

Community Perspectives on the Impact of Climate Change on Health in Nunavut, Canada

G.K. HEALEY,¹ K.M. MAGNER,² R. RITTER,³ R. KAMOOKAK,⁴ A. ANINGMIUQ,⁵ B. ISSALUK,⁶ K. MACKENZIE,⁷
L. ALLARDYCE,⁸ A. STOCKDALE⁹ and P. MOFFIT¹⁰

(Received 8 April 2010; accepted in revised form 3 August 2010)

ABSTRACT. The purpose of this study was to explore community perspectives on the most important ways that climate change is affecting the health of northern peoples. The study was conducted in Iqaluit, Nunavut, using a participatory action approach and the photovoice research method. Participants identified themes and patterns in the data and developed a visual model of the relationships between the themes identified. Five themes emerged from the data: the direct impacts of climate change on the health of individuals and communities, the transition from past climates to future climates, necessary adaptation to the changing climate in the North, the call to action (individual, regional, and national), and reflection on the past and changing knowledge systems. A climate change and health model was developed to illustrate the relationships between the themes. Participants in this study conceptualized health and climate change broadly. Participants believed that by engaging in a process of ongoing reflection, and by continually incorporating new knowledge and experiences into traditional knowledge systems, communities may be better able to adapt and cope with the challenges to health posed by climate change.

Key words: Inuit, northern communities, Nunavut, climate change, health, action, participatory research

RÉSUMÉ. L'objectif de cette étude consistait à explorer diverses perspectives communautaires quant aux manières les plus importantes dont le changement climatique a des incidences sur la santé des gens du Nord. L'étude a été réalisée à Iqaluit, au Nunavut, au moyen d'une méthode d'action et de recherche participative faisant appel à la « photovoice ». Les participants ont déterminé les thèmes de même que les tendances caractérisant les données, puis ont abouti à un modèle visuel pour établir des relations entre les thèmes ainsi déterminés. Les données ont donné lieu à la formulation de cinq thèmes, soit les incidences directes du changement climatique sur la santé des gens et des collectivités; la transition des anciens climats aux nouveaux climats; l'adaptation nécessaire au climat changeant dans le Nord; un appel à l'action (individuel, régional et national); et une réflexion sur les systèmes de savoir du passé qui sont en pleine évolution. Ensuite, un modèle de changement climatique et de santé a été élaboré dans le but d'illustrer les liens existant entre les divers thèmes. Les participants à cette étude ont conceptualisé le changement climatique et ses incidences sur la santé à grande échelle. Ils croyaient qu'en s'adonnant à un processus de réflexion continue et qu'en intégrant constamment de nouvelles connaissances et expériences aux systèmes de savoir traditionnel, les collectivités pourraient être mieux placées pour s'adapter et relever les défis posés par le changement climatique en matière de santé.

Mots clés : Inuit, collectivités du Nord, Nunavut, changement climatique, santé, action, recherche participative

Traduit pour la revue *Arctic* par Nicole Giguère.

¹ Qaujigiartiit Health Research Centre, PO Box 11372, Iqaluit, Nunavut X0A 0H0, Canada; corresponding author: gwen.healey@qhrc.ca

² University of Toronto, Dalla Lana School of Public Health, 155 College Street, Toronto, Ontario M5T 3M7, Canada

³ Nunavut Arctic College, Iqaluit, Nunavut X0A 0H0, Canada

⁴ Gjoa Haven Health Centre, Department of Health and Social Services, Government of Nunavut, General Delivery, Gjoa Haven, Nunavut X0B 1J0, Canada

⁵ PO Box 159, Panniqtuuq, Nunavut X0A 0R0, Canada

⁶ PO Box 57, Chesterfield Inlet X0C 0A0, Canada

⁷ Nunavut Research Institute, PO Box 1720, Iqaluit, Nunavut X0A 0H0, Canada

⁸ 31 Majestic Drive, Ottawa, Ontario K2G 1C6, Canada

⁹ 94 Mountbatten Drive, Ottawa, Ontario L9C 3V5, Canada

¹⁰ Northwest Territories Nursing Program, Aurora College, Bag Service 9700, Yellowknife, Northwest Territories X1A 2R3, Canada

