A tool for tracking and monitoring of patients in an acute mental health ward

Taralyn Schwering
Department of Electrical and Computer Engineering
McMaster University
Hamilton, Ontario
Email: schwert@mcmaster.ca

***Abstract*—Tracking and monitoring patients in an acute mental health ward is a routine task for mental health nurses [2]. Nurses must collect ongoing data on the physical, developmental, cognitive and mental status of all the patients being treated through monitoring things like daily activities, personal hygiene and functional health status [1]. This information must be documented in a retrievable format such as an electronic health record [1]. However, there are specific needs of nurses in an acute mental health ward which makes this project unique which include portability and ability to monitor multiple patients at once. This project will encompass the user analysis and design of a data entry tool for tracking patients within an acute mental health setting. The tool will be compatible with existing electronic health records systems and will run on a portable platform (such as a tablet computer). The goal is to streamline existing systems to make it more user-friendly and add new functionality to increase ease of use. Evaluation of the tool will be done based on the user requirements of mental health nurses.**

I. Scope and Objectives

The scope of this project is the design of an application and accompanying graphical user interface to input data for mental health patients in acute care. This will be a tool to work along with existing electronic health records systems. The intended use of the final application will be for ongoing regular monitoring of the well-being of acute mental health patients. The tool will be specialized for the needs of both nurses and doctors working in the mental health fields. More specifically, the user interface will be consistent with the usability needs of psychiatric nurses while the data collection will be determined by the diagnostic needs of psychiatric clinicians.

II. Motivation

Electronic Health Records have been shown to be beneficial to many areas of clinical medicine, however each field has its own unique requirements and potential benefits regarding EHRs [7]. Many mental health facilities have held off on high level EHR adoption due to current systems failing to meet these unique requirements (which are discussed in the next section) [4]. The motivation behind this product is not only to increase applicability and therefore the use of electronic health records in psychiatric medicine, but to harness the benefits of EHR's specific to the mental health field.

III. Background Information

There are several unique features of mental health care that must be considered when designing EHR for mental health. Patients remain in the care of a specialist for a long period of time (months or years) so resulting records could be very lengthy or have details of many patient-carer encounters [4]. In addition to many entries, due the long and unstructured (compared to other medical fields) consultations, clinician notes tend to be long and narrative in nature [4], [6]. Additionally, there are concerns over the security of EHR due to the sensitivity of mental health data leading to the potential for stigma and discrimination based on the information [3], [4].

Despite the difficulties of EHR, when compared to paper records they were found to reduce errors in documentation and incomplete documentation in mental health records [5]. There are several electronic health records systems in use by mental health facilities with mixed results. RiO is a standard EHR which was implemented in a mental health setting with mixed reviews from users but an overall positive result due to the strong push to incorporate EHRs into all medical practice [4]. New research is looking into ways of displaying patient data graphically as opposed to narratively, in the hopes of better communication of past psychiatric history [6]. While this research shows promise in using the technical advantages of electronic records in psychiatry, it also requires novel methods for inputting patient data.

In addition to clinician-patient interactions, in acute mental health facilities nurses are required to continually monitor the well-being of the patients [2]. Nurses must collect ongoing data on the physical, developmental, cognitive and mental status of all the patients being treated through monitoring things such as daily activities, personal hygiene and functional health status [1]. This information must be documented in a retrievable format so that it is available to the doctor for review [1]. This process is distinct from clinician notes in that entries are made often and consist of succinct observations of patients. Many EHR systems currently available lack the features required for nurses to complete these tasks or the functionality to use this data as meaningful information for the clinician.

IV. Problem Analysis

There are several requirements that need to be addressed with this new system. It must perform all the functions of the legacy or paper-based system. These functions include the ability to track multiple patients, record data on their well-being and the ability for authorized users to access and retrieve data. Existing features that need to be maintained or improved also include portability and ease of use for nurses

performing data entry. New functionality desired in the new system includes the ability to interface with electronic health records and the ability to organize information so that it can be consumed quickly and in a meaningful way (such as displaying information graphically). These desired features require that the information be stored as structured or semi-structured data. The design of the structured or semi-structured data as well the interface for data entry will be done by strictly defining and analyzing the needs of both doctors and nurses in the mental health environment.

