

Surviving on the Edge: Medicine in Antarctica

ALEXANDER KUMAR

DC8 Winter Crew Station Doctor and European Space Agency Research, Concordia Station, Antarctica

SOPHIE DUONG

Harris Academy, London

Living at Antarctica's Concordia Station, buried deep within the world's worst winter, this year's winter crew station doctor has time to appreciate where Antarctic medicine has come in the past 100 years.

In all the world there is no desolation more complete than the polar night. It is a return to the Ice Age – no warmth, no life, no movement. Only those who have experienced it can fully appreciate what it means to be without the sun day after day and week after week. Few men unaccustomed to it can fight off its effects altogether and it has driven some men mad.

Sir Ernest Shackleton

The quest for the South Pole has forged a unique celebrated, tragic and heroic legacy. Antarctic medicine stands on its own plinth of risk, tragedy and triumph, much like the physicians it entertains each winter.

Celebrating not only Antarctic medical staff, we bring to light other unsung heroes within the isolated, overwintering crews – including glaciologists, cooks and mechanics – who, among other untrained crew members, supported their lone doctors in daring, desperate and life-saving procedures on the ice, sometimes operating on the doctor themselves.

History

Past doctor's equivalents onboard Captain James Cook's voyages in the vicinity of Antarctica were arguably the first to practise medicine in this area. By the early 1900s, formal medical supplies and expedition doctors were a planned and important inclusion in expeditions by Amundsen, Scott, Shackleton and Mawson, among others, during the heroic

age of exploration. In times of health, expedition doctors conducted (and still do) natural science research.

We have had many past lessons to build our foundation of medical knowledge upon. Sir Douglas Mawson's 1911–14 Australasian Antarctic Expedition pioneered the use of wireless communications in Antarctica, enabling growth in the field of telemedicine.

Large advances have been made in the past 100 years in attempts to provide a means for medical self-sufficiency for the lone doctors littered among the increasing number of international crews, locking themselves into the brutal and unforgiving Antarctic winter, where a simple mistake or oversight can cost lives. Antarctic doctors have to be rehearsed and willing to act within all specialties of medicine – surgery, dentistry and even obstetrics. In 1978, Argentina's Emilio Palma was the first person to have been born on the Antarctic continent.

Antarctic medicine has become its own speciality. Long-standing Antarctic medical units have constructed their own training and handbooks. The British Antarctic Survey's Medical Unit provides its "Kurafid" handbook to its own stations and field crews.

Screening and Social Structure

Every national Antarctic program has its own methods to screen potential overwintering candidates, both medically and psychologically.

More so nowadays, blood tests for blood-borne viruses, including HIV and hepatitis, are crucial, alongside examinations of other body systems. Numerous problems caused by the gall bladder have made this organ a debated area of focus.

Antarctic crews made up of around eight to more than 50 members spend up to 9 months living together in complete isolation. Ultimately although survival relies upon teamwork in such extreme environments, overwintering crews endure long periods of isolation, sensory deprivation and complete darkness, embarking on a challenging journey of personal inner discovery.

Isolation and confinement can lead to intercultural and interpersonal problems, and this can even result in mutiny. During the winter of 1996 at Casey Station, the social structure disintegrated, leaving the station leader outcast and scrutinised by other crew members who called for mutiny and disobeyed his leadership.

A South Pole overwinter physician in 1999, Jerri Nielson, wrote in her book *Ice Bound*: “We had to keep reminding ourselves that there were no real monsters or demons under the ice at the South Pole. The worst ones were those that we made for ourselves, in our minds.”

Psychological screening has been utilised for many years to try to identify preferred behaviours, beliefs and traits. Despite this, unsuitable traits have “slipped the net”. Mental illness exacerbated by the cold, dark and lengthy isolation is exemplified well enough by Jack Nicholson in *The Shining*, a film enjoyed during mid-winter celebrations by most overwintering stations.

But numerous tests and research into psychological screening remain inconclusive, so the search for the “ideal” overwintering candidate profile continues.

Deficiency and Susceptibility in Mind and Body

Gone are the days of poor nutrition, illustrated by the tragic death of 1916 Imperial Trans-Antarctic Expedition member Arnold Spencer-Smith who, worn down by exhaustion and scurvy, was buried in the ice.

