



## Review on impact of clinical pharmacist's intervention in the prevention of medication errors and related adverse drug events

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### ABSTRACT

Medication error phenomena are very common within health care practice. These errors could result in adverse events and harm to patients. Clinical pharmacist has an identified role in minimizing and preventing such errors. Medication errors and adverse drug events still continue to be the important factors for out- and in-patient treatments. Medication errors are critical troubles in all hospitalized populations that can increase length of hospital stay, expenses, mortality, and morbidity. In many countries, clinical pharmacists have been involved in reducing medication errors from years ago. A growing body of evidence suggests that pharmacist interventions have major impact on reducing medication errors in patients, thus improving the quality and efficiency of care provided. This paper presents a literature review on the role of clinical pharmacists in reducing medication errors and related adverse drug events underscores the importance of pharmacist-physician-patient collaboration for all patients.

**Keywords:** Clinical pharmacy, Medication error, Patients, Adverse drug events.

### INTRODUCTION

Medication errors are critical dilemmas in all patients and may increase the length of hospital stay, expenses, mortality and morbidity.<sup>[1]</sup> Additional awareness of patient safety has been established since 1999, when the Institute of Medicine issued its report "To Err is Human: Building a Safer Health System". The statement was based on analysis of several studies by several organizations reporting the annual mortality rate of 44,000 to 98,000 people because of preventable medication errors. More specifically a medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures and systems, including prescribing, order communication, product

labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring and use. Medication errors are a well-known problem in hospitals. Studies have shown that medication errors and adverse drug reactions are one of the main causes for adverse events in hospitals leading to disability and death up to 6.5% of hospital admissions.<sup>[2, 3, 4, 5, 6, 7]</sup>

Pharmaceutical care provided by clinical pharmacists in the hospital setting allows multiple layer of patient protection which can reduce the potential risks of these errors.<sup>[8,9]</sup> Most of these clinical pharmacists are academic staff and involved in medical treatment team in the teaching hospitals. Clinical pharmacists can play an important role in intercepting and acting on possible prescribing errors and/or recognizing drug-related problems before injury, or further injury,

can occur. Adverse drug events (ADEs) are the most common cause of injury to hospitalized patients and are often preventable. Medication errors resulting in preventable ADEs most commonly occur at the prescribing stage. Prescribing errors phenomena are very common within health care practice. These errors could result in adverse events and harm to patients. Physician habit in prescribing became one of the main causes of medication error, adverse drug incident and patient poor compliance. A prescribing error may be defined as the incorrect drug selection for a patient or errors involving wrong drug, dose, quantity and indication for use or a contraindication.<sup>[10]</sup> One common dispensing error is selection of the wrong product, usually where there are two drugs with similar proprietary names (e.g. Losec® and Lasix®) which may look similar when hand written. Other dispensing errors include wrong dose, wrong drug and wrong patient and some reports suggest typing errors in computerized labeling as a common cause of error in dispensing. There is very little documented data around preparation and administration errors occurring in patients in the community. However, there is a reported wide variation in the rates of preparation and administration error within hospitals with rates varying between 3.5% and 49%.

Clinical pharmacists are uniquely trained in therapeutics and provide comprehensive drug management to patients and providers. Pharmacist intervention outcomes include economics, health-related quality of life, patient satisfaction, medication appropriateness, adverse drug events (ADEs), and adverse drug reactions (ADRs). An ADE is defined as “an injury resulting from medical intervention related to a drug,” and an ADR is defined as “an effect that is noxious and unintended and which occurs at doses used in man for prophylaxis, diagnosis, or therapy.”<sup>[11]</sup>

Research has shown that the potential risk for medication errors within the pediatric inpatient population is about 3 times as high as for adults, however there is limited information regarding the impact of a pediatric pharmacist’s contribution to decreasing medication errors and adverse drug events (ADEs).<sup>[12]</sup> As more has been learned about preventing medication errors in the adult population during the past 20 to 30 years, attention has shifted to the pediatric population. Clinical pharmacists are a

key member of health-care provider team that contributes significantly in preventing medication errors. Due to undeniable role of clinical pharmacists in decreasing medication error and cost saving, studies considering different aspects of clinical pharmacist interventions in hospitalized patients have been at the center of attention and interest during the last few years. The aims of the present review is to study the role of clinical pharmacist in detecting and preventing the medication errors and related adverse drug events.

