Arctic telehealth: North to the future

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ABSTRACT
Over the past thirty years the delivery of health care services in Alaska has gone from Citizen Band radio transmissions that were relayed through telephone bridges to one of the largest, state of the art telemedicine systems in the world. This transition has been marked by innovative approaches, learning from others, forged partnerships, open relationships with the telecommunication businesses, and a great deal of funding. This transition has required new approaches to health information, relinquishment of sole ownerships, collaboration, cooperation, and a unified voice.

The system is not standalone. There are components that have influenced other endeavors. Health Aids now must be trained to make use of the electronic tools that they have at their remote clinics. Upgraded components for airborne medical evacuations need to match the overall system. Health professionals doing rotations and contracts in Alaska must learn how to interface with the telemedicine system. New administrators are being trained through a Master of Public Health program within the University of Alaska Anchorage that is taught entirely over the "Blackboard" computer-based system for distant delivery.

The telehealth systems in Alaska and other Arctic nations are becoming the models to be replicated throughout the world. Excelsior.

INTRODUCTION
In 1971 I was working on radio biotelemetry in order to obtain information from Arctic animals including wolves and polar bears. Some of the information was their location. Other information was about their physiology and how their bodies dealt with cold. During the summer I was at a remote field camp of the Naval Arctic Research Laboratory. There were two of us collecting samples. One morning, to our surprise, as we were in the middle of open, unoccupied tundra, there was a knock on the door. A man stood there, out of breath and asked, "Are one of you guys a doctor?"
The person opening the door responded; "Yes." The man outside said; "Great! My buddy just shot himself!" The doctor then tried to explain that he was a Ph.D. Astronomer on the tundra collecting butterflies. Before the explanation was delivered I volunteered that I had been trained in advance first aid and was asking where his buddy was.

The next few hours became quite a learning experience. We were four people, eighty miles from help, and with no communications. Our research plane was not due for several more days. The hunter’s plane was to be in the next day. The patient was stabilized, pain was treated with what they had – whisky, and he was monitored until the airplane arrived to take him to the hospital in Barrow and then on to Anchorage.

History
The very first words reportedly ever sent via a telephone were a call for help. Over 120 years ago Alexander Graham Bell spoke a plea into the mouthpiece after spilling battery acid on himself while testing a new transmitter described in his recently received first telephone patent. His assistant, in a distant room, heard the now famous message from the receiver; "Mr. Watson, come here. I want you." Watson rushed to provide aid, and in the process confirmed that the system worked. A few years later, radio was being used
in polar telemedicine as well. Radio healthcare messages were sent to and from remote camps in Antarctica as early as 1913. Telecommunications and telemedicine have and will continue to be intimately linked.

At the same time some of the early attempts at telemedicine were fraught with problems of barriers to communications. High winds blew down or repositioned antennae. The aurora borealis disrupted radio transmissions. The low angle sun disturbed signals from satellites that are equally low on the Arctic southern horizon. While some of these physical conditions have not changed, technology has allowed for some ways to address the interference.

Likewise it is the community that is isolated due to a powerful storm or in winter darkness without runway lights that has the greatest need for assistance. Small, remote health clinics with limited staff and resources need to have access to technical support and training to be best able to provide local care.

In order for arctic communities to provide adequate healthcare to their people, there must be a sustainable means of delivering this care at a distance. Telemedicine has been identified as the use of computers, telecommunication and medical tools that allow physical parameters to be put into an electronic format.

Although telemedicine is part of the larger telehealth concept, and is dependent on systems of telecommunication, it also involves tele-education and other distance delivery systems. The services that are needed and are being delivered at a distance are defining these remote arctic cities and villages as the "tele-community."

