

Development and Implementation of an Integrated EHR for Homecare Service: A South American Experience

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Abstract

This paper describes the development and implementation of a web based electronic health record for the Homecare Service program in the Hospital Italiano de Buenos Aires. It reviews the process of the integration of the new electronic health record to the hospital information system, allowing physicians to access the clinical data repository from their Pc's at home and with the capability of consulting past and present history of the patient health care, order, tests, and referrals with others professionals through the new Electronic Health Record. We also discuss how workflow processes were changed and improved for the physicians, nurses, and administrative personnel of the Homecare Services and the educational methods used to improve acceptance and adoption of these new technologies. We also briefly describe the validation of physicians and their field work with electronic signatures.

Keywords:

Hospital information systems, Homecare services, Clinical data repository, Electronic signatures.

Introduction

Patient care in the home setting is a complex task. There are ongoing and intricate interactions between patients, medical, and administrative staff. Physicians and health care professionals, such as those in ancillary services, may be impeded in giving prompt care without access to real time clinical data or if they are unable to share knowledge efficiently. Communication can fail and when these elements are not properly coordinated, errors can occur. [1]

Compared with other levels of health care, homecare service involves a substantial flow of information. Delivery of services requires coordination of geographically distributed patients and professionals by central administrative personnel who usually have little access to vital medical workflow decisions.

For the personal that works on homecare services, to have restricted access to some of the right information in real time and in an not optimal format makes it difficult to make the decisions in their work. [2]

Much of the clinical and technical orientation in Home Care Service (HCS) is on telemedicine; previous works described how to improve the care of special patients with specific diseases or how to extend the telehealth to the home.[3, 4].Or even, describe technical support for close care and consistent information flow between different health care providers.[5]

Because Hospital Italiano de Buenos Aires (HIBA) wished to integrate all levels of care in the Hospital Information System (HIS), we decided that HCS should have the same interface as the existing applications. To create and put in place a platform that supports such complex model was not a trivial task: it required a carefully planned design.

The objective of this paper is to describe the experience of the development, integration, and implementation of an Electronic Health Record for HCS into the HIS of the HIBA. Our first planning phase and our first results involved two target populations in HCS, "Homecare" and "Follow up care".

Materials and Methods

The Hospital Italiano de Buenos Aires (HIBA) is a non-profit health care academic center founded in 1853, with over 1,500 physicians and 3,500 employees.[6] HIBA has a network of two hospitals with 750 beds (200 for intensive care), 500 "Homecare" patients under care, and 23 clinics. It has an insurance plan that covers approximately 150,000 people and also coordinates insurance for another 1,500,000 people who are covered by affiliated insurers. Each year over 38,000 inpatients (pediatric and adult) are admitted to its hospitals that are located in Buenos Aires and its suburban area. HIBA has more than 2,200,000 outpatient visits annually from patients from across the country and Latin America.

HIBA, a well-developed teaching hospital, offers both graduate medical education and residency training for 35 medical subspecialties and 34 fellowships programs. There are currently 400 residents and fellows in training.

In 1998 HIBA began the implementation of a Healthcare Information System (HIS) by integrating clinical information with administrative applications that were already in use. This in-house project currently handles all clinical and administrative

health care information from data capture through to analysis. It is now a fully implemented web-based, problem-oriented and patient centered EHR system.[7, 8] The system includes computerized provider order entry (CPOE) which is available to physicians throughout the HIBA network.

Early in 2008 we decided to start the design and in 2009 implementing the EHR into the HCS. We involved staff from admission, physician, billing for the process of design.

HCS Overview

The Homecare Service is different from all other clinical areas at HIBA; geographically HCS provides services over an area of approximately 350 square km (City of Buenos Aires). Has an average count of 350 to 400 admitted patients and is divided into two different areas according to the level of the patient care.

- 80 to 100 are allocated in Follow up care” (FC). Under Follow up care are those patient whose disease is not that acute and needs one physician and nurse visit per month, e.g. follow up to medication for deep venous thrombosis,
- 270 a 300 are allocated in “Homecare” (HC). Under Homecare is denominated for those patients whose disease only needs one home physician or nurse visit per week, e.g. surgical wound infection.

HCS is provided by 61 physicians : 49 internal medicine physicians, 12 physicians from others specialties (Cardiology, Psychiatry, Trauma, General Surgery, Infectious Diseases, Neurology, Palliative Care, Urology) and 4 physician-auditors that coordinate the service. 32 nurses that administer medications, draw blood samples, monitor and provide daily physical care and 6 Administrative personnel that coordinate the ratio patient/physician by location.

The Homecare Service Pre-Implementation

Pre-implementation administrative processes

The admission consists in the classification of patients and the determination of the priority of needs and the scope of treatment: homecare or follow-up care. Most of cases administrative workflow starts with an inpatient being admitted in HIBA. Each patient selected to be admitted to HCS from HIBA was assigned a physician who performed the first evaluation. This evaluation defined the scope of admission into HCS (FC or HC). The admission was done by an administrator by adding patient data to a spreadsheet. Then manually they admitted to the HCS, and added medication and oxygen if it was needed. Once the admission was confirmed in HCS office, the administrator opened another spreadsheet where all physicians were listed and then assigned a physician whose address most closely matched the patient address. Finally the administrator called or sent an e mail to this physician informing of the patient admission and assignment. The same process was followed in nursing.

