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ABSTRACT

Background Despite climate change being described as a code red for humanity, health systems have been particularly slow in both climate mitigation and adaptation responses. The effects of climate change on health and health systems will not be felt equally, with underserved and marginalised communities disproportionately impacted. The circumpolar region is warming at 3–4 times the global rate, amplifying already existing socioeconomic barriers and health inequities, with particular amplified effects for the substantial Indigenous population in the area.

Objectives and setting We therefore sought to explore perspectives of physicians around patient-planetary health (P-PH) 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.

Methods Thirteen semi-structured physician interviews were carried out in the NWT region between May 2022 and March 2023 using purposive sampling. Interviews were transcribed verbatim and reflexive thematic analysis was carried out to identify key themes.

Results There were three main themes identified including (1) current healthcare system does not support 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 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.

Conclusion The NWT health system has unique features due to its rural and remote nature and smaller population base. Despite this, our study identified some key opportunities for advancing P-PH co-benefit efforts. The identified opportunities may be considered in future intervention, organisational change and policy-making efforts with potential relevance in other settings.

INTRODUCTION

Despite climate change being described as a code red for humanity,¹ governments and health systems have been particularly slow in both climate mitigation and adaptation

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ To our knowledge, this is the first qualitative study on the topic specific to patient-planetary health co-benefit prescribing in a general populous of physicians.
- ⇒ Perspectives on the topic were 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.
- ⇒ A limitation of the study is that it does not include the perspectives of other health professionals or system stakeholders.
- ⇒ Due to the small number of physicians practising in this rural and remote Canadian healthcare setting, specific demographic details of participants could not be shared due to anonymity concerns which limited reporting the context of the participants.

responses. Yet, if no action is taken, the impacts of climate change on health systems will be in the tune of billions of dollars.^{2,3} It was not 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 WHO review of all 193 national climate plans (Nationally Determined Contributions (NDCs)) showing that most (91%) now include health considerations at some level.⁴ Many NDCs also now formally recognise the health co-benefits that come with climate mitigation actions in various sectors, including from reduced air pollution, healthier diets and active transport.⁴ The effects of climate change on health and health systems, however, will not be felt equally, with underserved and marginalised

communities disproportionately impacted and least able to 'prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts'.⁵

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 USA (Alaska).⁶ The region is warming at 3–4 times the global rate,^{7,8} 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.⁹ 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' (eg, socioeconomic marginalisation, high rates of poverty and health inequities).⁹ The region has been very much overlooked in the context of global health policy and practice.⁹

The Northwest Territories (NWT) in Canada 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 fires. 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.^{10,11} 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.

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.¹² In a recent systematic review on P-PH co-benefit prescribing, the most 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.¹³ Additionally, despite previous survey and leadership work having explored the attitudes of clinicians on climate change and health, there has 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 carried out in the USA.¹⁴ 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.¹⁴ We 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. We also aim to inform future intervention development in P-PH co-benefit prescribing in the NWT region while

reflecting on elements that may be transferable to other circumpolar or global contexts.

METHODS

Research aim and questions

We had two research questions: (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 P-PH cobenefit prescribing in their own practices and regions?

Overall design

We designed a qualitative research study with the intent of centring physician voices in our investigation (ie, person centred¹⁵) while gaining an in-depth exploration of the topic that has been lacking in the current literature.¹³ Qualitative approaches are particularly attuned to providing rich contextual data that can help inform future intervention development.¹⁶ We additionally took a pragmatic approach to the study to ensure appropriate contextualisation of the data, be solutions orientated (ie, taking a problem-solving approach to inquiry) and to be action based.¹⁷ We followed the Standards for Reporting Qualitative Research¹⁸ for this study.

Patient and public involvement

Two local NWT-based physicians were engaged at the outset of the project with the opportunity to provide input into the design and conduct of the research. Patients and the public, however, were not involved in this research's reporting. Results of this study will be shared with all participants including opportunities for the co-development of wider dissemination plans.

