Telemedicine in Baltic Sea Region: Experiences of Tartu University

The flagship of health care in Estonia is the Tartu University School of Medicine (cover page) with Tartu University Hospital. Innovative ideas, modern technology, and qualified specialists are the characteristics of the university medicine. One of the recent developments at the Tartu School of Medicine is the introduction of telecommunication in patient consultation, diagnostic methods exchange, teaching, and second opinion. Modern telecommunication has a great potential for improving the quality of medical care by making specialist knowledge and judgment available for patients far away from highly specialized medical centers. In Estonia, with 1.4 population on the mainland and several islands, the only medical faculty at the University makes the city of Tartu an integrated health region with a limited number of experts in different specialties.

There are some characteristic trends in the organization of health care in Estonia, which support the development of telemedicine: decentralization of the simple care, centralization of the difficult care, separation of different forms of emergency care, more out-patient care, less in-patient care, and a significant reduction in the average length of hospital and day care stay. Like in many other countries, the Estonian health care system has been hospital-focused, but over time a significant part of the medical care will be transferred to outpatient setting and homecare. With the implementation of family physician system in 1991, more emphasis was put on primary care. Since 1992, health insurance in Estonia has been administered by Central Sickness Fund and four Regional Sickness Funds (1).

**BITNET**

All Baltic countries have been applying telemedicine since 1998 to solve particular medical problems. Baltic International Telemedicine Network (BITNET) (Fig. 1) was a project for the development and quality improvement of health care in the Baltic Sea region. It was set up and has since been running on sustainable digital telemedicine networks within Estonia, Latvia, Lithuania, and Uppsala University Hospital, in Sweden. Several equipment providers were involved at several levels of the project, both for providing medical equipment and for related technical support and service of the infrastructure and for taking part in the evaluation and administration of the project. Regarding the telemedicine project, BITNET and other projects carried out in the Baltic countries, several factors have been identified as important for their success (2): 1) telemedicine projects have been implemented by experts with similar backgrounds and shared interests; 2) the projects have enabled to provide health care and medical care; 3) the telemedicine service has formed part of a national strategy and has received internal support; and 4) training and the exchange of information have been essentially supportive.

At present, three large hospitals and three family medicine units are connected in Estonia via the telemedicine network. The leading center is the Tartu University School of Medicine, together with the University Hospital. Since 2000, Tartu University Hospital has been running a network for neurophysiology with several hospitals in the referral area. In addition, a telemedicine and videoconference network with Tallinn Regional Hospital, Family Medicine Center on the island Saaremaa, and the Kohtla-Järve Hospital in northeast Estonia was established in 2000.

The network includes applications for neurophysiology, medical diagnostics, and radiology, as well as videoconference facilities for urgent and scheduled consultations, medical rounds, and education programs. This network is running on Integrated Services Digital Network (ISDN) platform for radiology and videoconferencing, and is mainly used for information exchange and consultations within Estonia, but if needed, direct contacts are possible with other countries for second opinion (3).
Videoconferences, Teleconsultations, and Continuing Education

The necessary equipment (ISDN-based videoconference equipment Tandeberg 800 and video monitors) has been installed in 5 centers and implemented for videoconferencing during clinical rounds, teaching, and consultations; a teleconsultation center was established at the Tartu University Hospital. The staff was also trained for running the telemedicine system. Application of telemedicine started with teleconsultations in neurology and family medicine (Fig. 2). Judging by an opinion poll, patients, physicians, and consultants are satisfied with the procedure. Telemedicine is a new tool and it requires changes in the day-to-day running of health care. It is not an easy task to change the culture in health care, but we believe it has definitely been successful (4).

The preliminary suspicions about success of such modality of both the faculty members and course organizers at the continuing education program have by now been replaced by recognition and approval. The only shortcoming by now is lack of both direct emotional contact with the audience and direct positive feedback.

Clinical Neurophysiology

Clinical neurophysiology is a small specialty for the evaluation of central and peripheral nervous system. This is made by recording bioelectrical signals from brain, nerve, and muscle. Neurophysiologists of the Tartu University have long-term contacts with colleagues at Uppsala University. Four modern Keypoint (Medtronic) EMG machines were installed in Estonia and three new neurophysiology units were founded. Neurophysiological network is the first and unique collaboration network in Estonia. These units have improved their backlog of knowledge and revamped their diagnostic approach. Their staff has obtained the first level for electromyography and nerve conduction studies; they completed theoretical and practical training courses at the Tartu and Uppsala Universities. The diagnostic level for various neurological diseases has been improved. The present network has offered to specialists of the two countries better possibilities for medical consulting, and signal communication has become a part of daily routines. The signal transfer is very reliable. The files from the Keypoint are sent as attachments and can be read and analyzed by others. Videocconferences are held on demand for consultations or teaching. At the same time, the neurophysiologic center of the University can act as a consulting unit for less experienced neurophysiologists working at other centers in Estonia.

