Acta Med. Nagasaki 50: 45－48

Review Article

New Concept of eHealth for Improving Medical Infrastructure around Chernobyl

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The term "eHealth" refers to the use of digital data -transmitted, stored and retrieved electronically- in support of health care, both at local sites and at a distance. Several years ago, the World Health Organization proposed to develop programs for eHealth, including tele-consultations, tele-referrals, forward-storage concepts (e.g., tele-radiology and tele-prescriptions) and electronic patient records, to improve early diagnosis of thyroid diseases and follow-up of patients who have developed thyroid cancer after exposure to radioactive fallout following the accident at the Chernobyl Nuclear Power Plant, the World Health Organization and the Sasakawa Memorial Health Foundation, in cooperation with the Ministry of Health in the Republic of Belarus, have established and promoted a project entitled "Medica1 Relief for Children Affected by the Chernobyl Accident through the Development and Implementation of Health Telematics," to achieve these goals. In this communication, I review the current state of eHealth and the development of the health telematics project in Belarus.

ACTA MEDICA NAGASAKIENSIA 50: 45－48, 2005

Keywords: Chernobyl; Telemedicine; eHealth; World Health Organization

What is "eHealth"?

Over the last decade, the need to develop and organize new ways of providing efficient health-care services has been accompanied by major advances in information and communications technology (ICT). This has resulted in a dramatic increase in the use of ICT applications in health care, collectively known as "eHealth."[1] Today, the integration and assimilation of eHealth into the everyday life of health-care workers is becoming a reality in both developing and developed countries. When we refer to eHealth, we refer to the use in the health sector of digital data -transmitted, stored and retrieved electronically- in support of health care both at local sites and at a distance.

By connecting health workers to primary health-care centers and then connecting these centers electronically to departments and referral centers in hospitals for the exchange of data, access and cost-effectiveness may be achieved:

- ✓ Direct tele-consultation between the community health worker and a relevant hospital specialist can reduce professional isolation and provide opportunities for continuing education to the community health practitioner (e.g., tele-cardiology founded on the exchange of digitized ECG, digitized echocardiology or digitized stethoscopy and tele-radiology based on the exchange of digitized radiographic images). Tele-consultations take specialists to the primary health-care level.
- ✓ Tele-consultations may reduce the need for patients to attend hospitals, saving both time and money. Hospitals can then focus resources on patients who may benefit from treatment at the secondary level of health service.
- ✓ Similar advantages can be obtained through an eHealth-based hospital referral system founded on digitalized data obtained through the application of essential health technologies.
- ✓ When applications such as electronic patient records, smart cards, physician order entry, medications systems and digitized diagnostic findings are available, eHealth can become a key driver for improved cost-effectiveness.
- ✓ Access to comprehensive, secure electronic health records has been shown to improve the quality of care and patient safety. Improved knowledge of the patient's history and previous medical interventions facilitates appropriate treatment.

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- ✓ eHealth can strengthen systems to reduce medical errors through the provision of vital information, alerts and guidance as to best practice.
- ✓ eHealth can also improve the cost-effectiveness of nursing, care and administrative work.
- ✓ e-Learning products targeting health-care professionals, patients and the general public may be effectively channeled through the primary health-care sector.

The World Health Organization (WHO) is already actively cooperating with the European Space Agency (ESA) in a program on eHealth and telemedicine via satellite to shape the preparation, execution and evaluation of joint projects dedicated to develop and validate sustainable solutions for the delivery of eHealth in response to real needs through satellite communications. Furthermore, the WHO is jointly developing the World Bank's Global Development Learning Network (GDLN; http://www.gdln.org/). The GDLN is an existing, global partnership of affiliates (Distance Learning Centers) in more than 70 countries who utilize information technology (notably video-conferencing and internet-based e-learning) to facilitate interactive, cost-effective learning and knowledge-sharing for sustainable development and poverty reduction. The GDLN has identified the health sector as a priority area for its work and within this framework has undertaken a number of initiatives, events and courses addressing priority topics in the health sector, with a focus on sharing best practices and promoting dialogue among stakeholders. The GDLN can contribute to the overall strategy in the following ways:

- ✓ Mobilize the existing network of affiliates and program partners to develop and deliver content in accordance with the needs assessments developed under the strategy.
- ✓ Host video-conference-based dialogues between stakeholders on topics of interest, both in the context of workshops and conferences and as standalone events.
- ✓ Host virtual meetings between course development teams and groups working on strategies, work programs, guidelines and standards. Develop and strengthen virtual communities of practice.
- ✓ Empower local Distance Learning Centers as agents of the eHealth initiative, including facilitation of discussions with local stakeholders concerning needs and resource mobilization.
- ✓ Ensure integration of eHealth activities in the work of the World Bank health program in each country.
- ✓ Assist in increasing the reach of eHealth offerings into provincial and rural areas within partner countries through mobilization of domestic and partner networks.
- ✓ Utilize existing capacity to assist in the quality control and instructional design aspects of eHealth content offerings.
- ✓ Help raise awareness of eHealth activities through GDLN in MDG priority areas.