Vitamin D – the new vitamin C – has become a focus of Antarctic long-term winter study, its

crucial role in so many body systems having been identified. In the absence of sunlight, and thus the ability to synthesise vitamin D, the body and mind lose their natural pattern. Body systems such as the immune system start to dissolve and dwindle during the long polar night. Other bad news and inability to cope only give further misery to such injury.

Common complaints noted among Antarctic overwinterers (“Polies”) include poor sleep, depression, irritability and blunted cognitive abilities. Despite a documented decline in vocabulary while overwintering at the South Pole, the community remains adaptive, inventing their own reassuring replacement expressions. The term “wide-eye” is used to describe the experience of poor sleep, which is universal among Polies. Tiredness, accompanied by poor diet, poor sleep and hypoxia at some locations, such as Concordia Station, can leave people susceptible to serious accidents. Comradeship is as crucial as teamwork for survival. Looking out for the well-being of your station mechanic or cook may save the lives of your team.

Alongside deficiency can arrive excess. In 1913 Mawson found himself completely alone on the ice, having witnessed the demise of his friend, Xavier Mertz, from madness to death due to hypervitaminosis A. Even a 100-gram meal of the husky liver they had consumed may have proved fatal.

Pandora’s Medicine Box

In reality, most serious and potentially life-threatening medical problems that occur during the Antarctic winter are rare and unpredictable. You have to prepare yourself for anything, expect the unexpected and be able to deal with it. Planning, training, packing and prevention are vital.

The remaining medical conditions that arise, from simple chest infections to fractured bones, are largely an inconvenience but can be managed on-site. More serious possibilities include poisoning, whether intentional or accidental, accompanied by an ever-present risk of fire; together they remain the greatest predictable threat.

Sir Ernest Shackleton’s *The Heart of the Antarctic* contained inventories of the drugs and medical equipment he packed, including iron, cocaine hydrochloride, dressings and dental

forceps. Captain Robert Scott's aluminum medical case was a mixed bag, containing hazardous treatments such as arsenic, belladonna mercury and strychnine.

Today's modern equivalent is comparatively luxurious. Concordia Station, like other year-round Antarctic stations, has a purpose-built infirmary containing a stocked pharmacy, diagnostic equipment, in-patient bed and even a dental chair and operating table.

This year's United States Amundsen-Scott South Pole Station doctor is Dale Molé. Having just retired from a long career working as a US Navy submarine physician, he decided to honour his interest in polar history and remote medicine by overwintering as the lone physician at the South Pole. Doctor Molé says:

My only thought is that dice have no memory. One could hope that statistically all the bad things that could happen have happened. I am now less than 12 weeks away from my relief arriving and have been exceptionally fortunate nothing really bad has happened ... either to me or to those under my care. Certainly the medical screening is much better than it was a decade ago, so the more preventable things have been addressed.

Medical Emergencies

In 1999, overwinter doctor Jerri Nielson (1952–2009) recognised a breast lump. While on the ice she wrote: "I knew it could be cancer, but I wasn't prepared to believe it yet". Using equipment delivered by an airdrop, unable to be evacuated, she diagnosed, treated and battled breast cancer during the long winter. Nielson recalls: "I had my picture taken in the treatment room of Biomed, sitting between photographs of Frederick Cook and Bill Wilson*, my medical predecessors on the ice. In my portrait you can see exhaustion in my face, a touch of sadness in my eyes, and a wry smile on my lips. I deliberately chose that spot between my 'dead doctors'; it was a grim joke only three of us shared." Nielson was successfully evacuated in October – the earliest opportunity – and underwent treatment back home in the USA. She passed away in 2009 from cancer recurrence.

Two years later, in 2001, 59-year-old South Pole physician Ronald Shemanski developed potentially life-threatening gallstone pancreatitis, requiring evacuation. A rescue team flew successfully in extreme temperatures,

landed and took off at the South Pole in darkness, despite considerable risk of a crash.

The year 1961 was noted for several life-saving operations being performed on the ice. At Australia's Mawson Antarctic base, mechanic Allan Newman suffered a cerebral haemorrhage. Doctor Russel Pardoe, aged 29 years and holding no experience in neurosurgery himself, fashioned a drill from dental equipment and tested it on the remains of a seal. Assisted by a cook and two geophysicists while under guidance by Morse code sent from Melbourne, he drilled two holes into the patient's skull, relieving the internal pressure and saving Newman's life.

