Cross-Border collaboration between Greece and FYROM: Mobile Healthcare Provision

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Abstract. Introduction of eHealth tools and applications denotes the new era in health care sector and especially in health care networks. The telemedicine applications in cross-border areas, referred as a Cross-Border Health network, serve the improvement of the quality of life for the population in cross-border areas. In this work a framework for such a network concerning the collaboration between Greece and FYROM is described. The network is in the first phase of design and is expected to be implemented within the next year. The requirements, the restrictions and the design of the network has been defined by the healthcare professionals and it staff that participate in the project. The results, so far, reveal the acceptance of the system from the staff of the healthcare organizations, while detailed results for the performance of the system will be available in the first quarter of the next year. The work denotes the successful efforts for the development of Cross-border Health Networks.

Keywords. eHealth, Cross-Border Health Network, Telemedicine

Introduction

eHealth tools and applications that improve the performance of health care organizations are the chronic disease management, eBooking, eLearning, ePrescribing, Electronic Health Record, Hospital Information System and other. eHealth applications that improve the services of several cooperating healthcare organizations are Cross Border Health Networks, Regional Network, National Network, Telecare and Telemedicine [1]. Within the scope of the cross border collaboration that serve the INTERREG III program is included the effort of the 3\textsuperscript{rd} Regional Health Authority (RHA\textsuperscript{3}) of Greece to apply eHealth applications in order to serve the collaboration of Greece and the Former Yugoslav Republic of Macedonia (FYROM) in the axe of improving the quality of life and health care provision.

\textsuperscript{1} Abbreviations used in this paper: RHA stands for 3\textsuperscript{rd} Regional Health Care System Authority of Greece, COPD stands for Chronic Obstructive Pulmonary Disease.
3rd Regional Health Authority manages 17 hospitals, 17 Health Units and 166 district health units. Penetration of Information and Communication Technology (ICT) infrastructure in hospital is extensive as there is Management Information System (MIS) in almost all hospitals. The Greek public network for providing internet access and telephony service has recently installed in most of the health units. Most importantly the 3rd RHA runs a project for the “Integrated Regional Health Information Network” [2] to implement information system supporting administrative and clinical services in hospitals, health units and Regional Health Authority.

On the other hand, INTERREG III is a Community initiative which aims to stimulate interregional cooperation in the EU [3]. It is financed under the European Regional Development Fund (ERDF). The initiative is designed to strengthen economic and social cohesion in the EU and special emphasis has been placed on integrating remote regions and those which share external borders with the candidate countries. Greece and FYROM are such two countries that share external borders.

eHealth projects introduce innovative technologies that enhance the cross-border collaboration of the two countries and enhance the level of health services for the population of border districts. With the aim to develop infrastructure for medical diagnosis and treatment along with collaboration of medical professionals of the two countries the framework of the project has been designed. The framework could be applied to ehealth projects that support collaboration of regions and lead to the development of Cross-border Health Networks. The proposed network concerns the collaboration of health institutions of Greece and FYROM, for the confrontation of asthma and Chronic Obstructive Pulmonary Disease (COPD) and other chronic respiratory illnesses. The telemedicine services concerns medical diagnosis at distance, education and prevention of illnesses. Moreover, the creation of a web portal for the education of patients on issues regarding asthma is included. The work will also focus in the preventive medicine to people with respiratory diseases that are found in district regions. The project is in the first phase – including the requirement analysis – and by the end of the first quarter of the next year detailed results of the project will be available.

1. Background

Primary health care provision is of paramount importance in Regional Health Care Systems. GPs and other doctors support the health care provision. However, health units do not provide medical services regarding specific medical specialities such as pneumonologists or other. E-health provides the technical means for the GPs to be in conduct with doctors with medical specialities in hospitals either with tele-monitoring or tele-consulting and other applications of eHealth. The ICT infrastructure gives the means to the patient or to the doctor to collaborate with the expert, avoiding the patient flow from rural areas to the urban.

