Adapting to the Effects of Climate Change on Inuit Health

Climate change will have far-reaching implications for Inuit health. Focusing on adaptation offers a proactive approach for managing climate-related health risks—one that views Inuit populations as active agents in planning and responding at household, community, and regional levels.

Adaptation can direct attention to the root causes of climate vulnerability and emphasize the importance of traditional knowledge regarding environmental change and adaptive strategies. An evidence base on adaptation options and processes for Inuit regions is currently lacking, however, thus constraining climate policy development.

In this article, we tackled this deficit, drawing upon our understanding of the determinants of health vulnerability to climate change in Canada to propose key considerations for adaptation decision-making in an Inuit context. (*Am J Public Health.* 2014;104:e9–e17. doi: 10.2105/AJPH.2013.301724)

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THE CANADIAN ARCTIC IS widely regarded as a global hotspot of the effects of current and future climate change.[1–4] The risks of climate change are significant, challenging human rights, livelihoods, and health.[5,6] Aboriginal populations, particularly Inuit, have been identified as highly vulnerable to these changes.[7] Such framing, however, can portray Northern populations as powerless victims of climate change, overlooking how social, cultural, and economic conditions determine how climate change is experienced, understood, and responded to, downplaying the resilience of communities and overlooking adaptation. As Costello et al.[8] noted, the time is right in the climate–health field to move from catastrophic fatalism to positive action, and to identify, develop, and implement adaptation strategies to moderate the health effects of climate change. This is a daunting challenge, compounded by limited research on adaptation in the public health field, but the urgency, inevitability, and reality of health effects compels us to focus more seriously on finding ways to adapt. To inform debate in this emerging policy area, we outline key considerations for adaptation to the health effects of climate change for Inuit in Canada. In doing so, we seek to initiate debate among researchers, policymakers, practitioners, Inuit organizations, and community leaders on how best to proceed with adaptation.