## METHODOLOGY

We have performed a systematic review of Medline database using pubmed for articles related to the medication error and related adverse drug events prevention by the intervention of clinical pharmacist. Searches were carried out for studies published in English in or after 1992 until 2013 that addressed any intervention designed to improve medicines reconciliation and prevent medication error at the point of admission into hospital by the clinical pharmacist. The search also looked for papers on the prevention of medication errors in pediatric patients and role of clinical pharmacist in neonatal intensive care unit. It included any type of comparative study and studies which had an indication of medication accuracy or prevention of error or discrepancy or prevention of adverse drug event. The results of the data extraction and quality assessment were presented in structured tables and as a narrative summary. The possible effects of study quality on the effectiveness data and review findings were discussed.

## RESULT

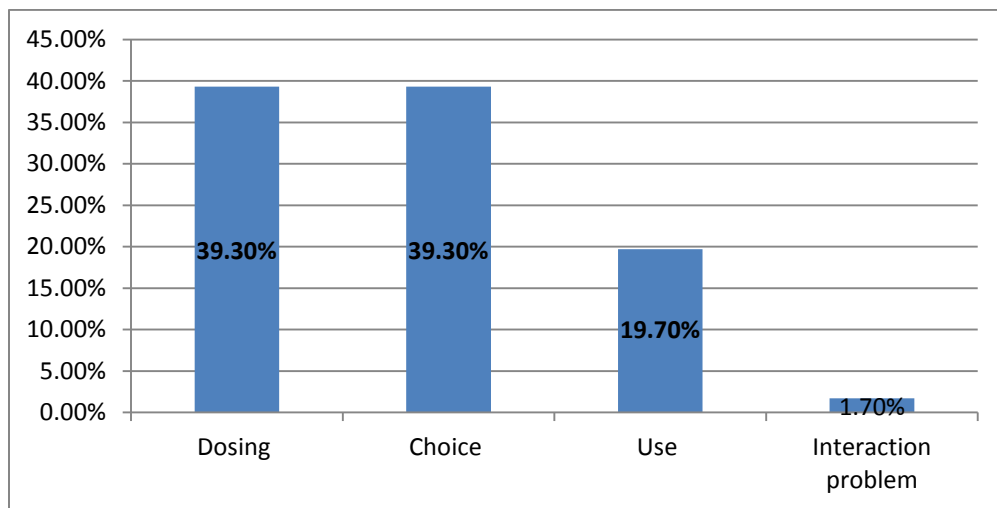
Accumulating studies suggest that pharmacist interventions have major impact on reducing medication errors and related adverse drug events in adults and pediatric patients thus improving the quality and efficiency of care provided.

In a prospective interventional study conducted in the Imam Hospital, Tehran, Iran during 1-year period (from December 2008 to December 2009) 861 patients (450 men and 411 women) admitted to the infectious ward were monitored by the clinical pharmacists for the detection of medication errors. Descriptive statistics and regression analysis were

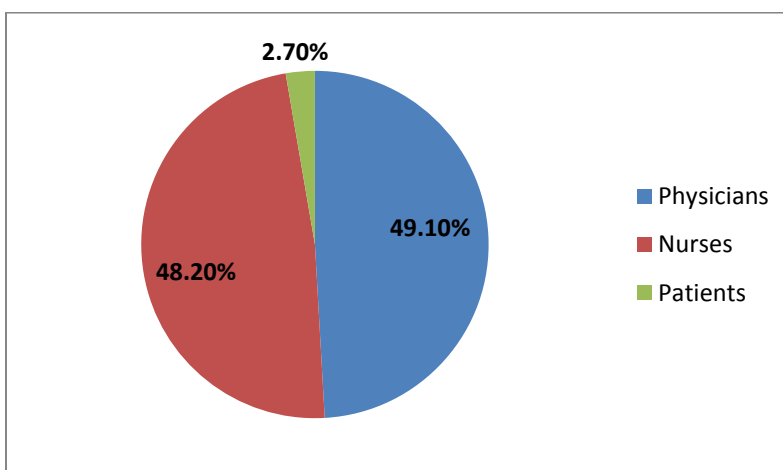
used to determine the occurrence of medication errors. Clinical pharmacists detected 112 errors among 861 patients that admitted to infectious diseases ward. Mean number of medication errors per patient was 0.13. Numbers (percent) of each type of medication errors were as follow: dosing 44 (39.3%), choice 44 (39.3%), use 22 (19.7%), and interaction problems 2 (1.7%) [Graph1]. In evaluation of the

medication errors origin, physicians were responsible for 55 (49.1%) of the detected errors in medication processes. Nurses are involved to the 54 (48.2%) of the medication errors, whereas patients were responsible for 3 (2.7%) of them. [Graph 2]. All of these errors were detected by clinical pharmacists and they made recommendations about these errors.