In 2004 the 3rd RHA has engaged a survey regarding the attitude of staff of four health units towards the use of ICT and the results were positive. The received questionnaires were 90 and the staff that participated in the study included doctors, nurses, administrative personnel and other. 41.83 % of the staff had already used Electronic Medical Record (EMR) software, 66.67% accomplished part of their work using Internet, 27.78% used Internet for commercial transactions like banking transactions. As a conclusion most of the staff regarded that the use of ICT
infrastructure would make their work easier, would improve the performance of the provided services and generally would provide a reliable way of working. Based on the positive attitude of personnel along with the benefits of the usage of eHealth tools to improve the health care services, the 3rd RHA has accomplished successfully some telemedicine projects and is developing some others. In the next paragraphs, short descriptions of two of those are given.

A telemedicine project included the integration of GPs in five rural Health Units with General Hospital and Expert Doctors for the need of following up the chronically ill citizens located in remote regions in Region of Central Macedonia, Greece had implemented successfully. The implementation has been based on the Mobinet service [4]. Communication of health centers and hospital was achieved by micro-telemedicine devices, it-telecom components (mobile phone etc), wireless communication networks and cellar telephony network. The Clinical Records (EMRs) were kept in a web server and access provided to physicians, patients and hospital staff. The EMR is enriched with vital signs like ECG, sets of pulmonary function parameters, heart rate, diastolic & systolic blood pressure, SPO2 and blood.

The results were impressive concerning the adaptation of doctors and patients to the usage of the system. Although none of the doctors had previous experience using telemedicine systems, they were all well-educated both in the ICT infrastructure and the usage of mobile medical devices. They all used the system for approximately 6 months and 981 sessions were accomplished. Each session included the patient data entry to the mobile device and the transmission of data via GPRS to the expert doctor. Expert doctors received the data from each session and send the clinical note either via the web-based application and internet or sending sms message to the GP. The system was used by the doctors several times per week as it was used for the follow-up of chronic disease patients or for children with the suspicion of asthma. GPs spend approximately 6.5 minutes per session for the usage of the system. However the expert doctors spent much time on the results of medical act in order to give his opinion.

Another project that is under development is the tele-psychiatry that is within the framework of project of “Integrated Regional Health Network” of the 3rd RHA [2]. In this project a tele-consultation scenario for psychiatric patients has been designed and developed. The scope of the project is to provide means for the follow-up of psychiatric patients from the remote health centers during their rehabilitation along with tele-consultation services for patients visiting the health centers. Within the range of the project is the communication of medical personnel of two hospitals in the region of RHA, six district health centers and units and two mobile units. The project has not yet finished and results are expected to be announced within the next year.

Several other telemedicine projects has been designed or implemented by the health organizations of RHA. However, a cross-border eHealth project has not implemented so far.

2. Requirements and design of the system

The healthcare organizations that participate in the Cross-border Health Network system include the two hospitals of Thessaloniki, namely the General Hospital of G.Papanikolaou and General Hospital of Papageorgiou and more specifically their pulmonary clinic. In one of them the telemetry central station will be settled and will be in coordination with the system located in the 3rd RHA head office. Five health units
and district units from the region of Central Macedonia will also participate in the system as the remote units for the project. One side of FYROM a hospital with three local points will also act as remote units for the project. The requirements are expressed with the scenario that is going to be implemented in the project and is presented in this section.

The proposed services concern the education of patient, via specialised web portal, where educational material will include for the confrontation of asthma and chronic obstructive pulmonary disease (COPD). The content of the portal will be available in three languages and it will be also used by the population of the regions that participate in the work. Also, the services concern the follow-up and convenient confrontation of any crises of chronic patients with respiratory diseases.

A central station of the telemetry service will provide the services to all remote units of the cross-border network. Hospitals and health units will be equipped with suitable devices (pcs, spirometers etc) for measurement of vital signals of patients. In the remote units the medical personnel will record the measurement of violent expiry (FVC) of patients with suitable appliances and then the measurements will be dispatched via telecommunication network (telephone, GPRS, etc) in the telemetry central station. In the case of chronic illness the health care professional in collaboration with the patient will establish a plan of follow-up of his health. At the end of installation of equipment and the test operation of services, the education of personnel to the use of equipment will follow. At the same time, the system will be installed in neighbouring municipality of FYROM, aiming to exchange of know-how and scientific knowledge for the joint confrontation of asthma and COPD. The hospital of FYROM will provide local points to use the service of telemetry. The healthcare organizations of Greece and FYROM will present the results of the use of the telemetry system in the regions and will study and make a comparative analysis of results.