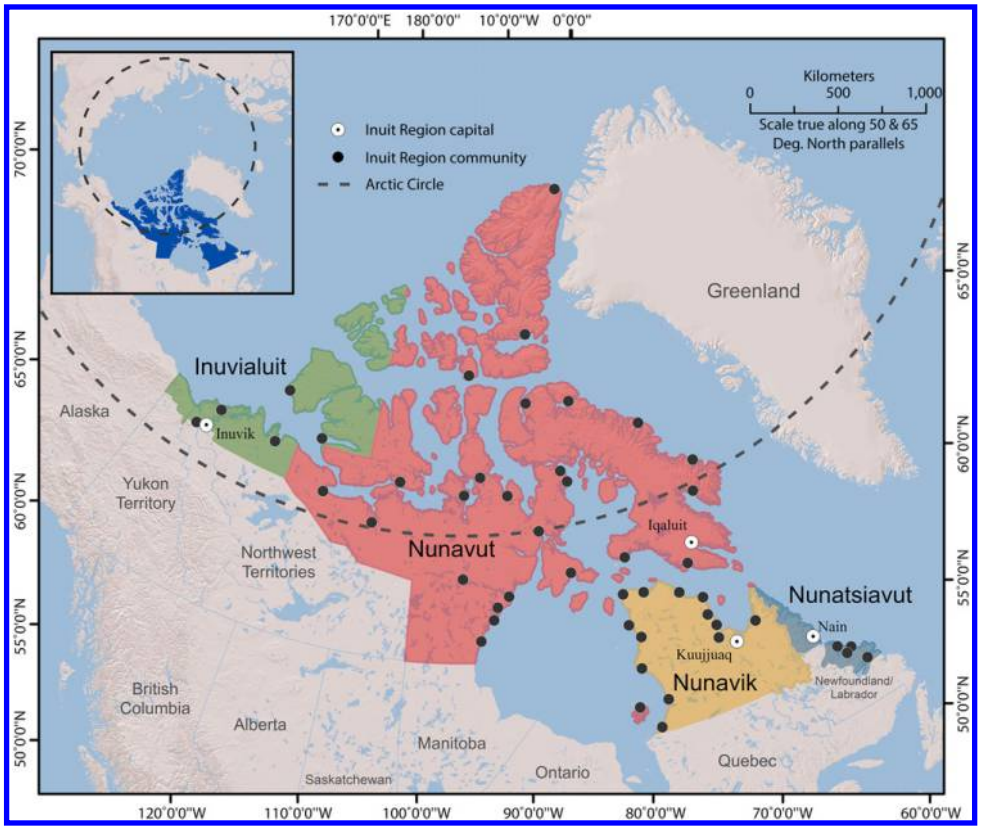
INUIT HEALTH AND CLIMATE CHANGE

For Canada's more than 50 000 Inuit who live in small, remote, mostly coastal communities scattered across approximately 31% of the country's landmass (Figure 1), numerous health implications from climate change have already been documented, including the effects on personal safety, food and water security, and mental health.[6] Changing temperature and precipitation regimes are projected to increase the probability, duration, and severity of extreme weather events and their outcomes (e.g., flooding, erosion) with implications for water quality, while creating newly hospitable environments for encroaching or introduced pathogens.[9–19] Warmer, wetter seasons also have the potential to increase the risk and incidence of waterborne, foodborne, zoonotic, and vector-borne diseases (e.g., *Escherichia coli*, campylobacteriosis, giardiasis, botulism, echinococcosis).[9,15,16,18–21] There will also be indirect pathways through which climate change will affect health.[10] Unstable ice conditions, for example, may inhibit movement in and out of communities, which could increase associated mental stress, limit the potential for subsistence hunting with food security implications, and increase the likelihood of accidental injury and death while traveling on the land.[22–25]

A number of factors affect how Inuit communities and their health systems experience and respond to climate change, in many cases increasing risk and susceptibility to health impacts. These include poverty and inequality, which underpin disparities in health outcomes; access to associated health services compared with the Canadian average, which influences health-seeking behavior[26–29]; institutional capacity challenges, which constrain the ability of health systems to respond to existing and emerging health problems[10,30–32]; and strong connections to the rapidly changing environment, with many Inuit dependent on land, sea, ice, and local environmental resources for livelihoods (e.g., hunting, fishing), culture, diet, and well-being.[7,11,17,33–35] Traditional knowledge (TK) and culture have been identified as protective factors, moderating exposure to climate-related health risks and underpinning adaptive capacity, albeit with concerns over such knowledge systems in light of socioeconomic transformations.[10,36,37] These factors are listed in Table 1,[10,26,38] which illustrates the key health risks posed by climate change and their role in influencing vulnerability and resilience across the Inuit Nunangat (Inuit homeland). Here, vulnerability refers to factors that increase susceptibility to harm, either by enhancing sensitivity to the health-related impacts of climate change or by constraining adaptive capacity to deal with them. Resilience refers to factors that underpin the ability of individuals, households, and health systems to respond to, moderate, and recover from health effects.[39–42]

NEED FOR ADAPTATION

Because of the risks posed by climate change, greater action is



Source. Indian and Northern Affairs Canada (2008), ESRI (2012), and Statistics Canada (2006).

FIGURE 1—The Inuit Nunangat (Inuit homeland) in Canada.

required to reduce the greenhouse gas emissions responsible for climate change. However, recent studies indicate that stabilizing global average temperatures below 2°C will be challenging, and that continued climate change and resulting effects can be expected.[4,43,44] Inuit communities and their health systems will have to adapt.

Adaptation refers to policies, measures, and strategies designed to reduce climate change impacts and support resilience. In a health context, adaptation is synonymous with prevention (i.e., it seeks to prevent or minimize effects), and may involve primary, secondary, and tertiary interventions.[45–48] Primary prevention aims to prevent or moderate adverse health outcomes by reducing exposure to risks; secondary prevention seeks to prevent the onset of adverse health outcomes associated with a particular risk; and tertiary prevention aims to reduce morbidity and minimize impacts.[45,47] These responses may be reactive or anticipatory in relation to climate change effects, range from building adaptive capacity to designing and implementing specific interventions to a known risk, and encompass actions at various scales from individuals and communities to governments and institutions. Thus, potential adaptations are diverse, ranging from the development and strengthening of surveillance and early warning systems, the development and enforcement of standards, community empowerment and education on risks posed, to the promotion of sustainable development.[49]

The importance of adaptation is increasingly being recognized in climate policy internationally and in Canada, and was identified by a Special Commission Report in the *Lancet* as the biggest challenge for global public health this century.[50] However, few studies globally or in the Arctic have examined or evaluated opportunities for adaptation, particularly with regard to health.[40,41,45,48,50–54] This deficit is an urgent area for research. As Ford et al.[55] documented in Canada, federal investment in climate change and health research, specifically adaptation initiatives, has been limited, totaling only $16 million Canadian dollars between 1999 and 2009, approximately $3 million of which focused on adaptation. Although a number of recent federal programs focus on and support adaptation in Northern Canada, this investment represents a small fraction of other federal expenditures and is insufficient for a problem as complex and potentially damaging to human and environmental health as climate change.[55,56]