Dramatic increase of childhood thyroid cancer around Chernobyl and the introduction of eHealth in this area

Within the framework of the Chernobyl Sasakawa Medical Cooperation Projects, medical cooperative projects from Nagasaki University to the former USSR have been performed around the Chernobyl Nuclear Power Plant (CNPP) since 1990. These projects have revealed a significant increase in the incidence of childhood thyroid diseases, including thyroid cancer. This is particularly evident in the Gomel region of Belarus, where incidence of thyroid cancer is 100-fold higher than before the accident.[2,3]

Analysis of the health care system at the time of the Chernobyl accident, particularly in Belarus, has shown that many gaps and unresolved problems remained. For example, health care resources such as facilities and manpower displayed an uneven geographical distribution throughout the country, access to health care was inadequate in radionuclide-contaminated areas due to the remoteness of many residents from medical centers and the inadequacy of modem communication facilities between primary, regional and national health care facilities, possibilities for training and educating local medical staff were insufficient and information was lacking regarding new methods in medical practice, particularly at the primary health care level.

To improve the above-mentioned gaps and problems, the WHO and Sasakawa Memorial Health Foundation (SMHF), after consultation with the Ministry of Health in the Republic of Belarus (the Ministry), agreed to combine their efforts in the development of eHealth in Belarus, focusing implementation on the improvement of humanitarian medical relief actions for children affected by the Chernobyl accident. The idea to establish the eHealth project was supported by positive outcomes from the earlier Second Chernobyl Sasakawa Medical Cooperation Project, which culminated in the introduction of a telecommunication system between the Scientific-Practical Center of Radiation Medicine and Human Ecology (RSPCRMHE, formerly the Gomel Specialized Medical Dispensary) in Belarus and the Nagasaki University Graduate School of Biomedical Sciences, Japan.[4] Since the establishment of this system, ultrasonographic and cytological images of the thyroid for over 500 patients with suspected thyroid abnormalities have been sent via the Immarsat B satellite communication system from Gomel to Nagasaki,[5] and the results have helped to diagnose thyroid cancer in the early stages in patients.

This project includes two main parts. The first is related to improving the early diagnosis of thyroid pathology, and is called as "telepathology." The second part deals with strengthening the education and training of medical doctors and students in Belarus, particularly for those who are working or will work in contaminated territories. This part of the project is called "tele-education."

To implement the above-mentioned tasks, telematic communication links were developed between Gomel and Minsk medical centers. In general, information technology and telecommunications infrastructures represent key factors in the effective implementation of eHealth activities. Participating bodies should make a systematic assessment of the available options to identify and select the most appropriate solution for each project. In this project, Belarussian Center for Medical Technologies, Information, Management and Health Care Economy (BelCMT) installed and completed the

telecommunication infrastructure in Belarus (Figure 1). This network was carefully designed to maintain the security of patient information.

For the development of telepathology and tele-education, Belarussian State Medical University (BSMU) developed software for pathological consultations between Gomel and Minsk, in addition to electric textbooks in the field of radiation medicine and endocrinology. Furthermore, GSMU also developed the tele-educational contents for the field of radiation medicine and endocrinology, and established the telemedicine center in the university (Figure 2).

In July 2004, the launch of the system was completed and an opening ceremony was held in the presence of representatives of the WHO/HQ, SMHF, and the Ministry. Furthermore, an e-lecturing system between Nagasaki and Gomel was established through this system, and the first lecture was delivered on 26 April 2005, on the 19th anniversary of the Chernobyl accident (Figure 3).