Teleradiology

Within the framework of the telemedicine project, a central radiology image server was installed in the Tartu University Hospital (Fig. 3). The direct network connections were set up between Kohtla-Järve, Tallinn, and Uppsala. The image sending and retrieving system was set up over TCP/IP (Transmission Control Protocol/Internet Protocol) protocol. Agfa Impax Basix PACS (Picture Archiving and Communication System) server with Web1000 software opened a new era in radiology at Tartu University Hospital. It was a great leap towards full-digital filmless radiology hospital. The system is very valuable for quick consultation of patients with severe neurotraumas in remote areas in order to choose optimal treatment.

The implementation of the electronic equipment has contributed to teleradiology on many occasions. Installation of digital communication equipment has established a good platform for further increased collaboration between different hospitals. The most valuable and intensively used connection was set up between Kohtla-Järve hospital and Tartu University Hospital. Kohtla-Järve is a heavy industrialized north-eastern region of Estonia, where the rate of traumatic injuries (especially head and spine trauma) is about 5 times higher than average. These patients are initially investigated and treated locally in Kohtla-Järve hospital. Usually axial computed tomography is performed and treatment strategy is chosen; patients are either treated on site or transported to the specialized neurosurgery center in Tartu. Teleradiology connection makes the decision-making much easier. The CT images are sent via DICOM-interface (Digital Imaging and Communications in Medicine) directly from CT
to the image server in Tartu. Afterwards the physician calls the neurosurgeon on duty in Tartu. Both physicians are able to retrieve the images over internet browser, which makes the connection quick and cheap. After negotiating and consulting the proper treatment strategy is chosen. The traffic is extensive: up to 10 patients are consulted over the network weekly. The Teleradiology Bridge between Kohtla-Järve hospital and Tartu University Hospital makes decision-making on patient treatment strategies quick and easy (5).

Impact on Estonian Health Care

Estonian medical professionals did not have any experience in telemedicine until this BITNET project was launched. During the period of two years, relevant knowledge has been disseminated in the country. We have been informing Estonian people and medical profession about all possibilities of telemedicine, using public presentations, daily newspapers, and medical and non-medical journals, and when teaching courses to medical students. Several administrators of medical services and head physicians of our regional hospitals have shown interest in the possibilities of applying telemedicine at their hospitals.

Setting up the system of family medicine has been one of the strengths of Estonian medicine in the last ten years. However, it needs constant support. Telemedicine project for one has had useful applications in this field, owing to the extensive cooperation between the Department of Family Medicine of the Tartu University and family physicians as partners in Kuressaare, the island of Saaremaa.

One drawback of Estonian health care is the lack of integration between Russian-speaking physicians practicing mainly in North-Estonia. Telemedicine has helped to mediate distance-learning courses in Russian for neurologists and family doctors in those areas. Specialist physicians and general practitioners from the North-Eastern region have actively participated in these courses.

One serious medical and social problem is the high incidence of brain trauma in north-east Estonia. These patients are surgically treated mainly in Tartu. The facilities of teleconsultation and teleradiology are actively used for this purpose today. As a result, cases are diagnosed and treated more adequately, and difficult patients are sooner referred to Tartu for surgical treatment.

One of the most important outcomes of the telemedicine project has been the development of a network of Neurophysiology in Estonia. It had a positive impact on Estonian neurology, as this method is, among others, a most important one in making neurological diagnosis. Owing to the applications of network of Neurophysiology and Modern EMG machines, Estonian neurophysiologists have gained experience and knowledge, and promoted their collaboration.

Telemedicine effectively integrates the limited facilities available enabling comprehensive application of new contemporary technology by which knowledge and know-how can be effectively exchanged. Its efficiency is tangible in Estonia, which is a small country with limited number of specialists and high-level medical centers (5). Accordingly, telemedicine provides a gateway for highly qualified university hospital specialists and sophisticated technology to wider population of patients and doctors who otherwise would miss the essential opportunity.

Telepathology is another direction of development. Today we do not yet have such possibilities but they are indispensable for providing good clinical practice (6).

In perspective, the next steps to be taken include fundraising to motivate all other county hospitals for setting up a network between specialists and emergency rooms of county hospitals and regional hospitals. It would help Estonian medicine to improve patients’ access to health care services proportionally. To achieve this, some reorganization of the present structure is needed. Another goal is to solve legal, financial and technological problems (reimbursing of teleconsultations, responsibility for diagnosis, security problems, personal data protection).

In 10 years time, we see the telemedicine as a constituent part of Estonian medicine. It is still difficult to predict what percentage of medical services will have access to new technological facilities, as the development of technology is not predictable. The development of telemedicine from the inception of the idea to tangible reality has been characterized by a surprisingly high acceleration. Hence, we expect to maintain the achieved rate in the future.

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References