Comprehensive Study on Medication Error to Improve Patient Safety

Prakash Kalke[1], Darshana Mundhe[2]

[1]Assistant Professor, Symbiosis Institute of Health Sciences (SIHS), Symbiosis International (Deemed to be) University, S.B. Road, Pune, Maharashtra, India, [2]Assistant Professor, Bharati Vidyapeeth (Deemed to be) Dental College & Hospital Pune, Maharashtra, India

Abstract

Despite of the increasing advancement in the healthcare system, medication errors continue to exist. These errors are an increasing burden in modern healthcare practice in terms of both human sufferings and financial costs. Classification, Preventive Measures and the methods of Incident Reporting are the crucial elements to be considered while determining medication errors. The data available for same is vast and widely distributed. So an effort is made to compile the data available and provide a learning platform to improve understanding regarding medication errors among trainees as well as all healthcare professionals in order to upgrade the existing healthcare facilities.

***Key words**: Crucial elements, incident reporting, medication errors, patient safety, preventive measures, healthcare providers.*

Introduction

Medication errors leave remarkable impact on both known and unknown subject. Neglected, unnoticed or non- documented errors can prove to be fatal. Medication errors have also increased burden in modern healthcare practice in terms of both human sufferings and financial cost. Drug- related errors cause an estimated 7000 deaths per year in USA [1]. Also, it has been found that adverse drug event cost a single teaching hospital $5.6 million of which $2.8 million was preventable [2]. Adverse drug event (ADE) is serious type of medication errors. ADE's are defined as injuries resulting from medical interventions related to drugs [3]. Among these ADE's, the preventable ones are medication errors [2–5]. At least 1.5 million preventable ADE's occur every year in the United States [3]. Preventable ADE's costs over $4685 in tertiary hospitals [6] and $3511 in community hospitals [7]. The field of anaesthesia and critical care medicine are even at a higher risk for medication errors due to increased used of highly potent fast acting narrow dose range drugs in a relatively short time period. Medication errors have a large impact on healthcare cost and patient safety as well [6,7.] Numerous studies have been conducted by various authors in the developing countries to evaluate the cause and determine the preventive measures to reduce the same. But the data regarding same is vast and widely distributed. The purpose of this review is to provide a platform to improve understanding regarding medication errors among undergraduates, interns, trainee as well as all healthcare professionals and take a step ahead in reducing the burden of medication error and improve patient safety in the future.

Corresponding author:
Prakash Kalke
Symbiosis Institute of Health Sciences (SIHS),
Symbiosis International (Deemed to be) University,
S.B. Road, Pune, Maharashtra, India. Pin- 411004,
Email: prakash.kalke@gmail.com, drprakash@sihspune.org

Methods

The online data sources Scopus, Web of science, PubMed, JSTOR, Science direct, MESH, google scholar and bibliographic databases were searched for key terms like incident reporting, medication errors, patient safety, preventive measures. Total 980 papers published from

1980 till 2019 were screened. Out of which 33 papers written in an English language, focusing on classification and cause of medication error, preventive measure were included for narrative review.

Definition of Medication errors:

The most compressive and widely accepted definition was proposed by Ferner and Aronson [8].

They defined medication error as a 'failure in the treatment process that lead to or has the potential to lead to harm to patients'. The 'treatment process' also known as the 'medication use process' is collectively the prescribing, compounding, dispensing, drug administration and monitoring processes, which are carried out after the decision for treatment has been made by the doctor. A 'failure' is the inability to attain a specified standard during the course of these processes.

The United States National Coordinating Council for Medication Error Reporting and Prevention defines a medication error as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labelling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use"[9].

Classification of Medication Errors

Medication error can be classified in many ways some of the commonly used methods of classifying medication errors are as follows.

I. According to their cause [8]

a. Mistakes: happen when an error is made in planned action. Further subdivided as

i. Knowledge- based errors: are due to lack of knowledge

E.g. Doctor prescribing wrong dose of drug due to unfamiliarity.

ii. Rule- based errors: are due to misapplication of a good rule or application of a bad rule.

E.g. prescribing penicillin-related drug to patient with known drug allergy to penicillin despite a system warning.

b. Skill- based errors: are committed when executing correctly planned actions. Could be

i. Slip (action based) E.g. pharmacy technician intends to dispense amoxicillin but picks wrong bottle and dispenses ampicillin.

ii. Lapse (memory based) E.g. nurse intends, but forgets to administer the evening dose of drug to a patient.