Setting of the study

The study was carried out in the NWT, Canada, which has a majority Indigenous population (First Nations, Inuit, Métis) and a land mass of 1 171 918 square km¹⁹ (approximate equivalent to the land mass of Spain, Portugal, and France combined), yet has a population of around 45 000 people. 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 50 total 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.^{20 21} The land mass area that makes up the broader NWT healthcare region is warming at triple the global rate, with increasing experiences of acute climate events, including flooding and wildfires.⁷

Author positionality

The first author (NR) is a member of the Deninu K'ue First Nation located in the NWT and has been working in Indigenous health and planetary health as either a clinician or researcher for over 13 years, including in the NWT region. The second author (JH-B) is a health policy researcher, recently relocated from the UK to the USA, with expertise in using evidence to inform health policy. The senior author (ST-C) is a primary care researcher based in the UK with expertise in studying the prescribing behaviour of primary care clinicians.

Recruitment and consent

We used purposive sampling in this study to ensure maximum variation²² of the physician participants in regard to gender, years of practice, specialty and the practice region within the NWT. Participants were recruited through existing and well-established networks and contacts known to the lead author (NR) as well as through snowballing given the small nature of the health system in the region. Participants were sent an email inviting them to take part in the study which included a 'Participant Information Leaflet' 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 any further questions. 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 21 potential participants originally sent emails, 8 did not respond, with a lack of confirmation on whether or not 4 of those 8 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 US\$200 donation in their name to a non-profit organisation of their choice in the NWT as a thank you for the time to take part in the study. A record of consent was taken, and the participant was sent a copy of the informed consent document for their records.

Interview data collection

Semi-structured interviews were carried out virtually by video conferencing software between 16 May 2022 and 10 March 2023. The interviews were audio recorded. Additional analytic memos were taken alongside the interviews to ensure reflection of the data with regular interview debriefs being held with the wider research team throughout the data collection phase to better facilitate an ongoing reflexive practice.²³ As one of the researchers who carried out the interviews (NR) has lived and worked within the NWT and was known to some of the participants due to the small population landscape within healthcare, engaging in systematic interview debriefs with the other members of the research team who did not have local connectivity (JH-B, ST-C) 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 semistructured interviews followed a topic guide made up of open-ended questions covering key topic items identified from the literature, including 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, views on specific prescribing practices in relation to the health of the planet (see online supplemental file). Although participants were asked open-ended questions, flexibility was also premised to allow for the exploration of additional relevant topics raised by participants.

Data analysis

Audio recordings were transcribed verbatim; however, additional anonymising was done to the transcripts given the higher chance of identifiability given the small physician population in the area. Once the interview transcripts had been anonymised, the transcript was sent to the respective participant for review to ensure the level of anonymisation met their comfort levels. Interview transcripts were then uploaded into NVivo (Release V.1.3) qualitative software for analysis. Analysis of the data occurred concurrently with data collection to allow for the time and space to probe into any relevant findings in subsequent interviews.

Reflexive thematic analysis as outlined by Braun and Clark^{24 24} and advanced in 2019²⁵ was carried out by inductive coding to generate key themes. The stages of coding were tracked through analytic folders as the refining, defining and naming of themes was completed to keep an audit trail.^{24 25} One author carried out the preliminary coding (NR) with a second author brought in for discussion and for the refining of the codes and themes (ST-C). Coders constantly referred back to the original transcripts, and when no new themes were identified from the data analysis process, data saturation was determined to be reached.²⁶

RESULTS

Thirteen semi-structured physician interviews were carried out in the NWT region between May 2022 and

**Table 1** Patient-planetary health themes and sub-themes identified from the data

Themes	Subthemes
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
	-Currently overburdened physicians and the healthcare system do not prioritise the planet
Considering change in the Northwest Territories to support patient-planetary health	-Unique health system considerations in the north
	-Patient-planetary health opportunities in the Northwest Territories

March 2023. Ages of the participants ranged from 32 to 59 years, with an average age of 44 years old, and average years of practice at 15 years. The years of practice in medicine among the participants ranged from 2 to 30 years in practice. 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.