**Graph 1: Percentage of type of medication errors**



**Graph 2: Percentage of medication error origin**



A retrospective study was conducted during the period of January 1<sup>st</sup> 2010 to December 31<sup>st</sup>, 2010 at the Morumbi ED of Hospital Israelita Albert Einstein

(HIAE). This unit sees adult and pediatric patients, daily treating approximately 400 cases in the clinical

areas of obstetrics, clinical, surgical, psychiatric, and pediatric and trauma. A total of 3,542 medical prescriptions were evaluated and there were 1,238 interventions found. The classifications and quantities of interventions were related to route of administration 105 (8.48%), frequency 73 (5.89%), dosage 431 (35%), renal function 14 (1.13%), compatibility 50 (4%), dilution 121 (9.77%), legibility 39 (3.15%), pharmacovigilance 7 (0.56%), adverse reaction to medications (ARM) 7 (0.56%), allergies 35 (2.82%), time of infusion 76 (6.13%), indication 52 (4.20%), medication reconciliation 2 (0.16%), enteral administration of medications 38 (3%), scheduling 7 (0.56%), specific protocol for anticoagulants 44 (3.55%) and specific protocol for hypoglycemic agents 42 (3.99%). The benefit of clinical pharmacist involvement in patient care was observed based on the number of interventions that occurred.

From January 2002 until January 2003, medication errors were prospectively reviewed in a large, tertiary referral neonatal intensive care unit. Errors were identified using critical incident reporting forms. A total of 105 errors were identified, four serious, 45 potentially serious, and 56 minor. Most (75%) were reported by the clinical pharmacist, the four serious errors included two involving 10-fold dose miscalculations. In one case, an infant who received an opiate overdose required naloxone, and in the second an antibiotic overdose was given which required no specific treatment. The third serious error involved administration of an antibiotic to the wrong baby. There was no direct harm to the infant. The final serious error was a "near miss" situation involving the use of insulin rather than heparin to reconstitute a bag of "heparinised" saline. Most (71%) of the medication errors were due to poor prescribing. Input from a clinical pharmacist, particularly within the context of a risk management programme, is important in the NICU both to monitor medication orders and to provide education to frequently changing members of staff.

## DISCUSSION

Medication error is an essential variable to determine patient safety services, so it is crucial to realize the weak points of health care members regarding medication error and provide an educational program

to resolve them. Studies have shown the benefit of pharmacist's interventions in improving patients' outcomes by involving in the health care team rounds, interviewing patients, reconciling medications, and providing patient discharge counseling and follow-up.<sup>[8,9,12]</sup> In the prospective study conducted in the Imam Hospital, Tehran, Iran, for one year the most common error types were drug dosing and choice problems.<sup>[12]</sup> As per the retrospective study conducted at the Morumbi ED of Hospital Israelita Albert Einstein 431 medication error related adverse drug events were identified. The benefit of clinical pharmacist involvement in patient care was observed based on the number of interventions occurred. Medication errors prospectively reviewed from January 2002 until January 2003, in a large tertiary referral neonatal intensive care unit a total of 105 errors were identified, four serious, 45 potentially serious, and 56 minor. 75% of the cases were reported by the clinical pharmacist. Inexperience is a particular risk factor for medication errors.<sup>[13-16]</sup> This is supported by our own findings.

## CONCLUSION

Clinical pharmacists have critical role in reducing medication errors, adverse drug reactions and adverse drug events. This review underscores the importance of pharmacist-physician-patient collaboration for all patients notably in the pediatric age group. The types of errors indicate the need for continuous education and implementation of clinical pharmacist's interventions. Most reported drug errors did not result in patient harm; however drug error types, drugs categories and clinical pharmacist interventions varied between the inpatient and outpatient settings. Communication-based recommendations or interventions were more common in the outpatient setting, whereas drug regimen changes were more common in the inpatient setting. Nearly half of reported errors were prevented by clinical pharmacists before the drugs reached patients and the majority of clinical pharmacist interventions and recommendations to prevent or ameliorate drug errors were accepted by prescribers. Our review supports the use of clinical pharmacists in the inpatient setting to improve the quality, safety, and efficiency of care. By further developing

collaborative health care, the clinical pharmacist can be an integral part of the inpatient care team. More research is needed to better understand the role of clinical pharmacists, clinical areas most likely to benefit, and patient-specific factors associated with improvements. Cost effectiveness can also be improved by identifying pharmacist duties most

beneficial to patients and determining whether less skilled and costly personnel can perform other duties. Future studies should describe interventions in sufficient detail that they can be reproduced and outcomes such as medication appropriateness and adherence should be measured using validated instruments.

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