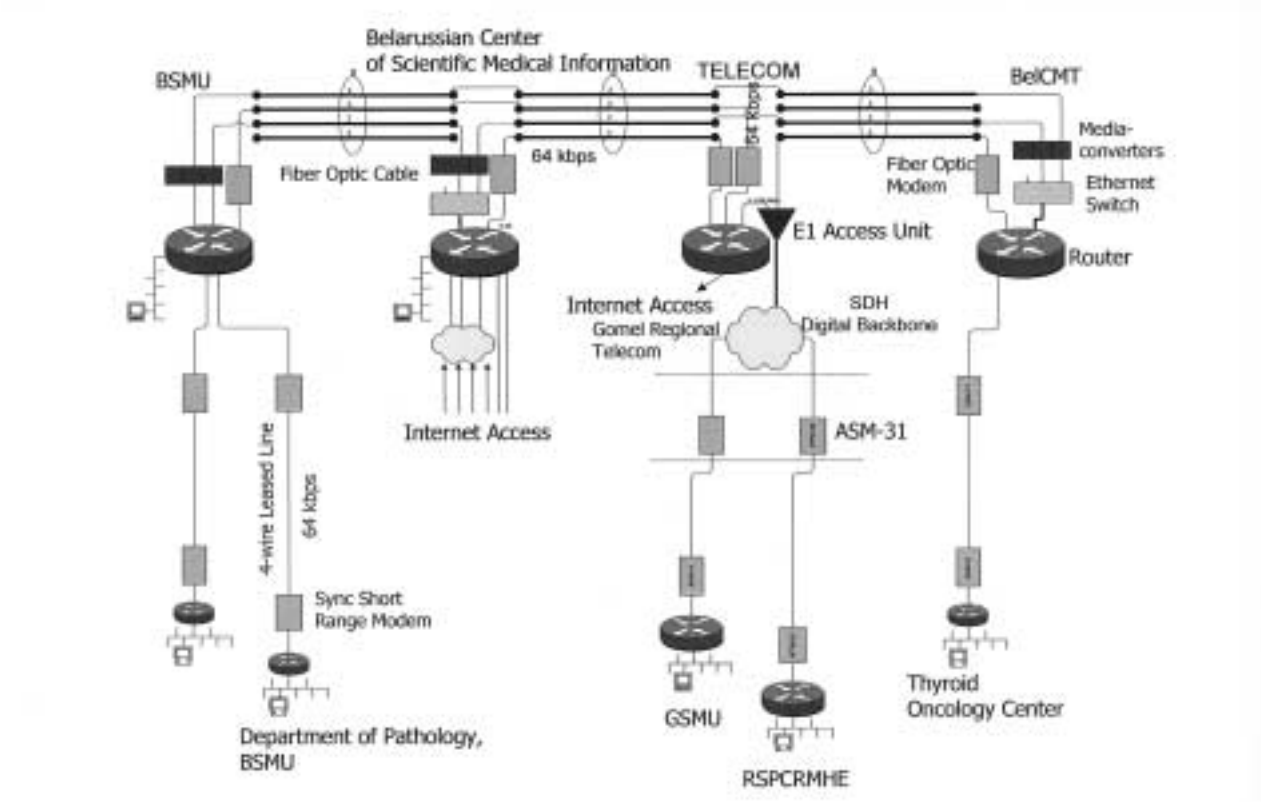

Figure 1. Telecommunication infrastructure for the establishment of telepathology and tele-education system in Belarus.

Figure 2. "Telemedicine Center" established in Gomel Medical University.

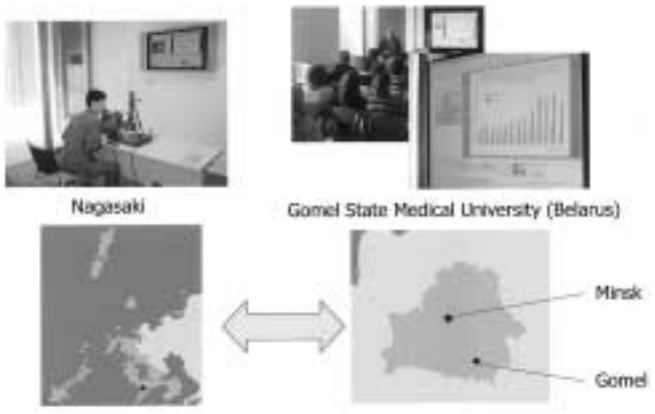

Figure 3. "e-Lecturing" system between Gomel Medical University (Belarus) and Nagasaki.

For further development of the project, this system will be linked to the Chernobyl Tissue Bank project (http://www.chernobyltissuebank.com/), to improve the pathological review system for thyroid cancer around Chernobyl. Indeed, several new findings have been obtained through the Chernobyl Tissue Bank.[6-8]

Conclusion

Important outcomes of eHealth are that countries and local communities have closed a substantial number of gaps in their healthcare services. In this project, the principal goal was to improve the early diagnosis and treatment of thyroid diseases in children affected by the Chernobyl accident through the development of a remote-area medical consultative system in Minsk and Gomel, and WHO Collaborating Centers, such as Nagasaki University. This is just the beginning to introducing eHealth for Chernobyl problems. Taking into account the estimate that about 4,000 additional cases of thyroid cancer can be expected over the lifetime of those who were children and exposed to radiation at the time of the accident,9 further medical monitoring of this category of Chernobyl victims is clearly vital.

The use of eHealth technology for these purposes may facilitate the involvement of qualified experts at national and international levels in the strengthening of local health care systems and the education of medical staff and students in territories affected by the Chernobyl accident.

Acknowledgements

I am grateful for the kind assistance and cooperation of the members of the Management Committee (Dr. K. Kiikuni from SMHF, from WHO and Drs. I. Zelenkevitch, V. Ostapenko and L. Postoyalko from the Ministry) and the Working Group (Drs. M. Repacholi , G, Souchkevich and S. Yamashita from WHO/HQ, Tamashiro from Hokkaido University and Mr. E. Glazkov from the Ministry). For further information on the activities of the project, the following website is available: http://www.who.mt/peh/Radiation/healthtelepres.htm.

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