A Roadmap to Construct a Center of Patient Safety Informatics in a Teaching Hospital

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Abstract

On the ream of patient safety, the information system has played an important role to improve the quality of care. The Institute of Medicine (IOM) brought patient safety issue into

on of information systems and computer-based initiatives to improve patient safety[2].

We constructed a center in a teaching hospital. In the pilot study of building an effective Patient Safety Informatics Center, we designed decision support systems, exploring the impact of the information system on medication interaction, executing thousands of rules to provide clinicians to make optimum decision effectively [3]. *With the goal of quality of care to providing physician with effective informatic system for a better medical decision*.

Keywords

Patient Safety Informatics, Medical Decision Support, Medical Error, Adverse Drug Event (ADE)

Introduction

Recently, the calamity of two major medication errors had shaken people's heart of the nation. Computer Physician Order Entry (CPOE) is adapted to more than 50% of all hospital and it identified that account for 39% of ordering errors. Therefore, the PSIC of Wan Fang Hospital focus on using decision support system to reduce physician ordering errors as its first mission [4]. Implementation in technology of healthcare system is expected to provide consistently high quality care. From the incidents of medical error, it demonstrate the system falls short in transforming new knowledge into daily practice, and need to apply new technology to reduce CPOE properly.

According to National Health Insurance Bureau (NHIB) the center of Patient Safety Informatics (PSI) in Municipal Wan Fang Hospital takes the responsibility with the aim of quality and safety improvement. Regarding medical care decision process via assistance of information technology. Its model structure is by

(1) Logical application based on principle creation

(2) Referring to medical professional

the public attention in its 1999 report To Err is Human [1]. *It estimated those medical errors responsible for 44,000 and 98,000 deaths in the United States per year. It is time to make correction because we all in a predicament, in which we are susceptible to the medical injury.*

We emphasized on the application

(3) Employing knowledge management to couple medical insurance ICD-9 code parameters.

Furthermore, three types of medical care decision support systems as instruction, reminder, and scoring system have been adapted in the hospital to meet the safety requirement.

Description

This study makes clear that a thorough exploration of pilot study before building the system, may be crucial because it can prevent mismatches and maximizes the chance that the information system meets its most important aim: to enhance patient empowerment and improve the quality of care.

From the IOM 2000 report described medical error cost losses was estimated to be between $1.2 million each year on the hospital of 200 acute beds, or 10-15% annual budget of the hospital. In which 1.89% error reached to level one medication interaction was report. It is estimated that 170-290 million of medical error cost per year and over 50% was preventable[5].The establishment of reducing medical error actions was executing as:

(1) Establish a focus to create information framework, it include research, tools, and protocols to enhance the knowledge base about safety. Identify and learn from medical errors through both mandatory and voluntary reporting systems.

(2) Error can be systematically recorded and analyzed. It evaluated by type of error, medication class involved, prescribing service, potential severity, times of day, and month. This system is expected to generate standards and results for improvements in patient safety through the oversight of hospital PSI team.

Patient Safety Informatics Interaction Model

Behavior of physician prescription can be classified into five-classes [6].

1. Patient Profile (PP): basic patient data such as age, gender, blood type etc.
2. Diagnosis /History (Dx): diagnosis and medical history.
3. Lab data: lab test and exam result.
4. Drug – drug interaction.
5. Procedure (Proc): treatment procedure.

Among the 5 classes of data, we can derive 31 possible interactions ranging from one-way to five-way interaction (we identified 14 clinical applicable ones) Which follows patient profile, diagnosis and history, laboratory test, medication, treatment procedure (Refer to figure 1). They are listed in the following text with clinical examples:

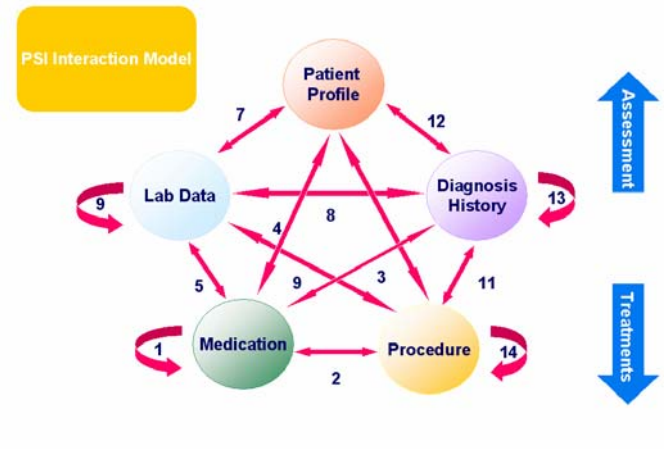

Figure 1: Patient Safety Informatics Interaction Model

A. One-way interaction

1. Drug vs. Drug (Interaction between medications): For example, simultaneous prescribing Digoxin and Furosemide will increase toxicity of digoxin for arrhythmia and hypokalamia, which often be graded as level one medication Interaction.

2. Lab data vs. Lab data (Interaction between lab data and lab data): For example, while the numbers of blood platelets are decreasing, it is unusual for blood coagulation time smaller than normal data.

3. Dx vs. Dx (Interaction between diagnosis and history and diagnosis and history): For example, if the patient has uterectomy history, there will be no chance to diagnose fibroid again.

