

## The new cold war

As researchers for the Defence Research and Development Canada, attending field trials, military exercises and operations for data collection purposes is a common and exciting part of the job. Over the past few years while conducting research during Arctic operations (Figure 1) we have experienced the challenges of trying to conduct basics tasks outside in the extreme cold. As civilian scientists, embedded with members of our Canadian Army (Figure 2) in the Arctic, this has been an extraordinary way to appreciate the challenges of the Arctic's harsh environment. There is nothing like personally suffering from frostbite to appreciate this!

Canada has one of the longest Arctic coastlines in the world, and there are significant reasons why the Canadian Armed Forces and its partners have, do, and will need a human presence there to guard this unique part of the world. Global warming and the accompanying opening of east-west passages across the region threatens North American sovereignty in the Arctic, by enabling a greater human presence in the vast expanse of the North for purposes that range from the economic (shipping, natural resources exploration) to new security challenges including criminal activity (e.g., smuggling, illegal immigration, illegal fishing) to increased tourism.<sup>1</sup>

The military has a common saying “no plan survives first contact with the enemy”. North of 60°, in the high Arctic, one persistent and capable enemy of the CAF is the extreme cold. The temperatures in Northern Canada, (which comprises the sub-Arctic, Arctic and the high Arctic) during the winter months can range from anywhere from –10 to –60°C.<sup>1</sup> Besides the cold, weather conditions such as fog, ice fog and blizzards present further challenges for operating in the Arctic. Together, these conditions pose a series of challenges that affect the Canadian Armed Forces' mobility, equipment, human performance, personal health protection, and basic survival when operating in the Arctic.

### History of CAF operations in the Arctic

When reviewing historic documents on past Canadian Armed Forces winter exercises over the last 70 years, it is interesting to find that even with our many advances in textiles (especially in the commercial/resource extraction, and outdoor sports industries), communication, technology, and building materials, many of the same or similar challenges that were an issue all those decades ago continue to be a challenge today. Over-land (and ice) transportation, dismounted mobility, communication, health maintenance, psychological effects of isolation, casualty evacuation, regular equipment, transportation equipment, nutrition, personal protective kit and frostbite treatment persist as challenges for personnel working in the Arctic. The apparent lack of progress highlights the harsh reality of the Arctic where the extreme cold can quickly render technology or a person completely ineffective. When operating in severe or extreme cold conditions (–35°C and below) basic survival is vital and therefore it is not uncommon for normal functions that we take for granted in thermo-neutral or warm settings, like the ability to use the hands for fine motor tasks, maintaining basic thermal comfort and health protection to become all-consuming priorities.

### Current cold weather injuries impacting Canadian Armed Forces in the Arctic

The Canadian Arctic covers such a wide area that the most reasonable mode of transportation for Canadian Armed Forces members is snowmobile (Figure 3) (despite the romantic notion that Canadian soldiers use dog



**Figure 1.** Pictures of the authors. February 2012, Resolute Bay, Nunavut, Canada. Used with permission from the authors.



**Figure 2.** Canadian Armed Forces training exercise. February 2016, Resolute Bay, Nunavut, Canada. Used with permission. Photo by: Master Corporal Louis Brunet, 3<sup>rd</sup> Canadian Division / 3e Division du Canada. Photo by Department of National Defence (DND)- Ministère de la Défense nationale (MDN) ©2016-DND-MDN Canada.



**Figure 3.** Canadian Armed Forces training exercise. March 2017, Hall Beach, Nunavut, Canada. Used with permission. Photo by Department of National Defence- Ministère de la Défense nationale (MDN) ©2017-DND-MDN Canada.

sled teams and Nordic skiing for dismounted travel). Although snowmobiles may be convenient and efficient when the machines do not break down, it means that Canadian Armed Forces soldiers spend a significant amount of time sitting and steering and not producing any significant metabolic heat. Compounding the scenario, extreme wind chill and cold promotes reflex redistribution of blood to the core, compromising blood flow



**Figure 4.** Canadian Armed Forces training exercise. March 2017, Hall Beach, Nunavut, Canada. Used with permission. Photo by Department of National Defence- Ministère de la Défense nationale (MDN) ©2017-DND-MDN Canada.

to extremities. Together, the conditions are such that the hands, feet and face are at put at a greater risk for a freezing cold weather injury.

