TELEPEDIATRIC EDUCATION OVER A DECENTRALIZED TELEMEDICINE NETWORK

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ABSTRACT

The demographic and geographic dispersion of Greece sets several obstacles in the delivery of proper pediatric education to practitioners across the country. Centralized Tele-education models have been already employed for the delivery of medical education and advice to practitioners and patients. These models created a heavy load for the centralized educational board and proved insufficient to support the multitude of islands and other isolated areas of Greek mainland. We capitalize on a decentralization of the existing Greek National Telemedicine system infrastructure that will reduce the burden of the central units. Telepediatric education can be offered as a service on top of this decentralized network. We design and present several scenarios of Telepediatric Education over this network, which target among others pediatricians, pregnants, new born babies and children with special needs. The scenarios show that the suggested solution can deliver quality care at low cost to the children. However, the main conclusion is that the educational programs must be carefully designed and operated in order to minimize running cost and maximize educational profits. This presumes recording and reuse of the existing infrastructure, training of trainees and smooth transition to the new structure of telepediatric educational programs.

KEYWORDS: telepediatric education, health personnel educational needs

INTRODUCTION

The combined utilization of the information and telecommunication technologies for the provision of distant health and education services, in the context of telemedicine, offers important advantages in health systems and respectively in patients. The most important are: a) immediate access to scarce human and material resources (specialized doctors and expensive biomedical equipment) from remote primary care units, which lack of such resources, b) reduction of medical errors, c) improvement of provided health services at local level, d) reduction of costs and unnecessary patient transports, e) offer of primary medical support to transport units f) facilitation of distant education and training programs[1], g) large-scale review and analysis of medical data (i.e. by geographical region), g) support of health advising briefings etc.[2]

Telemedicine is ideal for offering distant education and medical consulting but it proves insufficient when advanced healthcare issues must be solved. A centralized system for medical tele-education usually has to deal with an increased interest on general medical subjects and

limited interest on advanced issues. This results in wrong utilization of specialized doctors for consultation on trivial incidents. In addition to this, such architectures result in increased information traffic between the dispersed medical units and the single telemedicine central.

This study attempts to answer the questions: (i) how a decentralized educational system in the field of telepediatrics can be designed? (ii) How telepediatrics training can be organized and delivered as an exploitation vehicle for the evaluation of the dispersed educational platform reliability and efficiency?

THE DECENTRALIZED TELEPEDIATRIC EDUCATION NETWORK MODEL

The backbone of the suggested model is the hierarchical structure of the existing telemedicine system with the primary, secondary and tertiary health care providers operating harmonically for the efficient patient service. The decentralized model suggested in Apostolakis et al [3], will be exploited to deliver educational services in telepediatric issues to practitioners and individuals in rural and isolated areas. The decentralized Regional Tele-education centers will be the connecting node between primary health care and specialized care (see Figure 1). Regional Centers have an assistant role next to the tertiary healthcare providers (University and General Hospitals), while the latter have more time to invest in the planning a telehealth strategy and the provision of new prevention and briefing acts.