INTRODUCTION

The evidence that the climate is changing and that these changes can be attributed to human activities has become stronger in recent years (Hegerl et al., 2007). A recent report published by the Lancet Commission on Climate Change found that climate endangers health in six key ways: through changing patterns of disease and mortality, extreme weather events, food insecurity, water scarcity, heat waves, and threats to built structures, including housing and public infrastructure (Costello et al., 2009). The Arctic Climate Impact Assessment (ACIA) suggests that future climate change will be experienced earlier and more acutely in polar regions (ACIA, 2004). Indigenous peoples of the North are being affected by climate change, and future changes in climate are likely to pose serious challenges (World Health Organization, 2003; ACIA, 2004). However, the health-related impact on communities in northern Canada is not yet fully understood. Northern communities hold a close relationship with the land. Seals, whales, walrus, caribou, and other species provide highly nutritious food (Kuhnlein and Soueida, 1992) and provide a deep connection to the natural environment (Watt-Cloutier, 2004). The environment and the country foods that come from the land, lakes, rivers, and sea remain central to the way of life, cultural identity, and health of northern people (Egan, 1998; Duhaime et al., 2004; Watt-Cloutier, 2004; Van Oostdam et al., 2005). Hunting lies at the core of Inuit culture, teaching such key values as courage, patience, tenacity, and boldness under pressure, qualities that are required for both worlds—the modern and the traditional—in which Inuit live (Watt-Cloutier, 2004). For Inuit communities, sea-ice travel is critical to accessing wildlife resources and traveling between communities during winter months. Uncharacteristic weather patterns, storm events, and ice conditions are undermining the safety of travel and hunting or fishing activities (Furgal and Seguin, 2006). The increased risks to safety, as well as the longer traveling distances, are challenging the harvesting of country foods (Furgal and Seguin, 2006). The increasingly unpredictable weather patterns affect access to health services by threatening medical evacuation procedures that rural and remote areas rely upon for emergency and high-risk patient care. In addition to posing threats to livelihood and food security in the North, warming temperatures may be contributing to an increase in reports of never-before-seen species of biting flies and insects. Climate change is also proposed to pose the threat of increased vector-borne disease; however, this increase has not yet been clearly demonstrated (Kovats and Haines, 2005). Furthermore, permafrost melting attributable to a warmer climate will have serious implications for the structural integrity of northern houses and buildings (Furgal and Seguin, 2006). Northern community members have shared the concern that climate change, and the resulting changes in the environment and communities, may further compound existing health issues, including mental

health and wellness, nutritional deficiencies, rates of respiratory illness, livelihood and economic stability, safety, and the spread of disease (Furgal and Seguin, 2006).

Research on the health impacts of climate change in northern Canada is a newer field. To date, the literature has largely focused on the collection of local indigenous knowledge and observations about weather patterns, land and sea-ice conditions, animal behaviour, and species sightings (Furgal et al., 2002; Furgal and Seguin, 2006; Laidler, 2006; Laidler et al., 2008; Weatherhead et al., 2010); risk and community vulnerability to climate change (Ford and Smit, 2004; Ford et al., 2006; Ford, 2009; Laidler et al., 2009); and adaptation and adaptive capacity (Berkes and Jolly, 2001; Natural Resources Canada, 2004). Current approaches include a focus on indigenous knowledge and local observations of environmental change, as well as scientific assessments of the impacts associated with these and other forms of change (Furgal and Seguin, 2006).

Community-led Research

Research that strives to understand how climate change affects the health of northern communities must elicit meaningful community involvement in the research process. Moreover, community participation and social mobilization are essential for identifying the factors that enhance or inhibit local adaptive capabilities in the face of climate change. The data presented here resulted from an initiative by Qaujigiartiit Health Research Centre, an independent community organization located in Iqaluit, Nunavut, in response to community requests for a forum in which to gain technical knowledge and hands-on experience of research. The Centre's mandate is to enable health research to be conducted locally, by Northerners and with communities, in a supportive, safe, culturally sensitive, and ethical environment, as well as to promote the inclusion of both Inuit *Qaujijamajatuqangit* and Western science in addressing health concerns, creating healthy environments, and improving the health of Nunavummiut. The Centre is governed by a board of directors, whose members represent Nunavut-based research bodies, Inuit organizations, territorial and municipal governments, community members, and youth. This project was part of a research skills workshop held in Iqaluit on 12–14 May 2009, which included training in interviewing, survey administration, Inuit and community perspectives on ethics in research, and photovoice methodology. The photovoice research study presented in this paper took place over the course of that workshop.