There were three main themes and six subthemes identified from the data analysed (see [table 1](#)). The themes crossed patient-planetary healthcare more broadly (ie, 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.

Current healthcare system does not support planetary health

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

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 organisational 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, that many bureaucratic actors in the north do not 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. This lack of longer term vision was said to be 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].

Health system management-level challenges were highlighted specifically regarding the delivery of care. Physicians who reported trying to make changes in the system towards planetary health said they have had a noted 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 literal weeks [ID 1.6].

Ultimately, there was a recognition that with complicated interjurisdictional relationships existing between the NWT and other regions; that there is a tendency for

performative actions with no real embedded accountability; that there is high levels of institutional risk aversion; that continued top-down approaches are implemented without actual implementation support; and that change in the NWT often relies on a few champions working really hard—and this is not sustainable or feasible for lasting change.

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. The NWT specifically was stated to have a stark lack of human resources and capacity at multiple levels of the health system, 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, there was a noted lack of continuity of care affecting the ability to provide planetary health-based healthcare. 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 (eg, on-call, locums, fill-ins, etc). A lack of continuity of care was amplified with 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 were 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 balance of needing to ship somebody out on medical travel for an MRI needs to be considered with the high

financial cost of this travel to the system which can be independent to the high greenhouse gas contribution of medical travel itself.

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.

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 towards 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 eye rolls” (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 a 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 practise habits can be difficult and take time.

Currently, overburdened physicians and the healthcare system do not prioritise the planet

Participants were very clear in that currently overburdened physicians and the healthcare system overall are not prioritising 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 that 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 were 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).

Considering change in the NWT to support P-PH

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

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 P-PH. 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 among 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 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 broadband 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).

Patient-planetary health opportunities in the NWT

Despite the unique context apparent in the NWT, there were many P-PH 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 (eg, 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 programmes 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 (ie, whether a more planetary health-friendly drug was listed on formularies and/or available in stock); the use of planetary health-based prescribing statistics (eg, monitoring the amount of metered-dose inhalers [MDI inhalers] being prescribed vs dry power inhalers); and insurance coverage considerations for adjusting medical care to support planetary health (see [box 1](#)). Participants specifically noted that insurance coverage including the non-insured health benefits programme for Indigenous Peoples was an important variable for possible changes in drug prescribing practices that consider 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

Box 1 Specific opportunities for affecting change towards patient-planetary health (P-PH) co-benefit prescribing as highlighted by participants

Opportunities

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

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).

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 emphasised 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).

DISCUSSION

Our 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. It was made clear by participants 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.

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 (eg, 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 with urgent care and

primary care settings^{27,28}; however, another review showed that there was no impact on antibiotic prescribing from remote consultations.²⁹ Regardless, there has been a lack of cost-benefit analysis on the environmental impacts of overprescribing compared with a simple reduction in carbon emissions from reduced travel to medical visits. In the NWT where medical travel is relied on 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 organisational 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 coaligning systems perspective. For example, throughout our 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 emphasised 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 proposed³⁰ that move towards thinking about P-PH health through a fully integrated systems strategy (ie, cross-cutting); however, there have only been a few health systems around the globe that have been publicly pursuing large cross-cutting change efforts (eg, NHS England,³¹ Kaiser Permanente³²). Work has additionally been carried out to create technical road maps for larger health system carbon reduction,³³ and aligning procurement requirements for carbon-intensive medical supply chain emission³⁴; 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. Additionally, none of these efforts have taken into consideration P-PH health perspectives



of Indigenous Peoples who see the planet as being intimately tied to their own health.³⁵ 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 our 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 our data. 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,^{13 14 36-43} 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. There has been no examination globally that the authors are aware of 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 generalised examination and polling around climate change in the political and research context,⁴⁴ 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 USA 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.³⁷ In this same study, only 6% of patients ranked their physician as a top source of information on the topic.³⁷ 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 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 emphasised 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.⁴⁵⁻⁴⁷ Low work control (ie, over work conditions and decision-making) has been particularly highlighted as being a variable to physician burnout.^{46 48} Given the known increases in physician and other healthcare provider burnout in Canada and elsewhere amplified by the COVID-19 pandemic,⁴⁹ 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^{14 38 42 50} as well as the absence of peer support and networks^{42 51} as being barriers for P-PH co-benefit-related clinical practice.¹³ With this, positive work culture, and instituting peer support and leadership within systems will likely also be beneficial for successful change.

