

Telemedicine Services in Arctic Environments – Challenges for Successful Implementation

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Abstract

The growing interest in Arctic areas, both from professionals and tourists, is a challenge for the health care system in areas suffering from extreme weather conditions, long distances and poor communication network coverage. Offering adequate health care services for people who live in these Arctic areas might be very difficult in part of the year. Access to medical services, in particular specialist services, is limited. In cases of emergency such as a large-scale accident, the system is further challenged. This paper discusses major challenges for successful implementation of telemedicine services in Arctic environments, with a special focus on handling accidents. Lessons learned from less challenging regions will be addressed in order to recommend a common set of critical success factors for implementing telemedicine service.

Keywords:

Telehealth, arctic, search and rescue, emergency response, telemedicine, critical success factors for telemedicine.

Introduction

With an increased focus on severe weather conditions and climate changes like erosion and storm surge, availability of medical care has become important for sustainable societies in Arctic regions. Telemedicine plays an important role as a tool for offering health care to people in remote areas, and is used in all circumpolar areas [1-9]. Telemedicine in North Norway is widely known for early adoption of telemedicine services to serve the population living in rural and remote areas in the Arctic [10-12]. Visionary politicians, health administrators, doctors and researchers who saw the possibilities to offer high quality healthcare to everybody regardless of where they live, initiated the development of telemedicine services.

Since the first telemedicine services were established twenty-five years ago, telemedicine has enabled specialist health care services to people living above the Arctic circle in North Norway, one of Europe's most remote and exposed regions.

After its foundation in 1993, The Department of Telemedicine at the University Hospital of North Norway (UNN) in short time became one of the most recognized telemedicine centres worldwide, mainly due to the centre's capability to launch operative telemedicine services. In 1999, the department was renamed to Norwegian Centre for Telemedicine (NST) and was given extended responsibility in Norway. From 2002, NST has been a World Health Organization (WHO) Collaborating Centre for Telemedicine [10]. At the recognition ceremony, Dr. Gro Harlem Brundtland, Director-General of WHO (in 2002), argued in her opening speech that telemedicine

would have an important role in the development of health systems [10] by saying:

“Information and communications technologies (ICTs), as a whole, have introduced profound opportunity and potential for the worldwide advancement of medicine and health care. Telehealth, electronic health records, computer-prescription entry systems, and e-health, hold great promise for the future.”

To realize the full potential of telemedicine, Dr. Brundtland argued that several challenges had to be met within [10]:

- Security, privacy and confidentiality
- Legal and ethical aspects
- Organizational aspects
- Technical know-how
- Funding

Telemedicine services in Northern Norway include: teleotolaryngology (ENT), teleophthalmology, telecardiology, teleneurology (teledialysis), teleobstetrics/prenatal telemedicine services, teleemergency service, teledermatology, teleoncology, telecare, teleendocrinology, telesurgery, telepsychiatry, telepathology, teleradiology, telemedicine solutions for patient empowerment, maritime telemedicine, e-learning, e-messages, electronic communication in telemedicine services and use of videoconference for various purposes. In recent years, also mHealth solutions are being used to serve the population in remote areas.

This position paper discusses critical success factors for deploying telemedicine services in general, and in a specific search-and-rescue scenario in the Arctic. The paper will be extended with a thorough literature review for arctic telemedicine in 2016.

What is so special with the Arctic?

The most obvious difference between the Arctic and “normal environments” is the harsh weather conditions. Snow, wind and low temperatures have a strong influence on the way telemedicine services can be provided.

The SARINOR project¹ conducted a GAP-analysis on search and rescue (SAR) capacities in the Norwegian SAR zone around Spitsbergen/Svalbard [13]. Figure 1 shows a map with the Norwegian SAR zone.

¹<http://www.sarinor.no>



Figure 1 - Norwegian Search and Rescue zone

Personnel from all actors involved in SAR participated in a 2-day workshop to discuss how to handle a cruise-ship accident with 1900 passengers 400 km from Svalbard. The report clearly concludes that there is insufficient capacity outside mainland Norway to handle such a scenario. The main challenges identified are [13]:

1. *Long distances: even though the rescue helicopter can reach the destination 400 km from its base, there is not much time left to locate and pick up people.*
2. *Time: transport takes time, and the harsh climate limits the chances for passengers to survive in the sea or on the ice.*
3. *Collaboration with nearby ships, and the Coast-guard, is essential to find and rescue a large number of passengers.*
4. *Requirements to on-board rescue equipment should be reviewed.*
5. *Data communication capacity has low reliability and low bandwidth.*

The SARINOR GAP analysis concludes that the effect of telemedicine in a large-scale accident is unclear and should be investigated ([13], page 19), and that new technological solutions for SAR should be evaluated.