This study explored community perspectives on the impact that climate change can and will have on the health of northern peoples. We combined a research project with an educational opportunity in order to build confidence and capacity so that Northerners may participate meaningfully in projects that come to their communities and eventually lead their own research projects on health, climate change, or both, in the future.

METHODS

This exploratory, qualitative study used the photovoice research method. Six community participants from Nunavut communities (Gjoa Haven, Chesterfield Inlet, and Iqaluit), and two visiting graduate students took part in the training, data collection, and analysis of the study in Iqaluit, Nunavut. The participants were recruited through an open invitation sent by fax and e-mail to health centres, community organizations, and government and non-government agencies in Nunavut. The six participants volunteered to take part, and travel was provided to Iqaluit for the volunteers from other communities. The role of the graduate students was to learn about the research method and process and to record the discussion. The Participatory Action Research (PAR) approach (Macaulay et al., 1999) affords individuals the opportunity to participate directly in a study by sharing their knowledge and providing their perspectives on the research question. Participatory research attempts to negotiate a balance between developing valid, generalizable knowledge and benefiting the community that is being researched and to improve research protocols by incorporating the knowledge and expertise of community members. Collaboration, education, and action are the three key elements of participatory research. An advantage of a PAR approach in the North is that it stresses the relationship between researcher, participants, and community; capacity building in the community through research involvement; and the direct benefit to the community of the potential research outcomes (Macaulay et al., 1999). A goal is that research participants and collaborators should “own” the research process and use its results to improve the quality of life in the community. Photovoice (originally termed “photo novella”) is referred to as an educational tool, an advocacy tool, and a participatory action research method (Wang and Burris, 1994, 1997; Wang et al., 1998). Rooted in the tenets of participation, empowerment, accessibility, and self-documentation, photovoice is a technique for eliciting community perspectives and capturing everyday life experiences through photography (Moffitt and Vollman, 2004).

The photovoice technique was used to explore the impacts of climate change on health in Nunavut from the perspective of community members. The participants were the researchers and photographers: they own the data, and they were full participants in the analysis. Community participants were each provided with a camera and asked to photograph what they understood to be the most important effects of climate change on the health of the people in their communities. The photographs served to elicit individual perspectives and experiences in a group discussion about the effects of climate change on health. Participatory analysis emphasizes process, and participants are made central to this process (Moffitt and Vollman, 2004). Participants were asked to describe the rationale behind their photographs and to share the stories, perspectives, and experiences represented in these images. The printed photos were discussed one at a time, and the group members collaborated

to select a “message” or “title” that they felt represented the photo. The photos were then grouped (and re-grouped) according to patterns the participants began to identify in the images. Photographs that they considered similar were placed together, and the messages attached to each photo at the beginning of the process formed the basis for the themes identified. This process led them to develop a visual model of relationships between these themes. With the group’s permission, a written record of the discussion was kept.

As the participants in the project are the researchers and this project was initiated in Nunavut by Nunavummiut, this project was not eligible for review by a governing or legislative body. Therefore, a detailed discussion about community and Inuit perspectives on ethics was part of the process, and a locally developed “ethics checklist” was used as a guiding framework (Qaujigiartiit Health Research Centre, 2010). Additionally, the project adhered to the ethical principles developed by the Association of Canadian Universities for Northern Studies (ACUNS) and the Canadian Institutes of Health Research (CIHR) Guidelines for the Ethical Conduct of Health Research with Aboriginal Peoples (ACUNS, 2003; CIHR, 2008). Most importantly, the participants agreed to adhere to the Inuit principle of *Inuuqatigiittiarniq*, working in an environment of respect and appreciation for one another. The participants collectively decided how to share the results of the study with their communities, the research community, and the public in general. They have used local newspaper and radio interviews, a research report, and an exhibit at the Nunatta Sunakkutaangit Museum in Iqaluit (all in both English and Inuktitut), as well as a poster presentation at an academic conference and the present paper.