Limitations

Although we made strong efforts to interview a broad range of physicians practising in the NWT, our findings may not be fully representative of all physicians in the region. Given our spread of age range, years of practice and regional placements across the physicians interviewed, however, we are confident that our 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. We 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 (ie, have grown up, been schooled and/or have practised in other more southern Canadian jurisdictions in the past in addition to the NWT), we feel that there may be insights gleaned from the findings in this study to consider in other contexts, particularly in other rural and remote areas. Regardless, there is a need for further investigation into physicians' views 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. Lastly, physicians are 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.

CONCLUSION

The NWT health system has unique features due to its rural and remote nature and smaller population base. Despite this, our study identified some key opportunities for advancing P-PH co-benefit prescribing efforts. Key opportunities and leverage points identified included ensuring multilevel 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 (eg, 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 an NWT planetary health secretariat to advance education, advocacy and action across governmental departments. The identified opportunities may be considered in future intervention, organisational change and policy-making efforts with potential relevance in other settings.

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).

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REFERENCES

- Romanello M, McGushin A, Di Napoli C, *et al*. The 2021 report of the lancet countdown on health and climate change: code red for a healthy future. *Lancet* 2021;398:1619–62.
- Government of Canada. Government of Canada invests \$42.9 million to support individuals and the health sector to adapt to our changing climate. Available: <https://www.canada.ca/en/health-canada/news/2023/05/government-of-canada-invests-429-million-to-support-individuals-and-the-health-sector-to-adapt-to-our-changing-climate.html> [Accessed 27 Sep 2023].
- De Alwis D, Limaye VS. The costs of inaction: the economic burden of fossil fuels and climate change on health in the United States. Available: <https://www.nrdc.org/sites/default/files/costs-inaction-burden-health-report.pdf> [Accessed 27 Sep 2023].
- Wyns A, Neville T, Orsetti E, *et al*. WHO review of health in nationally determined contributions and long-term strategies: health at the heart of the Paris agreement. 2023. Available: <https://climahealth.info/resource-library/2023-who-review-of-health-in-nationally-determined-contributions-and-long-term-strategies-health-at-the-heart-of-the-paris-agreement/> [Accessed 27 Sep 2023].
- United States Environmental Protection Agency. EPA report shows disproportionate impacts of climate change on socially vulnerable populations in the United States. Available: <https://www.epa.gov/newsreleases/epa-report-shows-disproportionate-impacts-climate-change-socially-vulnerable> [Accessed 27 Sep 2023].
- UArctic. The circumpolar North. Available: <https://education.uarctic.org/circumpolar-north/> [Accessed 27 Sep 2023].
- Government of Canada. Canada's changing climate report. Available: https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_FULLREPORT-EN-FINAL.pdf [Accessed 27 Sep 2023].
- Rantanen M, Karpechko AY, Lipponen A, *et al*. The Arctic has warmed nearly four times faster than the globe since 1979. *Commun Earth Environ* 2022;3:168.
- Chatwood S, Bjerregaard P, Young TK. Global health—a circumpolar perspective. *Am J Public Health* 2012;102:1246–9.
- Tait C, Kirkup K, Smith A, *et al*. Dozens remain in Yellowknife hospital as evacuation stretches past deadline. *Globe and Mail*. 2023 Available: <https://www.theglobeandmail.com/canada/article-yellowknife-evacuation-continues-past-deadline-as-wildfires-encroach/>
- Carroll L. Patient dies during evacuation of Yellowknife hospital. *CBC News*. 2023 Available: <https://www.cbc.ca/news/canada/north/nwt-wildfire-update-1.6941729#:~:text=One%20patient%20of%20Stanton%20Territorial,the%20N.W.T.'s%20health%20minister>
- Redvers N. Patient-planetary health co-benefit prescribing: emerging considerations for health policy and health professional practice. *Front Public Health* 2021;9:678545.
- Redvers N, Wright K, Hartmann-Boyce J, *et al*. Physicians' views of patient-planetary health co-benefit prescribing: a mixed methods systematic review. *Lancet Planet Health* 2023;7:e407–17.
- den Boer ACL, Teherani A, de Hoop E. Discussing climate change and other forms of global environmental change during the clinical encounter: exploring US physicians' perspectives. *J Clim Change Dig Health* 2021;4:100058.