Critical success factors for deploying telemedicine

Over the years, much effort has been made to identify the critical success factors for implementation of telemedicine services. The most recent initiative is the EU-funded project MOMENTUM, which is a thematic network for sharing of knowledge and experience in deploying telemedicine services into routine care.

One of the deliverables from MOMENTUM is 18 critical success factors for deploying telemedicine [14]:

"The context:

1. *Ensure that there is cultural readiness for the telemedicine service.*
2. *Come to a consensus on the advantages of telemedicine in meeting compelling need(s).*

People:

3. *Ensure leadership through a champion.*
4. *Involve healthcare professionals and decision-makers.*
5. *Put the patient at the centre of the service.*
6. *Ensure that the technology is user-friendly.*

Plan:

7. *Pull together the resources needed for deployment.*
8. *Address the needs of the primary client(s).*
9. *Prepare and implement a business plan.*
10. *Prepare and implement a change management plan.*
11. *Assess the conditions under which the service is legal*
12. *Guarantee that the technology has the potential for scale-up.*

Run:

13. *Identify and apply relevant legal and security guidelines.*
14. *Involve legal and security experts.*
15. *Ensure that telemedicine doers and users are privacy aware.*
16. *Ensure that the appropriate information technology infrastructure and eHealth infrastructure are available.*
17. *Put in place the technology and processes needed to monitor the service.*
18. *Establish and maintain good procurement processes.*

In June 2005, Northern Norway Regional Health Authority (Helse Nord RHF) established a working group of senior doctors that should perform a systematic evaluation of telemedicine services in North Norway, and suggest which of the tested should be selected for large-scale implementation. In addition, the expert committee also discussed how to motivate health care workers to use telemedicine services. A number of actions were discussed. They argue that the equipment should be simple, user friendly and functional and that the reimbursement rates are in proportion to the total use of resources. In total, eight different actions were discussed. These are [15]:

- *Support team / super users:* To avoid technical errors or user errors "super users" of telemedicine systems and a support team that quickly respond to problem calls and alarms must be connected to the departments.
- *Training and codetermination:* All clinicians must get adequate training. The training must focus on the user's needs. A more comprehensive training must be offered to the "super users". Codetermination in processes is important factor for a good work environment and motivation.
- *Customer-oriented:* Patients should get access to and copies of their medical data.
- *Continuous operation must be ensured:* Only solutions that have proved to be reliable should be chosen.
- *Participations in development projects in the industry:* Hospitals should enable cooperation between contractors/developers of telemedicine equipment and groups of clinical specialists.
- *"Up-to-date" solutions:* A plan for continuous upgrade and replacement must be made.
- *Identifiable profits - tariffs (reimbursement):* The reimbursement system must reward the hospitals that

invest in the most prioritized areas of telemedicine services.

- Goal-oriented research: We must ensure that research resources are allocated to the fields that are most relevant for telemedicine research.

In their report, Normann et al. [16] present five recommendations for bringing telemedicine into routine service:

1. *Increased use of videoconferencing for clinical, educational and administrative purposes.*
2. *Strengthen the national initiative on electronic messages.*
3. *Focus on dynamic solutions to support complete and standardized patient paths.*
4. *Initiate a national effort to develop a methodology for the implementation of telemedicine.*
5. *Clarify roles and responsibilities for operation and maintenance of telemedical solutions.*

The next chapter will discuss these general success factors in terms of special aspects for providing telemedicine services in the Arctic.

Challenges for successful implementation of telemedicine in the Arctic

Even though the Arctic environment puts restrictions to the use of telemedicine services, some challenges of telemedicine are universal. According to Nesbitt et al. [17], the main goal for telemedicine (telehealth) services is:

“... to achieve a tight synergy between the fields of telehealth, mHealth, electronic health informatics, informatics and Health Information Exchange – with an overarching vision to improve access and quality in a cost effective environment.”