RESULTS

Five themes emerged from analysis and discussion of the photographic data: reflection on past and changing knowledge systems, direct impacts of climate change on health, transition from past climates to future climates, necessary adaptation to the changing climate in the North, and a call to action. The participants created a model of the themes identified during the analysis to illustrate visually the relationships they felt were crucial to understanding their perspective on climate change and health in their communities.

Reflection and Changing Knowledge Systems

Participants identified the theme of reflection and changing knowledge systems as central to the relationship between climate change and health. In the words of one participant, “We need to think about the past, reflect on our experiences, and look forward to the future.” Participants saw the capacity to reflect on the past and preserve Inuit *Qaujimajatuqangit* (Inuit knowledge) as essential to coping with the effects of climate change on health (Fig. 1). They also recognized the importance of new knowledge about the changing environment and its implications for the land



FIG. 1. A participant reading information about the historical context of the area displayed on a signpost outside of Iqaluit. This photo generated discussion about changes over time in the way knowledge is transmitted, as oral history was traditionally the primary means of sharing knowledge among Inuit, and now information comes in many forms, including written form.

and for community health: in their view, incorporating new information into traditional knowledge systems is essential to managing the health effects of climate change.

The Impacts of Climate Change on Health

Direct effects of climate change on health were a prominent theme in group discussions. Participants thought that climate affects health in six key ways: through contamination of food, contamination of water, changes in weather patterns, melting permafrost, isolation due to restricted mobility, and loss of their way of life and their livelihood. One participant reflected that access to country food will be altered profoundly by climate change. Participants felt that community members will have to travel farther, in more dangerous conditions, and using different modes of transportation, in order to ensure country food security and maintain a traditional diet. The participant who photographed the ski-doo (Fig. 2) said, “We’ll be seeing more of this... more machines for sale. We won’t be able to use them any more when it warms up,” highlighting her concern not only that ways of hunting will change, but also that people may not be able to hunt at all in the future.

The Transition from Past Climates to Future Climates

Participants reported that the transition from cold to hot was a particularly salient theme for the North, where history, health, and well-being are so intimately associated with colder environments. Figure 3, an image of ice and sand, is meant to represent the participants’ perspective on the melting environment and the change from cold to warmer climates. Notions of change and transformation were discussed, and with these ideas emerged expressions of vulnerability. One participant said, “I feel vulnerable to the changes that may come. The snow is melting, the ice



FIG. 2. This photo of a ski-doo with a “For Sale” sign was meant to convey the very real and immediate impact of climate change on community members if it results in a warming Arctic. Snowmobiles will become useless, and hunting practices and patterns may change. The group expressed grief at the idea that this photo may represent future events.



FIG. 3. This photo shows the meeting place of land and sea ice along a ski-doo trail on the beach in Iqaluit. The participants felt it was a metaphor for the receding ice in the Arctic.

is melting. It will be different.” Participants described feelings both of personal vulnerability (highlighted by the need to travel in dangerous conditions, for example) and of collective vulnerability (highlighted by the sense of collective



FIG. 4. This photo of a stop sign anchored into place with an old oil drum demonstrates the recycling of old products. Many of the street signs in the Arctic can't be placed into the ground because of the permafrost. Anchoring the signs with old oil drums filled with rocks has been an innovative way to meet needs and re-use old materials.

cultural demise). Participants associated the sense of loss they feel with climate change in the North. For many, the transition from colder to warmer environments means a loss of livelihood, a loss of tradition, and a loss of preferred activities, such as snowmobiling, hunting, and camping.

Necessary Adaptation

Building upon the conclusion that transition is nearly inevitable, the participants highlighted the importance of adaptation for health and well-being in light of climate change. Participants proposed a variety of strategies for coping with climate change and reversing its ill effects. For example, referring to the image of the stop sign (Fig. 4), the photographer said, "I took this picture because it shows we can recycle things. The old oil drum is being re-used to help hold up signs. There are many more ways we can recycle if we think about it." These ways included improving personal choices, promoting sustainability, discouraging waste, cleaning up our own communities, and advocating for hope and survival in the face of adversity. The participants felt that collectively, Northerners can make changes to adapt to the changing climate and make lifestyle choices that may help reduce the effects of human-induced climate change.

