements.

| COM-B | TDF¶ | Barrier (B)* or Facilitator (F)Ȼ | Example Statements |
|---|---|---|---|
| **Capability** | *Knowledge: An awareness of the existence of something.* | B1a - Lack of, or limited, knowledge and education | "Respondents' lack of knowledge about how to approach the issue with their patients (71%) ..."[104] |
| | | F5 - Existing knowledge | "… physicians' knowledge can be a key determinant of whether or not physicians give advice to their patients on how to reduce environmental health risks and increase exposure to beneficial environmental influences in their life."[98] |
| | *Skills: An ability or proficiency acquired through practice.* | F8 - Using a personalized communication style and approach with patients | "… they were particularly keen to learn conversation skills specifically for discussing this topic so as to tailor the conversation to their patients' interests, values and needs and make the conversation relevant and actionable."[97] |
| **Motivation** | *Beliefs about consequences: Acceptance of the truth, reality, or validity about outcomes of a* | B5 - Concerns over patient safety or lack of well-accepted guidelines to make informed and safe decisions | "… no data system is currently available to guide medical prescribing decisions in the clinical setting for selection of drugs having a low probability of environmental risks and hazards."[108] |

| | | | |
|---|---|---|---|
| | *behaviour in a given situation.* | F2 - Belief that environmental impact is important to consider with patients | "Most respondents indicated that the environmental impact of anesthesia is important and should inform clinical practice when choosing between products and processes that are otherwise equivalent in efficacy and patient outcomes."[103] |
| | *Social - professional role and identity: A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting.* | B7 - Patient seen as priority in clinical encounter over environmental concerns | "It's always been about your health and illness needs and not about situating you as a human being in the larger health of the planet."[97] |
| | | B3 - Physicians uncomfortable, unsure, or don't think it is their role | "Although >70% of family physicians in this study agree that climate change is relevant to patient care, two thirds do not think that physicians should take an active role in addressing this with patients."[101] |
| **Opportunity** | *Environmental context and resources: Any circumstances of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour.* | B1c - Lack of financial resources | "In terms of the availability of resources needed to adequately address linkages between ecosystem health and human health, more than two-thirds of all physicians perceived a lack of resources" [financial and material resources].[98] |
| | | B1b - Lack of time | "An important barrier that was mentioned frequently was the short amount of time that physicians are allowed to spend per patient. … This discourages physicians to bring up issues beyond what is strictly required."[97] |
| | | B9 - Unable to bill for time | "… barriers included non-billability of time spent speaking with patients about it."[104] |
| | | F3 - Available patient education materials and resources | "… patient education materials would be helpful."[102] |
| | | F6 - Medical specialty tailored education and implementation approach | "… participants suggested developing tools and resources with information on the health effects of GEC together with both professionals and patients, and tailored for different specialties."[97] |

| | | | |
|---|---|---|---|
| | | F1 - Having policy statements and guidelines from Associations | "Health professional societies should develop, or update, their policy statement on climate and health, and should explicitly encourage climate and health advocacy."[102] |
| | | F7 - Health system and hospital-level environmental metrics, support, funding, and buy-in | "Gaining support from hospital and OR leadership might be encouraged at levels above the hospital administration, as some respondents suggested, by including sustainability efforts in hospital accreditation processes."[103] |
| | *Social influences: Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours.* | B6 - Lack of peer support and networks | "Only 15% of the medical doctors know colleagues, co-workers, other persons or institutions which address these links, most of which are other medical doctors, followed by members of the senior hospital management, nurses and others."[98] |
| | | B2 - Lack of positive institutional culture and leadership | "Only 12.6% reported that hospital leadership encouraged sustainability practices, and only 18.0% reported there was a sustainability or green task force in their institution."[100] |
| | | B8 - Perceived patient disinterest | "… barriers included… patient disinterest (27%)…"[104] |
| | | B4 - Topic may be too controversial or risky to engage in with patients (e.g., political differences) | "… some participants for example said they talk about environmental topics and do not use the word climate change explicitly to avoid friction with patients who do not believe in CC [climate change].''[97] |
| | | F4 - Effective leadership, peer support, and collaborations | "… physicians who discuss with their peers about environment-health linkages are more likely to address these linkages in their work with patients."[98] |

¶Descriptions from *Michie et al*[86].
*Barrier sub-categories were mapped to the COM-B and TDF independently.
₵Barriers and facilitators were numbered according to listings in *Table 2* for mapping purposes only.

### 2.5.5 Behavioural gaps identified

In mapping the barriers and facilitators to the COM-B model and TDF, I was additionally able to identify gaps where the current literature focused its investigations from a behavioural

perspective. The main element of motivation that was identified in the included articles was through the TDF domain "belief about consequences" (see *Table 3*); however, the COM-B element "motivation" had overall the least coverage throughout the body of literature. Specifically, *reflective motivation* and its mapped TDF domains of goals, intentions, optimism, and *automatic motivation* and its mapped TDF domains of emotion, and reinforcement were not elucidated in the included articles. Behavioural influences that could potentially be of relevance, yet had no explicit representation in the available included articles, are listed in *Table 4*. It must be noted that some elements of the COM-B and TDF were not relevant to this topic (e.g., physical capability in the literal sense), so the lack of coverage of this element of the model is not a presented as a gap in the literature.

**Table 4.** COM-B and TDF behavioural influences not represented in the included articles.

| COM-B | TDF | TDF Descriptions¶ |
|---|---|---|
| **Capability-Psychological** | *Behavioural regulation* | Anything aimed at managing or changing objectively observed or measured actions. |
| | *Memory, attention, and decision process* | Anything aimed at managing or changing objectively observed or measured actions. |
| **Motivation-Automatic** | *Emotion* | A complex reaction pattern involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event. |
| | *Reinforcement* | Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus. |
| **Motivation-Reflective** | *Beliefs about capabilities* | Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use. |
| | *Goals* | Mental representations of outcomes or end states that an individual wants to achieve. |

| | | |
|---|---|---|
| | *Intentions* | A conscious decision to perform a behaviour or a resolve to act in a certain way. |
| | *Optimism* | The confidence that things will happen for the best or that desired goals will be attained. |

¶Descriptions from *Michie et al*[86]

All of the included articles made at least some reference to the supported need for more education and training of physicians through various mediums ($n$ = 12). Potential mediums recommended included conference lectures, formal curriculum during student training/residency/fellowship training, online e-modules, workshops for existing staff, requirements for continuing medical education (CME) on the topic, and communication training. Several articles ($n$ = 8) supported the need for physicians to be advocates and educators of patients and the public (e.g., "[a] majority of participants said they felt that health professionals have a responsibility to bring the health effects of climate change to the attention of the public [86% somewhat or strongly agreed] and policy makers [90% somewhat or strongly agreed]"[102]). Advocacy support was also noted to extend to professional associations and physician organizations throughout several articles (e.g., "For advocacy, responders suggested a greater presence of local professional associations involved in the issues and working to influence policy, community advocacy, public service announcements, and use of social media."[104]).

## 2.6 Discussion

### 2.6.1 Summary of findings

My systematic search resulted in twelve articles being included in this review. I identified nine main barriers and eight facilitators under the framing of P-PH co-benefit prescribing by physicians. The most noted barrier across all included articles was the perceived lack of knowledge (which may or may not represent actual knowledge) and education on the topic.

Additionally, the most cited facilitator across the article base was having policy statements and/or guidelines from relevant medical associations available on P-PH co-benefit prescribing parameters. The mapping of the identified barriers and facilitators to the COM-B model and TDF also identified key gaps in where the current literature has focused its investigations from a behavioural perspective. Gaps included a lack of coverage around specific behavioural influences including reflective and automatic motivation.

### 2.6.2 Behavioural theories in the context of this study

There has been some question within the literature on the usefulness of behavioural theories for implementation efforts such as those I have highlighted in this review.[109] The Behaviour Change Wheel (BCW), in which the COM-B is embedded, may provide a clearer pathway for connecting individual sources of behaviour with interventions, then mapped to policy categories.[85] For example, the BCW has already pre-mapped behavioural influences on intervention functions, which then relate to policy categories that aid efforts to impact multiple scales of influences. Given that several of the barriers and facilitators identified in my review cross into the physical (e.g., resources) and social (e.g., institutional culture) opportunity category of the COM-B/TDF, having guided pathways towards policy change levers may be helpful (see *Table 5*). More nuanced prescribing level interventions may still be supported by implementation guides currently available.[91]

**Table 5.** Some example linkages between identified barriers in the review to the COM-B model, a COM-B mapped intervention target, and example COM-B mapped policy levers (see *Table 2* and *Table 3* adapted from *Michie*[85]).

| Barriers | COM-B | Clinical Intervention Targets | Potential Policy Levers |
|---|---|---|---|
| Lack of, or limited, knowledge and education. | Capability-Psychological | Training | Guidelines, Fiscal, Regulation, Legislation, Service Provision |
| Concerns over patient safety or lack of well-accepted guidelines to make informed and safe decisions. | Motivation-Reflective | Education | Communication/Marketing, Guidelines, Regulation, Legislation, Service Provision |
| Unable to bill for time. | Opportunity-Physical | Environmental restructuring | Guidelines, Fiscal, Regulation, Legislation, Environmental / Social planning |
| Lack of peer support and networks. | Opportunity-Social | Enablement | Guidelines, Fiscal, Regulation, Legislation, Environmental / Social planning, Service Provision |

Despite a number of the included articles referring specifically to behaviour change or behavioural influences,[97,102,108] mostly in the context of their discussions, none of the articles noted any inclusion or framing of their study design or questionnaire tools around or including behavioural theories or frameworks. It also became apparent throughout my review that the sole qualitative research study[97] was able to elucidate a greater range of barriers and facilitators than many of the cross-sectional studies (see *den Boer et al*[97] in *Table 2*). There were a few cross-sectional studies that were also able to elucidate a large number of barriers and facilitators,[99,103,104] including one that included a few open-ended questions.[104] Regardless, for future research I recommend varied formats of investigation including qualitative and mixed methods studies to better contextualize the range of potential barriers and facilitators that may exist in a respective health system on this topic to better inform intervention development.

### 2.6.3 Comparison with the available literature

Qualitative and mixed-methods studies may also be able to elucidate a greater range of behavioural influences, including the behavioural gaps identified in my review from the COM-B and TDF (see *Table 4*). Elucidating a great range of behavioural influences may also support further development of focused survey tools for use within the topic area. There have been several research studies published (both quantitative and qualitative) examining physician behaviour through the COM-B in other fields that may be additionally looked to for potential further application within the patient-planetary health space.[87,110,111] Additionally, cross-analysis with other physician-specific studies into the behavioural determinants of prescribing may be helpful within the patient-planetary health space.[112] For example, despite long-standing guidelines surrounding the over prescription of antibiotics, there is still a state of overprescribing of antibiotics.[113,114] Leveraging lessons learned from other fields may create efficiencies for moving towards intervention scale up within the planetary health clinical space.

Although the results of my review highlighted some common barriers and facilitators identified in other types of prescribing-related behavioural literature (e.g., time, lack of knowledge), there were also potentially unique factors that were more specific to P-PH co-benefit prescribing (e.g., topic may be too controversial or risky to engage with patients). With this, the unique geopolitical landscape of countries surrounding climate change discourse may play a part in the perceived barriers of physicians within the clinical exam room. For example, "climate remains localized, with the USA becoming the most climate-skeptic country in the world: 52% of Americans do not believe in climate change caused by human activity…[The USA is] closely followed by Saudi Arabia (51%), Norway (50%), and

Australia (43%)."[115] By contrast, the European Union demonstrated "relatively homogeneous scores, with Italy and Spain being the most convinced of the human origin of climate change" at 75%.[115] The political orientation of physicians may also be relevant. Physician respondents with a right-wing political orientation tended to address climate change less with their patients, and were more likely to believe that addressing climate change was not their role as reported in the study by André et al[99] in Switzerland.

Despite differing views on climate change aetiology in general polls, there is a lack of research examining how patients might perceive or respond to clinical care delivery that brings in planetary health–orientated care elements within varied contexts.[101] In one study by Boland and Temte[101] that reported auxiliary patient data, only 10% of patients reported speaking to their physician about an environmental issue and its health effects. Without further inquiry into patient perceptions towards planetary health–orientated care, concerns for patient response to this approach may be minimized or exaggerated by physicians and other healthcare providers. As nurses and physicians have been consistently rated the most trusted members of society,[116] they may play a significant role in helping to educate patients on climate- and health-related impacts as it relates to their local context. By physicians having a better appreciation of patient perceptions in this topic area, coupled with access to shared decision making (SDM) tools expanded from existing efforts (see *Metting et al*[117]), a SDM communication skillset,[118] and planetary health–informed knowledge base,[38,84] climate-forward "reflective" positioning (see *Table 4*) within physician populations may be more easily enabled.

### 2.6.4 Implications for future work

Due to the differences in health-system structures that exist around the world, some barriers and facilitators may be more relevant in certain health systems. For example, being unable to bill for time was an identified barrier that came from health systems where physician billing parameters are a consideration.[99,104] Although not all health-systems have physicians formally billing under ICD (International Classification of Diseases) codes, those who don't may still not be able to log appropriate planetary-health related ICD codes into already-structured EMR (electronic medical record) systems as relevant ICD codes may not exist. Further work may then consider how and in what way ICD codes, private insurance billing, and EMR systems may influence planetary health–informed clinical work in varying contexts. Additionally, more research and educational work is needed to better clarify existing ways for physicians to ensure organizational responsibilities and patient quality-care metrics are met while carrying out planetary-health informed clinical work.

The MMAT assessment identified certain quality parameters, including a high risk of non-response bias across the included articles. Greater efforts should be made in future study designs to reduce non-response and selection bias to better ensure that subsequent intervention design is informed by the most accurate data. Lastly, although all health professional perspectives are needed on the P-PH co-benefit prescribing topic, I chose to focus on the physician population specifically for this review as they are often the main overarching prescribers within high-carbon health systems. Future investigations, however, should expand out to other health professional groups, patients, and other healthcare-system stakeholders, including leadership, while also being mindful of the potential for cross-pollinating initiatives across often siloed areas of care delivery. Additionally, due to a high proportion of studies

being based solely in high-income countries (HIC), a greater scope of research within low- and middle-income countries (LMIC) is needed to ensure implementation guidelines are context specific. Further consideration and exploration into the reduction of inefficient care through a planetary health research and practice lens is also warranted.

### 2.6.5 Strengths and limitations

P-PH co-benefit prescribing is an umbrella framing that covers many potential prescribing and clinical practices that considers both the patient's and the planet's health. As there is no set list of prescribing terms within the P-PH co-benefit prescribing space available, it is possible that I missed a prescribing term that is new, was not in English, or is not as well represented in the current literature. Therefore, this review may not be inclusive of all relevant studies. Despite this, I made strong efforts to pre-scan the literature and speak to experts in the field to ensure as many relevant terms were included within the search strategy.

I sought to gain a clearer perspective on the type and spread of available literature regarding physicians' perspectives around prescribing habits and the clinical advice given in the P-PH co-benefit prescribing context. With this, some of the barriers and facilitators that were identified in the review that had lower presence across the included articles could have been affected by the types of questions that were asked in the original study. Given this, although the barriers and facilitators in *Table 2* are listed in hierarchal order of presence within the content analysis, this may be due only to the number of times a certain type of question was asked across the survey tools. Therefore, judgements should not be made based on the frequency that a specified barrier or facilitator was identified. Due to this, I reported all results in this review even if their mention was only across a few papers to get a better picture

of the spread of factors that have been identified in the literature as barriers and facilitators across varied contexts.

Despite the limitations noted above, my review was the first time this topic has been synthesized both in general, as well as through a behavioural lens. Given the consistency in findings across geographic regions, the review has the potential to inform the development of future interventions.

## 2.7 Conclusion

This review identified key behavioural influences under the P-PH co-benefit prescribing framing that were similar across countries and clinical specialties. Behavioural influences related to knowledge, environmental context and resources, and social influences were commonly identified in the included articles. These influences should be targets for future clinical interventions such as education and training, environmental restructuring, and enablement. I additionally found gaps where studies did not report other potential behavioural influences; the use of behavioural frameworks may serve to improve future study and survey tool design. I recommend the continued development and utilization of more diverse study designs with health professionals, patients, and healthcare-system stakeholders to ensure a more holistic understanding of the individual, system, and policy levers involved in implementing planetary health–informed clinical work and guidelines. This review aided me in providing a baseline understanding of the topic which then supported the development of my interview guide for the research outlined in Chapter 3 below.

# Chapter 3 Patient-planetary health co-benefit prescribing in a Circumpolar health region: a qualitative study of physician voices from the Northwest Territories, Canada

## 3.1 Summary

This chapter presents an interview study that aimed to explore the perspectives of physicians around patient-planetary health co-benefit prescribing in a Circumpolar region in the Northwest Territories (NWT), Canada, known to be one of the ground zero levels for climate change. I carried out thirteen semi-structured physician interviews in the Northwest Territories (NWT) region between May 2022 and March 2023 using purposive sampling. I transcribed the interviews verbatim and carried out reflexive thematic analysis to identify key themes. I identified three main themes: 1) Current healthcare system does not support patient-planetary health; 2) Supporting patient-planetary health is currently difficult for clinicians; and 3) Considering change in the NWT to support patient-planetary health. Participants also noted key opportunities to move planetary health forward, with the NWT having the potential to be an innovative model for planetary health-informed change for other health systems. I discovered that the NWT health system has unique features due to its rural and remote nature and smaller population base, and I was able to identify some key opportunities for advancing P-PH co-benefit efforts.

Note: A version of this research has been published by the journal *BMJ Open*.[2]

## 3.2 Introduction

As I noted in Chapter 1, the Northwest Territories (NWT) in Canada, where the study presented in this chapter takes place, is one of the ground zeros for climate change, with

numerous climate change–related events having already stressed hospital systems and patient health within the last ten years (see Chapter 1, "Northwest Territories (NWT) region and health system"). As also noted in Chapter 1, patient-planetary health (P-PH) co-benefit prescribing encompasses all prescribing habits and clinical advice given to patients that explicitly considers both the patients' and the planet's health in the action of prescribing.[1] In Chapter 2, I presented a mixed methods systematic review on P-PH co-benefit prescribing, where one noted barrier for physicians operationalising planetary health approaches was a scarcity of resources, with a particular focus on the perceived absence of knowledge and education on the topic.[1] Despite previous survey and leadership work having explored the attitudes of clinicians on climate change and health, at the time of my dissertation there had only been one qualitative study carried out with physicians to gain a better understanding of physicians' perspectives on P-PH co-benefit prescribing-related topics in the United States.[97] This one qualitative study was also carried out with those who were already topic experts in this space, and no participants were from the general clinician population.[97] Findings in this qualitative study identified barriers including a lack of knowledge, conversation skills and guidance, and a lack of time to address the topic.[97]

## 3.3 Aims of the study

Due to only one qualitative study being done at the time of my research that was carried out with a very specific and knowledgeable participant base, I became more aware of the gaps in understanding the contextual factors that may exist behind the available survey data on the topic. The applicability of the survey data as well as the findings from the one qualitative study carried out in the US was unclear to me in how it pertained to the unique geopolitical context within the NWT region. I therefore sought in this study to gain a better understanding

of physician views on P-PH co-benefit prescribing in a region in the NWT, Canada. I additionally aimed to reflect on elements that may be transferable to other Circumpolar or global contexts.

## 3.4 Methods

### 3.4.1 Research questions

I had two research questions for this study, including: 1) What are Circumpolar-based physicians' views on their roles within planetary health discourses and practice, as well as their views on the behaviours and actions needed to incorporate planetary health within clinical practice? and 2) What do Circumpolar-based clinicians think are the influences, facilitators, and barriers to adopting and implementing patient-planetary health co-benefit prescribing in their own practices and regions? At the request of members of the local community, another research question was added on nature prescriptions (as one practical example of patient-planetary health co-benefit prescribing), and the findings for this additional research question are detailed in Chapter 5.

### 3.4.2 Overall design and research ethics

I designed a qualitative research study with the intent of centering physician voices in my investigation (i.e., person-centred[119]) while gaining an in-depth exploration of the topic that has been lacking in the current literature.[3] Qualitative approaches are particularly attuned to providing rich contextual data that can help inform future intervention development.[120] As described in Chapter 1, I took a pragmatic approach to the study to ensure appropriate contextualisation of the data, be solutions-orientated (i.e., taking a problem-solving approach to inquiry), and to be action-based.[49] I followed the standards for reporting qualitative research (SRQR)[121] for this study, and gained ethics approval from the Departmental Research

Ethics Committee at the University of Oxford (#SSHEQ_C1A_21_023), as well as from the Aurora Research Institute based in the Northwest Territories (NWT research license #: 16938).

### 3.4.3 Setting of the study

The setting of the study was in the NWT, Canada. See Chapter 1, sections "1.4.1 Circumpolar context and climate impacts" and "1.4.2 Northwest Territories (NWT) region and health system" for full description of the study setting.

### 3.4.4. Recruitment and consent

I used purposive sampling in this study to obtain variation[122] in the physician participants in regard to gender, years of practice, and the practice region within the NWT. Participants were recruited through my existing and well-established networks and contacts as well as through snowballing given the small nature of the health system in the region. Due to the small nature of the health systems in the region, I was limited in how many physicians would be able to realistically participate in the research. I estimated that there were generally around a total of 50 physicians serving the region based on conversations with local officials (specialists and family physicians); however, this number was noted to be constantly in flux with an accurate number difficult to confirm. There was additionally a potential reduction in the number of practicing physicians in the region at the time of my study due to the fallout from the COVID-19 pandemic (which was still occurring at the time of this research being carried out). With overburdened healthcare providers being a reality, I balanced my recruitment expectations with concurrent data analysis to identify when there was a high rate of duplication or recurrence of responses from participants.

Participants were sent an email inviting them to take part in the study which included a 'Participant Information Leaflet (PIL)' giving them additional information about what the study would involve. Participants were asked to respond with expressions of interest in the study, then, if interest was expressed, participants were sent the informed consent form for review by email and had the opportunity to ask me any further questions. I sent out emails to five potential participants at a time, and pending recruitment success, then sent emails out to another group of potential participants. Decisions around who to contact were based on ensuring the participants recruited had appropriate variation (e.g., gender), as noted previously. The participants were given as much time as they wished to decide whether they wanted to participate in the study before booking the date and time of the interview. No participants formally refused participation or withdrew from the study; however, out of the twenty-one potential participants originally sent emails, eight did not respond, with a lack of confirmation on whether or not four of those eight were still based within the NWT.

Due to mandatory adjustments during the COVID-19 pandemic for research in the NWT, all participants gave consent verbally and were offered the option of having their name entered into a confidential draw for a $200 donation in their name to a non-profit organization of their choice in the NWT as a thank you for the time to take part in the study. I took a record of consent, and sent participants copies of the informed consent document for their records.

### 3.4.5. Interview data collection

I carried out semi-structured interviews virtually by video conferencing software between May 16, 2022, and March 10, 2023. The interviews were audio recorded. I additionally drafted analytic memos alongside the interviews to ensure reflection of the data with regular interview debriefs being held with my supervisors throughout the data collection phase to

better facilitate an ongoing reflexive practice.[123] As I have lived and worked within the NWT, and was known to some of the participants due to the small population landscape within health care, engaging in systematic interview debriefs with my supervisors who did not have local connectivity was essential to ensure the research was continually grounded within the data being collected. Debriefs also allowed for the refinement of the interview topic guide.

The semi-structured interviews followed a topic guide made up of open-ended questions covering key topic items identified from the literature, including from the mixed methods systematic review presented in Chapter 2. Example topics within the topic guide included: views on global environmental change (GEC) in the context of their region of practice; views on health system responsibility with GECs; views on individual health providers' responsibility with GECs; and views on specific prescribing practices in relation to the health of the planet. Although participants were asked open-ended questions, flexibility was also premised to allow for the exploration of additional relevant topics raised by participants. As noted in section 3.4.1 (i.e., the additional research question being added at the request of members of the local community on nature prescriptions), questions pertaining to nature prescriptions within the NWT were added to the interview guide; these results are presented in Chapter 5.

### 3.4.6. Data analysis

I transcribed verbatim all the audio recordings; however, I carried out additional anonymization of the transcripts given the higher chance of identifiability given the small physician population in the area. Once the interview transcripts had been anonymized, I sent the transcript to the respective participant for review to ensure the level of anonymization met their comfort levels. I then uploaded the interview transcripts into NVivo (Release 1.3)

qualitative software for analysis. I carried out analysis of the data concurrently with data collection to allow for the time and space to probe into any relevant findings in subsequent interviews.

I carried out reflexive thematic analysis as outlined by Braun and Clark (2006[124] and advanced in 2019[125]) by inductive coding (i.e., without a pre-existing framework) to generate key themes. Reflexive thematic analysis is theoretically flexible, it can be used in a variety of research approaches, and it does not pretend to be neutral.[126,127] This approach was therefore not in opposition to my pragmatic theoretical orientation, as well as my lived experience from the region, and allowed me to develop, analyze, and interpret patterns across my dataset.[126] Additionally, it has been suggested that many healthcare workers would identify as pragmatists (i.e., "focus on the practical and achievable, rather than the theoretical or ideal"),[49] so viewing the data semantically helped me identify findings which could produce recommendations for practice; however, I remained attuned to latent themes throughout my analysis. I tracked the stages of coding through analytic folders as the refining, defining, and naming of themes was completed to keep an audit trail.[124,125] I carried out the preliminary coding iteratively while constantly referring back to the original transcripts with my supervisor, who was brought in for discussion and for the refining of the codes and themes. For the purposes of my research, a code was seen to be a short representation of the "salient features" of ideas that were expressed by the participants.[128] I separated out each level of coding and refinement in separate folders in NVivo (Release 1.3) qualitative software to keep an audit trail of my process (i.e., coding, generating themes, reviewing themes, defining themes). I viewed the characterization of relevant themes from a pragmatic perspective in that a theme was a meaningful, recurring pattern developed from the coded data used to interpret

that data relevant to the research question.[129] I identified supporting participants quotes to demonstrate the themes that I characterized.

## 3.5. Results

### 3.5.1 Participant characteristics and main themes overview

I carried out thirteen semi-structured physician interviews in the NWT region between May 2022 and March 2023. Ages of the participants ranged from thirty-two to fifty-nine years, with an average age of forty-four years old, and average years of practice at fifteen years. The years of practice in medicine amongst the participants ranged from two to thirty. There was a diversity of genders present with a slight dominance of females as well as more family physicians than other physician specialties represented, which is consistent with the local demographic of practicing physicians. More specific gender identification, physician specialty, as well as regional placement(s) of practice are not reported due to the overall small number of physicians in the NWT region and difficulty in ensuring anonymity by reporting these elements.

I identified three main themes and six sub-themes from the data analyzed (see *Table 6*). The themes crossed patient-planetary healthcare more broadly (i.e., the context in which varied prescriptions of clinical advice may be given), in addition to more specific elements related to prescribing, reflecting the focus of participants.

**Table 6.** Patient-planetary health themes and sub-themes identified from the data.

| Themes | Sub-themes |
|---|---|
| *Current healthcare system does not support planetary health* | -Existing health system creates difficulties in creating change for planetary health |

| | |
|---|---|
| | -Resource and capacity barriers prevent movement forward for planetary health |
| *Supporting patient-planetary health is currently difficult for clinicians* | -Planetary health–related care delivery not part of our common dialogue, culture, or training as physicians<br>-Currently overburdened physicians and the healthcare system do not prioritize the planet |
| *Considering change in the Northwest Territories to support patient-planetary health* | -Unique health system considerations in the north<br>-Patient-planetary health opportunities in the Northwest Territories |

### 3.5.2. Theme 1: Current healthcare system does not support planetary health

Participants were clear on the lack of optimal structures in place to support patient-planetary health within the NWT health system. They noted a general lack of support from within the health system itself as well as from government. With a tendency towards prioritizing short-term over long-term decisions, making top-down decisions, an overall lack of human resources to prioritize patient-planetary health, and the reality of siloed clinical disciplines, the system was stated to not be currently set up to support planetary health.

