

Extreme medicine in Australia's Antarctic programme

The operational capacity of the AAD's Polar Medicine Unit provides one of the many support functions necessary to achieve Australia's goals in the Antarctic, Southern Ocean and subantarctic. The unit is highly specialised and efficient, yet not prominent till a serious health or medical event occurs.

Its critical functions include recruitment of wintering, deep field and voyage medical practitioners; medical, dental, laboratory and surgical training; preparation for deployment; provision and maintenance of medical supplies and equipment; and comprehensive medical and dental screening of expeditioners and ship's crew. The unit also conducts research into biophysical and psychosocial aspects of human health in Antarctica.

The key to the success of Australia's Antarctic medical support is the appropriately trained, generalist procedural medical practitioner – on station or on the ship – who is capable of dealing with a broad spectrum of medical possibilities, from appendectomy to treatment of a broken leg, and the diverse range of mind and body ailments in between. However, the Polar Medicine Unit is also acutely aware of the limited sophistication of medical care possible by the lone doctor in Antarctica. The complete isolation of an Antarctic winter and the risks and potential impacts of summer operations do not allow for medical or operational complacency. These same risks are felt by those planning for space travel.

Comprehensive pre-departure medical screening is essential to our operations, given the limitations of the current medical support and logistics framework. Interestingly, the medical checklists and screening examinations over the past 15 years have produced consistently low numbers of unsuccessful candidates (see graph). Similarly, despite the extreme environment and potential risks for serious events, the consultation rates for both injury and illness from a trivial to a serious nature, have declined from 2–4 per person per year in the early 90s, to 1–2 per person per year today (for details see < http://aad-maps.aad.gov.au/aadc/soe/display_indicator.cfm?soe_id=49>).

Satellite communication links to medical practitioners at head office, who have all wintered in Antarctica, enable critical e-health support on a 'store and forward' telemedicine basis, via narrow bandwidth networks. This allows telephone consultation and digital transmission of X-rays and clinical images 24 hours a day.

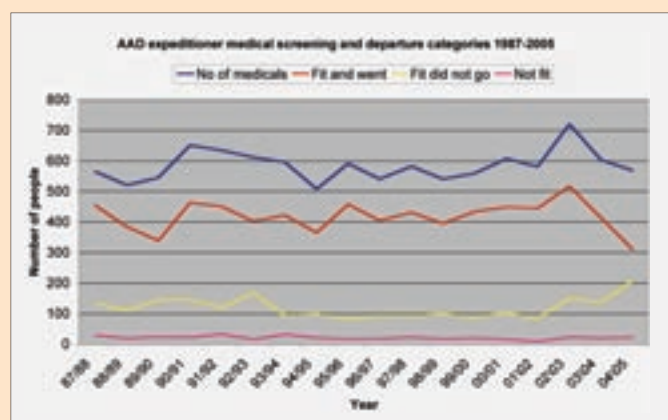
As technology advances, our doctors – on station or ships – are increasingly able to access professional and continuing education support. Technology also facilitates contact with a network of medical and dental specialists, many of whom have spent time in Antarctica. These advances aim to improve the health care of expeditioners from afar. E-health projects such as implementation of the AAD electronic health record will lead to further improvements in care.

In response to the changing needs of Australia's Antarctic programme, the Polar Medicine Unit recently designed and implemented a 'containerised medical facility' on chartered ships. It has also recently implemented an Antarctic aeromedical capability for deep field retrieval to stations, using the intra-continental CASA 212–400 aircraft, in case of emergency.

The Polar Medicine Unit contributes to the Australian Government's Antarctic goals of maintaining Australia's influence in the Antarctic Treaty system and undertaking work of practical, economic and national significance. It also contributes to Australia's national research priorities by promoting and maintaining good health, conducting research in an extreme environment and supporting the safeguarding of Australia's southern territories.

The AAD Human Biology and Medicine research programme, led by the chief medical officer, investigates human responses to, and interactions with, the Antarctic

This graph shows the results of medical screening and deployment as part of Australia's Antarctic programme. It shows the total number of medical screening examinations undertaken (blue line) and individuals that did not go south because of medical reasons (pink line) or other personal or organisational reasons (yellow line). The red and yellow lines also include medical screens for the Australian Customs Service Southern Ocean fisheries patrols, after 2002. In 2004–05, 569 medicals were completed and only 22 participants were deemed unfit.