The Call to Action

One participant, showing a picture of a sewage truck (Fig. 5), told the story of a recent event in her community. The local river eroded during the spring melt, washed out the bridge, and obstructed the route of the sewage-removal truck to the community. As a result, the community was forced to dump its sewage into the sea. The contamination of sea waters with sewage was a serious concern to community members. The participant told this story to illustrate her feelings of being "stuck between a rock and a hard place,"



FIG. 5. This photo shows a sewage truck removing waste from a home. Most homes in Nunavut are equipped with a water tank and a waste tank. Water is delivered to the home by truck and stored in the water tank. Used water and waste water are collected in the waste tank and removed by these trucks throughout the week. This photo prompted the telling of the story about river erosion in a community that blocked sewage trucks from accessing the treatment plant in 2008.

since communities in the North often have few alternatives, and thus little capacity to live more sustainably. Participants further indicated that geographic and environmental conditions in the North necessitate resource- and energy-intensive practices (such as sea-lift shipment, air cargo and air travel) and hinder environmentally friendly practices (such as recycling). The paucity of environmentally favourable alternatives for communities in the North was deemed, by participants, to be a call to action. One participant spoke of the need for action to protect our children from any harm or hazard that comes from human-induced climate change. In the context of the photo of a tricycle stuck in the snow (Fig. 6), this participant said: "This bike is stuck in the snow. Our children will be stuck in the future, too. They are stuck with what we leave for them. If we do nothing, they will be stuck with our mess."

Participants highlighted that action on an individual level can be two-pronged, involving education and responsible living. First, they suggested that information and education are essential to ensuring that individuals are knowledgeable about the effects of climate change in the North and can participate in meaningful, informed decision making on these issues. Secondly, they thought that individuals ought to be responsible for reducing consumption and living sustainably.

At the community level, it was believed that planning and consultation were essential to ensure successful management of climate-change effects on health. Engaging communities in political action was deemed imperative, and mechanisms of redistribution, or community sharing, ought to be strengthened to ensure more equitable access to country foods for communities whose access has been limited.

Participants associated a reduction in consumption with sustainable practices that would help mitigate the effects of climate change, and they stressed the need for investment



FIG. 6. This photo of a child's tricycle stuck in the snow near a play area in Iqaluit was viewed by participants as representing how our children are "stuck" with what we leave them. They will inherit a planet, a land, and an environment that we are responsible for keeping in the best possible condition for them.

in waste management services on a regional level, to ensure that recycling and compost programs have the capacity to operate throughout the territory. They felt it was also important to invest in territorial search-and-rescue programs, given the increasingly unpredictable weather patterns and sea-ice traveling conditions. Correspondingly, engaging policy makers was seen as essential to the promotion of environmentally friendly practices in Nunavut.

Finally, participants believed that the call to action on a national level involves a strengthening of knowledge sharing, consciousness-raising, and communication about the effects of climate change in the North. They believe that national policy makers can enforce corporate accountability and ban the dangerous chemicals that contaminate the environment and country foods in the North. Finally it was thought that investment should be made, at a national level, into alternative energy sources and innovative environmental practices.

The Climate Change and Health Model

The climate change and health model is a visual representation of the themes that emerged through the photovoice analysis process (Fig. 7). The model was created by the participants in the project. The placement of the themes around and within a circle, signifies interaction and overlap between ideas and messages. The theme of reflection and changing knowledge systems was identified as central to the relationship between climate change and health. The participants felt that knowledge, both past, present, and future, is one of the most important factors in mitigating the effects of climate change on health. From this central concept emerged four extensions: the themes of impacts, transition, adaptation, and action. Participants felt that the direct impacts of climate change both result from and contribute to the transition of the land, environment, and way of life

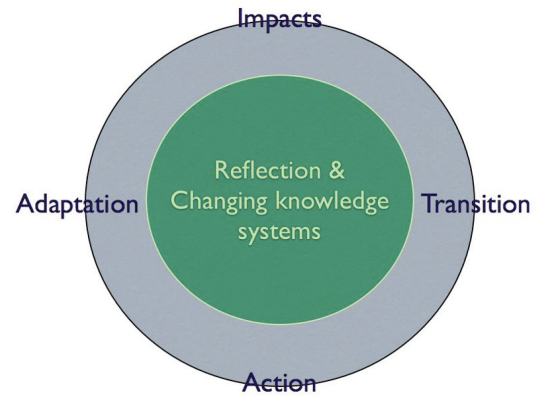


FIG. 7. The Climate Change and Health Model developed by the study participants to visually represent how the themes identified in the data analysis process relate to each other. The model illustrates how the impacts of climate change can lead us to take action (or lead to inaction), which in turn changes the influence or impact. They interpreted these processes as cyclical, with the quality and accuracy of the knowledge available being one of the central influences in the entire process.