#### *3.5.2.1 Existing health system creates difficulties in creating change for planetary health*

Participants noted that the existing health system creates difficulties in creating change for planetary health. Many participants mentioned engrained organizational structures and processes in the NWT health system, including cultural barriers, and barriers from

management, which make change difficult. One participant noted regarding the barriers of improving access to Telehealth that —

> *…despite years of trying to convince the Government and people in positions of authority about the value of this, it was exceedingly hard to seemingly get peoples' attention and sell this notion. It was shocking in a way because usually, quite apart from the climatological benefits and so forth, you would think cost would be compelling. Often for governments and health authorities, cost is something that would interest them but despite that, it seemed impossible to move that agenda* [ID 1.6].

There were repeated comments on the structures and operations of the government bureaucracy. More specifically, participants noted that many bureaucratic actors in the north don't have the "same amount of investment in the long-term vision and future of the north" [ID 2.4] with many coming to work in the NWT for short periods of time before moving back south. Participants noted this lack of longer-term vision was compounded by both electoral cycles of changing mandates, as well as by health systems that are often in "this reactive process…trying to fix the fires that are burning and it's perhaps an apt climatological analogy, putting out fires, that's exactly what they're running around doing" [ID 1.6].

Participants highlighted health system management-level challenges specifically regarding the delivery of care. Physicians who reported trying to make changes in the system towards planetary health noted a lack of support.

> *…I was doing an endometrial biopsy and it kills me because you open these trays and they're meant to be disposable but there's nothing disposable about them…they're fully metal…Some of my colleagues have gotten in such trouble for trying to transport equipment…to reduce the need for people to fly [yet] it was shut down because of infection prevention and control, even though it was being done in a really reasonable way…there's very, very little interest [from the health system] in compromising at all* [ID 2.1].

The seeming lack of interest from the system to make planetary health-motivated changes was amplified by physicians acknowledging that they may have power with patients, but not as much control and power systemically to make change within the system.

> *I certainly think that we can play a role… I guess I'm a little burnt out from trying administratively to get things done, and so I feel the voice of the physician is not that powerful; I certainly don't think it is here* [ID 1.2].

> *Outside of talking about things and pushing, we have very little power to actually implement anything…So I feel we're pretty powerless. Outside of again talking and insisting on some measure to be taken, we've not been able to make any impact to anyone* [ID 2.6].

One participant noted that there is often little room for discussion, and that it is disheartening to work in a system where "no one listens". Additionally, despite there being a sense of physicians not having flexibility within their employment contracts, generally, many did believe that high-level government involvement and decisions would be needed to make change in the NWT healthcare system.

> *To get a health system to do that [focus on planetary health] is going to require, frankly, a Premier that is going to say this must be done, and probably that Premier is also going to need to be pressured by a Prime Minister who's going to say, this needs to be a countrywide thing, or some middle people along the way with an enormous amount of vision and a lot of courage, who can do this without necessarily having that pan-governmental support* [ID 2.2].

There was an acknowledgement of the current siloed approach within healthcare delivery not being conducive to systemic change within the health system. Given this, there were repeated mentions of the need to involve pharmacists and other health professionals, plus multiple other stakeholders inside and outside the healthcare system to enable change. It was additionally noted that the pandemic triggered changes within healthcare delivery quickly, but climate change has not.

> *…we just didn't do it until Covid happened and then within weeks we were doing everything virtually which goes to show we were capable of doing this. There just*

> *seemed to be either a lack of desire, a lack of imagination, lack of organizational capacity, lack of governance wherewithal within the healthcare sector to transform itself in any meaningful way, in a manner that would be beneficial to all Canadians. And so, it's quite fascinating. So suddenly all these perceived obstacles, oh we can't do that, just vanished in literally weeks* [ID 1.6].

Ultimately, there was a recognition that with complicated interjurisdictional relationships existing between the NWT and other regions; the tendency for performative actions with no real embedded accountability; high levels of institutional risk aversion; and continued top-down approaches implemented without actual implementation support; that change in the NWT often relies on a few champions working really hard—and this is not sustainable or feasible for lasting change.

#### *3.5.2.2 Resource and capacity barriers prevent movement forward for planetary health*

Participants noted that resource and capacity barriers have prevented movement forward for planetary health within the NWT. In particular, they noted a stark lack of human resources and capacity at multiple levels of the health system specifically within the NWT, although this was platformed on a lack of movement in considering creative and practical options for benefiting patients and the planet.

> *…[H]uman resourcing in the territory is a huge issue as it is but I don't think there's been enough talk around actually balancing the cost of ongoing status quo medivacs, high reliance on medical travel, high reliance on short-term contracts of people being here for short periods of time and then high turnover and all the inherent costs of that, versus getting really high quality healthcare in communities through other strategies of aggressive training programs, trying to focus on upstream determinants like good-quality primary education in the north, getting people into health careers, getting people back, recruiting them back to the north* (ID 2.4).

With high turnover and a lack of permanent long-term staff, a lack of continuity of care affecting the ability to provide planetary health-based healthcare was noted. For example, one participant noted that it is difficult to adjust prescribing in a transient workforce due to the

time needed to develop trusting relationships with patients, with another participant noting similar challenges with seeing non-patients for prescription changes due to a lack of established relationship (e.g., on-call, locums, fill-ins, etc.). A lack of continuity of care was amplified by the standard time limitations for medical visits that were perceived to make addressing planetary health difficult in addition to regular care.

Issues with improving the availability of more advanced technology that could reduce medical travel was also highlighted by some of the participants. For example, "having a CT scan, a CT scanner does not operate itself. Although you'd reduce travel, you'd need to have a proper trained technician to be able to make the machine work" (ID 2.7). With the lack of human resources noted, there is also the high cost for technology infrastructure to take into consideration with one participant noting that physicians often need to balance patient recommendations with resource utilisation considerations independent of planetary health considerations. For example, the physician might need to balance the need to send somebody out on medical travel for an MRI with the high financial cost of this travel to the system; independent of the consideration of the high greenhouse gas contribution from the medical travel itself.

### 3.5.3. Theme 2: Supporting patient-planetary health is currently difficult for clinicians

Participants stated overall awareness of climate change and its related effects in the NWT, yet, this knowledge was lacking in how to bring the climate change context into the clinical environment. Participants were also clear on wanting to be involved given the effects of climate change, however, there was a perceived lack of clarity, support, and ability to make changes at the clinical practice level with patients.

#### 3.5.3.1 *Planetary health–related care delivery is not part of our common dialogue, culture, or training as physicians*

Participants noted that planetary health–related care delivery is not part of their common dialogue, culture, or training as physicians. One participant stated, "I would say it's probably not something that's really talked about, at least to me or by me" (ID 2.5), with another participant stating, "I don't think that is a big part…I don't even think it's a small part of most health discussions" (ID 3.2). Another participant stated that,

> *I've not been in a conventional medical learning environment where this even comes up…environment or nature has not even come up as a topic and as something to consider… we have not had any formal education on the subject* (ID 2.6).

It was therefore stated that people need more knowledge, training, and resources to move this work forward. Underlying the lack of dialogue and knowledge on the topic, most participants noted, however, that there is a tricky balance between patients being the priority and including planetary health considerations with many factors to consider. Perspectives varied with one participant noting that,

> *My patient is my primary responsibility but I'm also having to balance the health of the healthcare system when we look at resource utilisation. So, balancing the health of the planet I think is again one of those factors, along with lots of other things that I take into consideration but it's not going to be primary when my patient is sitting in front of me* (ID 4.1).

Participants saw the need for a balanced perspective with a need for "making sure that there's the right balance between the benefits of the individual and the benefit to the environment" (ID 2.7). With varied perspectives on the degree to which the planet should be the focus within the clinical environment, there was also clearly an anticipation of a mixed or unclear response from patients towards planetary health-informed care. Some participants confidently expected patients would be very receptive toward patient-planetary-informed care

with the right context and communication approach, with others citing direct experience already engaging patients on the topic.

> *I suppose in the individual interactions, if you were to explain your choices of I'm prescribing this medication to you because it's been shown to be better for the environment, the middle of the road people would probably just appreciate that and say that's great, thank you…*(ID 2.5).

Others, however, were not so confident with a positive patient response: "I think, to be honest, most people would completely dismiss it, or I'd probably even get some eyerolls" (ID 3.2). There were also some participants who were less clear on what the patient response might be to these discussions: "Maybe in my soul, everybody cares a lot. They would care a lot and maybe they don't or maybe I think no, it probably wouldn't be a priority here…So, the answer is I don't know" (ID 2.7). Regardless, there was clear note specific to prescribing that patients might be nervous about change, but also for the physician to be attuned to "…patient choice and what people value" (ID 4.1) when thinking about discussing planetary health-informed choices within clinical practice. Although there is 'some' knowledge and progress being made on patient-planetary co-benefit understandings by physicians, it was highlighted that in many circumstances, changing individual physician prescribing and practice habits can be difficult and take time.

#### *3.5.3.2. Currently overburdened physicians and the healthcare system do not prioritize the planet*

Participants were very clear in that currently overburdened physicians and the healthcare system overall are not prioritizing the planet. There was a sense of day-to-day burden with regular care that makes thinking about planetary health an extra weight of responsibility. Yet, despite the work burden, many wanted to be advocates to better ensure the planet is considered in the care provided.

> *…[T]hings are so stressed now that it is a very challenging to effect long-term change, visionary change in a system which is struggling to sustain itself on a day-to-day basis. That's the difficulty. So, the airspace is limited and yet not addressing it will just make the sustainability worse and this is what's happened with climate change in all domains or biodiversity, all these planetary threats. We've backed ourselves into a corner* (ID 1.6).

> *I feel right now we're just in this total crisis of it's hard to imagine that that's going to happen any time soon [i.e., integrating planetary health], when how are we going to fill our labor and delivery shift Thursday? It doesn't feel like there's a lot of capacity for that type of engagement right now, which is depressing and frustrating* (ID 4.7).

A participant added that "…the responsibility just seems really heavy" for planetary health while a personal pet peeve is that "…[e]verything is on us. I'm like, oh this is a problem, I need to fix it. We're not going to look at the system. I need to fix it, individually patient by patient" (ID 4.1). This responsibility for the planet put onto the shoulders of physicians was also amplified through a different lens with another participant noting that when the health system does not take action for planetary health, this can cause stress for physicians who understand the environmental imprint of their existing clinical practice: "I think we underestimate the amount of moral injury that healthcare workers experience as a result of the emissions that we know that our work is associated with" (ID 3.7).

Participants did note, however, that physicians should be advocates and leaders, and lead by example despite the sense of overburden often felt. One participant stated that, "I think it should be the responsibility of everyone, including physicians" (ID 2.6), with another one stating more firmly that, "…it's not just my opinion that it's the responsibility of physicians, it is becoming the professional norm that it's going to be the responsibility of physicians" (ID 2.7). Physicians were noted to play a role in "being advocates for the planet and climate change" (ID 4.7). However, this leadership and advocacy was noted to be dependent on accepting the notion "that the health of the planet is contiguous with our own

health, and the health and wellbeing of individuals and populations is the job and the accountability and the purpose of physicians" (ID 1.6). "You can't soil the sandbox…kids get unwell and we get unwell in our sandbox [the planet]…what's the point of ignoring the fact it's littered with shit and everyone's getting sick…pretending that working on them and ignoring what's happening makes no sense" (ID 1.6).

### 3.5.4. Theme 3: Considering change in the Northwest Territories to support patient-planetary health

Participants highlighted that the NWT is a unique place that requires unique considerations for supporting patient-planetary health. There was mention of key opportunities within the region, however, that could support change within the health system.

#### *3.5.4.1. Unique health system considerations in the north*

Ultimately, participants were very cognizant that there are very unique health system considerations in the north when it comes to thinking about patient-planetary health. Participants were clear, regardless of their perspectives on other elements of the topic, that global environmental changes are affecting or could affect patient health and the delivery of care in the NWT. For example, participants mentioned lung-related conditions and exacerbations from wildfires, and changes in food availability either happening or anticipated to happen in the north amongst other things.

> *…[W]e could easily have an entire summer where it's just smoke the whole summer basically and people who have pre-existing medical issues, respiratory issues, that would basically mean they wouldn't be able to be outside of a controlled ventilated setting, like a house with HEPA filters or a well-ventilated facility where they're not exposed to the smoke…otherwise if they are, they would have an exacerbation of their pre-existing medical condition and have to be in hospital* (ID 2.4).

Participants also referenced the loss of caribou as a food source and the health impacts this has on Indigenous communities in the area in addition to the impact of changing

landscapes on local communities. They have awareness or have increasingly managed within their clinical practices mental health–related issues given the increasing number of climate-related events in the region with patients presenting with,

> *…[f]eelings of vulnerability, fear, of a lot of worries about the future, frankly of just PTSD from some of those types of situations [i.e., climate change events], and a feeling of fragility that comes from living in these communities, but also just about your life in general. You want to establish your life, you want to establish your kids, you want to do all these things in the north, and have your families here, and then suddenly there's this question, is living in the north going to be a sustainable choice, are we going to be actually able to do this, when is the next fire going to come?* (ID 2.2).

Participants highlighted in different ways that the NWT health system has a role to play given the high per capita contribution to greenhouse gas emissions and impact on global environment change (GEC). This was noted specifically regarding the high amount of medical travel that occurs in the region and the high cost associated with this, as well as the high amount of medical waste produced without effective plans or management in place to reduce waste and pollution.

> *I think it's a huge topic that probably hasn't received the attention it deserves in the territory. I don't know the exact numbers, but I think per capita, the territory probably has some of the highest greenhouse gas emissions or just sheer amount of waste by-product of healthcare of any place in Canada. Just given our remote setting, just bringing up any medical devices, it's a large expense on the road* (ID 2.4).

Yet, it was noted that the global impacts of the NWT health system in terms of reducing its ecological footprint, "globally speaking, would not even be measurable because it's such a small jurisdiction" (ID 2.2). With this, there was a clear note from participants that there are planetary health implementation challenges in rural and remote areas that need to be considered. The acute care hospital service, for example, was noted to be entirely staffed by southern-based locums. "So, this drives huge cost and consumes a lot of fuel and just energy, moving people back and forth…" (ID 1.6). Additionally, "…just patient movement itself in

terms of the medivacs and medical travel, that's a huge expense to the system but also environmentally, when you think that, at any given moment, there's planes in the air transporting patients and whether that's transporting an individual patient on a medivac plane, like a small plane for medivac, or whether it's a patient going down for services they can't obtain in Yellowknife or other small communities going on a scheduled flight" (ID 2.4). To improve access to telehealth, however, available broad band access was a large issue in the rural and remote NWT landscape.

> *They [physicians] need to be able to hear them [patients] and not have this kind of really terrible internet connection where it's all crackly and you can't hear each other, and that's what a lot of our telemedicine appointments have been like, from having been involved in a number of these. So better internet to have better telemedicine would be great, so that we don't have to fly people around so much, because we have huge distances and really old, very environmentally unfriendly planes* (ID 1.5).

Given the unique landscapes and majority Indigenous population in the region, it was also highlighted that any planetary health-informed health system changes need to be done in a culturally safe manner given the continued colonial, inequitable, and paternalistic system for Indigenous Peoples limiting progress in the region.

> *Sovereignty is attached to self-determination and power…and right now I think we're still stuck in the consultative process [with Indigenous Peoples in the region]…like we're asking Indigenous Peoples their perspective about care without actually having a pipeline that leads to [them having] power [in the health system] and them actually being able to create frameworks that work for their communities* (ID 2.7).

#### *3.5.4.2. Patient-planetary health opportunities in the Northwest Territories*

Despite the unique context apparent in the NWT, there were many patient-planetary health opportunities in the NWT highlighted by participants. Participants noted through varied perspectives that the NWT could be an innovative model for change for other health systems given the smaller size of the jurisdiction and being on the front lines of climate change. These

changes were often noted to be dependent, however, on having "…set staff in the NWT and…a compelling leader who can say we really need to do this…" (ID 1.6).

*We need to be more creative and bolder in our approaches* (ID 2.7).

To start the process of initiating change, the NWT was said to need better baseline climate-related health system assessments and monitoring (e.g., life-cycle assessments), and the leveraging of technology for efficient change. There was also repeated emphasis that system changes should be enabled and promoted to support physicians' changing their prescribing and practice behaviours instead of relying on the individual level. System change could be focused on leveraging existing programs and processes. "…[I]n fact we could piggyback off Choosing Wisely because it already has a brand, it already has international spread" (ID 2.1). Additionally, participants stated that clinical guidelines and policies should be developed and implemented in the north to facilitate more efficient change.

> *I don't think that there's any policy or guideline barriers, I just don't think that there are policies or guidelines to support it* (ID 2.5).

> *But many, many people use guidelines as instruction and so they [guidelines] have a huge impact on how people prescribe because lots of people, especially new clinicians, will just follow those [guidelines] like a recipe* (ID 2.1).

Participants highlighted the opportunity for building up local capacity for care close to home to reduce travel. This was most often noted through better access to telehealth/virtual services that gained an increasing level of comfort throughout the pandemic.

> *It's sort of a win-win thing. It [telehealth] reduces system cost. It reduces displacement of people who may at times not want to be displaced from their family or whatever and it reduces consumption of fossil fuels…and it usually shortens time to care, so you can, rather than having to move people, see them virtually* (ID 1.6).

Lastly, participants additionally noted both challenges and opportunities around drug formularies and stock (i.e., whether a more planetary health-friendly drug was listed on

formularies and/or available in stock); the use of planetary health-based prescribing statistics (e.g., monitoring the amount of MDI inhalers being prescribed versus dry power inhalers); and insurance coverage considerations for adjusting medical care to support planetary health (see *Table 7*). Participants specifically noted that insurance coverage including the non-insured health benefits program (NIHB) for Indigenous Peoples was an important variable for possible changes in drug prescribing practices that considers planetary health.

> *But one thing that comes to mind is that a lot of our patients have NIHB [non-insured health benefits program]. So, if a certain medication that's less environmentally friendly is covered, but the more environmentally friendly medication is not covered, then unfortunately you're going to have to make that decision. For NIHB patients, usually they're not going to pay money for things, because a lot of them can't* (ID 1.5).

**Table 7.** Specific opportunities for affecting change towards P-PH co-benefit prescribing as highlighted by participants

| **Opportunities** |
|---|
| There needs to be an availability of medication alternatives |
| Prescription auto substitution at pharmacy or callbacks from pharmacists |
| Default drugs on electronic medical records (EMRs) could be considered |
| Remove harmful drugs from formulary |
| Publish quarterly prescriber stats to help support change efforts |
| Exceptional access program approvals should be considered |
| Require writing down indication for harmful drugs |
| Deprescribing when appropriate for health of people and planet |

Ultimately, despite the many opportunities that were highlighted, one participant stated that they "would only be on-board…if it was coming from within a community…and I'd be happy to jump on-board…but I wouldn't be wanting to invoke something…that wasn't coming from within the community, that wasn't something they'd decided was a priority for their community members" (ID 1.2). Given this, the consideration or implementation of

planetary health-informed changes was often emphasized to require co-design considerations with patients and other health system stakeholders involved in the process. Regardless, there was some hope for progress.

> *I do hope we can adopt…that we can make that [planetary health] a priority of the health authority…we've been so impacted, as so many people across the globe have been impacted, by environmental impacts. The time is now, for sure, to be doing that. So, I'd hope that we could have that as one of the priorities of the health authority, going forward, that we always apply that lens in whatever discussion we're having when it comes to policy and resource applications, that that's always kind of a consideration every time we're making those decisions. When you keep it at the forefront and you have that as a priority, then you can make change* (ID 1.2).

## 3.6. Discussion

### 3.6.1. Summary of findings

My study identified key themes and provided insights into physicians' views around P-PH co-benefit prescribing in a region in the NWT, Canada, known to be at one of the ground zero levels for climate change. Participants made clear that current health system structures do not support P-PH co-benefit prescribing with limited resources and capacity barriers inherent. Despite this, as well as the additional challenge of being a rural and remote health system, participants noted key opportunities to move planetary health forward generally in the NWT. Participants also highlighted that the NWT has the potential to be an innovative model for planetary health-informed change for other health systems with key leadership and investments made in a region warming at 3-4 four times the global rate.

### 3.6.2. Results set within the wider context

There were many references provided by the participants on planetary health-related care options that may surround the prescription or clinical advice given to patients (e.g., Telehealth, local food sources). Telehealth itself has been found in some studies to result in significant changes to prescribing behaviour; as an example, telehealth has shown to be linked

to greater antibiotic prescribing when compared to urgent care and primary care settings;[130,131] however, another review showed there was no impact on antibiotic prescribing from remote consultations.[132] There is also a lack of cost-benefit analysis on the environmental impacts of overprescribing compared to a simple reduction in carbon emissions from reduced travel to medical visits. In the NWT where medical travel is relied upon heavily to get patients to their medical appointments, and with many one-way trips in the order of 1000+ km, the environmental benefits of systems of care like telehealth may be obvious. Regardless, greater attention is still needed to ensure guideline-compliance "between remote and face-to-face consultations to understand the factors driving" overprescribing to ensure overall benefit for patient and planet outside of simple carbon reductions.

Despite questions based on prescribing, most of the perspectives shared by participants focused on systemic structures and organizational elements that are often outside of the control of the individual physician and their prescribing behaviours. This repeated framing by participants highlighted the difficulty in considering prescribing elements alone without a co-aligning systems perspective. For example, throughout my study, the status quo of healthcare was not seen to be currently well set up for P-PH co-benefit prescribing as previously noted. Particularly apparent was the idea of what constitutes "regular" care was not being seen to be inclusive of planetary health elements within the NWT health system. With this, the innate framing of P-PH-informed care as being something that only needs to be "added" in or "considered" at the healthcare provider level alone may be problematic for getting to net-zero healthcare in the NWT and elsewhere. This was highlighted by participants noting that the current work and personal burden of physicians is already very high, so P-PH health changes should not be put on the shoulders of physicians alone—systems changes were stated to be

needed to support their work in this area. With this, it was emphasized that the health system itself is the main barrier that needs to be structured in a way to enable change. P-PH-informed care being added in or considered at the health provider level is therefore very different from planetary health being foundational and innate to the health system itself.

Overarching planetary healthcare frameworks have been previously proposed[79] that move towards thinking about P-PH health through a fully integrated systems strategy (i.e., cross-cutting); however, there have only been a few health systems around the globe that have been publicly pursuing large cross-cutting change efforts (e.g., NHS England,[133] Kaiser Permanente[134]). Work has additionally been carried out to create technical road maps for larger health system carbon reduction,[135] and aligning procurement requirements for carbon intensive medical supply chain emission;[136] however, many of these larger national and international initiatives fail to provide on-the-ground step-by-step guidance for busy physicians in clinical practice such as in the NWT. Additionally, none of these larger efforts have taken into consideration P-PH health perspectives of Indigenous Peoples who see the planet as being intimately tied to their own health.[137] With the NWT having a majority Indigenous population, previous transformational change efforts have historically struggled to make large impacts due to long legacies of colonisation and exclusion that were highlighted by some of the participants in my study. Given this, the carbon-focused net-zero agendas and operational guidelines currently out there in other geopolitical contexts may prove tricky in the NWT without concerted efforts to platform Indigenous Peoples' understandings and perspectives on the topic as was highlighted in my data. This reflection helped solidify my need to include data collection from within the Indigenous community population as a part of my DPhil research which is presented later in Chapter 4. Differences in worldviews and

approaches to planetary health may also be apparent in other cultural contexts that need to be considered within health system change initiatives at both the healthcare provider and systems levels.

Participants also shared varied perspectives regarding how patients might react to P-PH co-benefit prescribing conversations in the clinic. Some participants were very confident that their patients would be receptive of the approach to care in keeping with other related research on the topic, and others thought that patients would not be receptive at all. Other participants shared that patient response would be mixed, context dependent, and dependent on the type of communication approach used with patients. This variability in the perceived response from patients to P-PH-informed healthcare may be a large issue when it comes to successfully implementing change processes in the NWT and in other regions as well. At the time of this research, there had been no examination globally on P-PH-informed care from a patient perspective. It is unsurprising then, that physicians have varied perceptions on how patients might respond to such efforts for planetary health-informed care. There has been generalized examination and polling around climate change in the political and research context,[138] which may or may not be informative to the clinical setting. One of the few studies that did explore patient attitudes generally on climate change in the context of health in the US found that 44% of patients believed that climate change was affecting their community's health, and that patients had high trust in their physician regarding environmental issues.[101] In this same study, only 6% of patients ranked their physician as a top source of information on the topic.[101] Clearly, there is a gap in patient perspectives and response around P-PH co-benefit prescribing that is worthy of exploring. Having better awareness on patient perceptions

on the topic may also give greater confidence to physicians for bringing this type of care orientation to their practices.

Particularly striking was the high level of powerlessness that many participants felt regarding having successful change initiatives advanced within the NWT health system. This sense of powerlessness was not only specific to P-PH co-benefit prescribing but other potentially beneficial change initiatives as well within the NWT health system. On the one hand physicians expressed that they do acknowledge a certain level of power with patient interactions, but this was missing when it came to power at the systems level. This was additionally apparent by how often it was emphasized that the only way things could move forward in the region is with high management and governmental leadership moving change initiatives and mandates forward. Given participants noting issues with relying on locums and non-permanent or transient staff within the local healthcare system, the overburden physicians were faced with was in addition to feelings of not being heard within the system. Other studies have pointed towards physician burnout and professional satisfaction relating to the local work environment being a major factor.[139-141] Low work control (i.e., over work conditions and decision making) has been particularly highlighted as being a variable to physician burnout.[141,142] Given the known increases in physician and other healthcare provider burnout in Canada and elsewhere amplified by the COVID-19 pandemic,[143] ensuring system support structures are in place for physicians to advance important change initiatives such as planetary health-informed care will be needed to move planetary health work forward. Previous research has also highlighted the absence of positive institutional culture and leadership[97,98,100,103] as well as the absence of peer support and networks[98,102] as being barriers for P-PH co-benefit-related clinical practice.[3] With this, positive work culture, and instituting

peer support and leadership within systems will likely also be beneficial for successful change.

### 3.6.3 Strengths and limitations

To my knowledge, this is the first qualitative study on patient-planetary health co-benefit prescribing in a general populous of physicians. Perspectives on the topic were also captured from a physician participant base who is living and working within one of the ground zeros of climate change in a culturally diverse setting with a majority Indigenous population. Although I made strong efforts to interview a broad range of physicians practising in the small health system in the NWT, my findings may not be fully representative of all physicians in the region. Given the spread of age range, years of practice, and regional placements across the physicians interviewed, however, I am confident that the findings are grounded in key perspectives of those from the area. There are inherent limitations within qualitative research regarding the transferability of findings to other contexts. I have described the context and population in which this research was carried out so others can assess how similar this area is to their own locations and populations of interest. Given that most physicians practising in the region are usually not originally from the NWT (i.e., have grown up, been schooled, and/or have practised in other more southern Canadian jurisdictions in the past in addition to the north), I feel there may be insights gleaned from the findings in this study to consider in other contexts, particularly in other rural and remote areas. A variable that also may be considered both a strength or limitation in the context of my research findings contained within this chapter is my own existing knowledge and connections with this region prior to initiating the research. Leveraging my positionality and placement within the research to better understand the context as well as cultural nuances within the region provided an opportunity for an

appreciation of how the results could be situated in the wider context. The perception of bias on the other hand could be seen to be a limitation that was in part mitigated by regular supervisor debriefs throughout data collection and analysis.

### 3.6.4. Implications for future work

There is need for further investigation into physicians' views of P-PH-informed care in other varied geopolitical contexts with a particular focus and emphasis on moving towards implementation research and the development of active climate mitigation and adaptation interventions. Physicians are, however, only one component of the health system. For a more holistic understanding of the health system state and needs in response to P-PH-informed intervention development, other stakeholders should be engaged on this topic. This could include patients, Indigenous Elders and communities, and other health system stakeholders in the NWT and beyond.