Figures 1 and 2 display the social model of the mental health facility as it applied directly to this problem. Figure 1 reflects the current system in which nurses are responsible for monitoring of patients and communicating with the doctor separately. In this model only the doctor depends on the nurse for complete information about the patient's on-going well-being.

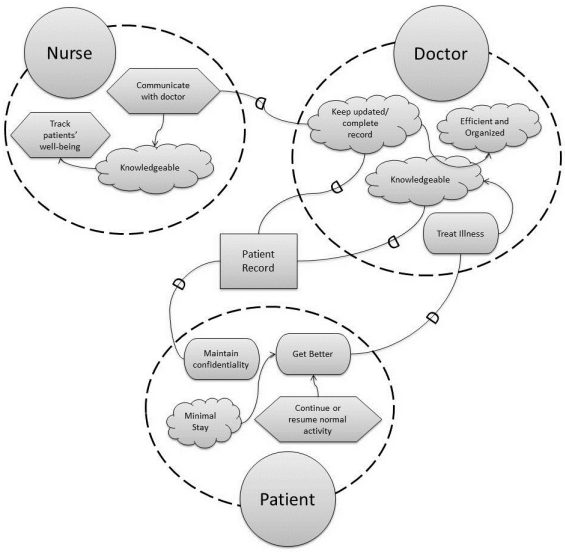

Fig. 1. Social model without new system

Figure 2 reflects the social model after the addition of the new patient monitoring system. The new system is responsible for keeping the doctor informed of the patient's well-being as well as including information in the patient's record. While the actions of the nurse are very much similar to the original model, the addition of the new system allows both the nurse and the doctor to become more knowledgeable, with the goal of improved treatment of the patient.

V. Specification of Proposed Solution

The proposed solution is a data entry application on a portable platform with data storage on an external database. The format of all data collected will be structured so as to be compatible with existing electronic health records. The structure of the data is important for the ability to convert data into graphics for quick and meaningful use by physicians. The actual display of patient information in a graphical format for efficient interpretation by physicians is not included in the scope of this project. Interfaces for data collection must be user-friendly and accommodate the needs of psychiatric nurses using the system. These needs include using the application to

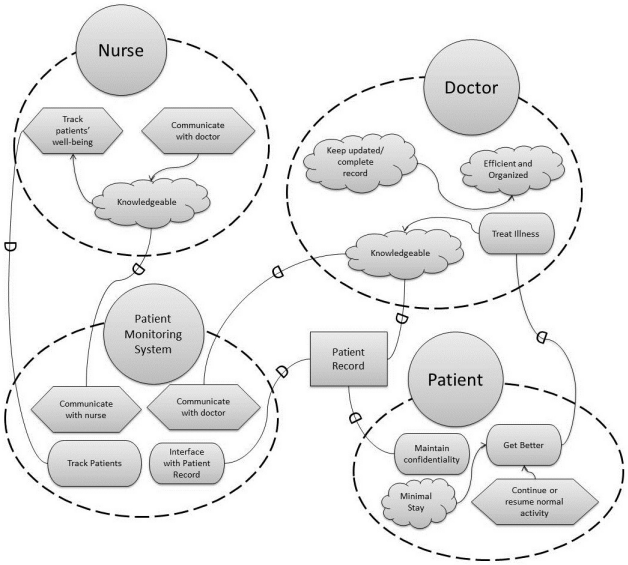

Fig. 2. Social model including new system

track multiple patients, simple to switch between patients and reminders for checking on patients based on a set schedule. Finally, the application must have user verification in order to protect the confidentiality of the patients.

VI. Development Methodology

Due to the nature of the problem we are considering, usability of the system by nurses and doctors is a key component of the final product. Because of this it would be helpful to have continual feedback on requirements and usability by these users through the development cycle. *Evolutionary development* offers opportunities for feedback throughout the design process leading to progressively better understood user requirements. Through initial analysis, there is a general idea that the functionality and ease of use of the original system need to be improved. This involves disassembling the features of the current system and achieving each part in the newly designed system. Once these features are incorporated into an initial version of the system, feedback from users allows developers to refine and add features in subsequent versions in order to achieve the users' desired functionality.

VII. Evaluation Methodology

Evaluation of the software solution will be done based on the requirements of mental health nurses and the potential to include additional functionality for viewing of information. The final product (or intermediate implementations) will be compared against the original expanded specification to determine how well it achieves its original goals and to determine if it provides a valuable service to users. The solution under evaluation will also be compared to previous solution attempts and the legacy system to determine whether it adds new or improved functionality and whether it improves upon ease of use of previous solutions.