of northern peoples. This transition has and will continue to promote action at the individual, community, regional, and national levels. Action may take the form of an individual lifestyle change (i.e., using more energy-efficient light bulbs) or advocacy on a national political level. The actions are part of our collective adaptation to the changing climate. The adaptive capacity of communities will be affected by the level and extent of the actions undertaken. These adaptations could then potentially change or mitigate the continuing and future impacts of climate change on health in this cyclic model.

DISCUSSION

Northern communities have figured prominently in recent research on climate change. However, little is known about the health effects of climate change in the North. What is more, community perspectives regarding these effects are largely absent from the literature. Our findings document the experience of a small group of community participants in Nunavut. Participants in this study conceptualized health and climate change broadly and identified the theme of reflection and changing knowledge systems as central to the relationship between the two concepts. They believe that by engaging in a process of ongoing reflection, and by continually incorporating new knowledge and experiences into traditional knowledge systems, communities may be better able to adapt and to cope with health-related challenges posed by climate change. It was in light of these ideas that the four additional themes emerged, and that the action plan was formulated. The five thematic areas identified by the participants in this study confirm, for the most part, the current, limited body of evidence on climate change and health.

Participants discussed personal and collective vulnerability in the context of the present climate transition. The

concept of vulnerability to climate change has been discussed somewhat in the literature. Ford and Smit (2004) conceptualize vulnerability as a function of exposure to climatic stresses and the adaptive capacity to cope with these stresses. They argue that in order to identify needs and improve adaptive capacity, the process must begin with an assessment of the vulnerability of the group of interest, in terms of who and what are vulnerable, to what stresses, and in what way, and what capacity exists to adapt to changing risks. The results of the present study add to this body of work by highlighting the need to explore individual vulnerability to climate change and the mental, emotional, and spiritual impact of climate change on the health of Northerners, as well as the collective vulnerability of all northern indigenous peoples, communities, and cultures.

Models of climate change and its impact on the health of northern peoples are fairly new in the literature. Existing models explore vulnerability to climate change, exposure-sensitivity of a community to climate change effects, adaptive capacity to deal with exposures, and risks (including but not limited to those associated with climate change). They include buffering factors such as the nature of the community in question and its economy, location, and population (Ford et al., 2006). The model developed by participants in this study highlights the importance of community perspective, knowledge, and the cyclic nature of the relationships between events and reactions to climate change. This model also reflects well-known Inuit perspectives of the integral connection between personal and community health and the environment.

The theme of reflection and changing knowledge systems is important in the context of the literature reporting indigenous knowledge and perspectives on climate change. The participants in this study placed importance on the roles of both traditional and new Inuit knowledge about the land, changing environment and climate, and adaptations to these changes. How knowledge is gained, transmitted, and shared within and between northern communities has changed over time with globalization and increasingly accessible telecommunications technology and media. Reflection upon these changes and critical analysis of the information available were viewed as important responsibilities for community members in exploring adaptation to climate change.

The perspectives shared in this study are not meant to represent all northern communities. Our purpose was to shed light on the impact of climate change and health through the eyes of Nunavut community members with an interest in climate change research. The particular photographs, stories, and messages that emerged through this research process reflect a unique community perspective, rendering these findings particularly relevant to the North and significant for compelling community action around the issue of climate change. The findings show that perceived effects of climate change on health are varied and multifaceted. Accordingly, responsive action to these effects must transpire at multiple socio-ecological levels, ranging

from individual choices to community, municipal, provincial or territorial, and federal strategies. The multilateral approach assumed in the participants' call to action reflects the multidimensional nature of the issue, as well as the varied opportunities for adaptation in the North.

CONCLUSION

Livelihood changes are predicted to continue and further alter Inuit communities and well-being (ACIA, 2004; Ford, 2009; Laidler et al., 2009). There will always be uncertainty about the magnitude of the adverse effects of climate change, and the burden of those effects will most probably fall predominantly on populations that have contributed little to the problem (Kovats and Haines, 2005). While the health impacts of climate change are not yet fully understood, this study contributes to the literature on perceived health effects of climate change in Inuit communities by identifying some community priorities surrounding this issue.