KEY CONSIDERATIONS FOR HEALTH ADAPTATION

Developing an evidence base to inform adaptation policy should, then, be a key focus of future research in Canada. This work needs to move beyond documenting impacts and identifying determinants of vulnerability (we now have a baseline understanding in a Canadian Inuit context [Table 1]) to prioritizing and evaluating locally appropriate and culturally relevant adaptation strategies. This is the focus of recent initiatives that we have launched (http://www.ikadapt.ca, http://www.ihacc.ca); however, research of this nature takes time and is compounded by an absence of frameworks for adaptation assessment in Indigenous contexts.[57] The need for adaptation, however, is pressing because climatic anomalies and their effects are increasingly the norm.

In response to this need, and to inform and initiate debate on the broad contours of health adaptation programming, we outline key considerations for adaptation to the health effects of climate change for Canada's Inuit. These insights are derived from our multidisciplinary knowledge and experience; we have been involved in research and policy debates on climate change and health in the Arctic since the late 1990s, and have worked in partnership with communities across the Inuit Nunangat, policymakers, and government

TABLE 1—Key Factors Affecting Vulnerability and Resilience to the Health Effects of Climate Change

Health Impacts Linked to Climate Change	Traditional Knowledge and Culture		Poverty and Inequality		Institutional Capacity	
	Resilience	Vulnerability	Resilience	Vulnerability	Resilience	Vulnerability
Accidental injury or death while hunting or traveling on the land	Survival skills Knowledge of trail safety and dangers Understanding of weather patterns Communication of risks Local search and rescue capacity	Land skills not being transmitted to youths Hunting technology altering human–environment relationships Rapidly changing conditions make conditions difficult to predict	Food sharing networks and community freezers decrease need to hunt in unsafe conditions Communities developing safety programming	Inability to afford safety equipment, such as GPS, helmets, life jackets	Training of local health care professionals Increasing support for traditional medicine systems and knowledge Increasing inclusion of and respect for traditional knowledge in policy	Disparities in health indicators compared with Canadian average Remoteness of communities makes access to health care difficult
Infectious gastrointestinal outbreaks	Knowledge on links between weather events and drinking water quality History of traditional food storage and preparation Use of many traditional remedies	Decreased knowledge transmission around food preparation and water safety Lack of comprehensive health surveillance systems Missing or incomplete health records	Local campaigns increasing awareness of hand-washing, food storage, and water supplies for all families and at schools	Housing overcrowding increases transmission risk Multigenerational homes increase transmission among multiple generations	Increased awareness from health practitioners of linkages between weather events and water quality and food storage, leading to new health communication campaigns	Some water and sanitation systems outdated and unable to cope with extreme weather events Limited surveillance and monitoring to detect outbreaks
Mental trauma	Mental or emotional strength from cultural continuity Cultural strategies for dealing with mental health challenges Community cohesion and cultural practices foundational for mental wellness Land-based knowledge provides mental or emotional strength	Weakening of cultural activities and identity Erosion of land-based skills and knowledge alters ability to engage with the land Weakening of customary mental health strategies	Programs to reduce poverty and increase economic opportunities support mental health and wellness Focus on family support and community cohesion supports	Intergenerational trauma from residential schools (in which Inuit children were removed from their communities for education that sought to promote assimilation), forced relocation, rapid acculturation, loss of language, increased rates of addiction and suicide, and systematic marginalization Lack of access to mental health services and supports	Increased number of local mental health workers Focus on supporting mental health and resilience in communities through programming Incorporation of traditional knowledge into mental health programming	High rates of addiction, suicide, and intergenerational trauma increase mental health needs Lack of access to mental health services Changing climatic conditions make the mental health programs difficult to run Suspicion of mental health service