- 15 Renjith V, Yesodharan R, Noronha JA, *et al.* Qualitative methods in health care research. *Int J Prev Med* 2021;12:20.
- 16 Yardley L, Bradbury K, Morrison L. *Using Qualitative Research for Intervention Development and Evaluation. Qualitative Research in Psychology: Expanding Perspectives in Methodology and Design.* 2nd. American Psychological Association, 2017: 263–82.
- 17 Long KM, McDermott F, Meadows GN. Being pragmatic about healthcare complexity: our experiences applying complexity theory and pragmatism to health services research. *BMC Med* 2018;16:94.
- 18 O'Brien BC, Harris IB, Beckman TJ, *et al.* Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med* 2014;89:1245–51.
- 19 Government of the Northwest Territories. Overview of the Northwest Territories, Available: <https://www.maca.gov.nt.ca/sites/maca/files/resources/hira-02-overview-of-the-northwest-territories.pdf> [Accessed 27 Sep 2023].
- 20 DHont T, Stobart K, Chatwood S. Breaking trail in the Northwest Territories: a qualitative study of indigenous peoples' experiences on the pathway to becoming a physician. *Int J Circumpolar Health* 2022;81:2094532.
- 21 Giles SM, Giles AR. Industrious, submissive, and free of diseases: 156 years of physicians in Liidlii Kue/Fort Simpson, Northwest Territories. *Can J Rural Med* 2008;13:111–20.
- 22 Etikan I. Comparison of convenience sampling and purposive sampling. *AJTAS* 2016;5:1.
- 23 McMahon SA, Winch PJ. Systematic debriefing after qualitative encounters: an essential analysis step in applied qualitative research. *BMJ Glob Health* 2018;3:e000837.
- 24 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psycho* 2006;3:77–101.
- 25 Braun V, Clarke V. Reflecting on reflexive thematic analysis. *Qual Res Sport Exerc Health* 2019;11:589–97.
- 26 Guest G, Bunce A, Johnson L. How many interviews are enough?: an experiment with data saturation and variability. *Field Methods* 2006;18:59–82.
- 27 Johnson KL, Dumkow LE, Salvati LA, *et al.* Comparison of diagnosis and prescribing practices between virtual visits and office visits for adults diagnosed with uncomplicated urinary tract infections within a primary care network. *Infect Control Hosp Epidemiol* 2021;42:586–91.
- 28 Vestesson E, De Corte K, Chappell P, *et al.* Antibiotic prescribing in remote versus face-to-face consultations for acute respiratory infections in primary care in England: an observational study using target maximum likelihood estimation. *eClinicalMedicine* 2023;64:102245.
- 29 Han SM, Greenfield G, Majeed A, *et al.* Impact of remote consultations on antibiotic prescribing in primary health care. *J Med Internet Res* 2020;22:e23482.
- 30 MacNeill AJ, McGain F, Sherman JD. Planetary health care: a framework for sustainable health systems. *Lancet Planet Health* 2021;5:e66–8.
- 31 NHS England. Greener NHS. Available: <https://www.england.nhs.uk/greenernhs/> [Accessed 27 Sep 2023].
- 32 Kaiser Permanente. Climate action. Available: <https://about.kaiserpermanente.org/commitments-and-impact/healthy-communities/improving-community-conditions/environmental-stewardship/climate-action> [Accessed 27 Sep 2023].
- 33 Health Care Without Harm. Designing a net zero roadmap for healthcare: technical methodology and guidance. Available: <https://noharm-europe.org/sites/default/files/documents-files/7186/2022-08-HCWH-Europe-Designing-a-net-zero-roadmap-for-healthcare-web.pdf> [Accessed 27 Sep 2023].