With my findings within this chapter highlighting unique health system considerations in the NWT, which included the majority Indigenous population in the region, and the need for planetary health-informed health system changes to be done in a culturally safe manner, I recognized the importance of further investigating the perspectives of Indigenous Peoples within the region as part of my DPhil. As Indigenous Elders are key leaders in communities of the NWT, and looked to for guidance, including by the local health system, I developed a study to better understand their perspectives which is further outlined in Chapter 4. As also noted within the methods section for this chapter, there was an additional research question added, and consequent additional questions added to the interview guide to better understand one specific P-PH co-benefit prescribing practice that is outlined further in Chapter 5 (i.e., nature prescriptions). Building on this, there is further opportunity to additionally investigate

other more specific P-PH co-benefit prescribing practices in future work (e.g., planetary health diets). Lastly, given the repeated highlights of the importance of moving towards changes at the systems level in both Chapters 2 and 3, outside and in addition to health professional-level changes, I recognized a need for more research to better understand the current state of health systems change for planetary health. I was therefore able to plan for a study examining planetary health frameworks that could better inform systems-level change processes which are further outlined in Chapter 6.

## 3.7. Conclusion

The NWT health system has unique features due to its rural and remote nature and smaller population base. Despite this, my study identified some key opportunities for advancing P-PH co-benefit prescribing efforts. Key opportunities and leverage points identified included: ensuring multi-level resource and capacity support to carry out baseline climate-related health system assessments in the NWT with ongoing accountability monitoring; governmental and health system policy review; work with federal and other relevant partners (e.g., pharmacists) to update drug formularies, drug stock, and insurance coverage to align with planetary health-informed care; promote Indigenous and patient leadership within the healthcare system; and the development of a NWT planetary health secretariat to advance education, advocacy, and action across governmental departments. The identified opportunities may be considered in future intervention, organizational change, and policy-making efforts with potential relevance in other settings. Overall, this chapter provided me baseline information on the views of physicians from the region on the topic. The views shared also included the importance of ensuring changes are made in a culturally safe manner given the majority Indigenous population in the area as previously noted. My findings in this chapter supported the

development of the research outlined in Chapter 4 which is focused on gathering perspectives from Indigenous Elders.

> *So, we are one of the most rapidly warming places in the world…We, therefore, have some of the most striking patient stories and despite the fact that Indigenous Peoples in northern Canada have certainly not contributed a per capita amount of greenhouse gas emissions to the problem that we're now facing, we do have an opportunity to show leadership by demonstrating that, as extremely affected people, we take this seriously and we're going to lead by example* (ID 3.7).

# Chapter 4 Indigenous Elders voices on patient-planetary co-benefit prescribing: A qualitative and relational systems mapping inquiry

## 4.1 Summary

In this chapter I present a study in which I explored the views of planetary health-informed health system changes within the NWT from the perspective of Indigenous Elders. Indigenous Peoples and their knowledge systems are increasingly being looked to for solutions regarding climate change, including within clinical health-care settings. Indigenous Elders specifically are noted knowledge keepers within their communities, and are often looked to with great respect for their Land-based knowledges as it pertains to planetary health approaches. I therefore held a sharing circle with Indigenous Elders, and then inductively coded the data to generate key concepts and themes. I then used the key concepts and themes identified to characterize their relational connections to one another in the format required for the creation of a systems map. I characterized four interconnected themes following a cyclical pattern that were also depicted with the relational systems mapping, including: 1) the past and how we got here; 2) where we are now; 3) where we need to go in the future; and 4) our reflections. My findings clearly demonstrated that the planetary health-related concepts discussed within health systems cannot be disconnected from the context around them. Overall, within my findings, health systems were stated to be currently devoid of any environmental context or consideration.

**Note:** A version of this research was in review with the journal *Lancet Planetary Health* at the time of this dissertation being submitted.

## 4.2 Introduction

Although my findings in Chapter 2 highlighted general physician barriers and facilitators to adopting P-PH co-benefit prescribing, it was unclear how relevant these findings were to the NWT. My participant focus for the research carried out in Chapter 3 were physicians in the NWT, however, incorporating more diverse views on the topic within the NWT was imperative for thinking about future change efforts. I therefore chose to focus on Indigenous Elders given their very important role in the communities within the NWT, as well as Chapter 3 highlighting the importance of taking into consideration the unique context in the north given the majority Indigenous population. Additionally, with humanity's compounding global crises risking survival itself, Indigenous Peoples and their knowledge systems are being increasingly looked to for solutions.[144-146]

Indigenous Elders in particular are noted knowledge keepers within their communities, and are often looked to with great respect for their Land-based knowledges. Indigenous Elders' knowledges are often strengths-based—uplifting the inherent strengths and positive attributes within communities—while being focused on upholding relationality and the centring of good relationships.[147] Elders also hold practical health knowledge relevant to health systems and the care of patients themselves with encounters with Indigenous Elders being associated with clinically and statistically significant reductions in depressive symptoms and suicide risk among Indigenous patients.[148] Due to the multi-layered nature of Indigenous Elders' knowledge and lived experience, their voices are particularly important when it comes to thinking about planetary health integration within health systems through a strengths-based approach. Despite this, to my knowledge, there has never been research carried out to gain the perspectives of Elders on the topic of planetary health and health systems. Indigenous Elders

have been engaged on other health-related topics, however, including as examples, Indigenous strengths-based approaches to policy and practice in healthcare and health professions education,[147] as well as on planetary health more broadly.[137]

Western-based climate change–related literature has often placed Indigenous Peoples within the 'vulnerable' category of climate risk. This 'vulnerable' characterization has often been perpetuated throughout the health research literature feeding into high levels of deficit-based research that commonly includes the problematization of Indigenous existence.[149,150] Attention and ongoing use of the term 'vulnerable' instead of the more appropriate 'marginalized' categorization continues to minimize the inherent and actual strengths of Indigenous communities within combined global crises, and can lead to a broadly assumed view of weakness within Indigenous communities.[151] The 'vulnerable' characterizations also risk the continued triggering of White saviourism towards Indigenous issues, with Indigenous Peoples assumed to be in need of Western guidance and solutions. Instead, it is important to acknowledge clearly that Indigenous Peoples are currently *marginalized* within the climate-change crisis due to the structural factors that continue to perpetuate inequities.[152] This marginalization extends to health systems where Indigenous Peoples face some of the poorest health outcomes on the planet as a direct result of colonisation and ongoing racism.[153-155] It must be acknowledged clearly that health systems have purposely excluded and vilified Indigenous knowledges and healing traditions, which have inherent connections to the health of the planet.[156,157]

## 4.3 Aims of the study

As noted in Chapter 1, P-PH co-benefit prescribing is a framing denoting the prescribing habits and clinical advice given to patients that explicitly considers both the patients' and the

planets' health in the action of prescribing.[1] P-PH co-benefit prescribing is seen, however, to sit squarely within the respective health system in which it operates, yet, how this approach is seen from an Indigenous lens is not well understood. After exploring physician views more widely within my Chapter 2 review, and then interviewing NWT-based physicians on the topic in Chapter 3, I saw the need as noted previously to gain the perspective of Indigenous Elders within the NWT region. Given this, I set out to explore views on planetary health-informed health systems change broadly while being inclusive of P-PH co-benefit prescribing within the NWT from the perspective of Indigenous Elders.

## 4.4 Methods

### 4.4.1 Research question

My research question for this study was: What are Indigenous Elders views on planetary health-informed health systems change in a Circumpolar health-care landscape? As noted in the methods section of Chapter 3, at the request of members of the local community, another research question was added on nature prescriptions that was inclusive of also gaining perspectives from Elders. The findings for this additional research question are detailed in Chapter 5.

### 4.4.2 Overall design and research ethics

I designed a qualitative study rooted within a decolonised research paradigm. The decolonised research paradigm platformed decolonial theory and Indigenisation, which involves a "collaborative process of naturalizing Indigenous intent, interactions, and processes and making them evident to transform spaces, places, and hearts".[52] A decolonial approach allows for Indigenous "traditional protocols"[13] to be respected, honoured, and followed while ensuring that research is able to be experienced as "ceremony",[53] which is in and of itself a

critical action in reciprocity (i.e., a cyclical obligation)[54] within many Indigenous communities. I used a "sharing circle"[158] to bring together the sharing of stories and perspectives from the Elders while respecting traditional cultural protocols.[159] A decolonial research paradigm and approach still allows room for bringing in Westernized research approaches; however, in my case they were done to supplement the Indigenous approach within my inquiry. With this, I still followed the standards for reporting qualitative research (SRQR),[121] and gained ethics approval from the Departmental Research Ethics Committee at the University of Oxford (#SSHEQ_C1A_21_023), as well as from the Aurora Research Institute based in the Northwest Territories (NWT research license #: 16938).

### 4.4.3 Setting

I carried out my sharing circle in a virtual setting with Indigenous Elders living in a Circumpolar region—the NWT, Canada. See Chapter 1, sections "1.4.1 Circumpolar context and climate impacts" and "1.4.2 Northwest Territories (NWT) region and health system" for full description of the study setting.

### 4.4.4 Recruitment and consent

Purposive sampling was used in this study to ensure maximum variation[122] of the Elders by the five regions within the NWT and by gender. I recruited the Elders through existing and well-established networks and contacts known to me. My positionality within the Indigenous community created a large advantage for recruiting Elders, which can be challenging for outside researchers. For the purposes of this study, Elders were not defined by age, but rather the Elders were recognized as Elders "because they have earned the respect of their community through wisdom, harmony and balance of their actions in their teachings."[160] I initially sent participants an email inviting them to take part in the research. The email

included a ‘Participant Information Leaflet (PIL)’ giving them additional information about what the research would involve. Some of the Elders preferred a phone call, which I honored. If interest was expressed for participating in the research, I emailed the informed consent form to the Elder with a follow-up phone call to review the consent and answer any remaining questions. The Elders were given the time they needed to decide on their participation in the sharing circle. With COVID-19-related research adjustments mandated by the local research licensing body at the time of approvals, all Elders gave consent verbally over the phone. I then sent each Elder a copy of the informed consent document for their own records. As per traditional cultural protocol, an Elder honorarium was provided as a gift for participating in the sharing circle.[161]

### 4.4.5 Sharing circle data collection

I carried out the sharing circle[158] virtually and in English by video conferencing software on February 28, 2023. One Elder was unable to attend the scheduled sharing circle, so I engaged them by phone afterwards for their contributions. The sharing circle was audio recorded with permission and approval by the Elders. As I was known to all of the Elders, the data analysis stages were shared with the Elders along the research journey to ensure the data was firmly grounded in the perspectives they were comfortable to share. The sharing circle followed a flexible topic guide made up of open-ended questions; however, given the decolonial approach, Elders were given the space to bring in any discussion points they felt were relevant. As I noted in section 4.4.1 (i.e., the additional research question being added at the request of members of the local community on nature prescriptions), questions pertaining to nature prescriptions within the NWT were therefore also added to the sharing circle topic guide with the presentation of these results detailed in Chapter 5.

### 4.4.6 Data analysis

I transcribed the audio recordings verbatim with additional anonymization carried out given the close-knit community that exists in the NWT. I then uploaded the sharing circle transcript into NVivo (Release 1.3) qualitative software for analysis. I adapted the analysis process described by Kiekens et at[162] as follows:

1) Inductively coded the data to generate key concepts and themes in NVivo (see the methods section within Chapters 3 [i.e., section: "3.4.6 Data analysis"] for details on the coding process also used for this data set]);

2) Using Excel 365, the key concepts identified from step 1, their descriptions, and their relational connections to one another were recorded in the format required for creation of the systems map. Connection types were labelled in Excel 365 (i.e., +/-) representing the polarity of the connection. For example, a + connection indicates that both concepts evolved in the same direction (i.e., when the first concept increases or is present, then the connected concept will also increase or be present). A - connection type indicated that both concepts would evolve in the opposite direction (i.e., when the first concept increases or is present, then the connected concept will decrease or not be present). I determined the directionality from the data using Indigenous knowledge on the topic, and also verified the directionality with a few of the participants to ensure accuracy from their perspectives;

3) I then uploaded the Excel 365 data to KUMU, an online systems mapping tool,[163] to enable the creation of my relational systems map;

4) I then formatted the relational systems map and documented key metrics of the systems map, including such elements as degree, closeness, and betweenness, which were calculated by the software.

I carried out relational systems mapping to more easily depict and connect the concepts and themes identified in the coding stage to the topic and research questions at hand. As Indigenous knowledges are often shared holistically and symbolically, with a large focus on the 'context' of the topic instead of merely the topic itself (common in oral knowledge transmission formats inherent within Indigenous communities), the systems mapping supports Western knowledge audiences in more easily seeing how what can appear at first glance to be disparate topics actually connect back to elements of planetary health within health systems. A decolonial approach requires sharing the results of inquiry within the worldview of Indigenous Peoples, which often doesn't conform to the linear research methodological approach where, as an example, 1+2= 3. Instead, stories are often shared to elucidate why 1 is the way it is and why 2 is the way it is so that 3 doesn't need to be explicitly described as the calculation becomes inherently understood. I recognize that this can be difficult for Western knowledge audiences who have not had exposure to Indigenous ways of knowing; however, I encourage readers to approach this work not wondering why the discourse may in some cases not appear to be connected to my research question, but instead to think about why the Elders are saying that it is. As there is not space here to describe every element or concept that is shared in depth, my work is therefore meant to be a first view into how Indigenous knowledge systems operate in the context of Indigenous research applications around topics related to the health of people and planet.

## 4.5 Results

### 4.5.1 Participant characteristics and overall themes

The sharing circle I carried out was made of up six Indigenous Elders ($n = 3$ female identifying, $n = 3$ male identifying) each being raised in a different geographic area of the

Circumpolar north of Canada. Due to cultural reasons, ages are not reported; however, participants are recognized Elders from their respective communities. I characterized four interconnected themes that were shared by the Elders that followed a cyclical pattern connecting the past to the future (see *Figure 4*): 1) The past and how we got here, 2) Where we are now, 3) Where we need to go in the future, and 4) Our reflections.

As reflections were shared by the Elders, the past is always a moment away (i.e., once you speak, your words are now in the past), so there was opportunity to continue to be in a reflective state based on what had been shared in any given moment by other Elders. This understanding exemplifies Indigenous cyclical understandings of the world in real time (see *Figure 4*). It is important to additionally note that it can be culturally inappropriate to alter the words of Indigenous Elders.[164] With this, the original narratives shared within the sharing circle have been kept intact as much as possible within the following results section.

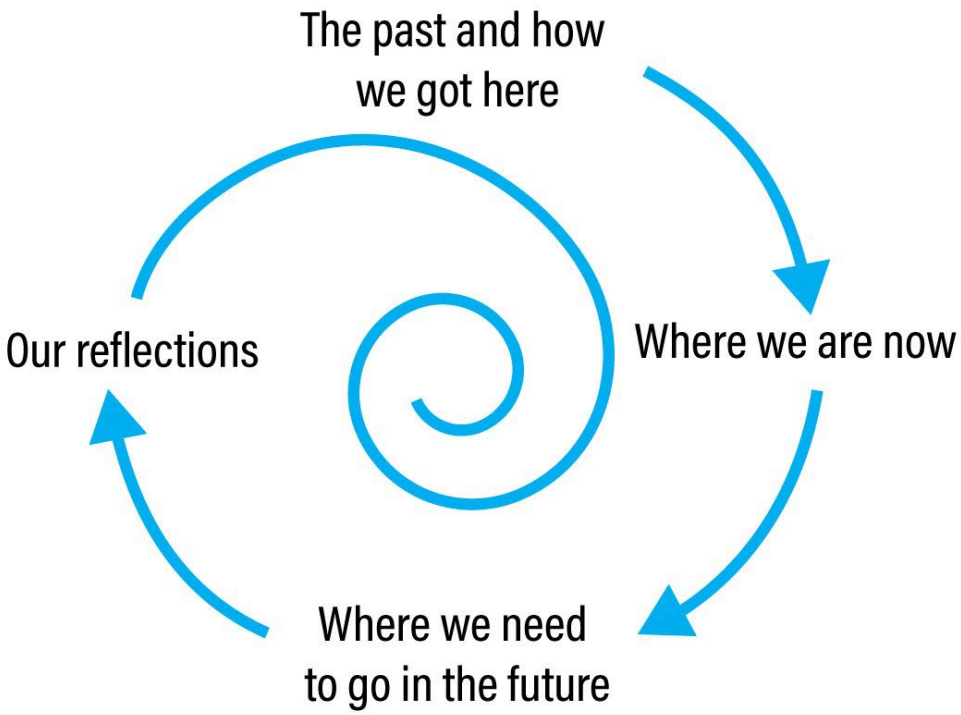


**Figure 4.** The main themes identified when discussing planetary health-informed health system changes depicted cyclically to denote the ongoing nature of the conversation in a constantly evolving world.

### 4.5.2 Theme 1: The past and how we got here

The context that healthcare sits within was noted to matter for planetary health. For example, there were many references to colonisation and its effects on Indigenous Peoples and their ways of life. Colonisation was noted to have imposed "the kind of laws that *they* [White Settlers] understood and brought from where they come from", with these colonial laws and policies not benefiting humanity or the planet. Colonisation attempted to forcibly disconnect Indigenous Peoples from the Land and environment, while also creating health systems that are disconnected from the health of the planet.

> *They tried to impose those laws on the earth, from where we were, where we are on Mother Earth.*
>
> *So those mandates, policies, they don't mean too much to us because the laws that we come from is coming from the Mother Earth and those laws are more powerful. The Natural Laws are more powerful than manmade laws. So, the sooner we see that, the sooner we understand that, I think it's going to be better for everybody concerned.*

Stemming from colonization was the residential-school era in Canada where Indigenous children were forcibly and often violently removed from their families and communities to be assimilated into colonial society. Residential schools platformed environmental disconnection while forcibly removing Indigenous Peoples as key stewards of the Lands around them. One Elder noted that, "The policies were there to get rid of us but we're still alive". Another Elder noted that, "There was a great interruption with residential schools and colonization, so we lost quite a bit of that oral understanding of our relationship

with the air, with the land, animals, that sacred relationship with our culture and our language". Despite the residential school legacy, there was note of the resiliency of Indigenous Peoples in keeping their connections to Mother Earth despite the continued lack of health-system connection to the planet: "So here we are. We did the best that we can."

Built off the back of colonization, residential schools, and their lasting impact and structures on law and policy in Canada were noted to also be reflected within the Canadian healthcare system.

> *All the procedures done by the doctors and nurses are all from those laws, from those procedures, from that school of medicine they are graduating from…*
>
> *The policies are basically manmade and the Federal health system, the provincial health system, the NWT health system, it's all based on manmade policies but they don't address our concerns. …the laws and the policies of the Federal, Provincial Government, they're not benefiting us…We have to live with the effects of things done in the past.*

There was specific note by one Elder when it came to the current colonial structures of the healthcare system which is the context where prescribing takes place within. They noted that there can be a specific Indigenous interpretation of the word 'systemic' in the field of health that can be exemplified through the shared history of non-Indigenous and Indigenous Peoples. The Elder noted, however, that nobody bothers explaining what systemic really is in the context of Indigenous Peoples in Canada. They noted there is a need to expose what 'systemic' actually is, and create a discussion and awareness of how to describe a systemic problem given its relevance for health of people and the planet: "It's protecting our ability, our rights to define what systemic is."

Essentially colonisation created the "*Indian Act*" (see here for background on the *Indian Act*[165]), which was the legal foundation for residential schools and the creation of Indian hospitals which were entirely disconnected from Land (see *Figure 5*). The *Indian Act* is

still in place today where "[we are] like wards in a ward system" giving "them that ability to create a system for Indigenous Peoples," that is not congruent with planetary health. The system still allows for control, "…they have total control" over the medicines, the prescriptions, the hospitals, the overall treatment, and even the education. Despite increasing recognition of Indigenous Peoples and their knowledges, this was noted to only come with an explicit legal agreement with the Government that usually only comes through the courts (see *Figure 5*). These agreements when made, however, don't currently come with complete Indigenous control of their own healthcare, which means Indigenous Peoples continue to receive clinical care that is divorced from the health of Mother Earth. In summary, colonisation created the *Indian Act*, which then gave government authorization for residential schools and Indian hospitals, which perpetuated a health system where there is ongoing total control over Indigenous Peoples' health down to the medicine and prescription levels. When Indigenous control is attempted, it usually can only come through the courts, but even if that is successful, it hasn't yet resulted in Indigenous Peoples having control over the type of healthcare they receive. With this historical and contemporary context in place, Indigenous Peoples and their Earth-centred knowledges are therefore divorced from the delivery of healthcare, which means an ongoing disconnection from the health of Mother Earth down to the prescribing level (see *Figure 5*). This summary was noted to be an example of an Indigenous interpretation of the word 'systemic', whereby a modern planetary health-informed clinical approach can only be seen within the context in which is it situated.

> *That's a rough and tough…[way]… of defining…[the]…systemic issue that we're dealing with.*

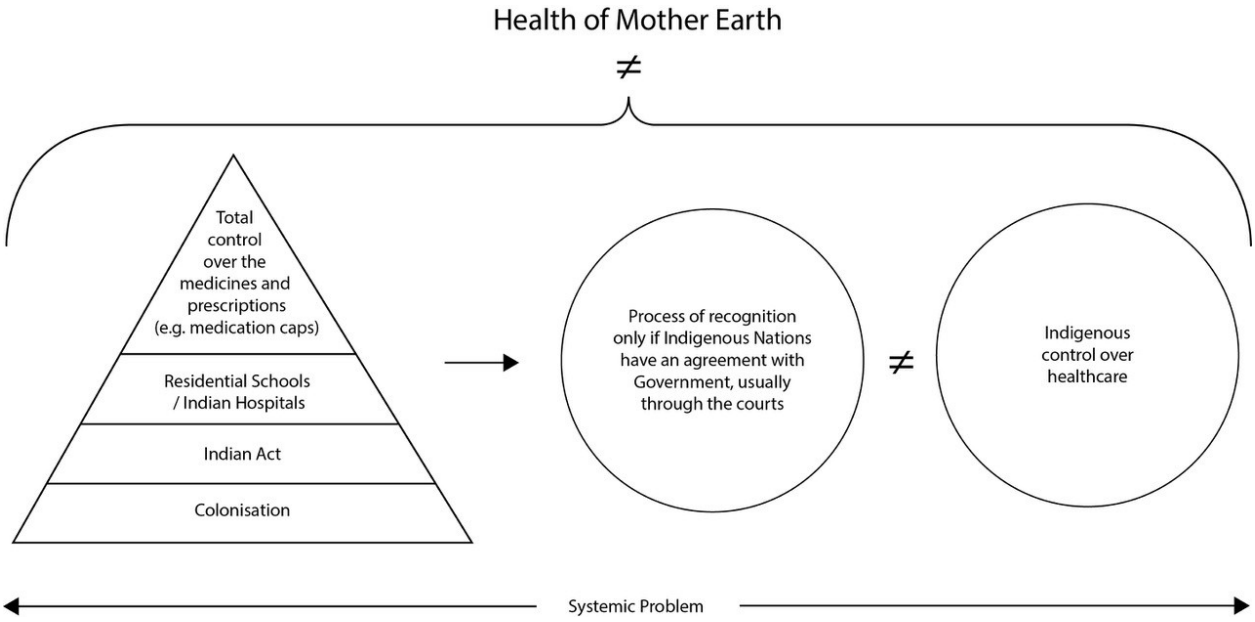



**Figure 5.** Symbolic depiction of the systemic issues that Indigenous Peoples are dealing with when it comes to Indigenous health and planetary health-informed health systems and care delivery.

**Indian as a term is still used in Federal government policy in Canada; however, it's no longer an appropriate reference for First Nations/Indigenous Peoples within Canada.*
***A triangle is used to symbolically denote colonisation as the foundation to many of the historical and contemporary events leading to non-Indigenous control over elements of the health system. The circles symbolically represent the hope for Indigenous recognition and control over their own health systems from an Indigenous worldview (i.e., a circular worldview) for the health of Mother Earth despite that not being the current reality.*

These systemic issues were noted to keep Indigenous Peoples separated from the Land as a healing place within healthcare environments. It was noted in the past and the present that, "Elders say go to the land to get healed". So, we need "…to be able to bring out our laws, our practices, best practices, bring out our protocols because protocols are really important too [within healthcare environments]. Those are the rules, coming from the land, from Mother Earth." Due to the residential school legacy and ongoing structural elements of colonization, "…our people are more concerned about survival", however, in the past "we were the happiest people… even though we didn't have much," as we were connected to the Land for health and wellbeing. One Elder noted that, "We've already been doing this

ourselves though taking care of the Earth", and another stated that "We didn't invent the words, they go back thousands of years" in reference to the Mother Earth healing knowledges that are inherent within Indigenous communities and that should be forming the basis for planetary health-informed health systems.

> *It's a way of life for us and we have all our stories out there, the Creation stories and all our culture and language comes from there, comes from the sound of animals and then we communicate like that with each other.*
>
> *We didn't even have to be taught when we were growing up. When I was little, we see it, we learn by watching. It was natural. We didn't even have to be taught by our parents because we did it because we live it. Our parents didn't even have to explain what was good for us.*

Ultimately, being able to place the current and/or potential structures of planetary health-informed healthcare, including prescriptions, within the purview for Indigenous Peoples, requires a clear look to the *past* to understand the systemic issues that continue to be in place. These systemic issues continue to restrict the health and wellbeing of Indigenous Peoples and the Lands they come from. As noted previously, the context that healthcare sits within matters for planetary health.

### 4.5.3 Theme 2: Where we are now

Despite the historical and contemporary challenges inherent within the delivery of healthcare for Indigenous Peoples, there was a sentiment that despite everything that has happened, "We're not extinct, we're very much alive," and able to contribute towards a better world. Yet, the environmental situation currently with the NWT region "has layers and layers of complexities and there's no easy answer to any of it". The Elders noted that climate change is affecting them now with changing weather affecting the caribou, hunting, and the ice is coming in late, which delays the fishing times.

> *I always go back to my dad. My dad passed away when he was 98, about five years ago now, and he always had talked about our weather, our climate is changing, and he could see it… like he said he used to look at the clouds and read the weather and he wasn't able to do that anymore when he became an Elder [due to the changing climate].*

One Elder noted that the colonial life is not the life we as Indigenous Peoples were supposed to have right now, and that climate change is exacerbating the effects of colonisation with effects going to be felt by their children and grandchildren. For example, "climate change is going to affect our Indigenous rights. Who knows how long we're going to be hunting because climate change is going to be devastating if we continue what we do". Everything that is happening with climate change was noted to be relevant to Indigenous Peoples' lifestyles. It was highlighted, however, that Indigenous Peoples are impacted more by other people's actions that cause climate change then Indigenous Peoples impacting the environment themselves given the small population and close connectivity to the Land. Nonetheless, climate change was noted to be a pressing, important, and a paramount matter that involves Indigenous Peoples' health and the future for all.

> *Biodiversity loss and climate change is going to affect us all—the plants, the water, the air, everything, including ourselves.*

The situation within the governmental health system was also noted to be complicated in relation to bringing in understandings of climate change and planetary health. One Elder noted that "[e]verybody understands that balance of nature but what they do and what they learn in schools, in medical schools, it doesn't jibe with that". Another noted in this regard that "…it's going to take quite a long time for us to be able to really be understood".

> *It's that wellness and equilibrium that we understand and then in the biomedical field, they just want to kill the disease and treat the disease and there's no room for the earth, how it's destructive to the earth…. There's a lot of chemicals in the hospitals, even with the medications.*

The health system was therefore seen to be clearly Western-based and focused. For example, even though a "bush kind of drug" (i.e., Indigenous medicine) might work better for someone it was not accepted within the Western system. The focus of even being able to engage with a prescription was noted to be enabled through Western-defined certifications and authorities that ultimately are situated in earth-destructive economic systems.