For over thirty-five years circumpolar health professionals have met to discuss the issues of the people of the far north and how to improve distance delivery of services. These professionals formed the International Union for Circumpolar Health (IUCH). A chronological listing of papers that address the concept of telemedicine or remote healthcare that incorporates the use of telecommunications reveals that since the 1960s there have been hopes, plans and expectations for how the new technologies would improve the delivery of health in the Arctic. The 43 papers that have been published through the proceedings of the triennial International Congress for Circumpolar Health (ICCH) make a wonderful summary of the vision, the efforts, the process and now the successes of telemedicine in the Arctic. (See IUCH Reference List at the end of the paper)

The ICCH papers have recorded the discussion regarding the links between healthcare delivery and the quality of telecommunications in the Arctic. The ICCH papers also reinforce that, although pilot studies and trial programs have been supported, plans to bring communities into the available communication systems and to make telemedicine an integral part of daily healthcare delivery, have not been fully realized.

In the clinics of Alaska in the 1970s there were still radios that connected the Community Health Aids to sub-regional clinics and regional hospitals. By the late 1970s, while most clinics were using radio, there was a telephone in the community, usually at the store. In both of these cases information about patients was discussed either on an open airway or in the store with others waiting to use the telephone. With expanded general telecommunication systems there are telephones in most all homes and the lines are quite secure for the transmission of health information.

There have been "experiments" and pilot studies with a number of telecommunication systems in Alaska. In 1967 and 1973 the US space program through NASA sponsored the ATS 1 and ATS 6 projects with satellite communications. People still remember the ATS 6 as providing excellent telephonic and visual communications. However, the ATS 6 satellite was needed over another area of the world, and the experiment ended as quickly as it had begun. Over the intervening decades there continues to be a desire to have such a dedicated communication system for health matters.

In the 1990s the Low Earth Orbiting (LEO) satellites offered a new opportunity through improved telephone communications. Thanks in
large part to our Finnish friends, cell phones are in everyone’s hands and they can be used to call for help just as Alexander Graham Bell did. Cell phones have been used for a number of rescues in Alaska. One particularly interesting event was coordinated by the use of personal telephones. The incident started with a telephone call from an injured hiker not far from the city of Anchorage. Soon the Municipal ambulance and rescue team were involved. Then a local military base offered a helicopter to access the remote site. The difficulty was that the various emergency response systems that were on site could not talk to each other.

While the coordination of emergency response infrastructures has been assessed through the eight-nation Arctic Council’s Emergency Prevention, Preparedness and Response working group, it appears that local and regional systems work collaboratively but each has their own set of priority linkages. In addition there is now a Circumpolar Infrastructure Task Force that is charged to improve telecommunications generally throughout the Arctic. CITF has been working with the Arctic Council and the Northern Forum members to foster an understanding for the need to improve telecommunications in the Far North.

Telemedicine follows telecommunications and will expand to the level of what information can be technologically transmitted.

Within Alaska those people who receive Federal support for their health care make up several sections of the overall population. A program titled the Alaska Federal Health Care Assessment Network was established to foster one system of telemedicine. A few years into the work a statewide group was formalized to assure that AFHCAN would link with non-federal health care providers such as the private sector hospitals, clinics and doctors offices. There is now an Alaskan Telehealth Advisory Council to forge the work that goes on among Federal health delivery programs, State Public Health Nurses, the private sector and with the telecommunication companies.

Recent work on a medical evacuation program has shown the need to be able to transfer patient information among all of these systems. In transporting patients who receive their services from a variety of providers there is a need to communicate information. As a patient is seen to, need specific services, such as infants and children, other professionals and health care systems come into action. The information on an infant may have to pass through several clinics, multiple medical care facilities and even more than one air and ground ambulance service, just to have a safe journey from a remote village to Anchorage.

**Coordination of Expanding Efforts**

The transition over the past few years has been marked by innovative approaches, learning from others, forged partnerships, open relationships with the private telecommunication businesses and a great deal of funding. This transition has required new approaches to health information, relinquishment of sole ownerships, collaboration, cooperation, and a unified voice. It has also required coordinating with a number of governmental agencies at local, State, and Federal levels. Emergency response for natural disasters may be conducted by agencies that do not provide daily health care. Therefore communication systems need to be discussed and exercised to assure a smooth flow of patient information.

