Configuring Electronic Medical Record Systems for Rehabilitation Treatment

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Abstract—Healthcare systems have improved tremendously since the advent of electronic medical records (EMR). Many commercial and open source EMR systems are already available for healthcare providers worldwide. However, it is noted that EMR systems are rarely used to record patient rehabilitation data. Rehabilitation treatment is of great importance to developing nations, especially to countries that have suffered from armed conflicts or other disasters. An EMR system which supports rehabilitation record keeping would be greatly beneficial to Sri Lanka considering the number of war victims receiving treatment at local hospitals. This paper reviews the feasibility of configuring an existing EMR system to record patient rehabilitation data, and highlights key issues developers should address to bridge the gap successfully.

Keywords—Electronic Medical Records, Medical Record System, Rehabilitation, Physiotherapy, ICD-10, OpenMRS, CPT, HL7

I. INTRODUCTION

The American Health Information Management Association (ACIMA) defines electronic Medical Records (EMR) as “the documentation of healthcare services provided to an individual in any aspect of healthcare delivery by a healthcare provider organization” [1]. Clearly, their definition indicates that EMRs may be used for all healthcare programs including rehabilitation treatment.

A large number of commercial and open source Medical record Systems (MRS) already cater to the need for EMRs. The implementation and use of EMRs has become high priority for healthcare providers, organizations, and government agencies [2]. Implementers report that many of these implementations are successful, and that their services have improved tremendously after the adoption of EMR [3-4]. However, there has been little interest in leveraging the success of EMR systems for rehabilitation treatment.

Designing and building a separate rehabilitation treatment system is an expensive and long term process. Therefore, it is important to consider the feasibility of saving both time and resources by configuring an existing EMR system to accommodate rehabilitation data.

This paper reviews the feasibility of configuring EMRs systems for rehabilitation data, and lists key concerns that may arise from this effort. A series of guidelines are presented for developers hoping to bridge the gap between rehabilitation and patient records systems.

II. INITIAL PLANNING AND SCOPE

The scope of this research is limited to recording physiotherapy treatment data. This includes the treatment of war injuries, amputees, stroke victims and neuron/brain disease patients.

Drug, alcohol and mental rehabilitation carried out by psychologists and other healthcare professionals were deemed out of scope for this project. It was also necessary to select an EMR system to evaluate the configuration effort. Our research is based on OpenMRS, an Open Source MRS tailor made to support healthcare in developing countries [5].

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A. About OpenMRS

OpenMRS was launched in 2004 as a joint initiative by the Regenstrief Institute of Indiana and Partners In Health, Boston. It was first deployed in the year 2006, and is currently being used at implementation sites in 23 developing countries around the world over [6].

OpenMRS is supported by the World Health Organization (WHO), the Canadian International Development Research Centre (IDRC), the South African Medical Research Council, Google, ThoughtWorks Inc. and the Rockefeller Foundation. Other collaborators include the Millennium Villages Project (MVP) based at Colombia University, USA and Baobab Health Systems in Malawi [7].

B. Why use OpenMRS?

- It specifically targets the EMR needs of developing nations [8].
- It is used in 23 developing nations [6].
- It is a mature system backed by a host of reputable research and medical organizations [7].
- It is a patient-centric record system [5]
- It does not currently support rehabilitation record keeping.

Given its maturity, wide usage and that OpenMRS is a system built on 30+ years of experience at the Regenstrief institute [8], it is assumed that OpenMRS already supports the full functionality expected of a standard EMR system.

C. EMR-specific vs. OpenMRS-specific: Maintaining neutrality.

Since this research was aimed at studying the ability to configure any EMR to support rehabilitation data, efforts were taken to differentiate between OpenMRS specific issues vs. issues common to any EMR. The research studies how the architecture and data model of a superior EMR system can be modified to record patient rehabilitation data. OpenMRS was used merely as a tool to gauge the feasibility of this effort. Therefore, all design and architectural issues specific to OpenMRS were ignored.