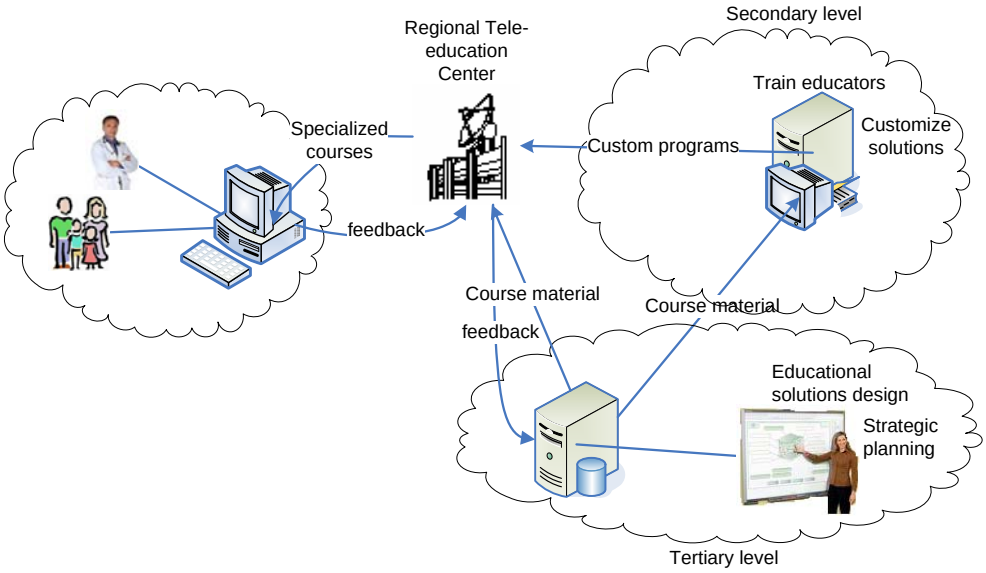

Figure 1 : The suggested model and the functions per level

Technical Characteristics

A critical factor for the effective operation of the new structure is the distribution of the workload between all involved partners. The first pre-requisite for a flexible and distributed educational system is the existence of well-equipped educational centers in the regions. The second requirement is those centers to be interconnected effectively to the central coordinator. The third requirement relates to various issues for managing the special health care needs of children[4] such as their psychology and diseases, community connectivity mechanisms to

support pediatric care and finally the health information needs of the family. The last requirement is the preparation of appropriate educational programs[5] in accordance to broadly accepted standards[6-8].

More specifically the distribution of the available infrastructure can be as follows: a) Local Educational Units in faraway regions will have the essential tele-education equipment, for conducting simple courses and supporting the region needs. b) A satellite and cable connection of the local educational units with the Regional Tele-education Centers will allow above average data transfer rates (for multimedia content) and uninterrupted communication. c) High skilled and high-end equipped staff in secondary and tertiary health units will support the educational process. d) Tertiary health units equipped with telepediatric experts will schedule new tele-education acts (i.e. campains) to increase healthcare awareness of the population, to alert in the case of an epidemy etc.

Organizational Characteristics

Regional Tele-education Centers serve local requests and act as a mediator to the central hospitals when it is needed. An analysis of the medical education profile of each region's population is required, in order to decide the appropriate location for each center that will allow the appropriate coverage and responsiveness to local requests. A strategic plan that defines the staff to be recruited, the equipments to be purchased and the redistribution in large scale is necessary. It is critical to develop a plan for continuous upgrade of existing equipment, supervision and improvement of educators and educational content. Online briefings will facilitate both the employees of the NHS and the local communities.

Operational features –Tele-education services

The educational services which can be offered to remote doctors and patients through the usage of computers and telecommunication networks imply the connection with research centers, retrieval of medical bibliography, continuing education of doctors, nurses and other staff. Healthcare education is complementary to medical and aims to a holistic confrontation of health subjects. It faces health problems in a broader context. Applications supported from computer science and telecommunication technologies can be: prevention planning, planned parenthood, education and training of healthcare service providers, general management of the tele-health system etc.

SCENARIOS OF TELE-PEDIATRIC EDUCATION

Telepediatrics is the practice of pediatric distance healing. We have designed extended theoretical courses to provide the required educational background to general practitioners, nurses and parents to participate in efforts for improving child health at distance via telemedicine. The summary of the proposed curriculum is presented below:

Telepediatrics Technology: In order to conduct a teleconsultation for telediagnosis or teletreatment (Figure 2) videoconferencing can be used as a Telemedicine solution both to provide regular sanitary care or medical care in the case of emergency to the children. Risk management and critical safety systems security are two extremely important issues in services provision, especially in the fields of videoconferencing and telemonitoring. The framework

presented in the CORAS EU project[9] discusses the main issues related to risk assessment in critical safety systems (i.e. identification, maintenance, integrity, authenticity, reliability, etc).
Handling pediatric pulmonary diseases at distance: A chronic disease can be managed at distance using a PC, an ISDN connection and conferencing software (i.e. ProShare by Intel).