The telehealth system as it is today is not standalone. The focus is no longer just the clinical care of the various forms of telemedicine. The advances are modifying components that have influenced other endeavors. Community Health Aids now must be trained to make use of the electronic tools that they have at their remote clinics. Upgraded components for airborne medical evacuations need to match the overall system. Health professionals doing rotations and contracts in remote Alaskan hospitals must learn how to interface with the telemedicine system. This training and support must come from the administrators, the delivery systems, and the educational training institutes.

New administrators are being trained through a Master of Public Health program within the University of Alaska Anchorage that is entirely taught over the "Blackboard" computer-based system.
for distant delivery. New nurses are being trained via remote site programs. Community Health Aids are being trained to use new computer linked digital tools that can see, hear, and feel the basic health parameters of pulse, temperature, blood pressure and visual examination. Doctors likewise are learning to access information about a patient through computerized files. Some clinic and hospital exam rooms are being outfitted with flat screens mounted on the walls to display the patient’s medical information as well as to provide health education. The healthcare providers of the north, no matter where they come from, need to know how to comfortably utilize the telehealth systems that are coming on line.

Not only is training needed on the equipment that is in place for clinic purposes, but all levels of health professionals need to know where to get information and help. Not only can remote sites ask for information, but they can also send information. It is usually someone in the community that knows the patient the best and can provide insight to doctors and nurses who are treating the patient away from home. The remote clinician can, when the systems are in place, view the patient in their distant hospital bed and provide commentary to the treating physicians.

In addition, the remote sites need to be able to access web-based information. The National Library of Medicine has recently established www.arctichealth.org to be a source of health information on Alaska Native health disparities and reports on the concerns and health research of the Arctic. More and more educational programs are being placed on-line, so people can be trained, or have updates of their knowledge by accessing the Internet or making use of programs that are CD-based. The State of Alaska’s Emergency Medical Services training programs are becoming available through a series of CDs.

There is no single factor that assures the success of a telemedicine program. There are several basic parameters that need to be considered. The Arctic Council’s Arctic Telemedicine Project’s 2000 report looked at the current status of telemedicine in the Far North and concluded that four factors are needed to make telemedicine successful (ATP, 2000).

Physical Infrastructures – This is the area of the telecommunication system that includes the hardware and software as well as supporting facilities. It is the basis upon which any current telemedicine program is supported. There cannot be telemedicine without the lines, the transmitters and receivers, the stable power sources, the stable heating systems for the clinics, and the equipment to transfer physical health parameters into digital or analog electrical formats for transmission. This is the focused application of the latest technology.

Training Structures - These are the health and medical training programs that incorporate the full utilization of the latest technology as part of daily clinic operations. Distance delivery of training programs will provide well-focused continuing education and skill development for remote health professionals. This enhances health delivery capacity at remote sites, and then expands the utility of telemedicine programs. This is the professional education.

Interoperability Guidelines - These are the guidelines developed under the auspices of local, national and international forums to assure that health practitioners, and the electronic tools they utilize, will function in either the same language or at least a language that can be understood by the receiver. This is the collaboration of working agreements.

Community Interface - This is the work of addressing how the larger healthcare system, in all of its sophistication, can be utilized effectively and efficiently by local providers for the maximum benefit of remote Arctic residents. This area incorporates local and cultural practices as well as identifies community needs and abilities. This is the commitment from the leaders.

These four parameters – technology, education, agreement, and leadership - need to be in place and coordinated in order for any telehealth system
to be successful. The physical and training structural components make up the foundation. The community interface will determine both the level of acceptance of the program as well as the amount of support it will receive from the government, administrators, trainers, practitioners and the public. The interoperability guidelines of the systems tie the other three pieces together and make the system work with other systems as well.

Since the Arctic Council’s report, the telemedicine programs of the Far North have continued to expand. The AFHCAN project has now deployed over 200 workstations throughout Alaska at clinics and hospitals. There is even one on a Coast Guard cutter. There was recently a remote directed ear surgery that was performed using this system. The Nordic Telemedicine Association has formally organized and has had several large meetings to discuss advances and collaboration. The fifth Nordic Congress on Telemedicine will be held in Umea, Sweden in September of 04. The NTA annual meeting is beginning immediately following this Congress and will be held in Tromso, Norway. Norway has selected a nationally unifying telemedicine system based on the work of the University and hospital in Tromso. Western Russia has regular interactive telemedicine consultations with neighboring nations to the west. Sweden has established a multi-agency teleconferencing system to address the many aspects of health delivery. The Circumpolar Infrastructure Task Force has been established and is working with both the Arctic Council and Northern Forum to foster greater telecommunications for the entire Arctic region. The International Journal of Circumpolar Health is planning a dedicated issue on telemedicine in 2004.