The culture, economy, and way of life of Inuit are under threat from human-induced climate change (Watt-Cloutier, 2004). The destruction of the age-old hunting economy presages destruction of the very culture of Inuit. The seriousness of the issue means that Inuit have to use every available avenue to bring their perspectives to the attention of decision makers who have the power to affect change (Watt-Cloutier, 2004; Kovats and Haines, 2005). This study further highlights the importance of participatory research and the merits of the photovoice technique in eliciting community perspectives and promoting social action from the individual to national level. Building social capacity, thereby empowering communities to gain a sense of control, is essential to managing the health effects of climate change (Costello et al., 2009). Our findings support this notion and suggest that an investment in community is an essential strategy for mitigating the ill effects of climate change on health.

This study provides the foundation for continuing community-led research projects exploring the land-health-environment relationship. Further community-led research using creative and participatory methods is needed to improve our understanding of the health implications of climate change in the North and to reduce health disparities between northern communities and the rest of Canada. This project provided community members with the opportunity to learn and apply new research skills and contribute to a growing body of knowledge about the effects on climate change on the health of Northerners. Given the health threats posed by climate change, further work should be done to bolster community involvement in these issues and to actualize change at multiple socio-ecological levels. It is by strengthening capacity that northern communities will be able to cope with, and potentially reverse, the effects of climate change on health in the North.

ACKNOWLEDGEMENTS

The community participants/researchers in this project shared incredible stories and experiences that cannot be articulated in the limited scope of this paper. For the opportunity to share and learn from each other, we are grateful. The funding for this research came from the Health Canada First Nations and Inuit Health Branch program entitled Climate Change and Health Adaptation in the North.