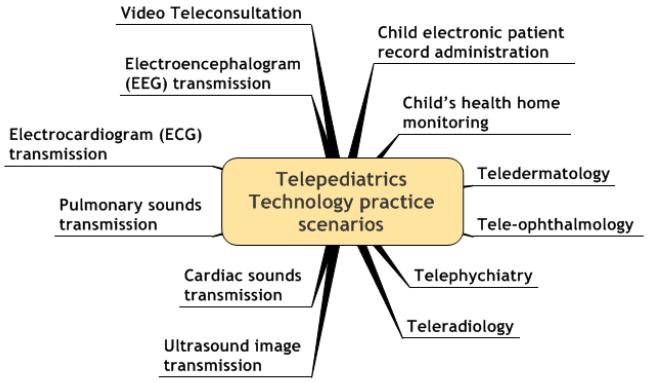

Figure 2. Practice scenarios for Telepediatrics

Pediatric wound care at distance: Medical Wireless LAN Systems have been used in applications related to accidents handling and their reporting in the units of emergencies with the obligation to provide medical support at distance.
Real time picture transmitting systems supporting Pediatric Surgery: In order to handle orthopedic conditions at distance[10] the child/parent/general practitioner can use the telephone to communicate with the expert or the clinical support unit that holds a database to keep child medical history and provide telephonic medicine advices. Applications in Pediatric Oncology[11] use PDA's for local data acquisition, local processing and reporting to an Internet server.
Telemedicine in Pediatric Cardiology: The existing techniques used to detect cardiac arrhythmias (Holter, Rtest, telemetry) can be supported by distant control services that use ECG sensors. In medical education there are systems, which allow training in the cases of cardiac emergencies. These systems encapsulate artificial intelligence techniques to mimic natural situations (situations of shock) with a realistic optical simulation for urgent incidents of patient treatment in a 3D virtual environment.
Neonatal and Maternal Teleconsultation: The psychological support for a baby in the Neonatal Intensive Care Unit (NICU) is essential. Families can use secure communication services to contact the hospital doctors and other families with similar problems and get precious psychological support. Telemedicine services can also be used to assist patients with high-risk pregnancy[12]. After a diagnosis of high-risk pregnancy, the control of the internal activity of the mother is achieved using a daily care telephone, which allows successful treatment for episodes of premature childbirth.
Pediatric care at home using telemedicine services: Home telecare is easy to be performed using portable devices to monitor child's vital signs and transmit child data to the regional center. Nurses or doctors can provide advices, patient care, or treatment. A home telemedicine unit, as described in IDEATEL[13], is necessary to handle diabetes via Telemedicine.
Telemedicine for children with special needs: "Telerehabilitation" systems combine therapy, education and play using wireless sensors and dialogic robotic games[14]. The robotic tools can be controlled from any part of the child's body using voice or touch. Other bio robotic devices[15] act as detectors of child's neurophychophysical health (supported by a simple joystick, a liquid

crystal display and audio). There are also devices for diabetic children that measure the level of insulin and determine their dose. Finally, efforts have been done in developing systems to support children in situations of isolation[16].

Telemedical practices on suspected child abuse cases: Communications can be proved extremely useful to handle cases of child abuse, with asynchronous interaction (e.g. using e-mail) during alleviation efforts of the child or the parent.

Telemedicine in mental child health: Local health care providers can practice telemedicine monitoring on pediatric moving patients with mental diseases and have access to specific patient data via the browser on the web. Wireless networks are adopted in health industry in small scale. Provision of mental healthcare services[17] in disaster victims, relatives and other groups – can be achieved using direct dialogic contacts in real time. Support is offered via optical contact with the patient via a camera and an interview from the specialist in the area.

Telemedicine in pediatric oncology: Telemedicine can be used from the general practitioners for video consultations related to diagnosis and administration of children with cancer. Teleoncology[18] can be practiced via the telephone between patients with cancer at home and the local doctor or a hospital. In the cases of pediatric oncology[19] the education of parents in their home environment is considered as an interesting opportunity to allow parents be informed for the illness and its treatment, for the short-term and long-term medical and sentimental side effects, and on how these can be handled effectively.

CONCLUSIONS

Herein, we have designed a decentralized telepediatrics educational platform and we have developed various scenarios of Telepediatric Education. This work suggests a dispersed educational architecture with more than one nucleus that hierarchically serve requests for medical training, starting from local medical units that handle small scale seminars on trivial maters and delegate advanced needs to higher levels. We consider that this approach is more flexible and efficient than the centralized equivalent and use a decentralized version of the Greek Telemedicine System as our carrier. The demographic and geographic dispersion of Greece (multitude of islands, isolated highland regions, and unbalanced distribution of population) and the shortage of specialized resources (human and material) turn the existence of a tele-education system, to a high priority issue. The suggested procedure can be easily applied to all countries that combine isolated mainland and island regions, as well as to countries with more than one population centers. In all cases the decentralized educational architecture is preferable, since it reduces reaction time for simple cases, fully exploits specialized practitioners and reduces network traffic to the minimum. Future work will be focused to develop the educational platform and deliver and evaluate the telepediatric courses in the regions of our country.

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