One of the most courageous cases from Antarctica's colourful medical history is the incredibly brave and daring auto-appendectomy performed by Russian doctor Leonid Rogozov, also in 1961. At just 29 years old and isolated at Russia's Novolazarevskaya Station during winter without the opportunity for an evacuation, he operated on himself and removed his own infected appendix under local anaesthetic. When later asked about performing the operation, Rogozov said simply that it was just "a job like any other, a life like any other".

Not all outcomes are as fortunate as Rogozov's. In 2009, during winter at India's Maitri Station (which neighbours Novolazarevskaya), a 57-year-old crew member suffered a massive heart attack and passed away. His body was cremated on site; later, at the beginning of the next summer, his remains were returned to his family in India.

Fire and Food Poisoning

Accidents are a continuing threat to Antarctic crews and may easily prove fatal. Among them, the possibility for poisoning and fires loom heaviest on the minds of overwintering crews.

In April 1983, at the beginning of the winter, Russia's *Vostok* lost all of its diesel generators to a fire. Having lost their principal heat source, the crew endured the entire winter, lighting asbestos wick dipped in diesel fuel and even continuing their scientific research until a plane could reach them in November – a testament to Russia's prolific and heroic Antarctic history.

A winter station struck and destroyed by a fire may leave surviving casualties homeless on the ice in worse conditions than those suffered

by Shackleton's crew when their vessel, *Endurance*, was crushed and sunk. This year a tragic fire at Brazil's Comandante Ferraz Antarctic base proved fortunate only in that it occurred during the summer when help, assistance and the possibility for evacuation of serious cases could occur. Two lives were lost with 40 survivors evacuated.

Contamination leading to poisoning of limited food stocks has been a problem since the heroic age of polar exploration. Departing in 1845 to the Arctic, Sir John Franklin's fate-ridden expedition remains shrouded in a cloud of mystery, not just for its fabled "disappearance" but also with evidence bearing the possibility of lead poisoning, tuberculosis and scurvy as contributing factors.

During Scott's expedition, physician Wilson was unable to account for cases of scurvy with the team's consumption of limes, and suspected ptomaine poisoning. He inspected, smelt and tasted each can of meat himself as it was opened but was not aware that copper vats, in which the limes had been transported and stored, had rendered the vitamin C within them ineffective.

Human–Wildlife Conflict

Although rare and usually limited to infections such as "seal finger", which follows seal bite, in an isolated case in 2003 British Antarctic Survey marine biologist Kirsty Brown was tragically drowned by a leopard seal while snorkelling near Rothera Research Station. Such incidents, while being unavoidable and unpredictable, remain a real risk when working in such wild environments the world over.

Transport and Tourism

Since Admiral Byrd's first historic flight over the South Pole, Antarctica's landscape has been littered with wrecks from plane crashes within the past century of exploration. The 1979 Air New Zealand disaster remains the largest tragedy, when a DC10 travelling en-route to the South Pole crashed into Mount Erebus, killing all 257 people aboard. Smaller but more frequent air crashes involving helicopters, a popular form of transport utilised around Antarctic bases, have claimed further lives. Skidoos and other such similar vehicles cause significant morbidity, but rarely death.

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Ships and icebreaker vessels remain popular methods by which scientists reach summer coastal stations, and for onward travel to inland field sites. However, in recent years there has been a marked rise in tourism to Antarctica, including private vessels visiting and cruising Antarctic waters.

The sinking of the Canadian tourist cruise ship *M/S Explorer* in 1979, having struck submerged ice, was considered a lucky escape when all 154 passengers and crew were able to be rescued. This was mirrored in 2010 when tourist vessel *Clelia II*, hammered by waves, had to declare an emergency. Limping back to port, the 165 people on board were lucky to survive. With the rise in tourism to the region, future cruise ships and their passengers may not be so fortunate.

Best of Times, Worst of Times

Despite advances in technology and communication when facing a medical problem, Antarctic physicians remain out of reach from specialist referral and diagnostic services. Although we may worry, we have never really been alone. Fortunately there is always the steady cut by a chef or the expertise of a mechanic's drill, ready and willing, to hand (or head). Like every remote medicine doctor overwintering in Antarctica, we live in hope that the Great White Silence will remain medically silent, having been so noisy in the past century.

* American Frederick Cook, alongside his claim to have been the first person to have reached the North Pole, was the first doctor to overwinter in Antarctica in 1898. British-born Edward Wilson was the first doctor to reach the South Pole in 1912.