> *But I just want to take it back to what I was saying earlier about prescription, that the prescription is really tied to the economics of the system that has been developed and is very Western. If a prescription is going to be made, it's got to be somebody that's authorised with some certificate or a business license, or, have a link to the system to say that those are the service providers.*

Many Elders did highlight, however, that thinking about planetary health within the health system was somewhat difficult when Indigenous Peoples are not even being treated well to begin with by the system. It was noted that if Indigenous Peoples themselves are not being treated properly within the health system, how can the planet be treated properly, as Indigenous Peoples are seen as an extension of the Lands around them. "It comes to the point where we feel like we're being ignored as a people, although in the medical system, we are the patients with rights". It was stated that many people in the north are concerned with the level of care, staff turnover, and increasing diseases that create less bandwidth for addressing other issues regardless of their importance. When all the dimensions of Indigenous health are not being sufficiently addressed (i.e., physical, mental, emotional, spiritual), there is less capacity to try and address systemic issues.

> *… it's more than…the NWT Healthcare system…We have all these movements for self-government and improving the economy but what good is that if we're an unhealthy society? And it's not only the physical health, it's the increase in suicides and the young people and mental health concerns.*

It was noted that some doctors don't even go into the Indigenous communities, never seeing what it's like on the lake, never been out in the bush, or in a tent, or hunting, yet they

are treating a patient base made up of a majority of Indigenous Peoples who have close connections and understandings of the health of the Land. One Elder highlighted that transient healthcare providers also make it difficult to get to know people with the providers and hospital systems being qualified in a quantitative way (e.g., through numbers, data, and variables), despite Indigenous patients being in a qualitative and subjective way (e.g., through stories and relationships to Land). Despite the ongoing and baseline challenges noted within the NWT health system independent of the planet's health, it was clearly understood that as a rural and remote health system, there are high amounts of energy needed for the health system (e.g., medical transport, cold-weather environment): "Right now, we are sending a lot of people out for medical care". It was also understood that there is currently a high amount of waste produced, which was noted to stem from needing "sterile" facilities made worse from the strict infection prevention measures during the COVID-19 pandemic.

> *I think a lot of it is not only the concern and responsibility of our healthcare but also the mentality that general people have in terms of thinking that we have to have a big sterile environment. I don't think we need to.*

There was also not much stated confidence for the government to act around planetary health within the health system.

> *Probably almost 100% of any kind of study involved in Government, politics, people, social conditions, end up in a report because the Government wants people to know that they are right on the job. That means they don't necessarily have to do anything about it. They have to appear that they're doing something about it and that's as far as it goes.*

Ultimately, despite the current state of affairs with the current lack of movement towards planetary health, one Elder noted they are grateful to still have a place to be in a quiet place and eat traditional food and reflect on the Land: "I'm learning every day". Another noted, that "we understand in our DNA, in ourselves, that we can be better taken care of

medically in our minds, in our bodies from the medications from the land, like from the plants". The idea of what is deemed a 'treatment' or prescription' was therefore expanded to include having an ongoing relationship with the Land (e.g., Land-based approaches to health and wellbeing). The importance of an ongoing relationship to Land being a form of treatment also meant there is an inherent responsibility both within and outside of health systems to be stewards of the Land.

> *This is our homeland, that's where we come from. This is our Indigenous unceded territory and we have a responsibility to protect our land, our animals, our plants, our earth in our part of the world.*

### 4.5.4 Theme 3: Where we need to go in the future

> *[T]here's that Western way of the hospital, the way they set up and what [we're] talking about with the environment, a prescription for the earth's planet, like the Planet Earth survival, our maintaining the Earth's health in a good way, that's really interesting.*

Many of the Elders were very clear on what they felt is needed to get both the health system and the planet back on track for Indigenous Peoples and for non-Indigenous communities at large. "It's important that they [doctors and nurses] understand that these patients, they're coming from our Land here and that we had our own medicine and our own water, clean water and everything was there for us, and then these Western ways came in…Sometimes it's very damaging in every which way." Given this, Indigenous involvement was stated repeatedly to be important for community and planetary health into the future. "We've just been that dormant too long and I think lo and behold, we are very much alive here and I think we have a lot to contribute to the world". "We can work with the medicines in a spiritual way and at the same time, we are practical too. Our Elders were practical. To bring practical solutions to community problems, we can do the same thing over here, bring practical

solutions to the world, to the Earth. It's nothing new for us. We've been doing that, and from my understanding too, for thousands of years."

Despite the ongoing lack of recognition of Indigenous Peoples and their knowledges within health systems, it was noted that there is increasing interest from non-Indigenous Peoples on how Indigenous knowledges may contribute to climate solutions more broadly given the scale of the planetary health crisis that humans are currently in.

> *We have to take it into our hands because we are at the wheel right now, whether we like it or not. If there's any change going to happen, it has to come from us because this is our time, this is our time in history where we're taking new steps, we're taking bold steps.*

One Elder noted that change is going to be hard but it's time we start pushing for a different way of doing things. It was stated that Western health professionals should also work and learn from Indigenous ones to help them understand the Indigenous way. "I think I'd like to see more Indigenous People to start teaching about our health system, how it was before and how it's been impacted by lack of education, being colonised so much in the past." One Elder noted that what they say is important as it was passed down through generations.

> *It's not only our words, we didn't invent that. We got that understanding from our Elders. It goes way back thousands of years and I think we still continue on and we pray that we're going to continue that information stream into the future because it's very important that we do so.*

In beginning the work for planetary health–informed systems, it was noted to be important when working with people to stick with common interest and common ground; however, starting the work with traditional Indigenous protocols and ceremony is important "because protocols are really important," as those are the rules that outline how we need to work with Indigenous medicine ways that come from the Land, from Mother Earth. "We need to put ourselves right beside the hospital with all our being, knowledge, and energy." "We

need to be present. We need to show ourselves within the system". There was a stated need to hold council about our health to share and learn, using Indigenous knowledges, but ultimately, "we can collaborate, or we can go hand in hand or metaphorically canoe side by side, because the science that people talk about is not going to cut it anymore, just by science itself and the Western ways".

There was specific note on the need to include the planet within NWT healthcare; however, "how I'm not really sure but that is, I think, a very good question to start us off on. I think we just need to pose more questions for us to really think about that question". There was clarity on the need for advocacy and education for people on this topic, and some more specific recommendations for consideration within the health system were given by many of the Elders (see *Box 1*). "There is a need to address "common and pressing concerns".

**Box 1.** Where the health system could consider moving forward planetary health-informed system changes as noted from the Elders' sharing circle.

- Start with things that don't cost much, do things in steps
- Train community people to be health leaders for both community and planetary health
- Care closer to home for things that can be helped
- Better coordination with medical visits to reduce travel need
- Do more telephone or zoom calls with patients
- If there is a medication that would be less harmful on the environment, then we should go that way
- Having a place by the hospital where people can see us cooking fish on the fire and singing the songs [that connect us to the Land around us]
- We need co-design in research, so we are involved in climate-change work
- We need research on climate change from people up north who know how to read the land through traditional knowledge systems approaches

One Elder was firm in noting that we need to "retain the language and the culture and ways of life because I think that's the key to the understanding of spirituality. That's the key to understanding our connection to the Land, to the air, to the water, to the plants—everything out there". The facilitation of the ongoing connection to the Land was repeatedly premised on the need to invest in Indigenous young people now and coming. "I think young generations in the future, they deserve better. They need to have more acknowledgement…they need to be more respected because we are human beings. We come from the Earth, we come from the Creator, our world". The young people were stated to be the ones who "…can take that over. They can be that future. Everybody's talking about the 21st century, the young people, the engagement with young people". One Elder noted that, "We do the best we can under the circumstances and I think whatever we talk about today…that it's important to teach our children, the young children today, I think they have a better chance to be able to, ironically, have a better understanding of what it is to live on the Land".

> *I think upon reflection about all this, I think there has to be an awakening, an awakening today and learn to understand how little time there is remaining, for all that we are hearing about the climate change and how it is destructive to the earth, and how everybody is getting together, all the governments.*

### 4.5.5 Theme 4: Our reflections

> *So, it's very important that the health of the earth is maintained"…"Our Elders say work together, let's work together, let's get along together, the Elders keep telling us and that makes a lot of sense to me.*

As the Elders shared their perspectives on the past, present, and future in relation to planetary health, there were repeated pauses where reflections were shared, contributing to and fulfilling the cyclical nature of knowledge translation common within many Indigenous contexts (see *Figure 1*). "We need to listen and then reflect on what's going on" (see *Box 2*).

**Box 2.** Summarized reflections of various Elders during the sharing circle.

- Any kind of stress that you introduce within the people needs to be addressed somehow.
- Don't bother writing anything down, you're bound to forget it. Try to remember what it has to do with you, and then you'll have some way to go to the future.
- Everything that happens to each person is a common concern.
- It's all about balance. Caring and maintaining balance is really important for the wellbeing of our children and all our future generations.
- It's important to focus the mind toward discipline, keeping your mind on the subject at hand.
- Knowledge is different from wisdom.
- We are here as ourselves and come from families with experience on the Land and with Medicines.
- We need to be thankful for this life and wishing people good health.
- Stories and experience are important to set the context for any situation.
- The Indigenous worldview is very powerful.
- The Plants, Rivers, Lakes, Wind, are all our relatives out there.
- We are connected and related to the Land.
- We need the raw, real Indigenous knowledge because it is coming from the Land.
- We need to maintain our relationship to our ancestors.

There was consensus that the Land is not prepared for the changes that humans have been causing. The animals were noted to be strongly affected, constantly bombarded with the noise of humankind and the changes to the climate with the animals having a better sense, as "they can feel it in their body." Ultimately, it was shared that the natural environment is one's home community that you can depend on—but only when you treat it right. Taking people out of this natural environmental "community" contributes to a lack of environmental context for

overall health engagement and progression towards planetary health. One Elder finished with the need for good leadership on this issue going forward, with leadership being about "dedicating your efforts on behalf of the community", and having the door open anytime to have somebody listen and even get a meal in exchange for information on what's happening.

> *And I believe that we're not here just like that. We're here for a reason. We have a purpose here and we can talk for ourselves.*

### 4.5.6 Relational systems mapping

> *So, when we reconnect to the Land and to the foods and the medicines and the plants, we really enjoy that because it's something that's been going on for thousands of years and our bodies recognise that.*

Sixty-two key interconnected concepts were identified from the sharing circle that are outlined (see *Figure 6*). Concepts generally referred to areas of Indigenous reality (e.g., Natural Laws, Traditional Protocols), the colonial reality (e.g., residential schools, illness, and disease), reconciliation (e.g., Truth and Reconciliation Commission Calls to Action), and health systems directly (e.g., biomedical field, transient workforce). The relational systems map outlines the interconnectedness of Indigenous sharing when in circle, and showcases visually how concepts discussed within health systems cannot be disconnected from the context around it (see *Figure 6,* however, due to the amount of detail relative to the page margins, the text is not legible within this dissertation format. Given this, I have created a readable and interactive overview of this map found online here [https://embed.kumu.io/960f6b0707fe2ab183b9b0825c061f9f#elders-voices-on-patient-planetary-health?s=bm9kZS05UU1pdWdTNQ%3D%3D] for better viewing in detail). As previously noted, the relational systems mapping is meant to more easily depict the connections between what may appear at first glance to Western audiences to be disparate

elements. The systems mapping also highlights key elements that tend to have more influence or impact on the health of the planet as described by the Elders.

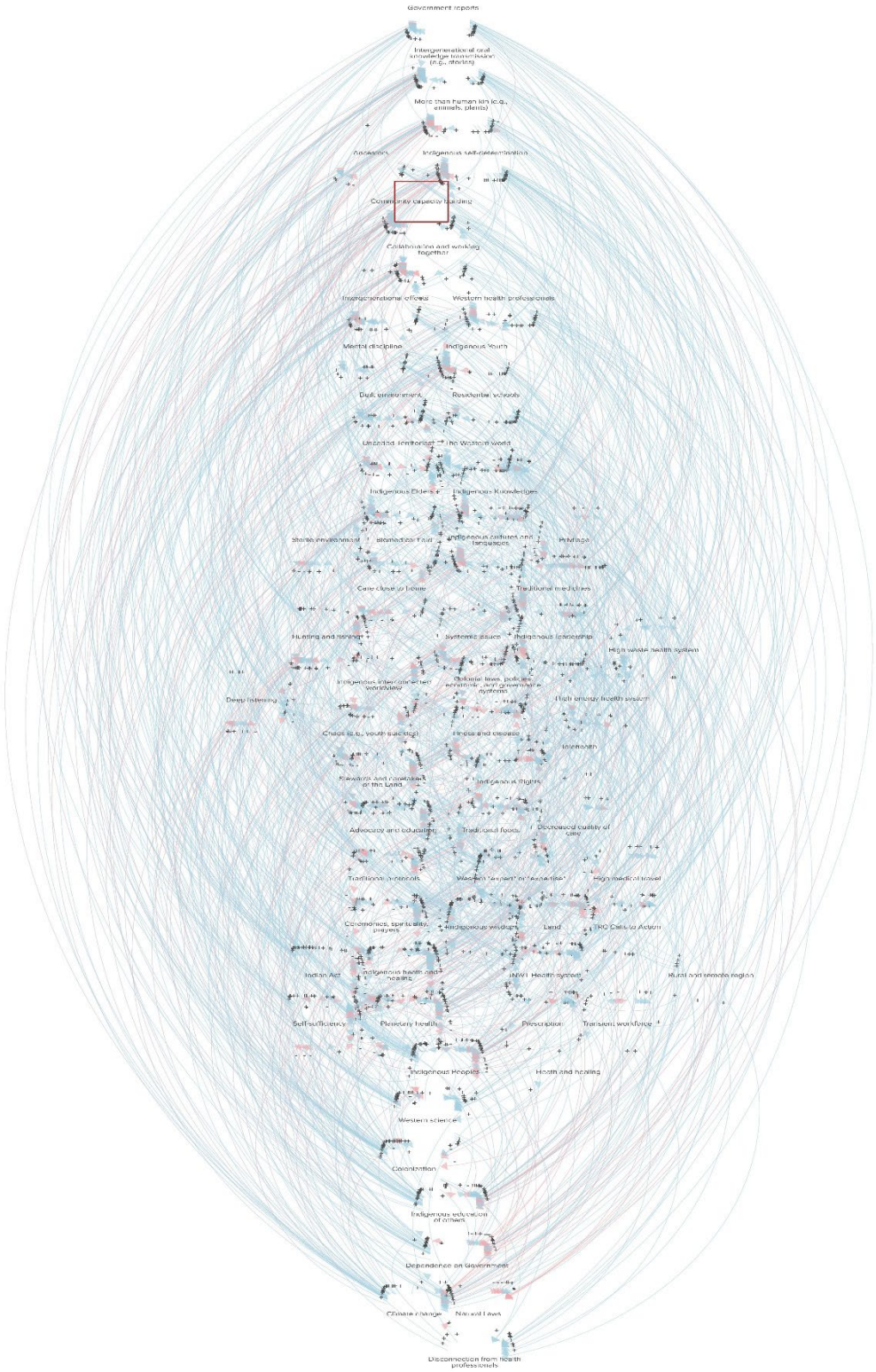

Government reports
Intergenerational oral knowledge transmission (e.g., stories)
More than human kin (e.g., animals, plants)
Ancestors
Indigenous self-determination
Community capacity building
Collaborating and working together
Intergenerational effects
Western health professionals
Mental discipline
Indigenous Youth
Built environment
Residential schools
Unceded territories
The Western world
Indigenous Elders
Indigenous Knowledges
Shared environment
Biomedical care
Indigenous cultures and languages
Privilege
Care close to home
Traditional medicines
Hunting and harvest
Systemic issues
Indigenous leadership
High whole health system
Indigenous interconnected worldview
Outdated laws, policies, economic, and governance systems
Deep listening
High energy health system
Chaos (e.g., youth suicide)
Illness and disease
Interhealth
Stewards and caretakers of the Land
Indigenous Rights
Advocacy and education
Traditional foods
Decreased quality of care
Traditional protocols
Western "expert" or "excellence"
High medical travel
Ceremonies, spirituality, prayers
Indigenous wisdom
Land
TRC Calls to Action
Indian Act
Indigenous health and healing
Inuvik Health system
Rural and remote region
Self-sufficiency
Planetary health
Prescription
Transient workforce
Indigenous Peoples
Health and healing
Western science
Colonization
Indigenous education of others
Dependence on government
Climate change
Natural Laws
Disconnection from health professionals

**Figure 6.** Relational systems map* based on the sharing circle with Elders on planetary health-informed health systems. An interactive and readable version of this relational systems map is located online here (https://embed.kumu.io/960f6b0707fe2ab183b9b0825c061f9f#elders-voices-on-patient-planetary-health?s=bm9kZS05UU1pdWdTNQ%3D%3D) where the reader can zoom in and click on elements and connections for more descriptive information on each of the elements and their connections.

**The connection type noted (i.e., +/-) represents the polarity of the connection. For example, a + connection indicates that both concepts evolve in the same direction (i.e., when the first concept increases or is present, then the connected concept will also increase or be present). A - connection type indicates that both concepts will evolve in the opposite direction (i.e., when the first concept increases or is present, then the connected concept will decrease or not be present).*

Some notable descriptive features of the relational systems map are as follows. 'Degree centrality', in general, is a measure of the elements with high degree of local connectors or hubs.[166] The top three most interconnected elements for the relational systems map on planetary health–informed health systems change (i.e., high degree of connectors) were: 1) Indigenous Peoples, 2) Indigenous self-determination, and 3) Indigenous health and healing. This translates to mean that many of the concepts for planetary health are connected to these three concepts. 'Closeness' measures the distance each element is from all other elements, with high closeness being able to facilitate the spread of information (i.e., act as leverage) to the rest of the systems network most easily.[166] The top three elements of closeness were: 1) the western world; 2) colonial laws, policies, economic, and governance systems; and 3) colonisation. This translates to mean that these three elements are currently still tightly bound to the trajectory of planetary health. Lastly, 'betweenness' centrality measures how many times an element lies on the shortest path between two other elements.[166] In general, elements with high betweenness have more control over the flow of information

(e.g., can act as a key influencer) acting as *key bridges within the network*.[166] Key bridges for this topic from the relational systems map were: Indigenous Peoples, their heath and healing, Indigenous self-determination, and Indigenous wisdom. In summary, when Indigenous Peoples have their self-determination and their health and wellbeing they have the potential to act as key conduits for planetary health within and outside of health systems; however, the system is currently set up in such a way that Western colonial actors are better positioned to spread their ways of knowing around this topic.

## 4.6 Discussion

### 4.6.1 Summary and Indigenous research context

There were four interconnected themes that were shared by the Elders in the sharing circle that followed a cyclical pattern connecting the past to the future, including: 1) The past and how we got here, 2) Where we are now, 3) Where we need to go in the future, and 4) Our reflections (see *Figure 4*). Despite my initial framing of this inquiry being inclusive of P-PH health co-benefit prescribing, it became apparent throughout the sharing that the "context" or the "systemic" structures of where a prescription is made were the more important elements for consideration for the Elders (see *Figure 5*). A planetary health-informed prescription was only seen as relevant by the Elders when the context is understood, and where the systemic barriers are removed to allow for environmentally connected care systems. Including a specific inquiry like P-PH co-benefit prescribing while allowing for iterative exploration with Indigenous Elders on the context of the topic was critical for me to truly understand the dynamics of engaging with planetary health within health systems from their perspectives. Given this, the decolonial approach I took with this research allowed me to be able to leave

room for broader reflections on the findings of the work, as well as reflect on the dynamics of respectfully carrying out research with Indigenous Elders.

### 4.6.2 Comparison with other perspectives shared in the literature

Other work has highlighted the importance, dynamic nature, and uniqueness of Indigenous scientific inquiry that may be "described as contextual, holistic, symbolic, non-linear, and relational, is not limited by time and uses the collective observation of its people to explain natural phenomena through real and metaphoric narratives."[137,167] Working with Indigenous Elders therefore required my research process to sit within the context of Indigenous Peoples' own lived experiences and forms of knowledge sharing that often do not conform to the answering of a specific research question as framed from within a Western line of inquiry. This has most often not been respected within research systems leading to the poor translation of research findings into indicators of social change or benefits for Indigenous Peoples; with research largely being controlled by non-Indigenous People, and conducted 'on' Indigenous People, and therefore strongly biased towards the incentives of the colonizing society.[168] With this, my decolonial approach to this inquiry as noted[52,53] allowed for the presentation of the Elder's sharing to be depicted through a cyclical nature while leaving much of the Elder's narratives intact.

The relational systems mapping I carried out showcased the interconnectedness embedded within Indigenous knowledge-sharing exercises (see *Figure 6*). The inherent complexity, depth of knowledge, and the holistic and interconnected nature of Indigenous knowledge concepts shared are often lost on the unattuned reader. The relational systems map was the first attempt to depict the deep connections inherent in and around planetary health generally for Indigenous Peoples, as well as the ties and impact from colonization and the

health system broadly. The relational systems mapping also highlights the potentially important placement of Indigenous Peoples, their overall health, and their self-determination as key elements for impact towards planetary health-informed health systems.

Additionally, the relational systems mapping highlighted the potential for Indigenous Peoples to act as key bridges within the network of planetary health-informed health systems to get humanity back on track. My findings are in keeping with other Indigenous-led work that has outlined key determinants of planetary health, including three relevant to my findings: Indigenous Elders and children, Indigenous Peoples' health, and Indigenous land tenure rights (i.e., self-determination).[137] When Indigenous Peoples have their teachings and knowledge passed on (e.g., Elders to children), and have their Lands to be able to facilitate this knowledge transmission through self-determination, they are more likely to be healthy and well.[137] When Indigenous Peoples are healthy and well, they are more likely to be able to continue stewarding 80% of the remaining biodiversity on the planet,[137] and additionally have the time, space, and ability to lead planetary health-related efforts. The relational systems mapping also made clear, however, that colonisation has continued its hold on progress for planetary health through colonially derived laws, policies, economic, and governance systems that continue to separate our health from the planet's health. This sentiment was recently made explicit through the most recent Intergovernmental Panel on Climate Change (IPCC) report stating unequivocally that "[p]resent development challenges causing high vulnerability are influenced by historical and ongoing patterns of inequity such as colonialism...(high confidence)".[169]

This inquiry was carried out in the Circumpolar North with unique geographies and diverse Indigenous Peoples. Despite the important avoidance of homogenizing Indigenous

Peoples and their knowledges and experiences, many of the Elder's words invoked similar connectivity to other Indigenous knowledge sharing on related topics within other global contexts.[170-172] With Indigenous Peoples being closely connected to their territories, much of the knowledge acquisition process comes directly from engagement through Land-based experiences (in the all-encompassing sense including Air, Water, Land, Animals, etc.).[173] Additionally, with human laws often being based on Natural or First Laws in many Indigenous communities,[13] there are common elements reflected throughout my inquiry that have been highlighted in other Indigenous communities as being integral for individual, community, and family health (e.g., reciprocity, relationality, respect for Land and Country).[174] With this, despite the localised context of this current inquiry, there may be some level of direct applicability to other contexts that could be further examined. As many Indigenous Elder teachings are said to be coming directly from the Land, the applicability for all health systems should not be lost despite their perceived disconnection from this Circumpolar context. Health systems have become further removed from the very Earth systems that enable them to operate. Clinical care is currently devoid of any environmental context or consideration as health systems continue to operate within a planetary health devoid bubble, as denoted by many of the Elder's perspectives shared within the inquiry.

> *You cannot understand true medicine power (in whatever capacity that may be) unless you have an understanding of the nature of things. To understand the nature of things, you need to be in nature, and you need to connect to the animals, the rocks, the plants, the stars, and the winds.*[175]

### 4.6.3 Reflections

It is culturally inappropriate in the context of decolonial research approaches with Indigenous Elders to state any potential deficiencies in the research that involved them (i.e., limitations). Given this, I instead frame this section as "reflections" instead of "limitations" which changes

the process for this section to one of learning in order to grow for the benefit of the community. One Elder for example stated that they didn't feel like they were very knowledgeable within the topic as it pertains to Western health systems, but spoke from their heart to what they did know and understand from their own lived experience on the topic. With this, I highlight that the knowledge and perspectives shared during the sharing circle I carried out was from Indigenous Elders from the NWT region only. As Indigenous Peoples around the globe are not a homogenous entity, but are incredibly diverse with varied cultures, languages, and geographies, the information presented must be seen from one Circumpolar region. Potential applicability to other contexts was also reflected above in my discussion section of this chapter. Additionally, despite relational systems mapping being the closest way I could identify to depict the understandings within Indigenous communities on the interconnectedness within our world, they are still two-dimensional depictions. Given this, the appreciation for spatial scales of influence (multi-dimensional understandings) cannot be easily depicted, minimizing to some extent the depth of the Elders' understandings within the relational systems map that I developed for this research.

## 4.7 Conclusion

The research I carried out for this chapter highlighted that healthcare systems currently operate within structural contexts and processes that have been formed by colonisation and continue to perpetuate a disconnect between individual, communities, and the planet. Despite the ongoing marginalization of Indigenous Peoples within health systems, their position within planetary health movements was seen to be critical moving forward. Indigenous Elders and their interconnected knowledge systems provided important viewpoints for health-systems by bringing the planet's health back into focus, highlighting the importance of

working together, the importance of context, and the importance of maintaining and learning from Indigenous ways of knowing that are innately connected to the Land. The positioning of Indigenous Elders as key leaders within planetary health system transformation, however, was seen to be dependent on a climate of reconciliation and good relationships while acknowledging the harm that has been inflicted upon Indigenous communities in the past and present context (i.e., truth before reconciliation).

As previously noted within the methods sections of both Chapter 3 and this one, at the request of members of the local NWT community, another research question was added to both studies to be inclusive of data collection on nature prescriptions. At a high level, with discussions on the ground with community members, there was a need to explore this particular form of prescribing (i.e., nature prescriptions) with both physicians and Indigenous Elders in the context of the NWT, while connecting it to wider planetary health-related movements. The details of this community request and the reasons for it are further outlined in Chapter 5.

# Chapter 5 Nature Prescriptions and Indigenous Peoples: A qualitative inquiry in the Northwest Territories, Canada

## 5.1 Summary

Nature prescription programs have become more common within healthcare settings. Despite the health benefits of being in nature, nature prescriptions within the context of Indigenous Peoples have received little attention. Therefore, this chapter presents a study that sought to answer the question: What are Circumpolar-based physicians and Indigenous Elders' views on nature prescribing in the NWT, Canada? I developed this unique research question after speaking to local physicians and an Indigenous Elder in the NWT and proceeded to add specific nature prescribing questions to my existing interview and sharing circle topic guides described in Chapters 3 and 4. With this, separate reflexive thematic analysis was carried out to generate key themes through inductive coding of the data. The main themes identified from the physician interviews included: the importance of cultural context; barriers with nature prescriptions in the region; and the potential for nature prescriptions in the North. Reflections shared by the Elders included: the need for things to be done in the right way; the sentiment that the Land is not just an experience but a way of life; the importance of traditional food as a connection with Nature. I discovered that there are key considerations needed when serving Indigenous communities in the context of nature prescriptions that are inclusive of supporting Land-based approaches to health and wellbeing, and that are considered within the context of Indigenous self-determination.

**Note:** A version of this research has been published by the journal *International Journal of Environmental Research and Public Health*.[4]

## 5.2 Introduction

As noted in Chapters 3 and 4, in this chapter I present a study which arose from an opportunity to be responsive to community-led priorities within the NWT. Specifically, community members in the NWT requested I add a separate research question on one specific form of P-PH co-benefit prescribing—nature prescribing. This request occurred during the initial planning stages of my DPhil which made it easier to add in the additional study focus. Given the complex history with research extraction (i.e., helicopter research) within Indigenous contexts,[176,177] as well as the need for ongoing relationship building with communities,[178,179] I readily obliged. I adapted my research process to ensure the accommodation of this study area which provided an opportunity to explore one form of P-PH co-benefit prescribing (see *Chapter 1*, *Figure 1*) from both Western and Indigenous perspectives, while being responsive to local needs. Chapters 3 and 4 both highlighted unique considerations for the NWT which are relevant in the context of nature prescribing.