Continued

TABLE 1—*Continued*

Food insecurity	Customary food sharing practices Knowledge of animal behavior; rules for allocating catch Understanding of edible and medicinal plants	Cash economy and growing community size disrupting customary rules of sharing Costs of hunting and foraging increasing, loss of knowledge transmission	Increased focus on traditional food sharing networks and development of community freezers to share food Development of local gardening initiatives and greenhouses	Challenge of obtaining store food because of expense Inability to undertake hunting-related adaptations to climate change that entail additional costs Constraints to traditional food access because of costs of equipment and related items	Support to promote healthy eating Increased awareness and education of healthy eating Health programming that teaches younger generation wild food gathering and preparation skills	Lack of access to healthy foods creates difficulties for healthy eating Lack of access to wild foods creates reliance on store-bought foods

Note. GPS = global positioning system.

representatives to understand how climate change affects Inuit health. Building on this extensive knowledge and experience, we use our understanding of the primary drivers of health vulnerability and resilience developed through previous work,[10,11,19,22,23,35,58–60] together with an analysis of characteristics of adaptation decision-making in the general adaptation field, to identify key considerations for adaptation (Table 2 and Figure 2).[61–65]

Enhancing Climate-Related Health Risk Management

The adaptation challenge is not entirely new because humans have lived with climate variability and change for a long time. The environmental and public health fields have a tradition of assessing and managing climate-related health risks, some of which are managed well, while for others there is room for improvement.[45,49,66] Many climate change impacts represent changes in the magnitude and frequency of current risks, and investments to enhance existing health infrastructure offer a foundation for proactive adaptation. For example, with regard to foodborne and waterborne illness, 15 enteric conditions are reportable by law; yet in Northern communities, there are numerous challenges to surveillance systems because of poor data from a lack of uniform reporting and the high costs of patient follow-up.[16,67] These challenges affect the ability to anticipate health problems, detect outbreaks, and generally understand and evaluate diseases, track transmission rates and mechanisms, and control measures to reduce risk—all of particular importance because of the changing climate.[33] An important starting point for adaptation could be to systematically evaluate health registries and surveillance systems, which is an inexpensive, quick, and effective starting point to enhance the monitoring and control of climate-sensitive health outcomes[16,19] (Table 2). Other adaptation priorities are listed in Table 2, and cover risk avoidance, reduction, and management in diverse areas, including emergency preparedness, education, and capacity enhancement.

Tackling the Root Causes of Vulnerability

Often, what makes people vulnerable to climate-related health risks has little to do with the actual climate, but rather is reflective of underlying social, cultural, and economic factors.[68] The challenge of obtaining sufficient food because of the changing climate, for example, is exacerbated by high rates of poverty compounded by the cost of living in the North, changing knowledge systems and food sharing practices, population growth, and inflexible wildlife management practices (Table 1).[10,58,69–72] Similarly, mental health issues documented among Inuit hunters in response to an increasing inability to hunt with changing ice conditions reflects not only the decreased ability to provide food for family, but also a loss of cultural identity and livelihood practices.[22,73,74] These factors, in turn, are influenced by the rapid acculturation of Inuit society since the 1950s.[26,31,75–77]

Focusing on the pathways that negatively affect the underlying determinants of health and make populations vulnerable to climate change is an essential component of adaptation.[45,67,78] Efforts to reduce vulnerability and enhance adaptive capacity to climate change can, therefore, be integrated into ongoing policy

TABLE 2—Specific Policies Relevant to Health Adaptation and Examples of Successful Implementation From Indigenous Communities in Canada and Beyond