Cold weather injuries, including frostbite are one of the major risks for the Canadian Armed Forces when operating in the extreme temperatures of the Arctic. Our most recent data collected during 2016<sup>3</sup> and 2017 military exercises (Figure 4) and operations found a high number of frostbite injuries among soldiers. As expected, the hands and feet are the most at risk, followed by the face and ears. It is difficult— due to a lack of longitudinal data— to determine if the high rate of frostbite injuries has increased over the past 10 years – especially considering that the Canadian Armed Forces had shifted its attention towards the Middle East post-9/11, conducting exercises in warmer southern Canada, and deploying in the Middle East. As a result, our ‘cold war’ reflexes have probably been diminished.

In the past, Canadian Armed Forces members’ frostbite that required medical attention was treated as an issue that was completely preventable and was considered a “matter for disciplinary action” against any soldier who reported frostbite.<sup>1</sup> Although that may no longer be the case, there still seems to be reluctance from Canadian Armed Forces members to report cold weather injuries, including those incurred during military exercises and operations, to their command or medical officers. In 2016 we found that almost half of the cold weather injuries were unreported or undiagnosed.<sup>3</sup> There appeared to be a variety of reasons for this, including pride, embarrassment, not recognizing they have a CWI, or not believing that their cold weather injury is severe enough to warrant reporting, and thinking they can handle/treat their injury on their own. Incidentally, we surmise that these same psychological factors and behaviour are implicated in preventable heat illness during hot climate training and deployments.

We are currently doing research to better understand the high number of cold weather injuries experienced by the Canadian Armed Forces. Anecdotal evidence points to a variety of reasons. These include, culture, leadership, education, training, inexperience and equipment deficiencies. Years of lessons-learned documents dating back to the 1940s have pointed out problems with personal protection equipment worn during Arctic Operations that are still being expressed today. For example, since 1940, those who have worked in the Arctic have recommended that the parka hoods be outfitted with fur trim to help protect the face.<sup>1</sup> This has still not happened, but remains a recommendation expressed by experienced CAF members today.

Physiological make-up, anthropometrics, age, fitness levels, and particular medical conditions can have an impact on one’s susceptibility to cold weather injuries. Ethnicity and gender can also put people at higher risk for cold weather injuries.<sup>4</sup> As the Canadian Armed Forces continues to diversify and attract more women and visible minorities including, those from warm or tropical parts of the world, there could potentially be a selection issue that impacts health risk for operations in the Arctic. The diminished ability for certain people to vasodilate the peripheral circulation is well documented in the scientific literature.<sup>4</sup> We should therefore be accounting for this



**Figure 5.** Frostbite injury during training exercise. February 2016. Used with permission by Captain P. Dhillon.

biological factor, and work to protect the various populations who deploy in harsh arctic conditions by providing the best clothing, methods for prevention the best medical treatment available.

To complicate matters, even if the frostbite is diagnosed, treating frostbite in the field is challenging. These injuries can in some cases be career-ending (Figure 5). Finger or toe amputation may be the outcome if medical care and medical evacuation times are inadequate.<sup>2</sup> There is a clear need to have experienced medical professionals trained in the diagnosis and treatment of cold weather injuries while in the field, because managing any medical incident is a challenge in isolated conditions with limited medical supplies, medical equipment, and the potential of long evacuation times<sup>2</sup> can be catastrophic.

As northern nations cast an eye increasingly more to the Arctic and its opportunities, and as we deploy our militaries there to guard it, we should rejuvenate our efforts nationally and internationally to mitigate the negative medical and human performance issues it brings with it. Certainly, if we collaborate and leverage each other's strengths, we could accomplish much to improve military human effectiveness in the harsh Arctic environment.

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<https://doi.org/10.1080/23328940.2017.1381799>