The health benefits of being within nature or having exposure to greenspaces have been increasingly described. Those who spend time in nature[180] or have access to green-space[181] report better health and psychological well-being compared to those who don't, with the effects being crosscutting across different occupations, ethnic groups, rich and poor areas, and in people with chronic illnesses and disabilities.[180] Physiological stress reduction,[182,183] improved cardiovascular health,[184,185] memory improvements,[186] increased natural killer cell activity,[187] and increased longevity in senior citizens[188] have been associated benefits of spending time in or near nature.

In recognition of the noted health benefits, organized national park and nature prescription programs have increasingly been developed within Canada and abroad.[189,190] A

park prescription program called PaRx, for example, is breaking ground as Canada's first national, evidence-based nature prescription program with several regional and national partners.[189] Park prescription interventions (PPI) have generally demonstrated improved physical activity in parks, recreational physical activity, and improvement in psychological quality of life.[191] A recent systematic review and meta-analysis also found that by incorporating nature-based social prescription interventions into mental healthcare plans, improved mental health outcomes occurred.[192] Additionally, nature prescriptions as noted previously fits under the umbrella of "patient-planetary health co-benefit prescribing"[1] as described in Chapters 1, 2 and 3, with research not only demonstrating the health benefits for patients, but additionally the planet, with spending time in nature being associated with increased pro-environmental attitudes and behaviours.[193]

Given the increased attention to nature prescriptions as a therapeutic intervention, it was brought to my attention by local community members that Canadian-based programs such as PaRx likely should be examined through a culturally safe lens with populations that may have long-standing relationships with nature. At the time of this research, as well as the time of the write up for this dissertation, there were no other primary research studies published on examining Indigenous Peoples perceptions of nature prescribing. There was, however, one study carried out examining primary care providers likelihood to prescribe nature prescriptions for children in the United States.[194] The study findings noted that participation in the nature prescribing project itself influenced the providers to discuss the value of nature and write a park prescription.[194]

As noted, despite the perceived and demonstrated health benefits of being in nature, nature prescriptions themselves within the context of Indigenous Peoples in Canada and

globally have received little attention. As Indigenous Peoples have lived in close relationship to the planet for millennia, the context of having Western health professionals prescribing nature is not often considered in current nature-prescription programs. Indigenous-specific nature programs have been increasingly platformed from within Indigenous communities in Canada; however, they have been most often situated within the context of Land-based healing, cultural, and education programs, and not necessarily within healthcare settings.[174,195-197]

## 5.3 Aims and research question

Given the context introduced in the section above (e.g., lack of research on perceptions of nature prescriptions broadly and with Indigenous Peoples; unique context in the NWT), as well as the request from members of the local community to investigate this topic in depth, I therefore sought to listen to the perspectives of physicians working with a high proportion of Indigenous patients, as well as a group of Indigenous Elders within the NWT on a form of patient-planetary health co-benefit prescribing[2] —nature prescriptions. With this, I sought to analyse data specifically on nature prescriptions within the context of Indigenous patient care from the data collected in studies reported in Chapters 3 and 4. My research question for this study was: What are Circumpolar-based physicians' and Indigenous Elders' views on nature prescribing in the NWT?

## 5.4 Methods

### 5.4.1 Overall design and setting

I originally designed two pragmatically orientated[49] qualitative research studies allowing space for a decolonised research paradigm[198] (i.e., embedding a "collaborative process of naturalizing Indigenous intent, interactions, and processes and making them evident to

transform spaces, places, and hearts"[52]) on patient-planetary health co-benefit prescribing with physicians (i.e., described in Chapter 3),[2] and with Indigenous Elders (i.e., described in Chapter 4) in the NWT. My pragmatic approach allowed me to be solutions-orientated and action-based as highlighted in Chapter 1.[49] In speaking to two locally-based physicians and Indigenous community members (including an Elder) based in the NWT prior to the onset of the research carried out and described in Chapters 3 and 4, I was given feedback from them on the perceived gaps in the understanding of nature prescriptions in the context of Indigenous Peoples in the region as previously noted. My discussion with the local community members was prompted by the potential expansion of the PaRx into the NWT. Given the importance of being responsive to the needs of the region as noted in Chapters 3 and 4, I identified a unique research question and proceeded to add questions to my interview and sharing circle topic guides specific to nature prescribing and carried out a separate data analysis.

### 5.4.2 Recruitment and consent

As described in Chapters 3 (section: "3.4.4 Recruitment and consent") and 4 (section: "4.4.4 Recruitment and consent"), I used purposive sampling[122] in both primary studies to ensure maximum variation of the physician participants ($n$ = 13) in regard to gender, years of practice, and the practice region within the NWT; and for the Elders ($n$ = 6), by region within the NWT, and by gender. Additional detailed recruitment and consent information can be found in the methods sections of Chapters 3 and 4.

### 5.4.3 Interview and sharing circle data collection

See the methods sections of Chapters 3 (section: "3.4.5 Interview data collection") and 4 (section: "4.4.5 Sharing circle data collection") for full details of interviews and sharing circles. For this study, both the interviews and the sharing circle followed topic guides with

open-ended questions that allowed me to explore the topic area openly and without restriction. Key topics outlined in the topic guides were informed by the literature as well as through engagement with two local physicians and two Indigenous Elders to better ensure the questions were clear, understandable, and relevant. I carried out the interviews and talking circle in English, and I queried on topics including perspectives around giving or receiving nature prescriptions, situations where nature prescriptions might be helpful or where there might be challenges in their delivery, as well as the perceptions around the terminology framing of 'nature prescriptions'.

### 5.4.4 Data Analysis

See the methods sections within Chapters 3 (section: "3.4.6 Data analysis") and 4 (section: "4.4.6 Data analysis"), for full details on the data analysis carried out for the research outlined in this chapter. Additional data analysis notes specific to this chapter are that the interview and sharing circle transcripts were loaded into NVivo qualitative software (Release 1.3) for data analysis; however, I analysed the physician interviews separately from the Elders talking circles to ensure the varied worldviews could be appropriately respected and not assimilated within my analysis. Additionally, for the work with both the physicians and the Elders, I analysed only the data within the wider transcripts that was relevant to my nature prescription research question.

## 5.5 Results

### 5.5.1 Physician-level perspectives

I characterized three main themes from the physician interviews reported below. Physicians highlighted key elements for consideration when it comes to nature prescriptions within the NWT region, including: cultural considerations and the positionality of non-Indigenous

physicians in relation to Indigenous patients with regard to nature prescriptions; the need to be mindful of the winter climate and how this might affect the nature recommendations given; terminology considerations that may better fit with Indigenous worldviews of interacting with nature; and widening the interpretation of what a nature prescription could look like in practice.

#### 5.5.1.1. The cultural context matters for considering nature prescriptions with Indigenous Peoples

Physicians noted the importance of the cultural context when considering nature prescriptions in the NWT given the colonial history. For example, the framing of nature prescriptions was repeatedly said to matter given the higher Indigenous population in the NWT and the high proportion of non-Indigenous health providers. There was noted risk that if nature prescriptions were not done in the right way, it could break trust with Indigenous patients, and also be seen as paternalistic—especially in the context of smaller and more remote Indigenous communities.

> *Well, you have to contextualize. I'm saying this to some Indigenous Peoples, like who the hell am I? The cultural context I think is important. That may be a challenge it may be perceived as paternalistic and sort of contrary to our shared history, when in fact … and as a non-Indigenous individual who's been part of this process of, how do you say it, not exactly promoting the destruction of nature but I think you understand what I'm saying* (ID 1.6).

With this, the use of prescribing in the context of nature was noted to be a problematic term, with a level of cultural inappropriateness when doing it in a way that is directive towards Indigenous Peoples given the power differentials inherent in colonial systems of healthcare (e.g., non-Indigenous physician prescribing a nature treatment to an Indigenous patient whose culture is inherently connected to nature).

> *When I'm working in a primarily Indigenous context, I am a visiting settler, I'm very aware of that. I feel absolutely not comfortable, and I feel like it's inappropriate to talk about prescribing nature and I think we've had those discussions in our meetings before about how challenging that is, to have something that's been part of culture and a lifestyle forever, then being medicalized and written on a piece of paper, like it's so ridiculous* (ID 2.1)

One physician noted that nature prescriptions might be better received from Indigenous health providers.

> *It's such a huge learning experience for me, living in the North but not living in a rural, isolated community like [community], and not really recognizing the obstacles to physical activity in communities because there are wolves and bears and polar bears circling your town. So, I think that was actually a big learning experience for me, and a good opportunity for me to recognize I need to ask questions and then make recommendations rather than it coming from a directive of this silly white girl, who came here doctoring, is now telling everyone to go for a walk so the wolves can eat them* (ID 1.5].

Another physician noted that, given the cultural considerations, they would feel comfortable giving nature prescriptions only if the request for incorporating this kind of approach came from Indigenous community voices.

> *To me I would only be on-board with that [nature prescriptions] if it was coming from within a [Indigenous] community, that they were hoping to kind of implement that within their community, and I'd be happy to jump on-board, but I wouldn't be wanting to invoke something like that that wasn't coming from within the community [given the cultural considerations], that wasn't something they'd decided was a priority for their community members* (ID 1.2).

Ultimately, there was an appreciation for the sensitivities inherent in a context where often Westernized health professionals are caring for Indigenous Peoples who have had deep relationships with the Land for millennia. Therefore, there was an understanding of the need to be carefully attuned to the perceptions Indigenous Peoples might have regarding nature prescriptions within the clinical environment.

#### 5.5.1.2. Highlighted barriers with nature prescriptions in the NWT region

There were many key barriers noted for nature prescriptions in the North that were thought to be in need of consideration. One barrier that was also directly interconnected to the cultural context (i.e.: the cultural context matters), was framed from the question: Is it actually culturally appropriate for me to give a nature prescription as a settler physician to an Indigenous person? Many of the physician participants noted a clear level of discomfort with the idea of prescribing nature to their Indigenous patients. This discomfort was in addition to the need for the general understanding of the cultural context of the region.

> *Telling Indigenous patients that they need to spend more time on the land, being a white person in a white institution that has done a number of horrific things in the past and continues to do so, is very problematic, and I'm very sensitive to that. So, knowing what's right for the patient and giving an order, or a prescription, for the patient, to do something that was taken away from their people by the people of the doctor, I'm not comfortable with* (ID 1.5).

Other physicians were less sure whether or not a nature prescription would be welcomed.

> *I would wonder, from an individual standpoint as a white [gender], if I would be welcomed to provide something like a park prescription to an Indigenous person, if that would be received well or poorly, and there would probably be a lot of variables, including the context in which we were interacting and our rapport and things like that* (ID 2.5).

In some cases, the concern around Settler to Indigenous relations in the context of nature prescribing was to the extent that the physician would feel comfortable offering this in the south of Canada but not in the context of the north in Canada given the higher proportion of Indigenous Peoples in the North. Nature prescriptions were noted to be a bit odd in the context of the North.

> *I think if I was in a bigger city [in the South], I might be more open to that, especially if there are people who never leave their apartment or only working in the city and never really getting out. But I think living up here [in the North], and certainly I would*

> *never, ever say that to somebody who's lived here for generations, who has their own relationship to the land. I'd feel it would be inappropriate for me to say that and kind of paternalistic, frankly* (ID 1.2).

Another barrier to nature prescribing noted in the NWT was cold weather and the ability to afford clothing for cold weather.

> *But still even in the winter, we get lots of people who hunker down in their apartments all winter long and get really, really depressed. So, I think the barrier is simply environmental, three hours or no hours of daylight, with temperatures that can frequently be stuck somewhere between -35° and -45°, is a pretty big barrier for some people sometimes* (ID 2.2).

> *I'm cautious again about making that outdoor prescription, or nature prescription, especially in the middle of winter, because if people don't have the wherewithal, or even the clothes, like the expense or the amount of money it costs to get the right clothes to be able to spend time outside* (ID 1.5).

The dark winters in the North and other safety considerations (e.g., environmental conditions) were mentioned as considerations to take into account in the context of the region.

> *In the NWT, our environment is inherently dangerous. It's beautiful, it's wonderful, there are so many cool opportunities, and the connection to the land can be so profound, but that always comes with, you need to respect the land, you need to respect the environment, because it can swallow you whole if you're not prepared* (ID 1.5.)

Others mentioned that having the available time to be in nature could be a barrier as well as the ability to have access to nature, in addition to resource barriers to spending time on the land (e.g., social determinants of health).

> *If somebody is impoverished and struggling just to make ends meet and raise their children, the thought of going out and spending time in nature can be a huge barrier* (ID 4.7).

Lastly, the high reliance on locum physicians in the North with little rapport with Indigenous patients was noted as a potential barrier, as well as potential issues with urban or intergenerational patient disconnection from being on the Land given the colonial history in the region.

#### 5.5.1.3. The potential for nature prescriptions in the NWT health system with more awareness and appropriate communication on the importance of being on the Land

Despite many of the stated challenges and barriers noted within the NWT context, there were several physicians noting that there is still lots of nature potential in the North with more amplification on the ongoing importance of being on the Land, including for mental health, needed within the health system.

> *Man, we can access nature within minutes of just about anywhere in the North…We're just so fortunate to live in a part of the world where we're absolutely blessed with an absolutely phenomenal nature environment that's easily accessible* (ID 2.2).

Almost half of the physicians interviewed were already giving some form of nature prescription, but not in the context of a written prescription or stated as nature prescriptions. Several physicians noted they were giving recommendations to patients verbally instead of in western-based prescription formats. Many physicians noted the importance of trying to speak the language of the people instead of using nature prescription terminology itself. For example, several physicians felt using on the Land or connection to Land kinds of terminology in the context of Indigenous patient care were more comfortable for them, while still being careful that the recommendations not be directive in nature.

> *I am comfortable with talking to patients, especially Indigenous patients in communities, and in [community], wherever, about the helpful impacts of being outside and being connected to the land, because I've seen that amongst many other patients, and friends and family. And speaking about whether that resonates with that patient and if that patient thinks that that might be helpful. But I'm very cautious and uncomfortable with giving directives, if that makes sense* (ID 1.5).

There was note that prescribers likely would be on board if nature prescriptions were done with "cultural safety" in mind (i.e., fostering "an environment where people of diverse cultural and ethnic backgrounds can feel respected and safe—spiritually, socially,

emotionally, and physically—from discrimination and denial of their identity and needs"[199,200]), and an acknowledgement that the type of nature activity in the north of Canada is different from the south of Canada.

> *We talk about nature differently in the North. It's more spending time on the land and that kind of thing and I think the very prescriptive, go out and spend 30 minutes at least five times a week, it's very Western, colonial medicine. So, I have always tried to tailor it in different ways, depending on who I'm talking to. So more an emphasis of spending time on the land and for a lot of people that means going out hunting and trapping and you're spending a week on the land, as opposed to 45 minutes five times a week or whatever. So, I have tailored it a little bit that way* (ID 4.7).

Nature was noted not to be a new health discovery in the context of Indigenous Peoples, and there were many culturally relevant ways to facilitate this kind of conversation in a patient visit that was inclusive of many relevant outdoor activities.

> *I think for a lot of patients it's more relevant to say time on the land where you're being active, you're going outside and you're having to chop wood or carry water or do some physical task around your camp, that kind of thing. I think that perhaps is more meaningful than something like exercise prescription. I think a similar thing for both nature prescriptions and exercise prescriptions, there's perhaps some wording that can engage patients a bit better in different cultural settings* (ID 2.4).

For interacting with Indigenous patients, these other kinds of relevant outdoor activities were noted to support the introduction of a more appropriate context of being on the land for the health and wellbeing benefits of Indigenous Peoples.

> *Writing it on a piece of paper, you will go outside for five minutes three times a day for the next week, I could trial it, I could make a trial of it but we end up having more holistic conversations about being outdoors. When were you on the land last? When did you go fishing last? When did you go hunting last? Who did you go with? How long were you out there for? When do you plan to go back? Would you want to go back sooner or are you okay with going there? Is there a reason why you're not able to go sooner or go when you would like to go?* (ID 2.7).

There was also a clear recognition on the overall benefits of nature prescriptions—especially if combined with exercise prescriptions.

> *So if the exercise is in the daylight in nature and I want you to be out in nature because of all of the evidence around changes in brain chemistry when you're in nature and I go through that and I'm like, you can do that in three separate chunks or you can do that as basically going for a walk in the middle of the day outside and you get all of them all at once* (ID 4.1).

There were some additional recommendations shared for having more grand rounds (i.e., group learning activities within a clinical settings) on the topic, and having a formal system in place to provide appropriate guidance for Indigenous patients.

### 5.5.2 Indigenous Elder-level perspectives

I report findings from the Elders in this section without defined categories or quote assignment in keeping with an Indigenous paradigm of sharing everything together as a whole. In the sharing circle, some of the Elders had a hard time seeing Nature (purposely capitalized in the Indigenous context to denote its significance as a living relative) as being a prescription; however, if it were to be done, then the process in which it would be done was seen to be very important.

> *…we all want to go home with a prescription, but I think it's a good idea and I can see it being done, but the process in which it's going to be done is important… Because I can't see it as a prescription, although I'm a big advocate for being outdoors and walking and getting as much as I possibly can… Anyway, for me personally I truly believe in that but… I think you need an information campaign.*

It was noted that if it's done in the right way, this kind of initiative may be perceived to validate Indigenous ways of traditional medicine and being on the Land.

> *I think if it's done in the right way, it could be perceived as validating what your people have been doing…is what you need and also included in that could be the traditional medicines…*

> *So, I think if it's very well done…I think it's going to be better for ourselves…for stress and for taking a rest, and done by professionals and it's legitimate. Even if it's not taking us over to the pharmacy, it's taking us to the land…*

There were some reflections about whether community-based activities might be more beneficial, such as starting a local walking group compared to an individual form of recommendation. There was also a note of potentially hiring somebody from the local community to take people out on the Land to let them rest away from the modern world (e.g., technology) as an option for this kind of initiative.

> *…if the hospitals know that illness is caused by stress and they say you should rest, but resting in a foreign environment, they put you back into the same environment and say rest. But if they give a prescription to say rest, you can maybe give it to your office, with some funds from Health Canada or something to say this person needs to have a rest, it should be outdoors. If they hire somebody from the local community to take them out by boat and take them for a ride into the environment, have a campfire and set up a little tent for a couple of days and just let them rest or maybe even a cabin somewhere, so that environment is… the people are kind of treating themselves.*

There was also clear reference to the Land not just being for a Nature experience but as a way of life that may not be appreciated by the health system.

> *I like to go and check out the Land, the water, as I talk to them about how it is over there in our homeland when we go hunting and fishing or just going out there for a week or a couple of days. It's not like a tourist base for us, it's real for us. It's a way of life for us and we have all our stories out there, the Creation stories and all our culture and language comes from there, comes from the sound of animals and then we communicate like that with each other.*

One Elder noted that maybe the physicians are the ones who need the Nature prescription.

> *I think it's going to be better for ourselves to be able to get that and we can provide that prescription to those doctors.*

Many of the Elders additionally noted that Indigenous traditional foods should also be encompassed under the umbrella of Nature prescriptions, thereby not limiting them to Western definitions of what Nature interactions should be constituted as.

> *And just eating natural foods for maybe a week might make some improvement and that kind of prescription can be brought back to the community and that means that somebody has to provide the fish.*

> *Maybe somebody in the community who's a fisherman and regularly has a fishnet out there, maybe they might get a prescription to say provide this person with a fish a day and even fillet it for them and just use natural cooking over the fire, and that means that… in a hospital, they provide that stuff and every time an Elder is admitted to the hospital, the first thing they complain about is the food. If it's natural, then they wouldn't be complaining.*

Ultimately, a more holistic Indigenous view was said to be needed for what might constitute a nature prescription in the North.

## 5.6. Discussion

### 5.6.1 Summary

The physicians in my study highlighted key elements for consideration when it comes to nature prescriptions within the NWT region of Canada, including: the importance of cultural context and the positionality of non-Indigenous physicians in relation to Indigenous patients with regard to nature prescriptions; the need to be mindful of the winter climate and how this might affect the nature recommendations given; terminology considerations that may better fit with Indigenous worldviews of interacting with nature; and, widening the interpretation of what a nature prescription could look like in practice and within the health system. The reflections that were shared by the Indigenous Elders included the need for things to be done in the right way if such a program were to move forward, that the word prescription in regards to nature may not be the most appropriate framing, the view that the Land is not just an experience but is a way of life that includes culturally-based activities that should be supported, and the importance of traditional food as a connection to Nature.

### 5.6.2 Results set within the wider context

This study is the first one that I am aware of where nature prescriptions were examined within an Indigenous patient context. Although there are a few studies that have been carried out on

green prescription 'health outcomes' within Indigenous Peoples in other geographic contexts,[201,202] none of the findings explicitly address the inherent barriers or challenges to this kind of initiative. More specifically, there has been no examination of the context where nature prescriptions are given to people whose traditional livelihoods are or have been entirely Land-based, and are receiving colonial forms of healthcare, which creates a different context for considering nature prescriptions.

It was clear throughout my research, however, that Indigenous Peoples should not be left out of the clear ongoing health benefits of Nature as they have been interacting with Nature for their health and wellbeing for millennia; however, engagement within Nature may be better premised within 'a way of life' approach with an expansion on what constitutes a Nature activity in the Westernized sense to be inclusive of cultural activities like hunting, fishing, and food foraging as examples. This was similar in essence to my findings in both Chapters 3 and 4 which clearly situated the importance of considering the unique considerations for Indigenous Peoples in the NWT in relation to planetary health-informed healthcare (i.e., Indigenous views were different compared to the physician views which is reviewed in more detail in Chapter 7). The connections to nature prescription programs generally may seem to be potentially irrelevant and cultural incongruent, which was highlighted within my research findings; however, given the current overall lack of appropriate health funding for on-the-Land activities for Indigenous Peoples, nature prescription programs may provide opportunities for funding and resources to allow communities to continue interacting with Nature in their own self-determined way. Land-based cultural activities, for example, were stated within my findings to be situated within the collective community activities that have been a part of Indigenous lived experiences for

generations (e.g., hiring community members to take people out on the Land for rest and wellbeing purposes).

### 5.6.3 Research implications and future directions

Given the Land-based orientation most common within Indigenous community settings, a reconsideration of the nature prescription terminology was also stated to be warranted within Indigenous patient care settings with a focus on Land-based or on-the-Land health promotion activities that are again culturally situated. Despite many physicians in particular noting clear discomfort with prescribing nature to Indigenous patients, many were already having verbal conversations with Indigenous patients on being out on the Land within the context of their health and wellbeing without issue. Given this, the definition of a nature prescription in the context of Indigenous Peoples may need to be expanded outside of having a written prescription pad, but instead seeing nature prescriptions through verbal health promotion approaches that amplify existing Indigenous knowledge on the health benefits of being out on the Land for improved health outcomes.

With this, nature prescription educational materials could therefore be developed to support physicians themselves in understanding how to amplify and support Indigenous patients in their longstanding Land-based activities through culturally safe approaches as opposed to physicians educating or giving prescription directives to Indigenous patients. As one participant aptly stated, “we can provide that prescription to those doctors.” This comment raises the important notion that instead of health systems considering how to prescribe Nature, perhaps it is the health system that needs the prescription of listening and learning from Indigenous Peoples in regard to Land-based healing approaches. Regardless, given my findings outlined in this chapter, as well as the increasing uptake of nature

prescriptions within health systems, there is substantial need for more consideration given to the mechanics and process of operationalizing nature prescription programs where Indigenous Peoples reside.

### 5.6.4 Strengths and limitations

To the best of my knowledge, this study was the first time this topic on nature prescriptions was formally investigated with Indigenous Peoples. Another strength to the study is that it allowed for a separate analysis of the Indigenous specific data to avoid assimilation of the data analysis. This ensured that the Indigenous voices contained within the data were able to be platformed in a culturally respective way. My study was exploratory, with a small sample size, in a northern Canadian geographic context. Given that many of the physicians that I interviewed were not originally from the NWT (i.e., moved to the NWT region to practice medicine), I sense, however, that there may be insights relevant to consider for other contexts where Indigenous Peoples reside. Regardless, Indigenous Peoples are not a homogenous group so the views shared from this region may not necessarily be completely reflected in other Indigenous contexts. Despite this, colonization is a common experience for many Indigenous Peoples, which is reflected in some of the sentiments shared from this region. As noted, however, this is the first exploratory research inquiry (of which I am aware) into nature prescribing within the Indigenous patient context, so further investigation is warranted to ensure that any potential outside implementation of nature prescribing is culturally safe and is considered within the context of Indigenous self-determination. Regardless, this study formed the basis of the coming launch of a local Nature prescription program by a national organization (PaRx) which paused their roll out of the program until my research was completed. Due to the nature of my findings, the organization is now working with local

community members to re-vamp their approach to their program given my results demonstrating the importance for things to be done in the right way given the local Indigenous cultural context.

## 5.7 Conclusion

Despite the perceived and demonstrated health benefits of being in nature, nature prescriptions themselves within the context of Indigenous Peoples in Canada and globally have received little attention. With greater awareness on the health benefits of nature, and the expanding nature prescription programs in Canada and abroad, my research identified key relevance and implementation considerations when serving Indigenous communities. These considerations include the need to question the relevance of nature prescriptions within Indigenous communities generally, the need for culturally appropriate and context-specific terminology use for framing nature prescriptions where appropriate, physician awareness of any cultural considerations when engaging nature prescriptions within Indigenous community settings, and attunement to the kinds of activities that may be considered on-the-Land activities to support Indigenous wellbeing outside of the more commonly understood nature prescription activities in a Westernized context.

Overall, my findings from Chapters 2 to 5 demonstrated movement towards contextual and systems factors being important for planetary health-related change. This movement set the stage to align Chapter 6's research towards the health systems–level more explicitly. I started in Chapter 2 with a systematic review looking at existing research to inform my primary research. Then, in Chapters 3, 4 and 5 I was able to do a deeper dive into specific topics relevant to the NWT region with two participant groups (i.e., physicians and Indigenous Elders). Based on how my findings from Chapters 2 to 5 related to broader

systems factors, there was a need within Chapter 6 to zoom back out to look at systems change with a focus on available planetary health-related frameworks.

# Chapter 6 Planetary health for health systems: A scoping review and content analysis of frameworks

## 6.1 Summary

This chapter presents the findings from a scoping review. My scoping review sought to identify planetary health frameworks proposed, developed, or currently used within health systems while reflecting on the framework elements commonly considered as critical to the development and functioning of environmentally sustainable healthcare systems. Planetary health movements have advanced substantially within the last ten years with new frameworks and models being considered within health systems in varied contexts. Despite key movements forward, there continued to be an overall lack of accessible and regional- or field-specific planetary health frameworks for health systems to adapt or work from. I therefore systematically searched key electronic databases and carried out manual searches for relevant frameworks. I then analyzed the included frameworks using content analysis to identify the different domains. I identified six overarching categories within the planetary health-related frameworks including: health system and environmental impacts; vision, advocacy, leadership, and communication elements; key structural components for environmentally sustainable health systems; climate resiliency and environmental sustainability of healthcare facilities and systems; climate resilient and sustainable technologies and infrastructure; and evaluation and accountability mechanisms. My findings highlight the need for better inclusion of all facets of planetary health (e.g., biodiversity), as well as key acknowledgement and work with other knowledge systems (e.g., Indigenous Peoples and their knowledge systems) to ensure planetary health-related frameworks are grounded in what we are trying to protect—the planet itself.

**Note:** A version of this research was in review with the journal *PLOS Global Health* at the time of this dissertation being submitted.