Adaptation Considerations	Potential Policies for Adaptation	Examples of Successful Actions Relevant for Adaptation
Adaptation is about enhancing current management of climate-related health risks	Enhance surveillance, monitoring, and early warning systems	The International Circumpolar Surveillance System has collected and shared data on infectious diseases in the Arctic since 1999. It leverages existing surveillance systems to provide early warning and has led to evidence-based policy interventions, such as a vaccination program against *Strepococcus pneumonia*.[61]
	Evaluate search and rescue capability, and public health and surveillance systems	
	Emergency preparedness education	
	Recognize and promote traditional health systems	
Adaptation is about tackling the root causes of vulnerability	Poverty alleviation initiatives	In British Columbia, epidemiological research by Chandler and Lalond[62] demonstrates a positive correlation between indicators of self-determination, including self-government and local control over health delivery services, and reduced youth and adult suicide rates.
	Strengthen role of Inuit in decision-making	
	Enhance the determinants of health: access to food, clean water, safe shelter, family support networks, employment opportunities, strong physical, mental, emotional, and spiritual health	
	Provide culturally appropriate health services and programming	
Adaptation is about leveraging and building on sociocultural strengths	Add culturally relevant and locally appropriate materials to school curriculum	In Arnhem Land, Australia, "caring for country" activities have been shown to offer significant health benefits for Aboriginal participants.[63]
	Strengthen land-based learning	A collaborative public health campaign in the west Kimberly region of Australia brought together Aboriginal and non-Aboriginal health workers, educators, and artists to promote preventative health resources using art, traditional language, and a film. The program increased discussion of health, and contributed to pride and self-esteem.[64]
	Document, preserve, and promote traditional knowledge	
	Increase Elder and youth knowledge sharing	
	Create cultural programming	
Adaptation is about integrating a climate change lens into policy programming	Apply climate change screening lens to policy programs at multiple levels	The *Upagiaqtavut: Setting the Course* framework, released by the Department of Environment of the Government of Nunavut in 2011, provides strategic direction for adaptation to climate change in Nunavut rooted in Inuit societal values. It incorporates a climate change screening lens for territorial-level policy.[65]
	Educate local and regional health practitioners about potential climate-related health impacts	

initiatives that span inclusive governance, education, cultural promotion, poverty alleviation, and public health. Allopathic health systems, for instance, need to take into account historical traumas that adversely affect well-being; tackle linguistic, cultural, and geographic barriers to access; and enhance the translation and integration of both traditional and scientific knowledge and approaches to health as a means of promoting resilience to illness and environmental change for individuals and communities[29,60,79–81] (Table 2). Cultural activities, in particular, are important for beginning to address stresses associated with acculturation.[82] Land-based programs are one such intervention discussed in the following section.

Leveraging and Building on Sociocultural Strengths

Traditional knowledge based on intergenerational transmission of knowledge and oral history on human–environmental relationships, personal and community well-being, and spiritual considerations, remains a key feature of Inuit life. A cumulative and dynamic body of knowledge and beliefs, TK helps to guide and influence individual and group actions, health-seeking behavior, and health beliefs. TK is pertinent to both health systems and climate change because it affects both sensitivity and adaptive capacity of communities, households, and individuals, and plays an essential role in avoiding, reducing, and managing climate-related health risks (Table 1). For example, land skills and knowledge, embodied in TK, underpin safe hunting practices, representing a collective social memory and repository of accumulated experience that is drawn upon to manage the

Note. In (a), Arctic ice is melting at an unprecedented rate, emphasizing the need for management of current climate change health risks. In (b), community health systems have a central role to play in adaptation as they incorporate allopathic and traditional approaches to health and well-being, and here Apea Sodluapik from Pangnirtung's Health Centre (Pangnirtung Nunavut, Northwest Territories, Canada) is speaking about climate change and health risks. In (c), for some Inuit, underlying socioeconomic and changing cultural factors are a root cause of vulnerability, and climate change can further stress individuals and families if, for example, ice conditions undermine hunting and associated food security. In (d), successful adaptation builds on sociocultural strengths, incorporating and promoting traditional knowledge and cultural values, like this hunter teaching his sons to secure food by catching walrus in Foxe Basin. In (e), ongoing health policy and programming must integrate a climate change lens, bringing adaptation solutions into the mainstream, creating proactive and flexible communities and institutions.
Source. Ian Mauro (a), (b), (d), and (e) and James Ford (c).

FIGURE 2—Visual representation of key considerations for health adaptation in Inuit communities.

dangers of traveling with changing snow, ice, and weather conditions, and therefore, moderating climate-related health risks.[59]

Tradition and culture can provide a strong foundation for adaptation, supporting capacities to manage emerging health risks and cope with a future characterized by uncertainty. However, the evolution and transmission of TK is being threatened by acculturation and rapid environmental changes, and our research has documented emerging vulnerabilities to the health effects of climate change associated with a weakening of TK systems across the Inuit Nunangat (Table 1).[10,36,37] Pearce et al.,[37] for example, documented reduced transmission of cultural knowledge and related land skills from older to younger generations associated with reduced environmental apprenticeship opportunities, arguing that this trend is responsible for increasing accidental injury of youths engaged in land activities, and not climate change per se. Similarly, Ford et al.[83] and Furgal and Seguin[10] noted how the implications of warming temperatures on traditional food preparation are compounded by reduced knowledge on the correct procedures for storage and butchering.