The restrictions of the system supporting the cross-border network are: (1) lack of specialized personnel to the usage of telemedicine systems, (2) lack of personnel to support the central station at a 24-hour base, (3) bureaucracy in the procedures to deploy extra personnel and (4) integration of EMR with other eHealth systems [4] that are installed in health units or hospitals. Under those restrictions that apply to many telemedicine or generally eHealth projects, the framework of the system was designed as is briefly described in the next section.

3. Framework

The system that is designed is shown in figure 1. In figure 1 the personnel is shown along with the equipment that the personnel is going to use. The personnel could be public officers or external contractors. For the needs of the project the external contractors of the system will be the following: (1) consultant of technical support: for administrative, educational and other issues (Actors1), (2) health care professionals to support the telemetry central station and the doctors in primary health units (Actors2), (3) health care professionals and staff to coordinate and support the creation of educational material for the web (Actors3), (4) administrative personnel to support the processes (Actors4) and (5) IT companies to provide and support the project (Actors5).

We are going to refer to each of the above groups with the description shown in parenthesis. For example Actors4 is the shortcut name for the group of administrative personnel to support the processes of the system. Actors2 and Actors4 can be public
officers and not external contractors. The phases of the project are five: (1) PHASE A: Requirement analysis and design of applications, (2) PHASE B: Development, parameterisations of applications, tests and integration of applications, (3) PHASE C: Supply and installation of equipment (pcs, microdevices etc), (4) PHASE D: Period of Pilot Operation - Education of users, (5) PHASE E: Period of SLA (Service Level Agreement). Several deliverables by the external contractors and public officers are included in their work. The most important include the actions in Table 1:

<table>
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<th>AXIS</th>
<th>Actions in the axis</th>
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<td>Reports including:</td>
<td>Actors1</td>
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<tr>
<td>Legislative for security and other matters</td>
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<td>Organizational matters</td>
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<td>Actors 1, Actors 4</td>
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<td>Design of architectural model for telemedicine services</td>
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<td>Technical characteristics of infrastructure</td>
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<td>Design of educational material</td>
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<td>Dissemination</td>
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<td>Acceptance of the system by users, patients, doctors</td>
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The citizens that can profit from the proposed service of telemedicine are those with chronic respiratory diseases, as well as those with particular needs of follow-up of their health as: a) Children with asthma b) Old men that should watch the development of their health, g) Persons with special needs, e) smokers d) persons with heart failures. The scientists of two regions might examine joint incidents that need investigation, while at the same time is created a medical database for the populations of cross-border regions, allowing thus the conduct of comparative studies and statistical analyses.

![Figure 1: The personnel and equipment of system](image-url)
4. Discussion and Future Work

In the cross-border area, efforts are made to cooperate in matters of improvement of quality of life. Increased cooperation in the sector of new technologies (especially as far as health is concerned) will lead to the establishment of new ways to tackle local problems affecting the region’s development.

The integration of telemedicine in the sector of public health through the proposed work promotes the level of provided services of health and contributes in the quality of life of population and exchange of knowledge for health care professionals. The proposed service of telemedicine ensures the provision of specialized medical services of patient near the place they live, avoiding frequent visits in the urban centre - hospital.

Cross-border network offer the opportunity to people using the tools of eHealth to be evaluated by specialised doctors. Patients avoid frequent visits in the urban centre - hospital. Patients also undertake a more active role in the follow-up of their health. The doctors having data from their patients frequently can offer better treatment. The hospital ensuring reliable control of patient from distance can decrease the hospitalisation per year, decreasing the incidents that need internal hospitalisation, decreasing the disposal of resources. Also, the hospital is able to offer medical services in wide teams of population, which could not previously approach because of geographic restrictions. Moreover, the forecasted cross-border action and diffusion of results of work in adjacent regions will contribute in the assimilation of technology and promotion of proceeding of telemedicine, demonstrating the effect of eHealth in primary care.

The expected results are summarised in the followings: overcome geographic restrictions for diagnosis by distance, improvement of quality of provided services of preventive diagnosis and medical care, reduction in the costs of resources, reduction of expenses of patients, reduction of time and costs of hospitalisation.

Acknowledgments

This work was supported and benefited from INTERREG IIIA Greece-FYROM (Decision 300658/15-03-2006; Interregional Health Network). Doctors and IT and Administrative personnel and are gratefully acknowledged for their ideas, their support and their work in the project.

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