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Asynchronous Dermatology Teleconsultations Using a Personal Health Record

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Abstract. Health information and communication technologies such as telemedicine provide alternatives for patient and physician communication. An increasing number of patients, providers and institutions are using this technologies to seek or provide health care. Asynchronous consultations requires a service of storing and forwarding health related information by the patient to the specialist physician or other healthcare provider. Dermatology is one of the major medical specialties in which telemedicine as proven benefits. There are many described *deployments* of asynchronous teleconsultations. The present work describes the design and *deployment* of an asynchronous dermatological teleconsultation service which uses the interaction of the Electronic Health Record and the Personal Health Record in a high complexity university hospital.

Keywords. Telemedicine; Remote Consultation; Electronic Health Records.

1. Introduction

Health systems can be evaluated considering 3 major challenges: (a) better access to health services, (b) increase quality of care, and (c) decrease costs. Health Information and Communication Technologies in Health (HIT) have a set of tools that could facilitate the overcoming of these challenges [1]. Telemedicine is part of HITs and, far from being an application, is a new form of health care delivery, in which technology is one of its components: a channel for the exchange of medical information [2]. Every day, an increasing number of patients, physicians and institutions are using telemedicine, based on different researches that show the therapeutic benefits in several specialties such as Psychiatry, Pathology, Cardiology and other specialties [3,4]. Among them, Dermatology seems to be one of the ideal specialties to deploy telemedicine, because many research papers describe its use in this mode of care [5–7]. One of the modalities in which telemedicine can be deployed is through asynchronous consultations (AC), also known as store and forward telemedicine, in which physicians and patients (or primary care providers) exchange information at different times. It has

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already been shown that this type of consultation has similar reliability compared to synchronous consultations (through videoconference). Many health professionals prefer AC's because they are considered to be more cost-effective in relation to synchronous consultation [8]. Also, the effectiveness of teledermatology in the detection, diagnosis, treatment and results of skin diseases is well known, allowing better, cheaper and faster skin care [9]. Usually this modality is used between primary care providers and dermatologists, and there are many available vendors offering AC tools for different medical specialties, especially those based on images. These solutions generally use platforms and databases not integrated with the underlying hospital information systems, requiring that both patient and provider must prove identity and log-in in the teleconsultation system. The objective of this paper is to describe the planning and deployment of a system for AC in dermatology integrated within a Personal Health Record (PHR) and an Electronic Health Record (EHR).

2. Methods

2.1. Scenario

This project was carried out in a highly complex University Hospital founded in 1853. Hospital Italiano de Buenos Aires (HIBA) is a non-profit health care academic centre founded in 1853. HIBA has a network of two hospitals with 750 beds, 1000 home care patients and 25 outpatient clinics. On an annually basis, the hospital discharges 50,000 patients and provides 3 million outpatient visits. The hospital has a Health Maintenance Organization with 160,000 members. Since 1998 HIBA has deployed a Healthcare Information System (HIS), an in-house project which currently handles all the healthcare related information from capture to its further analysis. The EHR is a fully web based, problem oriented, and patient centered record with customized functionalities depending on the level of care (outpatient, inpatient, emergency care and home care). The Clinical Data Repository (CDR) integrates information from different sources including multimedia objects such as digital imaging from our institutional PACS (Picture Archive and Communication Systems). In 2017 was certified as HIMSS LEVEL 7. Since 2007 the EHR is linked to the PHR giving patients access to healthrelated data (laboratory, diagnosis, preventive information, medications lists), and administrative task. In 2010, "messaging" functionality was introduced in our PHR allowing our patients to communicate with their primary care physician [10-12].

2.2. Dermatology

Given the numerous studies that talk about the effectiveness of teledermatology, we opted to start with this service for the implementation of AC. In order to understand the dermatologist workflows and their complexity, as well as the needs for a structure form, we worked together with specialist from the dermatology service.

2.3. Model of care

There was no model of care that was not based on the classic model of outpatient consultation, emergency room or hospitalization. We developed this new model of care

along the dermatology team, which was validated through a special committee of the institution, involving legal advice to evaluate the possible risks in terms of privacy, confidentiality, information security and possible impact on professional practice.

The possible problems of relying on patients' completeness of the questionnaire were handled trying to improve the comprehensibility of the questionnaire to the maximum so that the patients put the necessary information for the resolution by the dermatologists. Possible cases of consultation were analyzed regarding whether or not the case was accepted by dermatologists, problems in billing, failure to transmit information, incomplete or inadequate information and/or poor-quality images that didn't fit for a diagnostic orientation.