Initiatives that focus on the documentation, conservation, and promotion of TK can underpin successful adaptation, including camps where Elders take youths on the land to learn traditional skills, and participatory Web-based knowledge banks, radio dramas, and digital storytelling and filmmaking to document and convey TK on various health and climate change issues.[23,35,84,85] A study from Arnhem Land in Australia, for example, offered insights on the potential success of such initiatives in an Inuit context, finding that Aboriginal people involved in cultural activities through caring for country activities were more physically active, had improved diet, and experienced lower rates of psychological stress,[63] addressing a number of underlying determinants of climate change vulnerability. Given the orally based nature of TK, digital media are particularly effective tools, because they allow for the wisdom and teachings of Elders to be passed over generations, while helping to promote the Inuktitut language and its importance for cultural continuity. Such activities have significant value beyond climate change, with TK-based initiatives identified as essential to addressing a variety of social problems ranging from addiction to suicide,[79,86] not only among the Inuit, but also among Indigenous communities in general.[57,77,87,88]

Strategies, Policy, and Programming

In many instances, adaptation involves integrating climate change considerations into strategies, policies, and planning initiatives broadly designed to reduce risk and enhance health and well-being.[39,45,87] The rapidly changing conditions in Canada's North necessitates that a climate change lens be incorporated into proactive health policy and programming that recognizes the changing nature of climate-related health risks and actively engages local communities and health professionals in meaningful dialogue and action to design and implement locally appropriate health programming, policies, and adaptation plans. The era of climatic stationarity in decision-making is now over.[88]

CONCLUSIONS

Adaptation has been largely neglected within the health research and practitioner community. This has to change. In this article, we aimed to initiate and inform debate on health adaptation for Inuit populations by outlining key considerations for adaptation programming based on our understanding of the key drivers of climate change vulnerability in a Northern context, along with principles of adaptation planning developed in the general scholarship. Although these considerations cut across effects, risks, and regions, and target key drivers of vulnerability consistently identified in our work and that of others, they are not meant to be a definitive list. Health adaptations should always be designed to meet local requirements and respond to local sociocultural contexts. Responses specific to particular risks and community needs will also be required. Developing an evidence base of adaptation, therefore, is an urgent need.

Adaptation encompasses a variety of strategies and actions that make households and societies more resilient to climate change. These can be broadly categorized as focusing on better management of existing climatic risks, identifying opportunities to enhance cultural and institutional capacity to

respond to changes in existing risks, or transformational change to manage future conditions that are projected to be quite different from today.[89] In this article, we focused on the first 2 categories, in which adaptation is about doing things we should already be doing, but better—tackling pathways that lead to ill health, building upon TK and cultural values, and targeting the social determinants of health that are the root causes of many climate-related health vulnerabilities. These characteristics of decision-making are pertinent because there are many pressing issues besides climate change, and can help demystify adaptation, bringing it to familiar territory for policymakers. Such actions will require leadership by actors within the public health sector, but will also need concerted collaborative action with other sectors and across jurisdictions at local to national scales.

Building adaptive capacity and resilience to manage climate change effects is central to the lessons profiled in this article, with our aim to initiate debate on how we can dynamically plan in the context of existing conditions and anticipated, but largely unknown, social, economic, and environmental changes. Some scholars, however, have argued that enhancing adaptive capacity will not be enough in light of dramatic climate change projections, which will necessitate transformative adaptation.[90–92] Although we agree that tipping points caused by climate change could fundamentally shift the Arctic's ecological system[93] and must be considered, we also believe that immediate and better understood health risks should be among our first-risk management priorities. This position is justifiable given the already present and extensive need for health services in Inuit communities, our research-based understanding of existing risks and associated interventions, and the ability to adapt current programs to accommodate increased magnitude and frequency of anticipated changes.

Future research needs to expand upon the considerations profiled here, to comprehensively evaluate opportunities for health adaptation, and examine the effectiveness, desirability, feasibility, urgency, and durability of adaptations, under both current and projected future climatic and socioeconomic conditions. It is imperative that adaptation evaluation is done in active and meaningful collaboration with communities, organizations, and government; integrates insights from science and traditional knowledge; and emphasizes locally appropriate approaches to adaptation assessment. These are important times for health practitioners and policymakers. Although climate change is a daunting reality, opportunities exist to avoid, reduce, and manage the health effects of climate change, yet only if we collectively and collaboratively begin to recognize and meet these challenges. ■

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