WebOnCOLL Enabled Remote Cardiology Consultation for Suspected Myocardial Infarction*

C.E. Chronaki[1], X. Zabulis[1], D.G. Katehakis[1], A. Giannopoulos[1], N. Stathiakis[1], M. Tsiknakis[1], P.J. Lees[2], E.N. Simantirakis[2], P.E. Vardas[2] and S.C. Orphanoudakis[1,3]
[1]Center for Medical Informatics and Health Telematics Applications (CMI-HTA), ICS, FORTH
[2]Cardiology Department, Heraklion University Hospital, Crete
[3]Computer Science Department, University of Crete,

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Summary: *Acute myocardial infarction is a condition in which prompt thrombolytic treatment is critical to the health of the patient and can significantly improve prognosis. The telecardiology consultation system presented in this paper has the potential to play an important role in such cases by providing a General Practitioner (GP) with direct access to a specialized cardiologist. Telecardiology consultation folders linked to the patient's healthcare record maintain shared medical information and a record of the interaction between the cardiologist and the GP. The system is based on WebOnCOLL, an Internet-based collaboration platform for the healthcare and teleworking domains. The use of open standards in WebOnCOLL enables seamless integration with electronic healthcare record segments and interoperability with the evolving regional healthcare information infrastructure.*

1 Telecardiology Support to Primary Healthcare Centers

Prompt consultation with medical experts is in many cases critical to the health of the patient. One such case is acute myocardial infarction, where early thrombolytic treatment can significantly improve prognosis. A recent study found that a 30 minute delay in the initiation of thrombolysis reduces the patient's life expectancy by approximately one year [1]. The author concluded that "the magnitude of the benefit from early thrombolysis is such that giving thrombolytic therapy to patients with acute myocardial infarction should be accorded the same degree of urgency as treatment of cardiac arrest" and advised that "policies should be developed for giving thrombolytic therapy on-site if practicable and by the first qualified person to see the patient". Studies in the Netherlands indicate that the average time gained by the pre-hospital initiation of thrombolysis can be as much as 50 minutes [2,3]. Since the decision to administer thrombolytic agents must normally be made by a qualified cardiologist, providing telecardiology consultation facilities to primary health care centers, especially to those in relatively remote rural areas, is clearly of paramount importance.

Consider the following scenario. A GP at a primary healthcare facility admits a patient suffering severe chest pain. If the clinical findings raise the suspicion of myocardial infarction, the GP may request assistance from a central hospital offering specialized telecardiology consultation services. The GP submits a consultation request that includes clinical findings and the patient's electrocardiogram (ECG) to a Telecardiology Service Provider (TSP). The submission of the request triggers an alert in the selected TSP. A specialized cardiologist reviews the clinical data in the request and establishes communication with the GP. This communication may involve asynchronous transfer of objective medical data, tele-monitoring of the patient's vital signs and ECG, and video/desktop conferencing. The cardiologist may advise the GP that the patient should be given thrombolytic treatment. An ambulance is requested, while the cardiologist cooperates closely with the GP and monitors the condition of the patient. Finally, the patient is transferred to the hospital and comes under the direct care of the cardiologist, while the telecardiology consultation records become part of the patient's Electronic Healthcare Record (EHR).

2 *WebOnCOLL* Collaboration Infrastructure

The management of telecardiology consultation sessions requires interoperability with specialized applications, such as ECG acquisition software, and a collaboration infrastructure enabled by middleware services for directory access, security, and accounting. One of the current projects at the Center for Medical Informatics and Health Telematics Applications (CMI-HTA), ICS-FORTH, involves the development of *WebOnCOLL*, an Internet-based collaboration platform designed for the healthcare and teleworking domains [4]. The collaboration infrastructure of

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WebOnCOLL is based on virtual workspaces and user profiles. Virtual workspaces implement collections of heterogeneous objects, maintain history data, and support awareness regarding content updates and user interaction. Agents (human users or applications) connected to a workspace may create or add objects into the workspace. Agents connected to a workspace are notified of changes in the contents of the workspace and are aware of all other agents connected to the same workspace. User profiles enable the customization of workspaces according to user authorities, tasks, and preferences. User profiles also maintain account information and access information on subscribed services such as personalized information services. The interoperability of *WebOnCOLL* with enabling middleware services of the regional healthcare information infrastructure ensures availability of accurate resource information and certification of the exchanged data [5].

2.1 Telecardiology Consultation for Myocardial Infarction

Telecardiology consultation requests are structured forms which may be completed using a web browser or through the primary healthcare center information system. The system maintains the healthcare records of the patients visiting the center. The collaborating GP selects an appropriate TSP from the regional healthcare resource service and submits a telecardiology consultation request. The request form contains the name of the GP, patient identification information, clinical findings, and the patient's ECG. The form is designed so that data entry is semi-automated and is kept to a minimum. To address security aspects, the request form is signed using the digital signature of the GP.

In the TSP, a *WebOnCOLL* server manages a *reception workspace* that receives telecardiology consultation requests. An *alert application* connected to the *reception workspace* watches for incoming telecardiology consultation requests. Once a telecardiology consultation request arrives, the alert application notifies the cardiologist on call. Notification involves different options, such as flashing on the screen, sending a message on the cardiologist's beeper, or a short message on his/her mobile phone. When the cardiologist accepts the request, the alert application creates a telecardiology consultation response object in the *reception workspace*, which includes the doctor servicing the request and a link to a new Telecardiology Consultation Folder (TCF). At the same time, the GP at the primary healthcare center receives updates on the progress of the telecardiology consultation request. The TCF maintains all signed exchanged material between the cardiologist and the GP. In addition, if the cardiologist advises the GP to keep the patient in the center, relevant educational or clinical resources may also be inserted into the TCF to aid the GP in assessing the clinical evidence. Since telecardiology consultations are part of the EHR, the primary healthcare center segment of the EHR includes a link to the TCF. Specialized medical functionality is supported by an application for real-time acquisition and monitoring of a patient's vital signs and an SCP-ECG viewer. Archived TCFs are used to monitor activity relevant to telecardiology consultation.

3 Conclusions

A telecardiology station has been designed using the collaboration infrastructure of *WebOnCOLL* and will soon enter its validation phase. A noteworthy aspect of this work is the use of open standards to enable seamless integration of EHR segments and interoperability with the evolving regional healthcare information infrastructure.

4 References

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