REFERENCES

- ACIA (Arctic Climate Impact Assessment). 2004. Impacts of a warming Arctic. Cambridge: Cambridge University Press.
- Association of Canadian Universities for Northern Studies. 2003. Ethical principles for conduct of research in the North. <http://acuns.ca/website/ethical-principles/>.
- Berkes, F., and Jolly, D. 2001. Adapting to climate change: Socio-ecological resilience in a Canadian western Arctic community. *Conservation Ecology* 5(2): 18. [online] URL: <http://www.consecol.org/vol5/iss2/art18/>.
- CIHR (Canadian Institutes of Health Research). 2008. CIHR guidelines for health research involving Aboriginal people. <http://www.cihr-irsc.gc.ca/e/29134.html>.
- Costello, A., Abbas, M., Allen, A., Ball, S., Bell, S., Bellamy, R., Friel, S., et al. 2009. Managing the health effects of climate change. *The Lancet* 373:1693–1733.
- Duhaime, G., Chabot, M., Fr chette, P., Robichaud, V., and Proulx, S. 2004. The impact of dietary changes among the Inuit of Nunavik (Canada): A socioeconomic assessment of possible public health recommendations dealing with food contamination. *Risk Analysis* 24:1007–1018, doi:10.1111/j.0272-4332.2004.00503.x.
- Egan, C. 1998. Points of view: Inuit women's perceptions of pollution. *International Journal of Circumpolar Health* 57 (Suppl. 1):550–554.
- Ford, J.D. 2009. Vulnerability of Inuit food systems to food insecurity as a consequence of climate change: A case study from Igloodik, Nunavut. *Regional Environmental Change* 9:83–100, doi:10.1007/s10113-008-0060-x.
- Ford, J.D., and Smit, B. 2004. A framework for assessing the vulnerability of communities in the Canadian Arctic to risks associated with climate change. *Arctic* 57:389–400.
- Ford, J.D., Smit, B., and Wandel, J. 2006. Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada. *Global Environmental Change* 16:145–160, doi:10.1016/j.gloenvcha.2005.11.007.
- Furgal, C., and Seguin, J. 2006. Climate change, health and vulnerability in Canadian northern Aboriginal communities. *Environmental Health Perspectives* 114:1964–1970.
- Furgal, C., Martin, D., and Gosselin, P. 2002. Climate change and health in Nunavik and Labrador: Lessons from Inuit knowledge. In: Krupnik, I., and Jolly, D., eds. *The earth is faster now: Indigenous observations of Arctic environmental change*. Washington, D.C.: Arctic Research Consortium of the United States and Arctic Studies Centre, Smithsonian Institution. 266–300.
- Hegerl, G.C., Zwiers, F.W., Braconnot, P., Gillett, N.P., Luo, Y., Marengo Orsini, J.A., Nicholls, N., Penner, J.E., and Stott, P.A. 2007. Understanding and attributing climate change. Chapter 9. In: Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Avery, K.B., Tignor, M., and Miller, H.L., eds. *Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.
- Kovats, R.S., and Haines, A. 2005. Global climate change and health: Recent findings and future steps. *Canadian Medical Association Journal* 172:501–502, doi:10.1503/cmaj.050020.
- Kuhnlein, H.V., and Soueida, R. 1992. Use and nutrient composition of traditional Baffin Inuit foods. *Journal of Food Composition and Analysis* 5:112–126, doi:10.1016/0889-1575(92)90026-G.
- Laidler, G.J. 2006. Inuit and scientific perspectives on the relationship between sea ice and climate change: The ideal complement? *Climatic Change* 78:407–444.
- Laidler, G.J., Dially, A., and Joamie, E. 2008. Human geographies of sea ice: Freeze/thaw processes around Pangnirtung, Nunavut, Canada. *Polar Record* 44:335–361, doi:10.1017/S003224740800750X.
- Laidler, G.J., Ford, J.D., Gough, W.A., Ikummaq, T., Gagnon, A.S., Kowal, S., Qrunnut, K., and Irngaut, C. 2009. Travelling and hunting in a changing Arctic: Assessing Inuit vulnerability to sea ice change in Igloodik, Nunavut. *Climatic Change* 94: 363–397, doi:10.1007/s10584-008-9512-z.
- Macaulay, A.C., Commanda, L.E., Freeman, W.L., Gibson, N., McCabe, M.L., Robbins, C.M., and Twohig, P.L. 1999. Participatory research maximizes community and lay involvement. *British Medical Journal* 319:774–778.
- Moffitt, P., and Vollman, A.R. 2004. Photovoice: Picturing the health of Aboriginal women in a remote northern community. *Canadian Journal of Nursing Research* 36:189–201.
- Natural Resources Canada. 2004. Climate change impacts and adaptation: A Canadian perspective. Edited by D.S. Lemmen and F.J. Warren. Ottawa: Climate Change Impacts and Adaptation Division, Natural Resources Canada. http://adaptation.nrcan.gc.ca/perspective/profile_e.php.
- Qaujigiartiit Health Research Centre. 2010. Reviewer health research ethics checklist (draft). Iqaluit, Nunavut: Qaujigiartiit Health Research Centre. <http://www.nunavut.artichealth.ca/apps/Docs/displayDocs.aspx>.
- Van Oostdam, J., Donaldson, S.G., Feeley, M., Arnold, D., Ayotte, P., Bondy, G., Chan, L., et al. 2005. Human health implications of environmental contaminants in Arctic Canada: A review. *Science of the Total Environment* 352:165–246.
- Wang, C., and Burris, M.A. 1994. Empowerment through photo novella: Portraits of participation. *Health Education Quarterly* 21:171–186.
- . 1997. Photovoice: Concept, methodology, and use for participatory needs assessment. *Health Education and Behavior* 24:369–387.
- Wang, C.C., Yi, W.K., Tao, Z.W., and Carovano, K. 1998. Photovoice as a participatory health promotion strategy. *Health Promotion International* 13:75–86.

- Watt-Cloutier, S. 2004. Climate change and human rights. Human Rights Dialogue: "Environmental Rights." Series 2(11). New York: Carnegie Council.
- Weatherhead, E., Gearheard, S., and Barry, R.G. 2010. Changes in weather persistence: Insight from Inuit knowledge. *Global Environmental Change* 20:523–528, doi:10.1016/j.gloenvcha.2010.02.002.
- World Health Organization. 2003. Climate change and human health – Risks and responses: Summary. Edited by A.J., McMichael, D.H. Campbell-Lendrum, C.F. Corvalán, K.L. Ebi, A.K. Githeko, J.D. Scheraga, and A. Woodward. Geneva, Switzerland: World Health Organization. <http://www.who.int/globalchange/publications/cchhsummary/en/>.