## 6.2 Introduction

As I noted in Chapter 5 above, my findings from Chapters 2 to 5 demonstrated movement towards contextual and systems factors being important for planetary health-related change. In Chapter 2, there were several findings highlighting barriers and facilitators to change including: the absence of positive institutional culture and leadership; having policy statements; effective leadership; and health system and hospital level environmental metrics, support, funding, and buy-in. Additionally, many of the example linkages in Chapter 2 between the identified barriers within the COM-B model mapped to potential policy levers aligned with health systems level roles (e.g., environmental and social planning, fiscal, service provision; see *Chapter 2*, *Table 5*). Similarly, in Chapter 3, despite initial interview questions being based on prescribing, the perspectives shared by participants focused on systemic structures, with the health system itself stated to be a major barrier that needs to be structured in a way to enable change. In Chapter 4, there were perspectives shared surrounding the context of health systems, with one specific note made by one Indigenous Elder that the current colonial structures of the healthcare system are the context where prescribing takes place, and this needs to be recognized. There were additional perspectives shared on where the health system could consider moving forward planetary health-informed system changes (see *Chapter 4*, *Box 1*) including moving more formally towards having care closer to home with better coordination within the health system. Ultimately, as noted in Chapter 5, there was

a need within this current chapter to zoom back out to look at systems change with a focus on available planetary health-related frameworks.

Broader planetary health movements have advanced substantially within the last ten years with new frameworks and models being considered and developed within health systems in varied contexts, including within medical education.[203] For example, a task force was convened between 2019 and 2021 to develop 'The Planetary Health Education Framework' which considers five foundational domains believed to be "the essence of planetary health knowledge, values, and practice"[204] (i.e., interconnection within nature, the Anthropocene and health, systems thinking and complexity, equity and justice, and movement building and systems change[205]). Despite key movements within planetary health education spaces, there continues, however, to be an overall lack of accessible, and regional- or field-specific planetary health-related frameworks for health systems to adapt or work from in their goals towards climate-resilient and low-carbon health system. The World Health Organization (WHO) has published key high level operational frameworks;[57,206] however, they are at the broad health systems level, and it is not clear whether other frameworks exist that either build off of, or are built from the WHO-related work. Given this, identifying similarities and differences across existing frameworks could support organizations in the development of their own planetary health-related frameworks.

Frameworks or models and their respective domains have often informed change processes within healthcare contexts.[207] Frameworks also often guide the principles in health-system change, including in such areas of quality improvement (QI) (e.g., Institute of Medicine (IOM)'s domains of healthcare quality).[208] With this, well-built planetary health frameworks within varied aspects of health system functioning may facilitate easier routes

towards the implementation of key climate adaptation and mitigation measures; to ensure both a reduction in health systems' impacts on the environment, as well as climate change-related impacts on health systems.

## 6.3 Aim and objectives

Although frameworks for planetary health currently exist, they vary in scope and content, and people seeking to propose and enact system changes to support planetary health may not be clear on where to find these frameworks, and which elements apply to them. I therefore set out to conduct a scoping review to identify current planetary health frameworks that have been developed for health systems. More specifically, my review sought to: 1) identify planetary health frameworks proposed, developed, or currently used within health systems; 2) describe the content of these frameworks, their stage of implementation, and any accountability mechanisms noted; and 3) to identify the framework elements commonly considered as critical to the development and functioning of environmentally sustainable healthcare systems.

## 6.4 Methods

### 6.4.1 Scoping review approach and research question

For this scoping review I followed the methodology developed by Arksey and O'Malley,[209] that was further refined by Peters et al.[210] The scoping review steps I followed are as follows: 1) specified the research question; 2) identified relevant literature; 3) selected studies; 4) mapped out the data; 5) summarized, synthesized, and reported the results.[209] As the intention of my review was to have a broad view of the available frameworks, the scoping review methodology was the best tool to "provide an overview of the available research evidence."[211] I used the PRISMA-ScR extension[212] to ensure appropriate reporting standards for scoping

reviews, and I pre-registered my protocol on the Open Science Framework (OSF).[213] My review question was: What planetary health frameworks are available to guide the application and/or evaluation of planetary health approaches within health systems?

### 6.4.2 Information sources and search strategy

I consulted with a medical research librarian at the University of Oxford to co-create a systematic search strategy. I then searched the following electronic databases as a part of the review to identify relevant articles: Medline, CAB Abstracts, and Scopus. I reviewed the first 100 articles for relevance in both Google and Google Scholar using adapted search terms for Google [e.g., ("planetary health" OR "planetary healthcare") framework; ("green health" OR "green healthcare") framework]. I additionally carried out manual searches in Overton and Policy Commons. I then searched the reference lists of all articles that met the inclusion criteria to further identify relevant articles not found during my initial search steps.

### 6.4.3 Eligibility and study selection

All the articles I identified through the search strategy were transferred into Covidence review software (v2721 a9510157) to facilitate my article selection process. I only included articles in English due to resource limitations, and there were no limits on date of publication with the search carried out up to November 22, 2023. I included both empirical sources as well as government and organizational sources (e.g., health system reports) that included proposed, developed, or currently used planetary health frameworks within health-systems settings. I defined frameworks for the purpose of this review as any framework or model that proposes a structure around which planetary health within health systems can be considered or organized. I defined planetary health for the purposes of this review as per the definition provided in Chapter 1 (section “1.2 Planetary health”). Therefore, planetary health as a concept for this

review was used as an umbrella term for anything specific to planetary health itself inclusive of climate change and environmental sustainability. I did not include frameworks that were solely focused on planetary health education of health professionals; however, I included any articles where planetary health education of health professionals was a part of an overarching health system framework. This was the same for any health system frameworks that had some focus outside of planetary health-related elements (e.g., social, economic components). In these cases, I did include frameworks that were not only specific to planetary health, yet I only focused on the elements relevant to planetary health.

I engaged a two-stage article review process with the first title and abstract screening stage having 100% double screening by myself and a second independent reviewer. Any discrepancies were resolved by discussion with one of my supervisors. I then completed the full text screening stage, and a second reviewer reviewed 10% of the articles for audit purposes, with any discrepancies resolved by discussion with one of my supervisors.

### 6.4.4 Data characterization, summary, and synthesis

I then carried out data extraction on the included articles with a second reviewer cross-checking a random sample of 10% of the articles. I carried out all the article charting in Excel 365, and included: general article information, geographic location, level/sector of health system, framework name, framework description, framework purpose (e.g., explanatory, interactive, action-orientated), stage of implementation (e.g., conceptual or operational), and accountability metrics when described (e.g., specific indicators or measures to keep track of progress towards planetary health-related goals). As my review aimed to obtain a broad overview of the work in this area, including empirical and grey literature, quality assessment of the included articles was not undertaken, and all relevant work was reported.

I then proceeded to analyse the frameworks reported in the included articles using conventional qualitative content analysis[214] to identify the different domains, with one of my supervisors brought in for regular coding audits. Content analysis was a helpful approach to summarize "the key elements in the large amount of data identified during the review process."[215] As per Elo and Kyngäs[216], and further clarified by Mikkonen and Kääriäinen[215], I first carried out open coding of the included article frameworks, then, I organized the data with the purpose of reducing the initially identified categories (i.e., sub-categories) into higher-order categories representing the data. Finally, as per the Arksey and O'Malley[209] scoping review methodology, I have provided a narrative account of the findings organized by the characterized categories below.

## 6.5 Results

### 6.5.1 Study selection and characteristics

My systematic search identified twenty-six articles that met my inclusion criteria (see *Figure 7*). Most of the articles had a general health system focus ($n$ = 9), or a health system technology focus ($n$ = 6) (see *Figure 7*), with only ten of the articles specifying a geographic region of focus (e.g., India,[217,218] Canada,[219] Netherlands,[220] Palestine,[221] Australia,[222] Thailand,[223] United States,[224] Romania Moldovan,[225] Federated States of Micronesia/Marshall Islands/Palau[226]).

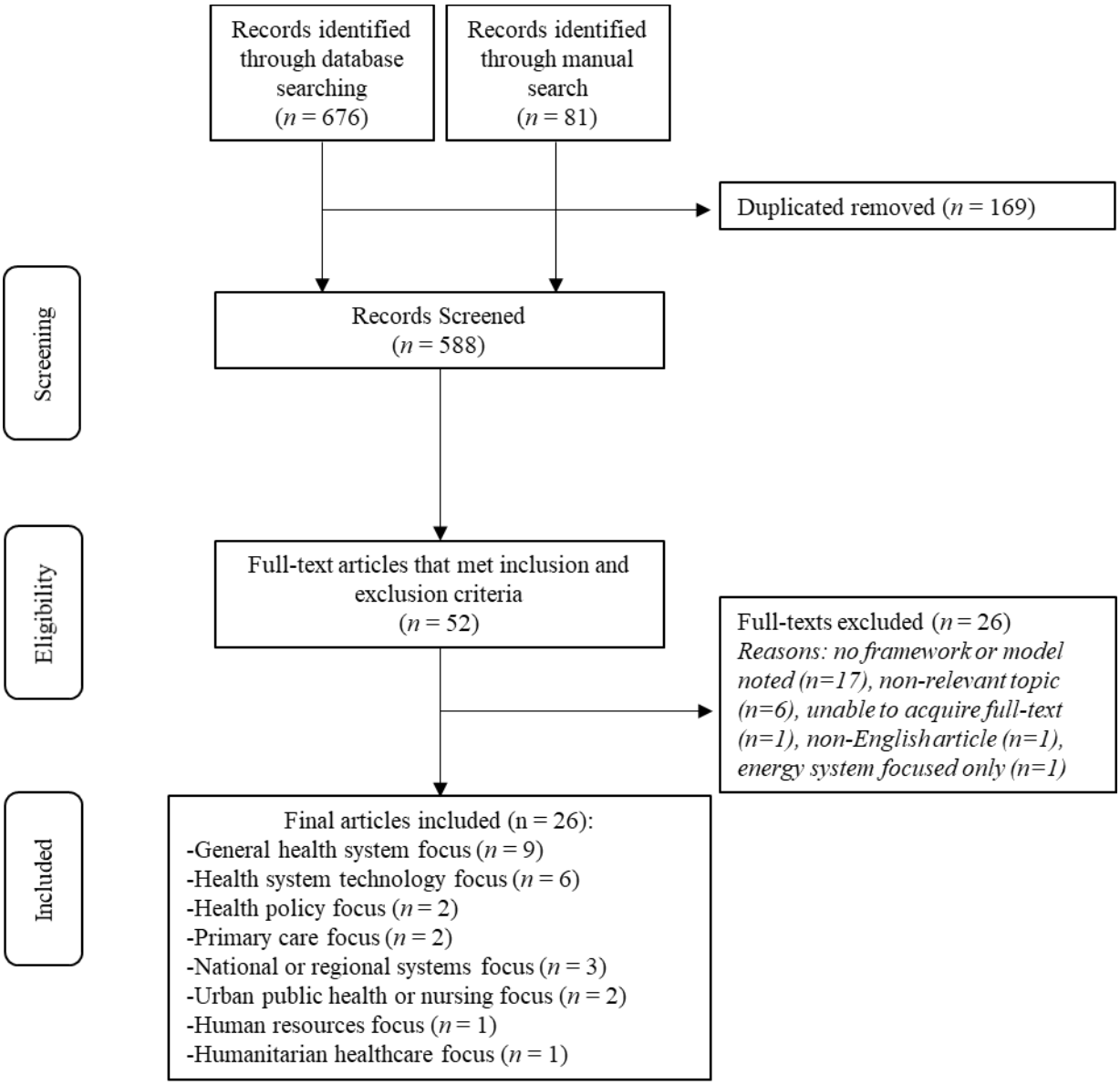



**Figure 7.** Adapted PRISMA diagram

All but three articles were published in the last ten years, with most published around 2020. Most of the frameworks were conceptual in nature ($n$ = 20), with only two noting explicitly that they had been validated.[217,218] Some other included frameworks had been at least partially "operationalized,"[219,223] or had been built or adapted from an existing framework that was most often used outside the context of planetary health.[226-229] Only seven

of the included papers noted some level of measurement indicator(s) for assessing progress or accountability from implementation.[57,221-223,225,230,231] All the frameworks were developed to be action-orientated with only one stating explicitly that their development was theory-based.[232] A few of the frameworks additionally contained broader sustainability elements (e.g., economic sustainability, social sustainability) in addition to environmental sustainability components.[217,218] There was also variability in the terminology used within the names of the included frameworks with some 'explicitly' including the term planetary health, and others using proxy terms such as sustainability or green within the titles or framing. See *Table 8* for key article characteristics and *Table 9* for the included frameworks' main health system focus areas mapped to the respective included article.

**Table 8.** Characteristics of included articles.

| | Level of health system* | Framework name | Framework description |
|---|---|---|---|
| *Bell, 2011*[233] | Health policy level | A whole-of-systems approach to developing health services for climate change | The whole-of-systems approach describes health system responses in terms that involve a wide range of health and community services that could feasibly be part of whole of- government or even whole-of-community responses to climate change. This approach includes strategic, political, and economic responses, not just narrow health interventions. |
| *Chalabi & Kovats, 2014*[230] | Health policy level | Health Adaptation Framework | A new generic conceptual framework was developed for development-compatible climate policy planning to evaluate policy options for middle- and low-income countries that reduce the adverse health effects of climate change. The proposed framework, incorporating system dynamics, provides a foundation for a decision-analytical approach to support the formulation of robust climate change adaptation policies to protect human health. |
| *Cimprich et al, 2019*[234] | General health system level | Industrial ecology framework for healthcare sustainability | An industrial ecology framework was developed for healthcare sustainability. The framework conceptualizes the healthcare sector as comprising "foreground systems" of healthcare service delivery that are dependent on "background product systems." |
| *Desmond, 2016*[235] | General health system level | Understanding climate change mitigation efforts: a conceptual model | A conceptual framework is proposed that offers a model for the pursuit of sustainable development practice in health services. A set of propositions is advanced to provide a systems approach to assist decision-making by decoding the challenges faced in implementing sustainable health services. |
| *Dhaini et al, 2023*[236] | Health system technology level | Intelligent green e-healthcare model/Green virtual machines (VM) Placement Model | A proposed segmentation model and an energy aware virtual machines (VM) placement methodology for an Intelligent and Green E-healthcare Model for an Early Diagnosis of Medical Images as an Internet of Medical Things (IoMT) is described. The proposed models are essential parts of an intelligent green e-healthcare model for an early diagnosis of Medical images as an IoMT application. |

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| *Falceto de Barros et al, 2022*[227] | Primary care level | The patient-centered planetary health (PH) care framework | A conceptual framework of patient-centered planetary health (PH) care is presented as essential for PH action at the community level. It is a reflective analysis of a clinical case report and describes and analyzes a clinical case of patient-centered PH care through 8 lenses. |
| *Gupta et al, 2023*[217] | General health system level; India | Analytical Hierarchy Process (AHP) Model of Sustainable Healthcare | The research identified the factors associated with sustainable healthcare systems through a literature review, then a questionnaire was developed and administered to 25 healthcare organizations. An Analytical Hierarchy Process was utilized to rank the factors and a conceptual model was developed. |
| *Hussain & Subramoniam, 2012*[237] | Health system technology level | Conceptual Model | A model is proposed for implementing 'Information and communication technology' (ICT) techniques in the healthcare industry to make the hospitals go green. Healthcare practitioners can use this model in understanding issues related to attaining competitive advantage via ICT. Researchers can use this model as a rough sketch to further explore the relationships between development in ICT and green healthcare. |
| *Kaladharan et al, 2023*[218] | Health system technology level; India | Sustainability triangle framework for digital health systems | A conceptual framework is proposed called the sustainability triangle framework for digital health systems (DHS) which includes an environmental component. At the core, it shows a sustainable digital health system connecting the three forms of sustainability. |
| *MacNeill et al, 2021*[238] | General health system level | Planetary healthcare: a framework for sustainable health systems | A framework for constructing environmentally sustainable health systems is presented. Three principle elements of the framework are: reduce demand for health services; match supply of health services to demand; reduce emissions from supply of health services. |

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| *McIver et al, 2017*[226] | National health system level; Federated States of Micronesia, Marshall Islands, Palau | Healthy Islands framework for climate change adaptation | The framework draws upon real-world experience and governance theory from both the health and climate change literature and, for the first time, places health systems adaptation within the vision for 'Healthy Islands' in the Pacific region. The proposed mechanisms for this model are: cross-sectoral collaboration from multiple actors; inform policies; and enable the implementation of appropriate and effective adaptation and mitigation measures. |
| *Moldovan et al, 2023*[225] | General health system level; Transylvania, Romania | H-S innovative framework | Domains of a new innovative framework were defined by collecting the latest medical practices related to environmental sustainability, designing indicators related to environmental responsibility and a matrix of indicators, followed by its validation in practice at an emergency hospital. The framework contains 57 indicators, of which 8 are dedicated to the environmental area. |
| *Mousa & Othman, 2020*[221] | Human resource level; Palestine | Green Human Resource Management (GHRM) Framework | A framework was developed to provide policy makers with set guidelines on how to influence and implement green human resource management practices for maximised sustainable performance. The framework was constructed according to five stages: 1) sustainability policy; 2) planning for sustainability; 3) implementation; 4) evaluation; and 5) review and corrective actions. |
| *Northern Sydney Local Health District, n.d.,*[222] | Regional health system level; Australia | NSLHD Planetary Health Framework | The framework is intended to provide direction for the monitoring, development, and implementation of planetary health related initiatives across the Northern Sydney Local Health District (NSLHD). The framework focuses on five priority domains: sustainable organisation; waste management and resource recovery; capital works and procurement; models of care; and people and places. |

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|---|---|---|---|
| *Puntub et al, 2023*[223] | Urban public health level; Khon Kaen City, Thailand | Framework for Climate-Resilient Urban Public Health Care Services | A novel framework is presented for operationalizing local public health care under the two future global mega challenges: urbanization and climate change. The framework assembles scenario planning and composite-indicator tools to fasten day-to-day public health operations and long-term strategic planning. The composite indicators provide a broader and deeper perspective of potential impact and promote spatial-network integration with other health determining realms that are more advanced than the existing practices. |
| *Rajagopalan et al, 2023*[228] | General health system level | 3-lens organizational framework | This framework includes three aspects: strategic (which includes processes and procedures); political (authority and power); and cultural (underlying attitudes and beliefs). It is stated that examining a sustainability agenda from the vantage point of the strategic, geopolitical, and cultural domains of HCOs, allows one to not only appreciate barriers that could impede progress but also shed light on pathways for successful transformation. |
| *Schenk, 2019*[224] | Nursing level; United States | "WE ACT–PLEASE" Framework | A framework for environmental stewardship in nursing practice is introduced. The framework is positioned within a global context of planetary health and planetary-level environmental harm. The framework describes five content domains of pollution from healthcare sources: Waste; Energy/water; Agriculture/food; Chemicals; and Transportation (WE ACT). It identifies six key professional elements: Professional Obligation; Leadership; Education; Accountability; Science; and Engagement (PLEASE). |

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| *Schwerdtle et al, 2020*[239] | Humanitarian healthcare level | An Operational Framework for Building Climate-Resilient Humanitarian Health Systems | An adapted framework was developed aiming to increase the capacity of humanitarian organizations to protect health in an unstable climate. The World Health Organization (WHO) operational framework for climate-resilient health systems[7] was adapted for a humanitarian health organization that delivers healthcare and additionally presented concrete case studies to demonstrate how the framework could be implemented. |
| *Sijm-Eeken et al, 2022*[232] | Health system technology level | Green-MIssion (Medical Informatics Solutions) framework | A theory-based framework was developed to enhance and accelerate development, selection, and implementation of solutions mitigating the climate impact of healthcare organizations. Existing frameworks were combined to develop the Green-MIssion (Medical Informatics Solutions) framework. The framework classifies solutions into three categories: (1) monitor and measure environmental impact of a healthcare setting; (2) help create and increase awareness among employees and patients; and (3) interventions to reduce environmental impacts. |
| *Sijm-Eeken et al, 2023*[220] | Health system technology level; Netherlands | SEIPS 2.0: a human factors framework (adapted to the implementation and adoption of Green MI solutions in hospitals) | Interviews were carried out with healthcare professionals from Dutch hospitals to gain insights into which organizational and human factors impact the implementation and adoption of sustainable solutions. Key factors mentioned are formalizing tasks, allocating budget and time, creating awareness and changing protocols to promote sustainable diagnosis and treatment procedures. These elements were transcribed onto the SEIPS 2.0 quality improvement model. |

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| *Sittig et al, 2022*[240] | Health system technology level | Information technology-enabled Clinical cLimate InforMAtics acTions for the Environment" (i-CLIMATE) | A framework is introduced to illustrate how clinical informatics can help reduce healthcare's environmental pollution and climate-related impacts. Actionable components of the framework include: (1) create a circular economy for health IT; (2) reduce energy consumption through smarter use of health IT; (3) support more environmentally friendly decision making by clinicians and health administrators; (4) mobilize healthcare workforce environmental stewardship through informatics; and (5) Inform policies and regulations for change. |
| *Sood & Teherani, 2022*[229] | General health system level | Expanded sustainability framework for health system science (HSS) | An expanded sustainability framework for health systems science (HSS) is put forward to promote health systems' capacity to deliver efficient, effective care for patients and to care for the planet by decreasing emissions and solid waste while cutting costs. Alignment of an expanded HSS framework that accounts for waste from medical outputs with existing HSS infrastructure (e.g., medical education curricular design) is stated to be achieved by applying Lean Six Sigma (LSS). |
| *Strashok et al, 2010*[219] | National health system level; Canada | Green Policy Framework-Decision-Making Continuum | This paper provides an overview of the Canadian medical community's recommendations for a green policy framework. The green policy areas discussed are a compilation of visions and strategies from many of the organizations in the sector, as well as key documents. |
| *World Health Organization, 2020*[231] | General health system level | Framework for building climate-resilient and environmentally sustainable health care facilities | The proposed framework aims to increase the climate resilience of health care facilities to protect and improve the health of their communities in an unstable and changing climate, while optimizing the use of resources and minimizing the release of wastes by becoming environmentally sustainable. There are three objectives under each of the four fundamental requirements to provide safe and quality care that are central to the action framework |

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| *World Health Organization, 2015*[57] | General health system level | WHO operational framework for building climate resilient health systems | The framework responds to the demand from Member States and partners for guidance on how the health sector and its operational basis in health systems can systematically and effectively address the challenges increasingly presented by climate variability and change. The objective of this framework is to provide guidance for health systems and public health programming to increase their capacity for protecting health in an unstable and changing climate. |
| *Xie et al, 2018*[241] | Primary care level | Framework for primary care actions to create health co-benefits, and mitigate or adapt to the health effects of climate change | The developed framework provides clear parallels between changes in health behaviours (e.g., smoking, exercise, nutrition) and climate change adaptation and mitigation strategies. The framework outlines how primary care providers (PCP) can serve the community as strong promoters of actions that encourage environmental change. |

*Where applicable the country context is noted.

**Table 9.** The frameworks' health system main focus area within the included articles.

| **Framework Focus Areas** | **Relevant Articles** |
|---|---|
| General health system focus | *Cimprich et a*l[234], *Desmond*[235], *Gupta et al*[217], *MacNeill et al* [238], *Moldovan et al*[225], *Rajagopalan et al*[228], *Sood & Teherani*[229], *World Health Organizatio*n (2015)[57], *World Health Organization* (2020)[231] |
| Health system technology focus | *Dhaini et al*[236], *Hussain & Subramoniam*[237], *Kaladharan et al*[218], *Sijm-Eeken et al* (2022)[232], *Sijm-Eeken et al* (2023)[220], *Sittig et al*[240] |
| Health policy focus | *Bell*[233], *Chalabi & Kovats*[230] |
| Primary care focus | *Falceto de Barros et al*[227], *Xie et al*[241] |
| National or regional health system focus | *McIver et al*[226], *Northern Sydney Local Health District*[222], *Strashok et al*[219] |
| Urban public health focus | *Puntub et al*[223] |
| Nursing focus | *Schenk*[224] |

| | |
|---|---|
| Human resources focus | *Mousa & Othman*[221] |
| Humanitarian healthcare focus | *Schwerdtle et al*[239] |

### 6.5.2 Overview of existing planetary health frameworks

Through my qualitative content analysis of the included articles, I characterized six overarching categories, and eleven sub-categories within the planetary health-related frameworks reviewed (see *Table 10* and *Table 11)*. I review these in further detail below.

**Table 10.** Overview of the categories and sub-categories characterized within the included frameworks.

| Categories | Sub-categories |
|---|---|
| *1. The bi-directional impacts between health systems and the environment* | N/A |
| *2. Vision, advocacy, leadership, and communication for environmentally sustainable health systems* | 2.1 Reasons for making planetary health-informed changes within health systems<br>2.2 Culture, attitudes, and beliefs aligned with environmentally sustainable health systems<br>2.3 Focus on co-benefits for human and environmental health |
| *3. Key structural components for environmentally sustainable health systems* | 3.1 Economic elements<br>3.2 Social elements<br>3.3 Political, health policy, and governance elements<br>3.4 Models of care |

| | |
|---|---|
| *4. Climate resiliency and environmental sustainability of healthcare facilities and systems* | 4.1 Green performance management, environmental sustainability planning and implementation practices<br>4.2 Health workforce mobilization<br>4.3 Emergency preparedness and management<br>4.4 Recycling, pollution control, and waste management programs while optimizing the use of resources and sustainable consumption |
| *5. Climate resilient and sustainable technologies and digital infrastructure* | N/A |
| *6. Evaluation and accountability within environmentally sustainable health systems* | N/A |

**Table 11.** The categories mapped to the included articles.

| **Categories** | **Relevant Articles** |
|---|---|
| 1. The bi-directional impacts between health systems and the environment | *Chalabi & Kovats*[230], *Cimprich et al*[234], *Hussain & Subramoniam*[237], *Schenk*[224], *Sijm-Eeken et al* (2022)[232], *Sijm-Eeken et al* (2023)[220], *Sood & Teherani*[229], *Strashok et al*[219], *Moldovan et al*[225], *World Health Organization* (2020)[231], *Xie et al*[241] |
| 2. Vision, advocacy, leadership, and communication for environmentally sustainable health systems | *Bell*, *Chalabi & Kovats*[230], *Desmond*[235], *Falceto de Barros et al*[227], *McIver et al*[226], *Moldovan et al*[225], *Rajagopalan et al*[228], *Schenk*[224], *Schwerdtle et al*[239], *Sijm-Eeken et al* (2022)[232], *Sijm-Eeken et al* (2023)[220], *Strashok et al*[219], *World Health Organization* (2015)[57], *World Health Organization* (2020)[231], *Xie et al*[241] |

| | |
|---|---|
| 3. Key structural components for environmentally sustainable health systems | *Bell, Chalabi & Kovats*[230], *Cimprich et al*[234], *Desmond*[235], *Falceto de Barros et al*[227], *Gupta et al*[217], *Hussain & Subramoniam*[237], *Kaladharan et al*[218], *MacNeill et al*[238], *McIver et al*[226], *Moldovan et al*[225], *Mousa & Othman*[221], *Northern Sydney Local Health District*[222], *Puntub et al*[223], *Rajagopalan et al*[228], *Schwerdtle et al*[239], *Sijm-Eeken et al* (2022)[232], *Sijm-Eeken et al* (2023)[220], *Sittig et al*[240], *Sood & Teherani*[229], *Strashok et al*[219], *World Health Organization (2015)*[57], *Xie et al*[241] |
| 4. Climate resiliency and environmental sustainability of health care facilities and systems | *Bell, Chalabi & Kovats*[230], *Cimprich et al*[234], *Desmond*[235], *Gupta et al*[217], *Kaladharan et al*[218], *MacNeill et al*[238], *McIver et al*[226], *Moldovan et al*[225], *Mousa & Othman*[221], *Northern Sydney Local Health District*[222], *Puntub et al*[223], *Rajagopalan et al*[228], *Schenk*[224], *Schwerdtle et al*[239], *Sijm-Eeken et al* (2022)[232], *Sijm-Eeken et al* (2023)[220], *Sittig et al*[240], *Sood & Teherani*[229], *Strashok et al*[219], *World Health Organization* (2015)[57], *World Health Organization* (2020)[231], *Xie et al*[241] |
| *5. Climate resilient and sustainable technologies and digital infrastructure* | *Dhaini et al*[236], *Hussain & Subramoniam*[237], *Kaladharan et al*[218], *MacNeill et al*[238], *Sijm-Eeken et al* (2022)[232], *Sijm-Eeken et al* (2023)[220], *Sittig et al*[240], *Sood & Teherani*[229], *World Health Organization* (2015)[57] |
| *6. Evaluation and accountability within environmentally sustainable health systems* | *Gupta et al*[217], *Hussain & Subramoniam*[237], *Kaladharan et al*[218], *Moldovan et al*[225], *Mousa & Othman*[221], *Puntub et al*[223], *Schenk*[224], *Schwerdtle et al*[239], *Sijm-Eeken et al* (2023)[220], *Sittig et al*[240], *Sood & Teherani*[229], *World Health Organization* (2015)[57], *World Health Organization* (2020)[231], *Xie et al*[241] |

#### 6.5.2.1 The bi-directional impacts between health systems and the environments

Fewer than half of the identified frameworks explicitly included elements acknowledging the connection and the bidirectional impacts between health systems and the environment. This was both from the standpoint of highlighting key elements of how health systems affect the environment as well as how global environmental change can affect health systems. Climate

change was most often highlighted with "inside-out impacts" (i.e., health system impacts on the environment), and "outside-in impacts"[234] (i.e., climate change impacts on health systems) most often noted. Examples of "inside-out impacts" included greenhouse gases and air pollution, impacts on water and sanitation, chemical and other waste production, resource depletion[229,231,232,234]—with only one framework explicitly identifying biodiversity effects.[224] Examples of "outside-in impacts" included floods, fires, heatwaves, temperature extremes, heat-related illness, sea-level rise, drought, storms, raw material supply disruptions, and climate-sensitive disease outbreaks;[231,232,234,241] with some frameworks noting just the generic element of "climate change"[224] or the "environment"[219,225,237] meant to encompass any number of factors.