- 34 Health Care Without Harm. Health care without harm celebrates HHS and NHS supply chain alignment. Available: <https://noharm-uscanada.org/articles/news/us-canada/health-care-without-harm-celebrates-hhs-and-nhs-supply-chain-alignment> [Accessed 27 Sep 2023].
- 35 Redvers N, Celidwen Y, Schultz C, *et al.* The determinants of planetary health: an indigenous consensus perspective. *Lancet Planet Health* 2022;6:e156–63.
- 36 André H, Gonzalez Holguera J, Depoux A, *et al.* Talking about climate change and environmental degradation with patients in primary care: a cross-sectional survey on knowledge, potential domains of action and points of view of general practitioners. *Int J Environ Res Public Health* 2022;19:4901.
- 37 Boland TM, Temte JL. Family medicine patient and physician attitudes toward climate change and health in Wisconsin. *Wilderness Environ Med* 2019;30:386–93.
- 38 Petre M-A, Bahrey L, Levine M, *et al.* A national survey on attitudes and barriers on recycling and environmental Sustainability efforts among Canadian Anesthesiologists: an opportunity for knowledge translation. *Can J Anaesth* 2019;66:272–86.
- 39 Sarfaty M, Mitchell M, Bloodhart B, *et al.* A survey of African American physicians on the health effects of climate change. *Int J Environ Res Public Health* 2014;11:12473–85.
- 40 Sarfaty M, Bloodhart B, Ewart G, *et al.* American thoracic society member survey on climate change and health. *Ann Am Thorac Soc* 2015;12:274–8.
- 41 Sarfaty M, Kreslake JM, Casale TB, *et al.* Views of AAAAI members on climate change and health. *J Allergy Clin Immunol Pract* 2016;4:333–5.
- 42 Völker M, Hunchangsith P. Drivers of physicians' engagement in addressing ECO-health problems. *Ecohealth* 2018;15:853–63.
- 43 Wang J, Li S, He B. Chinese physicians' attitudes toward ECO-directed sustainable prescribing from the perspective of Ecopharmacovigilance: a cross-sectional study. *BMJ Open* 2020;10:e035502.
- 44 IPSOS. Canadians are concerned about climate change, yet demonstrate low awareness and low hope for action. Available: <https://www.ipsos.com/en-ca/news-polls/canadians-are-concerned-about-climate-change-yet-demonstrate-low-awareness-and-low-hope-action> [Accessed 27 Sep 2023].
- 45 Shanafelt TD, Noseworthy JH. Executive leadership and physician well-being: nine organizational strategies to promote engagement and reduce burnout. *Mayo Clin Proc* 2017;92:129–46.
- 46 Linzer M, Manwell LB, Williams ES, *et al.* Working conditions in primary care: physician reactions and care quality. *Ann Intern Med* 2009;151:28–36.
- 47 Shanafelt TD, Balch CM, Bechamps GJ, *et al.* Burnout and career satisfaction among American Surgeons. *Ann Surg* 2009;250:463–71.
- 48 Wong AMF. Beyond burnout: looking deeply into physician distress. *Can J Ophthalmol* 2020;55:7–16.
- 49 The College of Family Physicians of Canada. Position statement on physician burnout in Canada. Available: <https://www.cfpc.ca/en/policy-innovation/health-policy-government-relations/cfpc-policy-papers-position-statements/position-statement-on-physician-burnout-in-canada> [Accessed 9 Oct 2023].
- 50 Ard JL, Tobin K, Huncke T, *et al.* A survey of the American society of anesthesiologists regarding environmental attitudes, knowledge, and organization. *A A Case Rep* 2016;6:208–16.
- 51 Kotcher J, Maibach E, Miller J, *et al.* Views of health professionals on climate change and health: a multinational survey study. *Lancet Planet Health* 2021;5:e316–23.