

REVIEW ARTICLE

Role of Information Technology in Preventing Medication Errors: An Overview**T.K. Ponnuswamy*****Professor, Dept. of Pharmacology, PSG Institute of Medical Sciences, Coimbatore, Tamilnadu, India*

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ABSTRACT

Medication errors are the most common preventable cause of adverse events. They have important implications for patient safety, and their identification is a main target in improving clinical practice errors, in order to prevent adverse events.

They are important because they increase the period of hospitalization and financial costs. They occur for a variety of reasons. Information technology (IT) can be used to prevent medication errors. Computerised physician order entry is one application. The net result will be a much safer system, which will still require substantial human guidance.

Key words: Medication errors, adverse events, patient safety, information technology, Computerized physician order entry, Bar-coded medication administration (BCMA).

INTRODUCTION**No one makes an error on purpose. Lucian Leape**

Medication errors cause a large number of adverse drug reactions (ADR) with negative patient health outcomes each year and are a major public-health burden. In the USA, medication errors are estimated to harm at least 1.5 million patients per year, with about 400 000 preventable adverse events^[1].

A medication error as per Good Pharmacovigilance Practices (GVP) refers to any unintended error in the prescribing, dispensing or administration of a medicinal product while in the control of the healthcare professional, patient or consumer. Medication errors do not always lead to ADRs but if they do they may cause harm and are considered preventable. **They are the most common single preventable cause of adverse events in medication practice.**

Medication errors are important because they could increase the period of hospitalization and costs to undue discomfort and disability or increase mortality^[2,3]. The frequency and severity of medication errors are not evenly distributed in the population, and there are clusters of patients, drugs, and settings that are associated with higher risks; however, these can generally be attributed to common underlying contributory factors^[4,5].

Common prescribing errors include using the wrong drug or dosage form, incorrect dose calculation, not checking for allergies, and failure to adjust dosages in patients with renal or hepatic dysfunction^[6].

Prevention of medication errors has therefore become a high priority worldwide. There is mounting evidence that systems that use information technology (IT), such as computerized physician order entry, automated dispensing cabinets, bedside bar-coded medication administration, and electronic medication reconciliation, are key components of strategies to prevent medication errors

Relative importance

In 1925, 4 main types of adverse events identified for hospitalized patients were burns due to hot water, delirious patients jumping from hospital windows, accidents connected with hospital elevators and mistakes in the use of drugs^[7]

Various studies have been carried out to find out the impact of medication errors; but, the issue received maximum attention in the immediate years after the Institute of Medicine report in 1999 was published^[8] The published data demonstrates that approximately 5-10% of all hospital admissions are drug related^[9]

"All parts of the health care system—including health professionals and patients—have a role to play in preventing medication errors."

Approaches to detect medication errors

The approaches used to detect errors are likely to be different in research and routine care, given the available resources ^[10]. In order to prevent medication errors and reduce the risks of harm, organizations need tools to detect them ^[11]. Any system must then be able to analyze errors and identify opportunities for quality improvement and system changes

The major methods for detecting medication errors and associated adverse drug-related events are chart review, computerized monitoring, administrative databases, and claims data, using direct observation, incident reporting, and patient monitoring. All of these methods have both advantages and limitations.

Information technology can be used to prevent medication errors. Computerized physician order entry is one application.

Information technology systems in medication management

Clinical decision making is a complex process that depends on human ability to provide undivided attention and to memorize, recall, and synthesize huge amounts of data – all vulnerable areas. IT systems can improve access to pieces of information, organize them, and identify links between them. Clinicians often 'know' the information (such as a patient's allergies, a drug recall warning, or a drug–drug interaction) but forget to consider it at the time of prescribing. IT systems are effective in bridging this 'knowing–doing' gap ^[12], by presenting the relevant information to the clinician at the time of decision making.

Computerised physician order entry

Computerised physician order entry (CPOE) is an application in which physicians write orders online. This system has probably had the largest impact of any automated intervention in reducing medication errors; the rate of serious errors fell 55% in one study ^[13] and the rate of all errors fell 83% in another ^[14]. Computerisation of ordering improves safety in several ways: firstly, all orders are structured, so that they must include a dose, route, and frequency; secondly, they are legible and the orderer can be identified in all instances; thirdly, information can be provided to the orderer during the process; and fourthly, all orders can be checked for a number of problems including

allergies, drug interactions, overly high doses, drug-laboratory problems (giving a patient a drug when they have a known biochemical factor that predisposes them to risk), and whether the dose is appropriate for the patient's liver and kidney function. A large decrease in the number of errors can be achieved by computerizing the process even without providing much decision support.

Bar-coded medication administration

Bar-coded medication administration (BCMA) systems require that the nurse who administers the medication at the bedside should scan the patient's identification bracelet and the unit dose of the medication being administered. The system alerts the nurse to any mismatch of patient identity or of the name, dose, or route of administration of the medication. BCMA reduces medication errors by ensuring the five 'rights' of medication administration: the right patient, drug, dose, route, and time. BCMA systems reportedly produce 54–87% reductions in errors during administration of medications ^[15]. In a London teaching hospital, implementation of a 'closed-loop' system including CPOE and BCMA reduced prescribing and medication administration errors ^[16].

The other strategies to prevent medication errors are automated dispensing cabinet and electronic medication reconciliation.

Looking ahead

In future, physicians will write orders online and get feedback about problems like allergies and decision support to help them choose the best treatment. The orders will be sent electronically to the pharmacy, where most will be filled by robots; complex orders will be filled by pharmacists. Pharmacists will be much more clinically oriented and will focus on promoting optimal prescribing and identifying and solving problems. Automated dispensing devices will be used by nurses to provide drugs to patients. All drugs, patients, and staff will be bar coded, making it possible to determine what drugs have been given to whom, by whom, and when.

Limitations

Although IT systems provide clear and compelling mechanisms for reducing medication errors and improving safety, with a significant body of evidence to support their role, there are several concerns about their widespread clinical use.

Most of the current evidence is based either on single-site evaluations in large academic hospitals

that have developed the systems internally and incrementally^[17].

The other concern is raised by evidence of the potential negative consequences of IT systems on patient safety^[18]. IT systems can adversely affect clinical care by generating more work or new work for clinicians, causing workflow problems, or even generating new kinds of errors^[19].

One approach to addressing this problem is to require that clinical IT systems in the market place be tested and approved by a certification agency. This certification process assures a buyer that a system meets minimum standards in the domains of functionality, interoperability, and privacy and security.

CONCLUSIONS

IT systems are key components of a multifaceted strategy to prevent medication errors and improve patient safety.

Several information technologies have been shown to improve the safety of drugs. Computerized physician order entry seems to be the most potent of these, and it can be expected to become even more useful as more data become computerized. Information technology should also improve safety in other parts of the process, including dispensing and administering, but the full benefits will not be achieved until all the components are electronically linked.

It is important to understand that they have the potential to affect clinical workflow with attendant complications. This can be addressed by Improving standardization and certification of the design and implementation of such systems.

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