All information related to the admission was manually added and shared through a spreadsheet, with the exception of email notification. Another spreadsheet included the number of patients admitted with the personal contact information.

Pre-implementation Clinical workflow

A patient's case history was accessed from the HIBA EHR through a Virtual Private Network (VPN); this also displayed the levels of care that patient had received. If a laboratory or radiology test was requested, the physician needed to call or to send e mail to the administrator for coordination with the nurse. This process had an average delay of 5 days. The laboratory nurse then took the administrator's call and had to update the patient information in the spreadsheets; this increased the possibility of clerical error. Results were seen in the Ambulatory EHR through VPN connection. Also if a patient needed to be readmitted to HIBA because of a complication, the HCS physician was infrequently informed in real time of this re-admission.

Design of the Homecare Services EHR

The design consisted on meetings and analysis of HCS needs based on pre-implementation evaluation on 2008. This initial design was for defining obligatory applications and functionalities of the HCS EHR should have similar to the EHR already running at HIBA so the integration was more equal. In this meeting, personal of the technician service were present too, and the basis of module was developed. Then in a second phase, the 4 physician-auditors of HCS were invited to review the HCS EHR prototype. Few changes were asked, but the most important need was for physician validation, authentication and certification, so electronic signature was adopted as a form of authentication.

Implementation Plan

Training in the use of the Admission Discharge Transfer (ADT) Application

ADT training of full time HCS administrative staff was done one month prior to the implementation. The ADT system for inpatient has been a part of HIBA for more than 8 years. ADT interacts with the EHR for many patient admissions, discharges and transfers. ADT workflow process was modified with patients leaving the HCS “domain” to the HIBA emergency room and either return to HCS or is admitted to HIBA administrative staff from both HCS and other services were informed and trained in order to avoid compromising patient care.

Training in the use of the "Homecare" Service EHR

Training in the use of HCS EHR was given one month prior to implementation. Physicians who were to use the application on a daily basis attended a workshop, and were given face to face instruction. All instruction manuals were provided on HIBA's “virtual campus”. A more detailed course was created for newly registered physicians. They were required to take an exam, after which they were given access to the EHR.

The implementation of the Electronic signature

HCS EHR physicians received virtual and face to face instruction on how to install the software and the hardware. All HCS physicians were required to sign a legal agreement that was validated by the legal department of HIBA. This agreement is an informed consent that validates the physician signature on electronic documents; it provides security, privacy, confidentiality and authorship of the information entered on the EHR.

Results

Informatization of the Homecare Services

ADT system functionalities

Once HCS is integrated into ADT system an admission to this service precedes as follows: First the medical team of the HIBA decides to admit the patient to HCS. Second, an email is sent or a call is made to the HCS physician-auditors. Third, when the patient is physically admitted into the HCS system the auditors' physicians call the HIBA medical team to request the HIBA discharge via the EHR.

The administrative inpatient personal of HCS receive an email alarm with the data of the patient to be admitted. They re-check the data with the physician-auditors and then confirm the incoming ADT message. The clerk creates the episode and all the personal data of the patient is loaded automatically from the Master Patient Index. At this point if the patient is not discharge from inpatient episode through the EHR, the clerk has an option that is called "PRE DISCHARGE". This state allows to virtually admitting the patient for 48 hours waiting for the medical team of HIBA discharge. The ADT system interacts with the Geographical Information System (GIS) so the patient address can be located.

The Homecare Service EHR

Access to the Homecare Service Electronic Health Record (HCS EHR)

Because of the geographic distribution of physicians the HCS EHR is through web access. Homecare Services physicians can access to the EHR from any PC with Internet connection. Physicians log into the HIBA web page and then to HCS through an icon on the intranet web page. There though a SSL certification and two servers that make web application between the Data Base and the web. The web app server 1 include web applications without logic and the web app server 2 with the logic. You can only access the Data Base server by IP assigned by web app 2, then Physicians are sheltered from the Data Base web server thought the web app 1 that can not get to the Data base server. Thought this way all data is preserved. Information flows safely and encrypted.

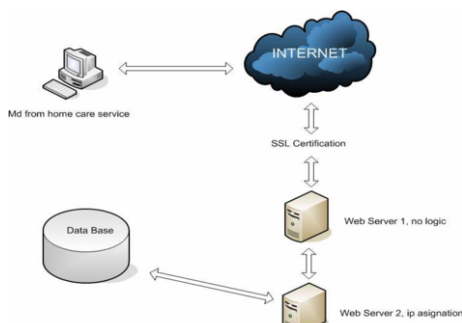


Figure 1- Network & data flow diagram

The Homecare Service Electronic Health Record

The first screen a physician views shows lists of patients, clinical practice guidelines, and a messaging system. This intermediary level default display presents a preferential way of visualization.

Patients' records can be retrieved through a search function. After the physician retrieves the correct patient he/she is presented with a modular, problem oriented and patient centered EHR.