In 2000, the Arctic Council published the “Arctic Telemedicine Project Final Report” [9]. Telemedicine specialists from the member countries in the Arctic Council developed the report: Canada, Denmark (including Greenland, Faroe Islands), Iceland, USA (including Alaska), Sweden and Norway. The report concludes that telemedicine can play an important role in providing adequate healthcare to people in the Arctic. However, it was identified that telemedicine is “work in progress” and effort should be focused on:

- Telecommunication should be in place in Arctic areas to support telemedicine services. Affordable and reliable communication is the cornerstone for implementation of telemedicine services.
- Health professionals in the Arctic must receive adequate training in order to fully utilize the telemedicine tools.
- When implementing new telemedicine services in the Arctic, priority should be given to front end users in the most remote and under-served communities.
- People living in Arctic should be informed about telemedicine programs and services in order to get “greater acceptance for the values of quality distance delivered health care”.
- Health care managers and administrators shall be notified about availability of different telemedicine tools that can be used to meet identified health service needs.
- Arctic telemedicine systems should be spatially and temporally interoperable.
- Implementation of telemedicine service should be based on international guidelines.

- Close collaboration with Emergency Prevention, Preparedness and Response (EPPR) Working Group of the Arctic Council.

Even though a number of telemedicine services have been successfully implemented in the Arctic part of Norway, still many regions in the Arctic have not yet fully exploited the potential of telehealth services. Basic challenges include:

- *Telemedicine services:* Identify and prioritize potential services.
- *Standards:* Recognize appropriate health ICT standards.
- *Interoperability:* Investigate most appropriate solutions for clinical ICT systems’ interoperability.
- *Funding:* Provide sufficient funding for implementation and operation of adequate telemedicine services.
- *Privacy:* Implement appropriate mechanisms for privacy and confidentiality.

The goal is to offer improved access to care as well as improved quality of care for people living in Arctic areas.

Telemedicine services to support search and rescue in the Arctic

In a review paper from 2014, Amadi-Obi et al. [18] present the results from a structured literature review of telemedicine applications in the pre-hospital environment. The initial search gave 1279 studies, of which only 39 were accepted for further analysis. Studies that did not address cost-effectiveness, feasibility or clinical outcome were excluded.

The overall results from the review show that there are very few studies that report on the effectiveness of telemedicine in emergency medicine. However, the authors conclude that:

“Telemedicine could enhance emergency medical services by helping expedite urgent patient transfer, improve remote consultation, and enhance supervision of paramedics and nurses.”

In a study from 2009, Reddy et al. [19] identify three major challenges to effective crisis management:

- Ineffectiveness of current information and communication technologies.
- Lack of common ground: shared understanding of the situation and the procedures to be carried out.
- Breakdowns in information flow: information is lost somewhere between sender and received, often in the “coordination centre”.

Even though Amadi-Obi et al. [18] conclude that telemedicine can play an important role in emergency response, the challenges identified by Reddy et al. [19] may be even more emphasized in an arctic environment. Given the special factors in the Arctic as described in the introduction, and the uncertainty of telemedicine effects identified by both Amadi-Obi and the SARINOR GAP analysis, it is clear that more research is needed on arctic telemedicine.

Future work

The work presented in this position paper is a high-level view on telemedicine services in general and how special conditions in the Arctic may limit the effect of the services. Extreme scenarios such as a large-scale accident may emphasize existing challenges with telemedicine in emergency response.

This paper has identified a set of focus areas, major challenges to deployment, and some promising evaluations. The next step is to conduct a thorough literature review of telemedicine in the Arctic, to clearly identify proven solutions for search and rescue, which support general and more specific services.

Conclusion

In order to successfully implement telemedicine services in Arctic areas, we need to:

- Understand the role of telemedicine in Arctic environments, both in primary and secondary health care.
- Understand the role and impact of information technology in implementation of sustainable telemedicine services in the Arctic.
- Realize the influence of telemedicine on clinical outcomes, patient empowerment, safety and quality of life in Arctic areas with basic health services only.
- Recognize design and implementation challenges associated with telemedicine systems in the Arctic. Identify and investigate issues related to standardization between on-board equipment on ships and SAR-team infrastructure.
- Carry out sound studies that measure effectiveness of telemedicine in arctic environments.

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