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Emergency response in a rapidly changing Arctic

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Summary points:

- Wide disparities in both rates of unintentional injury, and access to search and rescues services and emergency medical care, exist between Southern and Northern Canada.
- Recent high profile events in the North West Passage have drawn attention to the potential for a large scale disaster in the Canadian arctic.
- Persistent gaps in the emergency medical care available to Inuit communities

  living in the Canadian North, and spur interventions to improve resiliency – particularly in the face of the effects of climate change - and access to emergency medical response services.

Emergency response capacity in the North was in the national spotlight in the summer of 2016 as the largest cruise ship to date, the *Crystal Serenity*, navigated from Alaska to New York via the North West Passage. The journey raised concerns about Canada's capacity to respond to any large scale disaster in the Arctic given limited infrastructure and the challenges of remoteness (1). Indeed, in 2010 the *Clipper Adventurer* ran aground roughly 100km east of Kugluktuk, Nunavut, requiring that 128 passengers be evacuated, straining emergency systems (1). Yet, such events that garner widespread public attention should also serve to highlight persistent gaps in the emergency medical care available to Inuit communities living in the Canadian North, and spur interventions to improve resiliency and access to services.

Medical emergencies in Canada's North, particularly those occurring outside of established communities, illustrate some of the most dramatic health disparities experienced in Canada. In the Canadian Arctic, rates of unintentional injury are estimated to be 3.7 times the national average (72.5:100,000 vs. 19.8:100,000) with elevated rates of ATV and snowmobile injuries and drowning/asphyxiation compared to Southern Canada (proportionate injury ratios of 1.93 and 1.52 respectively) (2, 3). Search and rescue incidents have more than doubled over the past decade, with a rate of roughly 14.1:1000 noted in Nunavut in 2015, which suggests an increasing burden (4).

The majority of Canada's 60,000+ Inuit live in one of 53 communities spread along our northern coastline. In these communities, travel and hunting on the land, ice, and water is a regular activity that is central to wellbeing, cultural identity, and food security. Trips 'on the land' can range from day-trips to a cabin by ATV, snowmobile, or boat, to multi-day trips to harvesting grounds, cultural sites, or neighboring communities. For anyone stranded due to a breakdown, or injured from a fall through ice, barriers in access to definitive medical care can be life threatening. Of the 543 incidents above 55^{o}N in 2014, 20% of the people involved were either dead or in critical condition on arrival at a health care facility (5). Prehospital medical care, however, is almost non-existent across the region, with no ground Advanced Life Support (ALS) prehospital care in the three territories. Further, only 29% of communities in the territories have ambulances, most of which are at a first responder level (6, 7). In most locations, definitive medical care requires transport in personal vehicles and snowmobile or ATV to community health centres by volunteers who, at best, have basic first aid knowledge (8-10). While community health centres can treat minor injuries, most do not have the capacity to care for major traumas, which means that aeromedical evacuation to regional hubs or southern hospitals is required.

Climate change is expected to alter the Canadian Arctic profoundly, with the region anticipated to have ice-free summers within the next half century, along with increasingly unpredictable storm activity. Environmental changes will affect hazards as sea ice seasons shift, ice thickness changes, iceberg abundance increases, and weather becomes more unpredictable (11, 12). A recent case-control study of 202 search and rescues in Nunavut, for instance, demonstrated a strong link between sea ice, temperature, and probability of an incident (4), while risks of navigating in poorly charted Arctic waters are well known (1, 12). It is only a matter of time before a major incident occurs.

In-light of current disparities and clear future challenges, it is essential that we take stock of emergency response capacities in the Canadian arctic and develop robust policies at local, regional, and national levels that are adapted to climate change and the pressing health needs of the region. First, improved governance and funding, to address gaps in search and rescue services and in local capacity for advanced life support prehospital care in the territories, is urgently required. (8, 9). Efforts to prevent incidents and emergencies, also key to addressing health inequalities, will require investment in and collaboration with Inuit communities. Opportunities for intervention include promotion of intergenerational exchange of traditional knowledge that has long underpinned safe and respectful use of the Arctic environment; removal of barriers to harvesting and land use activities; and evaluation of the use of new technologies for reducing risks associated with land use, including unmanned aerial vehicles and social network solutions (9). Such actions would serve to reduce health inequalities between Southern and Northern Canada, and will enhance communities' resilience into the future.

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