#### 6.5.2.2 Vision, advocacy, leadership, and communication for environmentally sustainable health systems

Just over half of the included frameworks had explicit elements noted around vision, advocacy, leadership, communication for environmentally sustainable health systems either as isolated components or in combination. Participation and inclusiveness was platformed as being important[223] for progress forward with different levels of leadership highlighted as being necessary, from health providers to community leadership.[224,240] This leadership was contingent and connected to having health system supports in place for clinician and administrator decision-making around environmental sustainability. The health system itself was also highlighted as needing to lead by example by having a strategic profile that ensures climate-aware leadership approaches are in place across the system.[235] This could include, as one example, having recognized green teams and/or individuals across the health system.[220] Ultimately, it was noted that health systems needed to have a clear vision[220] and focus[217-

[219,224,230-232] on environmental sustainability, with environmentally sustainable healthcare being the default. To better ensure success, it was highlighted that there should be formalized communication structures in place across the health system,[220,231] while ensuring appropriate engagement on the topic.[224] Three additional sub-categories were highlighted across the framework elements of vision, advocacy, leadership, and communication, which I discuss briefly below.

##### *6.5.2.2.1 Reasons for making planetary health-informed changes within health systems*

Nine of the included frameworks included specific reasons for making planetary health-informed changes within health systems. These included such things as: health professional obligation or intrinsic motivation,[220,224,239] to reduce poverty incidence and inequities[230,241]; to preserve cultural heritage[230]; and to alleviate suffering, save lives, and reduce impacts on vulnerable populations.[239] It was also highlighted that health systems have a responsibility for patients impacted by climate change,[232,235,241] and that they should be held to higher orders including doing things for the greater good.[219] It was noted that health systems are supposed to have a humanitarian focus—ensuring the platforming of human rights and maintaining human dignity by ensuring a healthy environment[225,239] through environmental protection and responsibility (i.e., protecting biodiversity, water, environmental resources).[224,225,230,241]

##### *6.5.2.2.2 Culture, attitudes, and beliefs aligned with environmentally sustainable health systems*

Within the included frameworks, the culture of health services was stated to need to "adapt to meet the demands of climate change."[233] This cultural adaptation towards environmentally sustainable health systems included attending to the underlying attitudes and beliefs that exist

within health systems,[228] while also considering the different mechanisms for change processes that are inclusive of behavioral elements.[233] Frameworks noted that to promote a "green culture"[220] there needed to be a clear awareness of the specific actors involved in and around health systems who were often explicitly named within the included frameworks. Specific actors highlighted in addition to health system actors themselves were civil society organizations, communities, NGOs, other government agencies, and regional and international agencies.[225,226] The importance of cultural competency within primary care[227] was additionally called out as being an important attribute for planetary health-informed health systems. Lastly, when positive health systems change was occurring, it was highlighted that sharing successes and lessons learned was important to further facilitate positive environmental change.[220]

##### *6.5.2.2.3 Focus on co-benefits for human and environmental health*

One framework stated the importance of understanding that healthy people are only possible within a healthy environment.[231] The ability to have co-benefit approaches through having climate-informed health programs[57,239] within health systems was additionally platformed as being critical for environmentally sustainable healthcare. Interestingly, a few frameworks specifically called out agricultural elements, including food systems,[224,241] as also being a critical component of consideration for environmentally sustainable health systems. From a co-benefit approach this was from the standpoint of understanding that having a healthy environment means healthy and more nutritious foods for people within and outside of health systems.

#### 6.5.2.3 Key structural components for environmentally sustainable health systems

Most of the included articles in the review noted or platformed varied structural components critical to ensuring environmentally sustainable health systems. These elements are reviewed below.

#### *6.5.2.3.1 Economic elements*

Several frameworks had clear economic components including: 1) matching supply to demand of health services while redefining value to ensure environmental sustainability is considered;[238] making the business case with environmental sustainability as a business strategy;[228] the need for circular economy in supply chains, and climate-smart supply and procurement systems;[222,238-240] reengineering the business processes surrounding health systems towards environment sustainability;[237] ensuring climate and health financing with improved economic performance and fiscal sustainability;[57,233,239] ensuring there are asset management skills in place for anticipated climate impacts;[233] the need to platform domestic production for climate resiliency within health systems;[217] and finally, the potential for increased employment and productivity as well as the creation of "additional jobs in the health sector for developing and implementing the adaptation and mitigation options" within an environment of climate change.[230]

#### *6.5.2.3.2 Social elements*

Some of the included frameworks highlighted the social determinants of health as being an important element for environmentally sustainable health systems.[57,229] Much of this stemmed from the understanding that the social determinants of health affect "the vulnerability of populations to climate change and their capacity to adapt."[241] The need for a social determinants lens within health system management in the context of climate change was seen to be an inherent social responsibility.[225,235] This determinant of health approach also made

space for environmental sustainability processes to be focused on people and places, including being family orientated.[222,227] Interestingly, across the frameworks there was minimal explicit mention of community engagement for environmentally sustainability health systems; however, there was note of stakeholder consultations and community surveys being carried out to support climate-related project work.[226] One framework noted the importance of social capital for bonding and bridging climate change and health-related networks[226]; while another noted the importance of digital social networking for professional interaction on the topic.[237]

##### *6.5.2.3.3 Political, health policy, and governance elements*

Many of the included frameworks included elements reflective of political, health policy, and governance landscapes. This included ensuring that the regulatory and financial environment, legal requirements, and formal legislation (laws) are conducive to promoting and better ensuring the context and backing is set for enabling environmentally-informed health systems.[220,226,234,235,237,240] There was specific note on the importance of having a supportive external policy environment that included national governments platforming sustainable healthcare,[220] optimal insurance rules[232] and hospital accreditation standards for environmental sustainability,[225] as well as the explicit need for political stability, appropriate authority, and enabling power for change at the political level.[228,230,235,237]

Policy implementation considerations and needs were highlighted as being important for environmentally sustainable health systems. There was a stated need to create structures to allow for easy policy implementation in the area while complying with the required optimal timing of policy interventions for best results.[230] This could be enabled through formalized tasks within the system for green actions led by green teams,[220] and by being aware of interdisciplinary rivalries and power differentials that could prevent needed action.[235] At the

governance level, there was a stated need for climate-aware organizational governance[57,222,232,235,239] with effective decision-makers in place to enable change.[221] With climate-aware organizational governance, climate and sustainability-specific policies and procedures[221,229] could be enacted with a preference for a "whole-of-systems policy response"[233] with strategic development plans[226] in place to enable environmentally informed change.

#### *6.5.2.3.4 Models of care*

Within the umbrella of environmentally sustainable health systems, effective models of care were frequently highlighted as being important within the included frameworks. Alongside the need for environmental considerations, the what, where, and how care is delivered still matters (e.g., fair healthcare practices)[57,225,233-235]. This included ensuring access, continuity, coordination, and comprehensive patient-centered care.[227,238] There was clear understanding that when you can improve human health (e.g., health promotion), it can reduce the overall demand on carbon and environmentally intensive care.[226,238] Health promotion and health prevention activities to reduce healthcare needs were partly enabled by ensuring well-supported primary care-orientated models of service delivery.[238,241] Additional leveraging of value-based care was seen to reduce defects in system processes by better controlling for variation in carbon-intensive healthcare delivery.[225,229] With supporting management functions and activities in place to influence clinical decisions towards environmentally sustainable healthcare (e.g., procurement, waste management, administrative services, food service),[234] planetary or green healthcare and implementation practices would be more easily enabled.[219,227] Lastly, moving towards models of care that uplift regenerative and restorative

principles was noted as being essential, with the ongoing understanding that it is an environmental imperative to live within the global biophysical carrying capacity.[219]

#### 6.5.2.4 Climate resiliency and environmental sustainability of healthcare facilities and systems

Most of the included frameworks highlighted aspects of embedding climate resiliency and environmental sustainability into both healthcare facilities and systems. The need for overall climate-related adaptation of infrastructure, processes, technologies, and products were repeatedly highlighted. This could be regarding the promotion of new systems and technologies for climate-related adaptation and mitigation, or specific management and system processes to facilitate the movement towards environmental sustainability of health care operations and faclities.[231,238] I highlight below key sub-categories that were represented within the included frameworks for this section.

##### *6.5.2.4.1 Green performance management, environmental sustainability planning and implementation practices*

Close to half of the frameworks included management, planning, and implementation practices in relation to environmentally sustainable service delivery within health systems. For environmental sustainability planning and implementation to occur, there was a noted need for movement towards innovation and systems change backed by strategic transformation processes.[228] These change processes could be leveraged by utilizing established approaches such as systems change approaches and Lean Six Sigma methodologies.[229] Some of the additional management schemes that were noted to help support the context for climate resiliency within planning and implementation included systems that had: built in flexibility and modularity; were responsive; supported policies around appropriate integration and

coordination of service delivery; and that mainstreamed climate-risk within the systems themselves.[223]

#### *6.5.2.4.2 Health workforce mobilization*

The ability to build coping and adaptive capacity towards climate-related events and health system resiliency was highlighted as being dependent on the health workforce being able to be mobilized to respond.[223] Green human resources practices were found to have had a positive influence on environmentally sustainable performance.[221] This was through on-the-ground operational practices such as having specific environmental goals adopted by every manager and employee in the organization, rewarding staff when they improve environmental programs, or rewarding staff when they come up with "remarkable ideas."[221] Having green hiring in place across the health system was an additional element highlighted. Specific green hiring practices included having job descriptions include environmental aspects, job interviews including the testing of knowledge on the environment, and specifically recruiting employees who have knowledge about the environment.[221] Frameworks included the need for green training, education, and empowerment within the existing and future health workforce.[224,231,241] Having a climate-informed workforce and workforce development process in place[233,239] (e.g., carbon literacy and systems support[235]) would better ensure the overall familiarity with green practices and capacity development across the system.[231]

#### *6.5.2.4.3 Emergency preparedness and management*

Some of the included frameworks made specific reference to climate-related emergency preparedness and management as key facets for building climate resiliency and environmental sustainability within healthcare systems and facilities. For effective emergency preparedness and management in this regard, the need to mainstream climate-risk in planning processes

across the system was highlighted.[223] Many of the frameworks where this sub-category was highlighted specifically flagged vulnerability, capacity, and adaptation assessments as being a critical piece for health systems to prioritize.[57] In addition, there was note of prioritizing integrated risk monitoring and management, and early warning and response within the health system.[57,231,239]

##### *6.5.2.4.4 Recycling, pollution control, and waste management programs while optimizing the use of resources and sustainable consumption*

Many of the frameworks highlighted processes to reduce the overall impact of healthcare facilities and systems on the planet. This was most often regarding the need to reduce energy consumption and emissions (e.g., decarbonized energy and transportation systems), as well as reducing pollution and waste (e.g., supporting systemic change towards a circular economy [i.e., "a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible"[242]]) from health services.[231,234,238,240,241] There was noted need to be strategic in how healthcare resources were mobilized while being responsive to health system needs and reducing redundancy in the overall system for better efficiency.[223] This was supported by, for example, enabling the reprocessing of used medical devices and resource recovery processes that enabled more sustainable consumption.[222,234] Other examples were ensuring cleaner overall production and disposal methods within procurement, supply chains, and waste management stages.[218,231,238] Overall, however, it was highlighted that minimizing overall waste and resource use (e.g., water) while limiting environmental costs and adding value to patients within the health system was needed (i.e., resource stewardship and environmentally preferable practice).[229]

#### 6.5.2.5 Climate resilient and sustainable technologies and digital infrastructure

Several of the articles were focused on the climate resiliency and overall environmental sustainability of the technologies and digital infrastructure used within health systems. This was both from the standpoint of how technologies and digital infrastructure could help to reduce healthcare's environmental impact (e.g., improving efficiency),[57] but also by being mindful of the high energy usage needed for many technologies as well as the production of electronic waste (i.e., e-waste), and how to better mitigate this.[240] In moving towards climate resilient and sustainable technologies and infrastructure, many operational examples were given that were dependent on health system awareness and knowledge of IT solutions including: the use of integrated technology systems (e.g., medical devices connected to information technology [IT])[236,238]; making use of green dashboard and footprint data for monitoring and improvement work[220]; leveraging expert systems and knowledge platforms to yield reductions in errors and improve efficiencies[220,237]; and the use of cloud infrastructure with fog computing (i.e., a form of distributed computing) to support medical alerts, notifications, and monitoring to improve early diagnostics in a green-aware fashion.[236]

Frameworks also highlighted the important application of technology interventions for environmental sustainability within health systems. These included telehealth (virtual care) and the efficient use of electronic health records (EHR)/electronic medical records (EMR), as well as having more effective data-sharing processes in place.[220,237,238] Other kinds of clinical informatics and technology were highlighted for consideration on the pathway towards better environmental sustainability including the internet of things (IoT),[236] picture archiving and communication systems (PACS), intelligent decision support systems (IDSS), artificial neural network, and clinical decision support systems (CDSS).[237] Ultimately, there was need to be

able to monitor and assess problems through IT architecture to support the movement towards environmentally sustainable health systems while being mindful of potential security challenges and the overall need for effective IT governance.[220] Appropriate implementation entailed balancing the potential efficiencies gained through less use of resources while designing systems that were also not resource and energy intensive themselves.

#### 6.5.2.6 Evaluation and accountability within environmentally sustainable health systems

Over half of the frameworks included elements connecting the importance of formal evaluation processes and accountability mechanisms alongside the movement towards environmentally sustainable health systems. Most commonly noted were the monitoring and evaluation of environmental performance and outcomes using a metrics-driven approach.[218,223,229,231] Environmental performance, however, was still seen to be connected to measuring overall hospital and patient outcomes, social performance, and patient and employee satisfaction alongside environmental outcomes.[217,221,225,237] Climate-informed needs assessments and sustainability scans, ongoing performance evaluations, and quality improvement processes were seen to be integral to expanding the work while ensuring effective progress.[220,225,229,239] Increased research and development was highlighted in several of the frameworks as being necessary to ensure environmental sustainability processes are grounded in appropriate evidence.[57,217,239,241]

## 6.6 Discussion

### 6.6.1 Summary of findings

I identified six overarching categories and eleven sub-categories in this framework review relevant to planetary health within health systems. These categories included: the bi-

directional impacts between health systems and the environment (e.g., emissions, medical waste, climate weather events); vision, advocacy, leadership, and communication (e.g., climate-aware leadership and communication approaches); key structural components for environmentally sustainable health systems (e.g., making the business case for environmental sustainability, inclusion of a social determinants of health lens, appropriate regulatory and financial environments in place) as well as models of care felt to be needed (e.g., value-based care, supported primary care systems); climate resiliency and environmental sustainability of healthcare facilities and systems (e.g., climate-related adaptation of infrastructure, processes, technologies, and products); climate resilient and sustainable technologies and infrastructure (e.g., improving efficiency throughout the system); and evaluation and accountability mechanisms (e.g., monitoring and evaluation using a metrics-driven approach).

Notable across the frameworks was that the vast majority were conceptual in nature ($n$ = 20), with only some either being validated ($n$ = 2) or only partially operationalized ($n$ = 2). It was therefore not surprising that only seven out of the twenty-six included frameworks explicitly included some level of measurement indicator(s) for assessing progress or accountability from an implementation lens. Most of the frameworks were also published quite recently. Given this, I anticipate that more of the frameworks will be operationalized in varying contexts in the future. This would allow for a more fulsome analysis of their uptake and impact, as well as being able to gain a better understanding of any potential challenges and barriers, or lessons learned that other health systems may learn from, as the planetary health field progresses within healthcare spaces.

Concerning, however, was the dearth of explicit processes outlined within the frameworks or their respective descriptions for any community engagement processes carried

out in the development of the frameworks themselves. There were only three that explicitly included recognition of some level of community orientation, involvement, or engagement within the frameworks themselves.[84,226,227] A few others included some level of stakeholder engagement for their data-gathering process in development of the framework (e.g., survey),[223] or noted the importance of community engagement when considering local implementation processes for environmental sustainability within their descriptions.[57,231] Given the noted conceptual nature of many of the included frameworks, there appears to be substantial need for more community and stakeholder involvement in the development and refining of frameworks towards more informed implementation processes.

### 6.6.2 Context of the review in wider dialogues

The included frameworks were majority climate change focused, with pollution also being relatively well-represented. Biodiversity considerations were almost non-existent within the included frameworks with only two mentioning the word biodiversity in the context of either biodiversity loss or protection.[224,230] Frameworks were therefore almost completely devoid of concepts or domains related to nature and ecosystems, and the planet itself. With this, most of the frameworks only addressed 'components' of planetary health without orienting towards planetary health more explicitly and comprehensively. The concept "green" or "greening" was the closest identification to nature within the frameworks,[219,221,236,237] although it was often unclear how this framing was being interpreted in the context of nature. Given the increasing concerns around "greenwashing" within healthcare and other organizational and business spaces,[243,244] it will be integral to have clear and transparent reporting, as well as accountability mechanisms put in place when considering planetary health-related implementation processes.

Additionally, wider environmental sustainability and climate change movements have been criticized for being overly mechanical and anthropocentric in nature (i.e., centering humans' needs), and attempting to maintain the same standards of overconsumption that has perpetuated planetary harm.[38,245] Most of the frameworks included in my review appeared to focus on maintaining the status quo of health system operations reinforcing a transactional approach to understanding health and health system function (i.e., human and techno-centric approaches) without interrogating the cultural factors and values that underpin overconsumption and overuse of resources. A few frameworks did highlight the importance of investing in upstream drivers of health and wellbeing, including the social determinants of health and ensuring adequate access to primary prevention and care,[227,238,241] which are known to decrease the need for complex care. All included frameworks, however, were still underpinned by Euro-Western value systems, epistemologies, and knowledge. Along these lines, none of the included frameworks explicitly stated the values or value systems that underpinned them. It has been argued that if one tries to tackle "an existential threat with the same epistemological underpinnings that caused the problem, the solutions will not create the change needed for the health of our biosphere."[38] With this, there may be argument for future planetary health-related frameworks to consider nature and the planet more explicitly, while reflecting at a systems-level the overall goals of environmental sustainability work and the value systems that underpin the work for deeper levels of change. This doesn't minimize, however, the need to build off the existing included frameworks and their respective domains to work towards efficient and urgent change within health systems.

In Chapter 7, I reflect further on the context of the review as relevant to my previous dissertation chapters.

### 6.6.3 Implications for future work

Overall, there were some comprehensive frameworks in my review that included many of the domains I identified.[57] Other frameworks were not as comprehensive yet went into more detail and depth on topic-specific areas that would be more helpful for department-level implementation than perhaps the more comprehensive ones (e.g., human resources, IT systems), reflecting differences in scope. From an operational standpoint, there was clearly more emphasis and focus on clinical care, with an acknowledged lack of research and information on important medical activities, supporting activities, background product systems, pharmacy services, hospitalization, ambulance services, and biomedical research in the context of environmental sustainability.[234] Given this, it becomes more difficult for health systems to prioritize change implementation processes (especially in resource-limited environments) outside of the larger more obvious planetary-health related needs (e.g., decarbonization, reduction in waste, etc.). I therefore call upon regional, national and international governments, funding agencies, and organizations to support further research and implementation work around planetary health-informed health systems change while considering existing frameworks and the nuances inherent within regional contexts. I additionally call for increased attention towards health system frameworks that explicitly acknowledge planetary health more comprehensively (i.e., climate change, biodiversity loss, pollution, and marine degradation).

### 6.6.4 Strengths and limitations

Given the varied use of terminology with the planetary health space broadly (e.g., sustainability, green, climate change, etc.), as well as my inclusion criteria being inclusive of English language articles only, there is a possibility that my search strategy missed relevant

frameworks. Despite this, given this is the first review of this nature of which I are aware, with most of the included articles being published relatively recently, I feel I have captured some of the key categories for consideration in future work. Many of the identified categories were included across either different geographic domains or practice domains that helped ground them in varied contexts. Scoping reviews do have inherent limitations as their focus is to "provide breadth rather than depth of information in a particular topic."[246] Given this, I focused on giving a high-level overview of the available framework components, as opposed to going into depth on selected specific domains. This means I may have inadvertently minimized some components of included frameworks. As my intention was not to create a hierarchy of different components of the frameworks (i.e., rate their importance or priority level), I feel my framework category summaries provides a preliminary overview of the key components to support future work. Finally, as this was a scoping review, I did not set out to critically appraise the framework development processes, instead focusing on providing a comprehensive overview of the frameworks available.

## 6.7 Conclusion

My scoping review identified several planetary health-related frameworks that may be useful to environmental sustainability activities within health systems, as well as domains that should be considered by organizations moving towards planetary health-informed structures and processes. Although I identified domains within the included frameworks that have more discussion and coverage around them in the context of health system environmental sustainability (e.g., carbon emission and medical waste reductions), I also identified domains that are generally less well-appreciated (e.g., green human resourcing, environmentally sustainable IT systems). My findings identified a greater need for community engagement

processes in framework development as well as a need for more evaluation and accountability mechanisms built into environmental sustainability planning and practice (i.e., a metrics-driven approach). My findings also flagged the need for inclusion of *all* facets of planetary health (e.g., biodiversity), instead of solely focusing on climate change-related and pollution-informed health systems change. Lastly, further work is needed with other knowledge systems (e.g., Indigenous Peoples and their knowledge systems) to ensure planetary health-related frameworks are grounded in what we are trying to protect—the planet itself. The research contained within this chapter can be reflected on with the findings from the previous chapters (i.e., Chapters 2 to 5) to provide some higher-level insights which are discussed in the next chapter.

# Chapter 7 Discussion

## 7.1 Summary

Chapter 7 is my concluding chapter for this dissertation. I first summarize the individual chapters, and then reflect on the overall strengths and limitations of the dissertation in full. I discuss the contributions of my work to the existing evidence base, and the implications of my work for research, policy, and practice.

My dissertation work is addressing an important and globally relevant problem that has a lack of available evidence in general. With this, my DPhil work has been platformed on the urgent need for more evidence on planetary health-informed health system change given the continued and increasing impacts of climate change. I have additionally brought in additional novelty to the topic area by focusing on the Circumpolar region, inclusive of Indigenous Peoples. Additionally, the robust multi-methods approach provided an opportunity for broader reflection of the topic within a Circumpolar health system, with a particular focus on the inclusion of Indigenous perspectives. My work is limited, however, by the scope being focused primarily on one key health professional group (i.e., physicians), and with the bulk of the data coming from high-income country settings despite the globally relevant topic area. Despite these limitations, the bridging of non-Indigenous and Indigenous perspectives is a key contribution of this dissertation as it provided an opportunity to fill a key void in regard to Indigenous perspectives around planetary health-informed system change. In addition, the research contained in my dissertation on whole has contributed towards a new conglomerate of the available evidence through a planetary health lens, allowing for more informed health system planning in regard to both climate adaptation and mitigation efforts. Overall, my findings create a number of different paths forward for research, policy, and practice.

## 7.2 Overview of the thesis

The aim of this dissertation was to identify the influences on planetary health-informed health systems change in a Circumpolar and diverse healthcare clinical setting, while exploring transferable elements and knowledge for other contexts. The work bridged both Western and Indigenous perspectives from a region in the Circumpolar North, the Northwest Territories (NWT) in Canada, that is within the ground zero of climate change.

To explore key views and influences on the ground in the NWT, it was important to first synthesize the existing literature to identify barriers and facilitators to adopting patient–planetary health (P–PH) co-benefit prescribing through a behavioral lens at a broader level. At the time of initiating this research, there had been no review carried out that brought together information on P-PH co-benefit prescribing, let alone through a behavioural lens. My systematic review in Chapter 2 therefore identified barriers and facilitators to adopting P–PH co-benefit prescribing by physicians and mapped these onto the Capability, Opportunity, Motivation, and Behaviour (COM-B) model and Theoretical Domains Framework (TDF). Clear behavioural endpoints were identified within Chapter 2, with the behavioural pathways mapped out using the COM-B and TDF (e.g., knowledge, skills, environmental context and resources).

Chapter 2 informed the development of the interview guide used to explore the perspectives of physicians around patient-planetary health (P-PH) co-benefit prescribing in the NWT, as presented in Chapter 3. Previous research on the topic area had focused mostly on gathering survey data from physicians, with only one other qualitative study having been carried out with physicians who were already topic experts in this space. Additionally, my interview study was the first time that I am aware of where perspectives have been gathered

on the planetary health and health systems topic from physicians within a Circumpolar area in the midst of active climate change. Although results showed that supporting patient-planetary health is currently difficult for clinicians in the NWT, with similar barriers (e.g., resource and capacity barriers) and facilitators (e.g., knowledge and skills) reported in Chapter 2's systematic review, there was a noted emphasis on the need for structural system change over the focus on individual clinician behaviour change alone. Additionally, unique elements were highlighted in Chapter 3 including the need for any planetary health-informed health system changes to be done in a culturally safe manner given the continued colonial, inequitable, and paternalistic system for Indigenous Peoples limiting progress in the region. This was likely in part due to the demographic make-up of the region, with a shift towards thinking about planetary health-related implementation work through an Indigenous lens, which was missing from Chapter 2's findings.

Chapter 4 presented a study that explored the views of planetary health-informed health system changes within the Circumpolar North from the perspective of Indigenous Elders. There are some known difficulties in bridging understandings of some of the Indigenous interconnected worldviews and topics discussed by the Indigenous Elder participants into Western writing formats. For the first time in the literature that I am aware of, a full systems map was created to help visualize the interconnectivity of the discussed topics for readers less attuned to Indigenous ways of knowing. The Elders' perspectives stated clearly that the planetary health-related concepts discussed within health systems cannot be disconnected from the context around it. Additionally, within my findings, health systems were seen to be currently devoid of any environmental context or consideration from an Indigenous perspective.