The modules available are:

- Overview: The initial view where all modules are summarized.
- History and Problem lists: This module allows for the visualization of the clinical history. It also provides for the addition of new problems or change in of level of care which had been entered into the Problem Manager by other clinical staff.
- Progress Notes: This is a critical view for physicians. Patient co morbidities and, clinical history is integrated into the record which physicians can easily navigate. The physician can access laboratories results, additional studies, current and historic medications prescribed, and write progress notes (Figure 2)

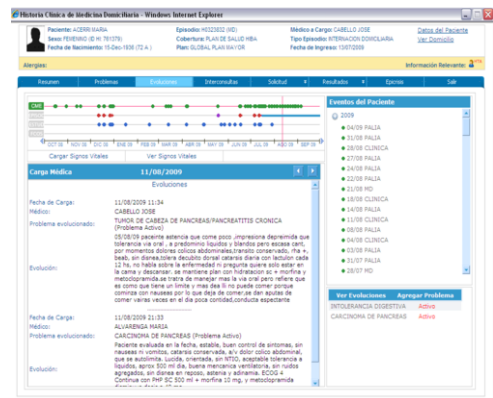


Figure 2- Progress notes module of the "Homecare" Service

- Referrals: The physician can request consults for their patient with any HCS specialist through the EHR. This request automatically generates two e mails -- one to the specialist and the other to administration as an advance notice for billing purposes.
- Clinical or lab studies: the physician can electronically order new studies and lab tests. In addition when if the lab test requires a blood sample to be drawn an email is sent to the nurse where they coordinate the draw example.
- Results: All historic and current studies can be accessed and reviewed. In some instances visualization tools have been created for improved longitudinal result views.

- Episode data: This module enables the physician to close the episode and discharge the patient. The discharge summary includes a principal diagnosis, if necessary a second, comorbidities, and an episode; and with the epicrisis.

Patient discharge of Homecare Service

The finalization of the episode is complete; as said before, by the discharge summary. When it is determined that a patient can be discharged; also to other areas of HCS such as "Follow-up Care" if patient was on "Homecare" and vice versa. When the patient is finally discharged by the physician through the EHR, ADT sends an automated alarm and email to the HCS administrator and they can then finalize the episode.

The more complex situation occurs when the patient experiences an exacerbation of his or her disease(s), is admitted to the ER and needs admission to HIBA for higher level care. When in the emergency room physician admits the patient an ADT automated alarm is sent to the HCS physician and the other to the HCS administrative staff. HCS administration gives the patient a "PRE DISCHARGE" notation in ADT\ which allows the HCS physician 48 hrs to complete the discharge in the electronic medical record of HCS EHR.

Electronic signature

Since authentication is done by electronic signature, a digital photo is taken and printed in a chip card with personal data (private key and certificates), which is given to each physician with an USB card reader to install on their PC or Notebook (Figure 3). A paper instruction manual and a face to face tutorial on electronic signatures were provided. In addition we replicated this information in our "Campus Virtual del HIBA (www.campus.hospitalitaliano.org.ar)"; here they could download the manual and see the instruction at their convenience or for knowledge reinforcement. The documents to sign were the new clinical notes, the discharges and discharge summaries.



Figure 3 - Agreement-Card-USB card reader

Post-Implementation Data Analysis

During the period from January 2009 August 2009, the HCS admitted a total of 10,836 patients, 82% of "Homecare" and 18% of "Follow-up".

There is an average of 26 days of hospitalization for "Homecare" and 38 days for "Follow- Up care".

32 % of the patients admitted on ER where from HCS because of exacerbation of their disease.

The ten most frequently input clinical disease were taken from ICD 9 classification. During the same period, the four most frequent were: Essential hypertension (27%), Dementia (12%), cognitive deficit (11%), Urinary tract infection (8%).

The remainder was further classification of factors influencing health status, infections and diseases of the nervous system and sensory organs, injuries and diseases of the circulatory system, musculoskeletal and connective tissue, and the genitourinary system.

Clinical information captured will enable research, audits to improve care and better clinical management. Improved patient monitoring identifies deficiencies in the process and assists management in the HCS [9].

Workflow can be monitored online and patient's relatives can be better informed. The initial stages were overcome, but one of the critical was the transition from the administrative work in paper to the electronic form. Also to select the proper technology and way of implementation so the work flow is not interrupted.

Other critical task was not to add unnecessary complexity or increase the cognitive effort required for interaction with devices. If information technology is not implemented or not well integrated into the work often result in duplication or sub-optimal division of tasks. [10]

The limitations of our work were that we didn't measure any outcome or any test of usability yet. Another limitation of the system that is being developed and nearly implemented, the possibility that nurses can write notes and physician can prescribe the patient's chronic medications.

Conclusion

The design and implementation allowed, personal previously excluded (medical, administrative, and nursery) now included in the Health Information System of the Hospital Italiano. Strikingly improved the staff communication of the HCS with the rest of the Services and between themselves too. Now there is information into Clinical Data Repository and also to manage and audit for future. Now all patients are correctly located in the city with georeference. All clinical notes of physicians are complete and more organized.

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