To clarify architectural design further, OpenMRS architecture was compared against the EMR design proposed by H.S.F. Fraser, P. Biondich, D. Moodley et al [9].
III. KEY DESIGN DECISIONS

A. Patient data model

In OpenMRS, data is stored in accordance to the following basic structure.

- A patient may visit a healthcare provider once or several times.
- Each patient visit is stored as a visit object in the system.
- The patient/healthcare provider may fill several forms during each visit. Each of these forms is recorded as an encounter.
- Each encounter will contain one or more observations, which store the specific question/answer data collected.
- Patients are mapped to drug regimens, which record the medication, dosage and frequency prescribed.

It is noteworthy that this model meets the requirements for a rehabilitation record as they can also be modelled on multiple visits, observations and regimens. Therefore, this design is consistent with requirements for rehabilitation record design.

B. The Patient Entity

We studied the OpenMRS patient object, and mapped it against EMR system architecture design proposed by H.S.F. Fraser, P. Biondich, D. Moodley et al [9]. The EMR data model was also compared against the physiotherapy patient record guidelines proposed by the Agence Nationale d’Accréditation et d’Évaluation en Santé (ANAES) [10].

It was noted that physiotherapy patient records defer from EMR patient records in one major aspect, that physiotherapy records require data fields such as profession, family situation, environment – lifestyle and the subjects general fitness. This additional data can be captured easily by either extending the patient object or by introducing a new interface, and requires relatively small modifications to the data model.

C. Security: Managing user restrictions

Physiotherapy treatment records can be broken down into two functional components, the physician’s instructions to the physiotherapist, and the physiotherapists’ report to the physician [11]. The physicians’ instructions segment may be left blank in the event that the patient contacted the physiotherapist directly. It is also important for the physician to see rehabilitation treatment results and vice versa. However there are different schools of thought on whether physiotherapists should be allowed unlimited access to all confidential patient data [11].

Therefore, it is necessary to create a role based security system where registered physiotherapists can view physician diagnosis and specific examination data such as X-rays.

It is important to decide which particular reports a physiotherapist is allowed to see, and restrict his access to that particular data.

To this end, we propose the following system design,
recording diagnosis in their systems. They are further advised to adopt the Current Procedural Terminology (CPT) to record therapy procedures [16]. Alternatively, implementers may also consider the International Classification of Functioning, Disability and Health (ICF) published by the WHO [17]. Both ICF and ICD-10 belong to the WHO family of international classifications.

ICD-10 gives users an etiological framework for the classification by diagnosis, of diseases, disorders and other health conditions. By contrast, ICF classifies functioning and disability associated with health conditions. Therefore, these two standards are complementary to each other. The WHO recommends that implementers use both standards together to create broader and more descriptive patient records [17]. However, implementers hoping to adopt this method should be aware of the additional complexity and learning curve involved.

G. Storing complex observation data

The storage of rehabilitation related information poses a challenge to our efforts. Physiotherapy observations/diagnoses can be in the following formats,

- Simple text
- Standard medical terminology
- A measurement (time limit, length, weight)
- Dates
- Complex files (images / Text files)

OpenMRS supports all above mentioned data structures. Users can easily record most rehabilitation related observations using the existing system. A majority of other leading EMRs also support similar functionality.

However some rehabilitation record data may be modelled into other complex data structures. These structures would be hard to record using the standard existing methods. Few EMRs offer support for complex custom data types. However, OpenMRS developers are currently engaged in a project to allow users to create complex custom data types. [18] This functionality is expected to be rolled out by early 2012.

It is also important to consider how the creation of new data types will affect the interoperability of a healthcare system. Standard EMRs use Health Level seven standards (HL7) for the exchange, management and integration of electronic healthcare information [19]. HL7 already supports complex data such as files and images [20]. However, despite being able to exchange custom data using these standards, implementations which receive the data will fail to render the complex data structure since they do not share the actual data structure.

Therefore users are recommended to store complex data structures as either images or text files. They are discouraged from attempting to create their own custom data types.