4. Proc vs. Proc (Interaction between medical procedure and medical procedure): For example, unless the organ is symmetrical, it is impossible to have twice resections in one patient.

B. Two-way interaction

1. Drug vs. Proc (Interaction between medicine and medical procedure): For example, some surgeries tend to more easily bleed. If patient takes anticoagulant prior to surgery, this may increase risk of post-surgery bleeding.

2. Med vs. Dx (Interaction between medicine and diagnosis and history): For example, if patient who has asthma with combinative heart disease that has been prescribed B-blocker, his/her asthma will be aggravated.

3. Med vs. PP (Interaction between medicine and patient data): For example, Retinoid cannot be prescribed to pregnant woman. Otherwise, fetus may have risk of becoming misshapen.

4. Med vs. Lab data (Interaction between medicine and lab data): For example, the patient who takes finasteride has lower index, because his/hers PSA (Prostate Specific Antigen) is oppressed. Besides, oral antifungal drug ought to be prescribed under normal liver function.

5. Lab data vs. PP (Interaction between lab data and patient profile): For example, it is impossible for male patient to have positive pregnant test.

6. Lab data vs. Dx (Interaction between lab data and diagnosis and history): For example, the diagnosis of C type hepatitis usually accompanies (+) Anti-HCV.

7. Lab data vs. Proc (Interaction between lab data and medical procedure): For example, usually drainage of the ventricles of the brain must operate while there is symptom of hydrocephalus or IICP showing in computerized axial tomography (CT) scan.

8. Proc vs. PP (Interaction between procedure and patient profile): For example, pregnant woman is prohibited having radiological test.

9. Proc vs. Dx (Interaction between medical procedure and diagnosis and history): For example, pregnant woman with prepositional placenta generally cannot have pelvic vaginal exam.

10. PP vs. Dx (Interaction between patient profile and diagnosis and history): Diagnosis of specific sex, for example, only male can have BHP diagnosis, just as can only female have uterus and ovary disease diagnosis.

Systemic Approach to Improve Patient Safety

From the literature review, medication error counts up to 30% of all error in regard to patient safety. Therefore, the Informatics teams work closely with Patient Safety Committee (PSC) to establish the project of systemic approach of patient Safety improvement. We clearly defined the limitation of each field of medical error. Then Patient Safety Informatics (PSI) system can play an important role on the process of patient safety. PSI invites each medical department and unit toward the questionnaire to address requirements for patient safety prevention, and then interviews and analyzes requirements from each unit to come up with rule based description framework.

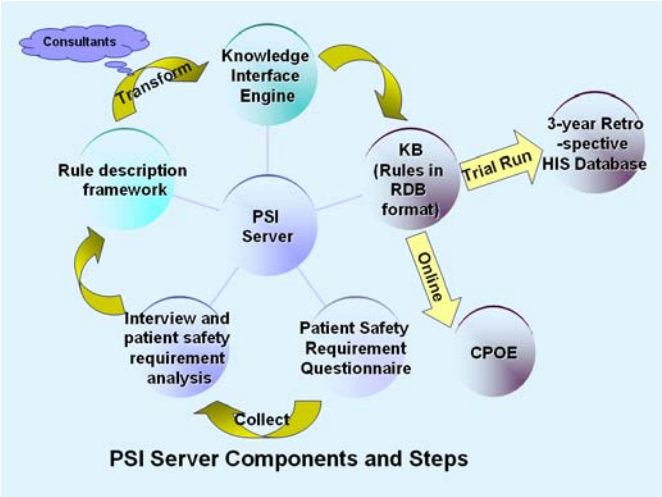

Figure 2: PSI Server Structure

Furthermore, those principles are transformed into parameters plus suggestions from each medical expert; knowledge interface engine and KB (Rules in RDB format) database are shaped. Then compared with 3-year retrospective NHI database, the method to prevent from this Interaction has been analyzed. Consequently, a set of OPD system is created to provide medical decision support, and assists each unit preventing from medical mistakes.

Reminder System, which is designed from the above system, will be enacted according to characteristics of each department and unit, and also it must possess following features.

1. It cannot over remind physician, and affects the medical treatment.
2. It must always be artificial overwriting.

Building a safer Medical Environment

Improved understanding of medication prescribing errors should be useful in the design of error prevention system. All medication prescribing errors from the hospital with potential for adverse patient outcome detected and averted by staff [7]. Medication-prescribing error frequency and characteristics occurring during the 3-year study period.

Confirmed medication-prescribing errors with potential for adverse patient consequences were detected and averted during the study period. The reminder system is designed to accommodate the medical staff requirement.

1. Not to interfere physician daily practice.
2. Manual correction is capable.

Medication errors were intercepting by PSI instead of health care practitioners, and health care systems must incorporate adequate error reduction, prevention, and detection mechanisms into the routine provision of care[8].

Future works

As we moving forward to tackle the hurdles of potential errors, such as nurse administration error, bar code system, pharmacy transcription error, we should keep in mind that not to bother too much on the people, who are using computer system, this would make PSI system easier to be accepted by the users.

The framework of PSI is aiming to enhance the quality of patient safety. By the same token, it expected this model can apply to the other healthcare organization within the country, let people who wants to build a safer health environment can march toward a brighter tomorrow.

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