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environment. The more we delve into the nature of small Antarctic groups arriving from temperate climates, the more questions arise. For example, what is the effect on the immune system of this geographic change? Is the observed immunosuppression and viral reactivation caused by psychological, hormonal or neuronal stressors? What triggers the changes in thermal physiology to cause acclimatisation?

The research programme also conducts psychosocial studies on small groups and individuals in isolation, and their positive resilience factors and adaptation responses, both on Antarctic stations and back home. These studies may provide insights into optimal psychological support at selection and during an expedition. They may also assist re-integration of expeditioners on return to Australia. Application of the research findings to humanitarian, military, disaster and other challenging environments is possible.

There are many other questions. How can we operate more safely and improve the health and wellbeing of expeditioners, and mankind in general, in challenging environments? Are the observed changes impacting on the health of Antarctic expeditioners in the short or the long term? Are they reversible or irreversible? How can we apply these findings to other extreme environments; to frontiers of industry and ultimately, space travel?

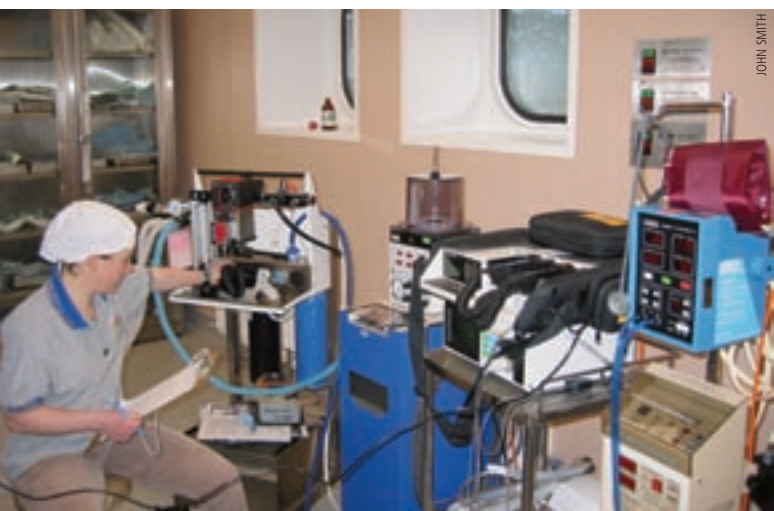
In the International Polar Year (2007–08), the Scientific Committee on Antarctic Research Expert Group on Human Biology and Medicine has proposed a multidisciplinary Arctic-Antarctic health research project. The project will provide an extraordinary opportunity for all polar researchers to study physiological, public and occupational health in polar regions, and to scale up studies of small populations in both the Antarctic and Arctic. The study will provide a legacy of ongoing databases, education and outreach, and will answer significant research questions on many facets of polar human biology and medical research.

For further information on the IPY visit <<http://www.ipy.org>>. Further information on the IPY research proposal, *Taking the Antarctic Arctic Polar Pulse*, is available from the AAD Chief Medical Officer – jeff.ayton@aad.gov.au.

— JEFF AYTON

Chief Medical Officer, Polar Medicine Unit, AAD

Assistant anaesthetist Megan Tierney monitors anaesthesia equipment during a training session at Mawson Station. The equipment includes, from left to right: Ulco anaesthetic machine, manual suction apparatus (in case of electricity failure), Campbell anaesthetic patient ventilator (for artificial breathing) sitting atop an anaesthetic ventilator and medical gas compressor, Lifepak 10 defibrillator and heart monitor, Datex anaesthetic vital signs monitor, Critikon blood pressure monitor (blue box at right) and an ATS automatic tourniquet cuff system (to assist with bloodless limb surgery and regional anaesthesia).



JOHN SMITH



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Committing to work as a doctor in Antarctica can be a disruptive and challenging career move. Doctors may have to sell a practice or put unforgiving training schedules on hold. They are then sent to one of the most isolated regions on Earth where, if a medical emergency arises, their only assistance is from a small band of willing volunteers and experts at the other end of a satellite phone. With the right attitude and effective use of the time, opportunities and facilities available, doctors can gain great personal and professional benefits from a stint in Antarctica. Two doctors, recently returned from the ice continent, describe their experiences.

Dr John Smith's experience at Mawson Station in 2003 was professionally and personally rewarding.



JOHN SMITH

Dr Tanya Kelly medivacs a patient from Casey Station to the RSV *Aurora Australis* under the support and coordination of the Polar Medicine Unit.



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