2.4. Development

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The development of the interface was following requirements engineering methodologies. For development, JAVA language was used on an ORACLE database. As a work team, software developers and healthcare professionals from the IT area worked on the interface design of the tool within the PHR, its integration with the EHR and processes impacted in the dermatology service. An iterative method was used in the interface design, changes were made with each use case until the final version was achieved. We reached a generic model which was first deployed in Dermatology, with the scope of later replicating it in other departments.

2.5. Deployment

The deployment process was planned in 2 stages, the first in which a pilot in charge of the residents of Health Informatics in conjunction with the specialists in Dermatology was carried out. A second stage in which it will be actively deployed for patients (PHR users) and physicians (EHR users). At the close of the present work we have completed the first stage of pilot simulating 10 cases, and being able for a fine tuning of the model of care. The second stage has just been started and 8 patients are performing teleconsultations with the dermatologists.

3. Results

For the realization of the project, the PHR and EHR were integrated. The dermatologist responsible for AC visualizes the list of consulting patients on the home page of the HER. The AC document sent from the PHR is a standard document (Clinical Document Architecture Standard). Physicians have the possibility to close the consultation with a recommendation to the patients and register a final clinical note only visible in the patient's EHR.

3.1. Personal Health Record

Patients access the PHR through a secure log-in (user name and password, sent to their registered email). A new module called "My Virtual Health" was added to the PHR, including a link to "Deferred Consultations", the name assigned to AC. Once a patient starts a deferred consultation, terms and conditions must be accepted. The next step is

to fill the structured fields defined by the specialist. There are 5 steps in the form of a wizard: 1) Personal Data, 2) Consultation, where images can be attached images; 3) Personal history and skin diseases history, 4) Complementary Studies, 5) Payment of service. It is also possible to preview the CDA document prior to being sent to the EHR.

Once the consultation has been sent to the EHR, it is shown as "in progress" in the "Active Consultations" tab, waiting for the physician to start the communication. The messaging was configured in such a way that only physicians can send the first message and begin the communication with de consulting patient. In addition, when a physician closes the consultation from the EHR, the messaging is disabled and the query is automatically archived in the medical record with the CDA document that was sent at the beginning.

3.2. Electronic Health Record

Access to EHR is done through the institutional Intranet. Two types of user roles were defined for this tool: "coordinating physician", who receives the consultations sent from the PHR and can also answer the consultations and finish it, or otherwise refer it to other providers. Second type of user is the "care physician" who is only able to perform medical care of those consultations or to refer them back to the coordinating physicians. About the status of each consultation (after being taken by the professionals) there are three available status, "Answered", "Pending" and "Completed", applicable for both types of users; in the case of medical coordinators have 2 extra status for those new queries: "Referring Pending" and "Referred".

When entering the patients listed, a button allows to accept the consultation or to refer it. The PHR-EHR messaging service, allows providers to exchange messages with the consulting patients. Dermatologist can request more information regarding the description of an injury or even a new photograph if the one presented initially is not entirely clear or image quality is not acceptable. When the consultation is closed, dermatologist must perform a final progress note and associate a problem. Document is stored in the patient's CDR making it accessible through the EHR.

4. Discussion

We didn't find evidence of any AC systems, where patient request a consultation through a PHR, integrated with the EHR, and forwarded to the specialist physician. Taking into account users' Technology Acceptance Model (TAM) [13], whether they are providers or patients, is mandatory in order to deploy the tool. Carrying out a new healthcare modality, where distance plays a major role, without taking into account our users' needs, would make the deployment fail [14]. The development of the tool was defined taking into account dermatologist's opinions.

Regarding the limitations of the article, it should be noted that the care flow proposed, the different questions asked in the form and other characteristics may not be reproduced nor replicated in other institutions. However, the general model of care with the description provided in this article could generate new ideas and provide the basis for future modalities of distance care. In future works we plan to survey the operation of the system quantitatively, the satisfaction of professionals and patients with the care received and the interfaces used, as well as long-term cost-effectiveness studies.

5. Conclusion

This article set out to describe a deployment of Telemedicine. To date there are no teleconsultation solutions that integrate a PHR and an EHR. In our proposal, patients access their PHR and request a consultation. In a second time, a professional access the EHR. In this way, the patient is taken care of by an accredited professional of our network, virtually they are "inside" the hospital.

Images available at: https://drive.google.com/open?id=1HFY_MoxvOVFl3O36ZfH9_kjZoS41tEPS

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