VIII. Project Plan

Further work on this project begins with addition analysis of user needs to determine initial project requirements. This

will be done through building increasingly more complete and complex models of the system and identifying shortcomings of these models through stakeholder discussion.

Using these requirements, an initial prototype will be developed as the first step in the evolutionary software development model. Ideally, this initial design will be evaluated and adjusted to better meet the needs of the users. Due to the time constraints of this project a final working implementation is not realistic; however a working intermediate prototype is feasible within the constraints.

Evaluation of the initial prototype and subsequent intermediate implementations will be done based on the needs of the initial users to ensure that it continues to provide a meaningful use.

A. Technical Feasibility

The technical aspects of this project require an application running on a tablet device to communicate wirelessly to a secure server to hold the patient information. User authentication is required to access or input patient data into the system. Based on these technical specifications, this project is technically feasible within the time frame of the project.

B. Economic Feasibility

To determine whether this project is economically feasible, the costs and benefits of the solution must be weighed. Implementing a new patient tracking system such as the one discussed here requires users to be trained on the functionality of the system. This results lost productivity during training and while users are becoming accustomed to using the new system in addition to the monetary cost of training. Additionally, this project has costs associated with the equipment and the technical personnel required to implement and operate the system.

With the goal of increasing quality of patient care while lowering costs, implementing a new patient monitoring system has the potential to be beneficial in many ways. The most obvious way it can be beneficial is by increasing nurses' productivity through increased ease of use and efficiency. Additionally, because the system integrated with existing electronic health records it reduces redundancy in entering information into those records. Finally, when looking at the impact this new system will have on quality of patient care, it will increase accountability and communication between team members through increased transparency of documentation.

The costs of implementing this solution are primarily startup costs and are inherent in implementing any new technology into a workplace. It is believed that in the long term the on-going benefits of updating will outweigh the costs of the new system.

C. Organizational Feasibility

There are many justifications for not using new systems for record keeping in medical care. Due to the difficulties of existing tasks required of nurses, there is a justified need of a solution to streamline these tasks. Because the system is being built with direct feedback from front end users, it should solve the problems with the current system as well as address unforeseen issues that may arise. It is therefore reasonable to believe that the new patient tracking system will be beneficial to current users.

IX. Future Directions

The ideal goal for patient tracking systems in mental health facilities would include a convenient and user friendly data entry tool for nurses as well as an interface for efficient viewing of patient information by doctors and other healthcare professionals. There has been research looking at the benefits of including graphical interfaces for viewing patient data [6]. The idea of creating a graphical map of patient data harnesses the unique ability for electronic health records to organize structured data. Figure 3 shows an example of the display of patient history in a graphical format.

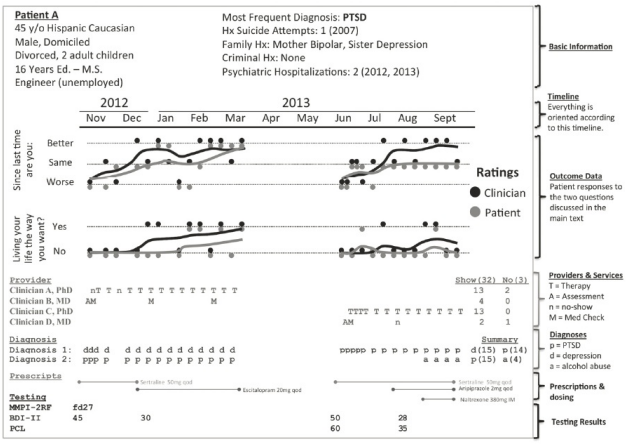

Fig. 3. Example of graphical display of patient data [6]

In addition to the information in traditional patient records, the type of information being recorded on an on-going basis by nurses in mental health facilities lends itself well to graphical display. The brief nature as well as the dense schedule of the entries means that the recorded information could be easily viewed as a timeline of patient-wellness. As mentioned in [6], use of a graphical display of patient data can increase efficiency and quality of care provided by physicians at mental health facilities.

This system has been proposed with the intention that the functionality to view patient data graphically can be added at a later point. Including that additional functionality would increase the amount of analysis required and the technical difficulty of the project in such a way that it would not be feasible within the constraints of this project.

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