Chapter 5 provided an opportunity to be responsive to community-led priorities within the NWT. As noted in Chapters 3, 4, and 5, local community members requested I add a separate research question on one specific form of P-PH co-benefit prescribing—nature prescribing. The main themes identified from the physician interviews included: the importance of cultural context; barriers with nature prescriptions in the region; and the potential for nature prescriptions in the North. Reflections shared by the Elders included: the need for things to be done in the right way; the sentiment that the Land is not just an experience but a way of life; and the importance of traditional food as a connection with Nature. As noted previously, the research in Chapter 5 formed the basis of the coming launch of a local Nature prescription program by a national organization (PaRx) which paused their roll out of the program until my research was completed.

Given the focus of my findings from Chapters 3 to 5 being towards contextual and systems factors highlighted as being important for change, Chapter 6 was an opportunity to move the research towards the health systems–level more explicitly. I carried out a scoping review to identify planetary health frameworks proposed, developed, or currently used within health systems while reflecting on the framework elements commonly considered as critical to the development and functioning of environmentally sustainable healthcare systems. Although there were some consistent results with Chapters 2, 3, and 5 (e.g., advocacy, leadership, communication), there was a clear omission in the frameworks of 'all' facets of planetary health (e.g., biodiversity), as well as any acknowledgement or inclusion of other worldviews outside of Western knowledge systems (e.g., Indigenous Peoples and their knowledge systems). Given the results of Chapters 4 and 5 highlighting the important health and wellbeing connections between people and Land/Nature, and the stark cultural diversity

around the globe, ensuring planetary health-related frameworks are grounded in what we are trying to protect—the planet itself—is currently missing. This is problematic. Across Chapters 2, 3, and 6 specifically, there was a noted focus on EuroWestern-centric perspectives which minimizes the connections of health professionals, their practices, and health systems to the planet.

My own interpretations of the findings across the chapters are summarized and reflected upon here. I noticed, for example, that there was **an implicit focus and understanding within the results reported that some level of the status quo (i.e., Nature disconnection) is still being perpetuated within research and discourse around planetary health-related health systems change** (see *Figure 8* for my visual representation of this finding).

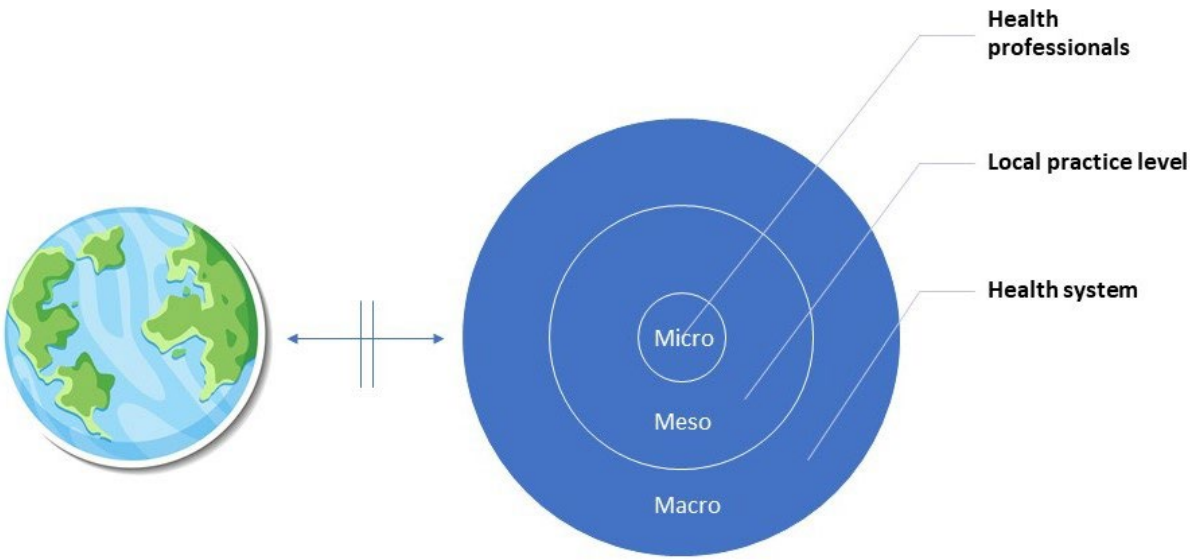



**Figure 8.** Image depicting my interpretation of the continued foundational disconnection of health professionals, their practices, and health systems from the planet (the two vertical lines located on the bidirectional arrow are symbolic of the barriers currently present).

*Earth graphic designed by Freepik: https://www.freepik.com/free-vector/earth-globe-cartoon-sticker-white-background_21307040.htm#query=earth%20clip%20art&position=4&from_view=keyword&track=ais_hybrid&uuid=fdc52c06-6244-46bc-b99f-16652de4a11e

Chapters 4 and 5 required the explicit prioritization of Indigenous ways of knowing and understanding the world. With the results highlighting that the Land is not just an experience but a way of life, the approach to speaking about planetary health-related change was much more "relational" than the other results findings from Chapters 2, 3, and 6. From an Indigenous perspective, relationality as a concept, "is how the world is known and how we, as Peoples, [Land], entities, stories and more-than-human kin know ourselves and our responsibilities to one another."[247] Given this, my results from the Indigenous-specific analysis was multi-scalar (see *Figure 9* below for a visual representation of this finding) with relationships embedded within the varied perspectives shared by the Elders. The Elders' perspectives naturally transgressed individual-level knowledge to additionally be inclusive of collective knowledge that spans from the individual and family, to the community, and to the ancestor realm. All of these represented levels were deeply interconnected to Mother Earth/Land (see *Figure 9*). With this, there was a noted difference from what is represented in *Figure 8* above.

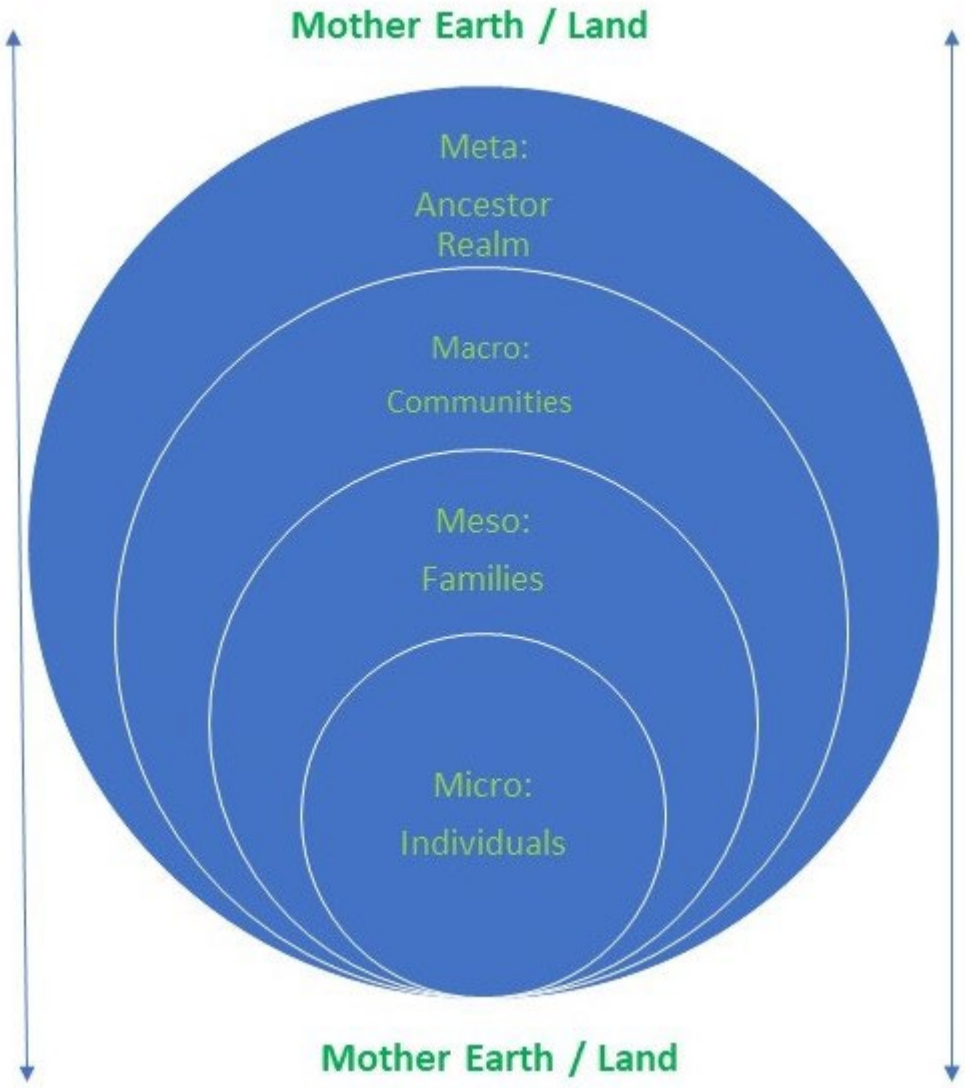



**Figure 9.** My visual representation depicting the foundational interconnected and multi-scalar relationships embedded within the varied perspectives shared by the Indigenous Elders.

What was additionally particularly striking, was the differences in the kinds of language used to share perspectives on the topic between the non-Indigenous and Indigenous-based chapters' findings. For example, varied elements were broached across the dissertation chapters with a clear difference in the framing of the issue between Chapters 2, 3, and 6 (non-

Indigenous focus), and Chapters 4 and 5 (Indigenous focus). *Figure 10* outlines some of the stark differences between the framing used between the different sets of data (non-Indigenous versus Indigenous) analyzed in my dissertation.




**Figure 10.** Domain coding across Chapters 2 to 6 outlining the differences in the kinds of language framing used to share perspectives on planetary health and health system change between non-Indigenous (left side) and Indigenous-based (right side) research data.

*I have noted a directionality to the figure (i.e., 'To') in addition to the comparison (i.e., 'Versus) from non-Indigenous to Indigenous to highlight the need based on the findings (i.e., Chapter 4) to moved towards Indigenous ways of knowing on the topic.

Overall, Figures 8, 9, and 10 showcase an Indigenous perspective where the planet and the delivery of healthcare are seen as inseparable, compared to them being viewed as two separate entities as in most non-Indigenous settings. The contrast between the two different viewpoints (see *Figure 10*) may create the need for a pause or refresh in how we ask research

questions, how we carry out research, and how we approach health policy and systems/change in the context of the colliding planetary crises.

## 7.3 Strengths and limitations

There are strengths and limitations that apply to the full dissertation, which are discussed below. Any strengths and weaknesses of the individual research studies outlined in Chapters 2 to 6 are detailed in the relevant discussion sections of those chapters.

### 7.3.1 Strengths

When I began this dissertation, there was a need to bring together the elements of planetary health-informed health systems change that were often being thought about or put together in a siloed and disconnected manner.[248-251] The siloed and disconnected nature of the work being carried out at this time was also challenged by inconsistent use of terminology when referring to planetary health-informed clinical care (see *Chapter 1*).[1] With this, a key strength of my research was that it initiated and reiterated consistent use of language around the topic to align with ongoing policy-related work within global health spaces, and disseminated this terminology through publications in academic journals.[1-3] The consistency in the use of planetary health-related language, with coordinated efforts and messaging across public health, health systems, and policy spaces, has led to an increasing appreciation and use of the framing alongside other efforts.[252-255] This more consistent use of planetary health-related terminology has also been from an Indigenous planetary health lens (see *Chapter 1*), which has been a key contribution of my work in this area.[13,137,173,175,252,254,256,257] This dissertation therefore has built out a stream of scholarly planetary health-related research that platforms the analysis of health systems change through the lived experience of an Indigenous person who has grown up in the context of climate change. To the best of my knowledge, no other

research has been carried out in relation to planetary health and health system level change that has platformed Indigenous ways of knowing within the work.

Considering the above noted inclusion of Indigenous worldviews, a further strength of the research was the use of multi-methods. Rather than focusing on one type of methodology or method, I included both Western-based and Indigenous-based qualitative approaches. In doing so, the dissertation allowed for the methodological flexibility needed to work with two very different worldviews while demonstrating how research approaches can be bridged to tackle existential problems. The process elements of this dissertation work (i.e., how Indigenous research is carried out from a methodological standpoint) is therefore just as important as the results themselves in considering future research agendas. Ultimately, the use of multiple approaches to the topic enabled the research questions to be viewed from several different angles, which allowed for a broader set of insights to be reflected upon given the vastly different lived experiences coming from the data collected and analyzed (i.e., non-Indigenous/Indigenous).

### 7.3.2 Limitations

There are three key limitations that need to be highlighted when considering the entirety of this dissertation. Chapter-specific limitations have been outlined within the respective chapters' discussion sections.

The first is the use of terminology. Although terminology was also noted as a strength regarding the consistency brought forward through this dissertation work, there are also weaknesses that need to be acknowledged. Planetary health-related terminology is still very much used in the academic realm, as well as in certain known health professional circles where active climate change advocacy has been taking place.[6,258,259] In the general population,

the terminology is still new, and is often confused with other, somewhat interrelated terminology such as One Health, Eco Health, and Environmental Health.[8,260] Given this, the overall dissertation relied on either other research teams' interpretations of planetary health-related terminology (see *Chapter 1*: *Figure 1*) within the context of the reviews (i.e., Chapters 2 and 6), or proxy explanations that were more easily understood at the community level (e.g., Chapter 4: Mother Earth's health). These terminology issues had the potential of creating opportunities for relevant data to be missed or existing data to be misinterpreted. With this, although the interpretation of terminology can be problematic, this does not negate the results presented in this dissertation—it simply means that the results may have further gaps in need of further exploration. Additionally, gaps were expected given the infancy of the research within this topic area, and the preliminary nature of the inquiry as it applies to planetary health and health systems change. Given the overall consistency of the elements identified across the chapters, however, I am confident the findings are relevant to the research and practice field of planetary health.

The second overall limitation of this dissertation is in relation to the demographic as well as the health professional make-up of the participants (i.e., the representativeness and the scope). Chapters 2, 3, and 5 in particular were focused on physicians, which are only one key player within the healthcare ecosystem. Other health professionals play key roles (e.g., nurses, pharmacists, etc.), as well as healthcare leaders, and patients themselves, with potentially differing views and perspectives. Additionally, Chapter 2 had most studies being published from high income countries; Chapters 3 and 5 had a lack of ethnic diversity within the participant base given the overall demographic make-up of physicians in the region; and all resources and data gathered for this dissertation were in English. Given the planetary scale of

the topic area, and the diversity of cultures and languages around the globe, this dissertation is therefore limited in its findings as they apply to other health system contexts. Future research on this topic therefore should target other health professionals, and other health system contexts, including low- and middle-income country contexts. Regardless, high income country health systems have overall higher impacts on the environment[261] given the higher level of infrastructure, resources, and technology surrounding clinical care, so it makes sense that high income countries have a higher responsibility to urgently limit their environmental impact. Given that many low- and middle-income country contexts are in the process of advancing their health systems, however, the findings in this dissertation may prove to be helpful for reflecting on key decisions as they move their work forward.

The third overall limitation is that studies relevant to my systematic and scoping reviews (Chapters 2 and 6), may have been published after the last search dates—a limitation fairly common within the dissertation setting. I have become aware of one study in particular that was published since my last search date relevant to Chapter 2's systematic review that would have been included in my analysis. I have read the article in full, and have identified no inconsistencies that would have changed the nature of my findings;[262] however, there were two additional planetary health-related clinical actions that were identified in this paper that did not come out in my findings. These included the promotion of patient access to contraception and plant-based diets explicitly; however, this data was gleaned from a Canadian physician participant base that were described as already being "climate-engaged."[262] I am also aware of one additional study that was recently published that may have been eligible for inclusion in my scoping review (i.e., Chapter 6).[263] In reviewing the article, there were no additional elements that were not already included in my findings.

## 7.4 Contributions of the research to the existing evidence base

This research was carried out against a backdrop of both the COVID-19 pandemic and escalating climate change. In the NWT, where a large portion of the research was carried out, there have been significant wildfire events, overland flooding, and increased costal erosion all connected to climate change since I began my dissertation work.[264] In 2023 alone, there were 238 wildfires in the region that led to the evacuation of 68% of the entire region's population for up to five weeks.[264,265] Multiple health centres were evacuated on short notice without sufficient plans in place, including the evacuation of a 100-bed hospital with the nearest evacuation centres being upwards of 1500km drive away.[42,43,266] The majority of these climate-related events were affecting northern health centres which didn't have formal plans in place for climate change–related events that required the need for city-wide evacuations.[267-269] This region is but one example of the lack of health system preparedness across the country of Canada as well as across the world in regard to changes in the health of the planet.[270-274] Given this, one challenge of conducting research in this area is that there has been very little existing research evidence to build upon, particularly when it comes to evidence relevant for Circumpolar health systems. My dissertation work, therefore, was the first time the topic was investigated in the region, and the first time Indigenous Elders were engaged on the topic globally to the best of my knowledge.

As noted in Chapter 1, more articles have been published regarding Indigenous knowledges within planetary health spaces, even throughout the timeframe of my dissertation work. Most of this work has focused on general notions of planetary health unconnected to the delivery of healthcare or health systems.[137,275-277] Existing climate change and health-related publications relevant to Indigenous Peoples have been primarily focused on either examining

the current or expected health impacts from climate change on the population[278] (including in the Circumpolar North[279]), and/or building climate and health-related resilience.[280,281] To date, outside of my dissertation, I have not been able to identify any existing research papers applying Indigenous knowledges to planetary health-related health systems change.

Indigenous research has often been challenged in how to express itself through EuroWestern-centric mediums (dissertations included), where the concept of what constitutes "evidence" is seen, examined, and critiqued through a EuroWestern lens (i.e., colonial lens). This has been perpetuated by higher representation throughout past academic history of Indigenous research being led by non-Indigenous Peoples, which continues to be a problem today in many regions.[282,283] Prior work has also shown, however, that research articles embodying principles of Indigenous methodologies are articulated much more clearly by Indigenous scholars than by those authored by non-Indigenous scholars.[284] With often "unconscious assumptions about the dominance of Western paradigms"[285] within education and research spaces, Chapter 4 therefore allowed space for the wide-ranging narratives that operate around what are often linear research questions (from an Indigenous perspective) to be present. The systems map in Chapter 4 also provided a visual image of the deep interconnectedness of Indigenous knowledges. Despite the epistemic challenges inherent in trying to apply Western research or dissertation frameworks towards research such as that presented in Chapter 4, this dissertation allowed for some level of insights into Indigenous Peoples' worldviews through a Western medium (i.e., research paper/dissertation).

Set against the backdrop of Chapters 4 and 5's inclusion of Indigenous perspectives, Chapter 6's lack of explicit Land and Nature-based connection within the review's included frameworks showcases in and of itself the importance of Indigenous Peoples carrying out

Indigenous research. Would a non-Indigenous researcher have picked up on this Nature and Land-connection gap in the included frameworks given the non-Indigenous worldview lacking a Land-based worldview inherently? I cannot answer this with certainty; however, anecdotally, after years of working in climate and health as well as within planetary health spaces, this Nature- and Land-based lens has been severely lacking.

I do need to note that as my dissertation work progressed, there was an increasing number of articles that were published on planetary health and health systems more broadly (i.e., non-Indigenous focused). However, these have mainly focused on planetary health-related 'education' of health professionals.[286-289] In addition, many of these articles have been primarily comments, opinions pieces, personal views, and editorials (i.e., calls to action, advocacy focused, summaries),[286,288,290] with less formal research outputs. With this, the idea that to continually call out the need for urgent planetary change will be enough to make change is not proving to be effective. This is where a pragmatic approach proves particularly useful. In Chapter 2's systematic review, the research was able to highlight example policy levers that can be connected back to clinical intervention targets (e.g., communication, guidelines, regulation, service provision; see *Chapter 2*, *Table 5*), as well as behavioural actions that were identified through the analysis. This is but one example of being able to provide an evidence-based pathway for quality improvement projects going forwards that also have the potential to engage system-level change. These identified behavioural and policy endpoints connect well to the views shared by physicians in Chapter 3 and 5. However, as noted previously, Chapters 2, 3, and 6 were lacking in the grounding to Indigenous conceptualizations of planetary health as seen through Indigenous Peoples represented in the dissertation work (e.g., Chapters 4 and 5). With this, it is hoped that a legacy of my

dissertation work is to have an advocacy reference point for the re-grounding of planetary health-related health systems change back to Land and Nature itself, while avoiding the perpetuation of the ongoing mechanical and technocratic solutions alone that continue to keep health systems and the people within it separated from the planet and her health.

## 7.5 Dissemination of research findings

The research studies contained within this dissertation were designed to be responsive to current needs within both the planetary health space as well at the community-level in the NWT. The studies were also designed to provide a unique contribution to the research area, while helping to inform future research, policy, and practice. To date, the results of my research have been disseminated through the following routes:

- The introduction to 'patient-planetary health co-benefit prescribing' (Chapter 1), and the mixed methods systematic review (Chapter 2) have been published in peer-reviewed journals,[1,3] with thirty-four citations across both articles so far. I have additionally presented concepts and findings from the work in these chapters at multiple conferences both nationally and internationally, including for the World Health Organization (WHO).
- The physician interview study (Chapter 3) has also been published in a peer-reviewed journal,[2] and has been presented at conferences.
- Results from the Indigenous Elders study (Chapter 4) have been presented at several academic conferences. At the time of submission of this dissertation, an article describing this chapter's results was under review at *Lancet Planetary Health*.
- An article describing results from the nature prescription study (Chapter 5) has been published in a peer-reviewed journal.[4] The results have also been presented to the

Canadian Nature Prescription Program (PaRx), as well as to the principal investigators of a Land-based Nature prescription program in Ontario, Canada.

- At the time of submission of this dissertation, an article describing the results from Chapter 6 was under review at *PLOS Global Health*. The results have also been presented to the Planetary Health Alliance (PHA).

Given the urgency of the current planetary health crisis, I have invested a large amount of effort into ensuring ongoing dissemination of my work to a range of audiences, both academic and non-academic, including policy makers. I have described below, further implications and possible directions for future research.

## 7.6 Implications for future research: Research, policy, and practice

The research I have presented in this dissertation leads to several future research, policy, and practice directions. Additionally, there are findings that could support the development and implementation of quality improvement projects and policy changes across health systems outside of research and on the ground practice alone, which are discussed in more detail further below.

Given the current climate change emergency, we are running out of time to investigate planetary health-related health systems change in a vacuum disconnected from the timely needs of this emergency. The relatively consistent elements identified across my dissertation findings (e.g., need for knowledge, education, training, and resources for providers and leadership, organizational culture change and supports), including practice (e.g., *Chapter 3*: *Table 7*) and policy (e.g., *Chapter 2*: *Table 5*) change ideas, provide opportunities for moving forward quality improvement projects at both the clinical and the systems level. Change processes should not be thought about in a linear fashion, with one step coming before

another, but tackled from a systems approach (as exemplified by Chapter 4) with multiple co-aligning change agendas (e.g., education of health professionals, the development of clinical guidelines, and baseline climate-related health system assessments and monitoring all co-occurring). Key preliminary areas of focus likely will, however, lead to more efficient progress as time goes on. These areas of focus based on the dissertation findings include:

- *Baseline climate-related health system assessments and monitoring* being developed and operationalized with evaluation rubrics being co-developed in concert with the various layers of the health system (e.g., clinical). Further research is needed in developing appropriate and more specific planetary health-related indicators not only at the health systems level but at the clinical level (in concert with health professionals), which is currently significantly lacking. Chapter 6 was critical in pointing out the significant lack of accountability mechanisms within planetary health-related health system frameworks currently in place.
- A better understanding of *patient perceptions and needs* aligned with the *development of ethical guidelines* to support health professionals and health systems is needed. Such efforts will serve to support clinicians and health systems in balancing patient and planetary health dynamics within clinical care (i.e., balancing patients and planetary health considerations). Bioethics has been historically disconnected from Nature and the Planet, with only preliminary work started within this area.[291-293] As climate change progresses, there will be ongoing and signification disruptions to the provisions of care of people and communities. Grappling with the coming ethical dilemmas will situate the health system more efficiently to deal in real time with issues as they arise (e.g., disruptions to supply chains including critical medicines,

environmental or patient tradeoffs).[294-296] Patients must be a part of these conversations, and as Chapter 3 highlighted there is a current lack of confidence from physicians on how patients will perceive planetary health-related health system change.

- As outlined in Chapters 3 and 6, there have been technological advances that have enabled more efficient forms of care to be provisioned within health systems (e.g., telehealth). Despite these advances, as also highlighted in Chapter 3's findings, there have been large challenges and barriers at the policy level in seeing some of these technologies advanced in varied contexts. With this, research activities to further highlight which technologies in which contexts are more likely to lead to positive planetary change are in need. Additionally, there has been a lack of research and investigation into new medical technologies from a planetary health lens. What are the environmental tradeoffs if any (e.g., carbon emissions and/or pollution outputs)? Are there unanticipated planetary health effects that need to be considered for more informed decisions? Overall, there are several avenues that need exploration, with a call for more planetary health integration into the development and study of new health technologies. This is especially important in an era with increasing artificial intelligence (AI) use, which is known to be extremely energy intensive.[297]
- The health and medical insurance industries play a large role in health systems functioning. As highlighted in the dissertation findings, the question of insurance coverage, and insurance responsibility was brought to the forefront regarding potential barriers for P-PH co-benefit prescribing. Health and medical insurance coverage differs around the globe, however, there has been a lack of overall investigation into

how the insurance industry could play a role in the transition towards planetary health-informed healthcare. As the insurance industry will continue to face increasing costs due to climate change-related events, a sicker population from an unhealthy planet, as well as increasing costs of treatment, there may be a role for insurance-related research to set benchmarks or expectations for health systems to abide by to reduce planetary and therefore human harm. Policy mechanisms are additionally in need of exploration in this area, with potential avenues for insurance policy reform that align with planetary health.

- Lastly, there is also the potential to build off the research carried out in Chapter 4. Additional listening and sharing sessions could be carried out with Indigenous Elders and knowledge holders to build off of the initial discussions. In particular, working towards the development of an Indigenous framework for health system change that could sit in alignment, or be a grounding tool for wider planetary-health related elements would be particularly useful. Involvement of diverse Indigenous Peoples would be needed for such a framework to be widely relevant.

Ultimately, it is hoped that initiation of varied research agendas can also co-occur with local change initiatives such as those identified in *Chapter 3, Table 7*. It has often been stated that evidence-based practices (EBPs) take on average seventeen years to be incorporated into routine general practice in health care.[298,299] With climate tipping points becoming a more likely reality,[300] we need all hands-on deck, the bridging of disciplinary backgrounds, and the alignment of research agendas around the largest human threat. We do not have 17 years to make planetary health-related change.

## 7.7 Conclusion

In conclusion, the research contained within this dissertation has contributed to a new conglomerate of the available evidence as well as brought together diverse and novel perspectives through a planetary health lens. Bridging worldviews within this dissertation has allowed for a wider spread of perspectives to inform health system planning in regard to both climate adaptation and mitigation efforts. In addition, the research has further amplified the importance of Indigenous perspectives within planetary health-related work. With this, my findings create several different avenues forward for future research, policy, and practice. Overall, my findings highlighted that planetary health-related health systems change needs to be viewed from a systems level, with a planetary health lens becoming the forefront integrated context for any health system as opposed to a siloed topic separate from it.

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# Appendices

**Appendix 1.** Mixed Methods Appraisal Tool (MMAT) results from mixed methods systematic review (Chapter 2).

| Authors | Quality Score |
|---|---|
| *André et al, 2022* | *** |
| *Ard et al, 2016* | **** |
| *Boland & Temte, 2019* | **** |
| *den Boer et al, 2021* | ***** |
| *Kotcher et al, 2021* | **** |
| *Petre et al, 2019* | **** |
| *Sarfaty et al, 2014* | **** |
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| *Völker et al, 2018* | *** |
| *Wang et al, 2020* | **** |