H. Inpatient vs. outpatient rehabilitation

Rehabilitation treatment can be provided to inpatients (patients still receiving treatment at hospital) and outpatients (patients who live else where, but visit the healthcare centre for their treatment).

Some outpatients may not posses any physician reports since they decided to seek rehabilitation treatment by themselves. However, this issue will not affect our project since either scenario can be handled thanks to the flexible physiotherapy regimen system described above.

IV. IMPROVEMENTS TO EXISTING SYSTEM

A. Added new Rehabilitation Management Links to the Administration Panel.

The rehabilitation management system is based on a series of key tasks. Therefore, a set of links leading to these tasks were added to the main administrative panel (Fig. 3). Each of these links lead to a page where the user may complete the given task.
B. Register Patient to Program

The Registration page (Fig. 4) allows an administrator to register a patient for rehabilitation treatment. The patient may be either a newcomer or an existing patient who needs to undergo rehabilitation treatment. The registration page contains all basic information required for a successful registration.

C. Creating Concept Regimen Types

A physiotherapy regimen is defined as an exercise prescribed to a patient. Physiotherapists need to define their own exercise types per program. They may do so via the concept regimen management page (Fig. 5 above).

D. Prescribing Custom Regimens

A concept regimen (specified above) represents a generic exercise. However, the same generic exercise cannot be prescribed per each and every patient. Factors such as repeats, difficulty level and frequency level for each concept regimen must be defined on an individual ‘per patient’ basis. The ‘physiotherapy regimens’ portal (Fig. 6) allows therapists to prescribe custom therapy treatment per each patient. Custom regimens created in this page represent a single unique treatment process / exercise prescribed per individual patient.
E. Documenting Lifestyle Data

Therapists may create records of their patients’ lifestyle history via the ‘Lifestyle Data’ portal (Fig. 7). This can be used to record a patient’s physical condition during any phase of his life. Here, the patient’s social position (student / career) was used to record his physical conditions over the past years.

V. RECOMMENDATIONS

- Programmers should develop a highly flexible role based security system to administer rehabilitation records. Strict guidelines should control who can access which records.
- Healthcare professionals have developed several stringent quality standards for the management of patient data [21]. Developers should select appropriate measures to improve their own systems by researching these standards.
- Developers must ensure the interoperability of their system by implementing a HL7 messaging service.
- Implementers are advised to maintain parallel paper based and software based record systems during the initial phase of the implementation process. A similar approach is followed by the TRAC-PLUS clinic at Rwanda [22]. This is recommended to ensure that an early software failure does not result in the loss or corruption of patient records.
- Highest priority should be given to interoperability and compliance to International standards and coding systems (ICD-10 etc.).

VI. CONCLUSIONS

The purpose of adopting an EMR system is to improve the efficiency and quality of data management. However, configuring or maintaining an EMR is not an easy process [24]. Enhancing an EMR system to store rehabilitation data would require even more effort and resources. Implementers must understand that this process includes a moderate development effort. They are recommended to adopt an incremental development and adoption process to enhance their system. This will also reduce the margin of failure and improve chances of user acceptance. However, more importantly, implementers should be in a position to provide proper training on how to use the new system. Emphasis should be given on how to use standard medical coding systems.

Implementers should not launch a configuration effort unless they are financially and technically capable of making it a success. Upgrading the existing system should not affect
its stability, interoperability or data security in any manner. Implementers are urged to study other successful implementations to understand reasons for success and failure. They are advised to be open to the needs of their end users. However, improving a healthcare system to accommodate rehabilitation data is a feasible effort with a satisfactory chance of success.

ACKNOWLEDGMENT

We are indebted to OpenMRS co-founder and Research Scientist- Regenstrief Institute Dr. Burke Mamlin, Director of OpenMRS API Development Benjamin Wolfe and Director of Health Information Systems/Medical Informatics for the Millennium Villages Project Dr. Andrew Kanter for advice on the use of medical terminology in EMR systems.

REFERENCES