These ideas and programs are innovative. They are supported by nations that place a high value on being leaders in the delivery of health care. The north is moving forward in efforts that will improve the health of people all over the globe.

CONCLUSION
While these efforts are young, they are based on years of frustrating experiences that have lead the practitioners to ask for new technological solutions to the transmission of information about distant patients to equally distant health providers. Similarly there has been a request for distant training that is now being addressed by programs that range from individual modules to complete upper division degree programs that can be provided. Remote practitioners can now see and hear lectures or attend rounds through video conferencing. Arctic health information and research is now available through a sustainable project under the US National Library of Medicine and there are similar projects in Canada and Finland. As these web sites expand they should provide the best and latest information on the health concerns of indigenous peoples, circumpolar health studies and research, as well as be a link to previously produced Far North materials on well-being.

In the time of seeking the Northwest Passage and the North Pole, the goal was to transit vast territories and achieve the zenith. In the process it was learned that this area of the world is challenging, but that year-round residents who knew how to survive inhabited it. Once local knowledge lessons were learned, the newcomers were able to succeed in their endeavors and ultimately reach the top of the world.

Today, the time of seeking improved quality of life in the circumpolar regions, the goal is to be able to transit vast territories and achieve the zenith. In the process the year-round northern peoples are taking charge of their health services and enlisting the technical support and systems of the newcomers to work toward success. Now the top of the world is not defined as a geographic location but a state of well-being.

Telehealth IS the way health care has been, is, and will be delivered in the remote areas of the circumpolar regions. We lead at telehealth because we know this tool and how to use it. We are creative and flexible in our problem solving. With new technologies there are great opportunities for further advances. As in the days of old the refrain that is shouted is excel-sior – To the Top!
REFERENCES
ATP Task Force. 2000 Arctic Telemedicine Project Final Report. An international assessment as part of the Sustainable Development Program of the eight-nation Arctic Council. Available among the October 2000 Barrow, Alaska Ministerial Meeting Documents at www.arctic-council.org. 88 pages.

Thirty-Five Years of IUCH Telemedicine References

International Union for Circumpolar Health (IUCH) - The following is a listing of the 43 published presentations on the concept of telemedicine or remote healthcare that incorporates the use of telecommunications from the proceedings of the triennial International Congress for Circumpolar Health (ICCH). Note that for over thirty-five years there have been discussions on the link between healthcare delivery and the quality of telecommunications in the Arctic. These papers also reinforce the point that pilot studies and trial programs have been supported for many years. Efforts to bring communities into the available communication systems, and to make telemedicine an integral part of daily healthcare delivery, have not had a similar level of support over time. Only recently have telemedicine programs reported being modified for specific northern applications.

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NORWAY - Oygard, K. Health Service for Sparsely Populated Areas. Pp 38-42.

SWEDEN - Henriksson, J. Delivery of Medical Care to Isolated Communities. Pp 43-46.

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SWEDEN - Haraldson, S. Health Services Among Scattered Populations. Pp 50-55.

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CANADA - Sarsfield, P. Two Remote Canadian Medical Practices. Pp 406-409.

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1990 - 8th ICCH, Whitehorse, Yukon, Canada Circumpolar Health 90 Editors: B.D. Postl, P. Gilbert, J. Goodwill, M.E.K. Moffatt, J.D. O'Neil, P.A. Sarsfield, & T.K. Young. University of Manitoba Press, Winnipeg, Manitoba, Canada as well as Arctic Medical Research, Vol.50: Supplement 5, 1991.

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USA - Larson, K. The Evolution of a Village-Based Health Education Project. Pp153-156.
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