II. According to the stage in the process [8]

a. Prescribing errors: further subdivided as

i. Irrational and inappropriate prescribing: occur if drug is prescribed based on missing or incorrect information and also if drug is prescribed without understanding the relation between the pathophysiology of the problem and the mechanism of action of the drug.

ii. Ineffective prescribing: is prescribing a drug that is not effective for the indication in general or for the specific patient.

iii. Under prescribing; is failure to prescribe a drug that is indicated and appropriate, or the use of too low a dose of an appropriate drug.

iv. Overprescribing: is prescribing a drug in too high a dosage.

b. Transcription errors: specific type of data entry error that is commonly made by human operators

c. Dispensing errors

d. Drug administration errors

Dispensing errors and drug administration errors are further subdivided as

i. Wrong drug: is giving totally different drug than that is prescribed

ii. Wrong dose: giving high or low dose

iii. Wrong frequency: advising to take a particular drug once rather than twice.

iv. Wrong route: giving oral dose rather than intravenous/intramuscular.

v. Wrong patient: giving a drug not intended for that patient.

III. According to the severity of outcome [10]

They are classified as per the degree of severity as

a. A- Potentially serious error that can cause permanent harm to patient, may increase hospitalization or need of additional treatment.

b. B- Clinically significant error can increase need for patient monitoring.

c. C- Clinically non- significant error that does not harm the patient.

IV. According to medication error severity index [9].

The most widely used severity scoring system for medication errors was introduced by the National Coordination Council For Medication Error Reporting And Prevention (NCC MERP) of United States.

Is based on severity reporting program and is effective in identifying problem areas and trends so that quality assurance and medical committees can implement measures to improve drug use.

But this system underestimates the actual number of medication errors.

The categories of medication errors as per severity index are:

Category A: circumstances or events that have the capacity to cause errors.

Category B: An error occurred but the medication did not reach the patient.

Category C: An error occured that reached the patient but did not cause patient harm.

Category D: An error occurred that resulted in the need for increased patient monitoring, but no patient harm.

Category E: An error occurred that resulted in the need for treatment or intervention and caused temporary patient harm

Category F:An error occurred that resulted in initial or prolonged hospitalization and caused temporary patient harm.

Category G: An error occurred that resulted in permanent patient harm.

Category H: An error occurred that resulted in near- death event.

Category I: An error occurred that resulted in patient death.

V. According to the nature of onset [11]

They are distinguished by the length of time taken for a bad outcome to occur and the place in the organizational hierarchy where the errors originate.

a. Active errors: have an immediate effect; active errors are committed by people who are in direct contact with patients

b. Latent errors: have delayed effects; latent errors occur due to failure in strategic decision making in the system that takes place higher up in the organizational hierarchy. They do not have immediate bad outcomes, and may lie dormant for a long time until they combine with an active failure to allow an error to happen.

Preventive Measures:

According to Reason's theory, medication errors occur as a result of combination of both active and latent failure[12,13].

Active failures occurs due to human negligence, carelessness and forgetfulness [13]. But human errors are inevitable.

On the other hand, medication errors can be easily reduced by stopping latent failure by improving the system in a way that error cannot occur[13].

Broad approaches that can be used to combat medication errors are as follows –

A. Technological Interventions

a. Computerized Prescription Order Entry [14]

Refers to a process of medical professional entering and sending medication orders, test results and treatment instructions electronically via a computer application instead of on paper charts directly to the pharmacy or other healthcare provider to administer to patient.

b. Computerized decision support system [15,16]**.**

Is defined as "any software designed to directly aid in clinical decision- making in which characteristics of individual patients are matched to a computerized knowledge base for the purpose of generating patient-specific assessments or recommendations that are then presented to clinicians for consideration."

c. The Prescribing Information & Communication Systems [17]

Is an evolving system developed in Birmingham, England. It combines electronic prescribing facilities together with patient history and reports and contains algorithms to prompt the prescriber.

d. Personal Digital Assistants [18,19]

Also known as Handheld Computers, Pocket Personal Computers and Palm Pilots.

They are pocket sized computers that are capable of accessing the internet, sending and receiving data and storing textbooks worth of information.

They provide immediate access to vital and clinically relevant disease information at the point of care.

Several infectious diseases applications are available that provide information on pathogens, diagnosis, medication and treatment.

e. Mobile Clinical Assistants (MCA) [20]

These are smart phones and tablets containing medical software for use by Health Care Providers.

Smartphones and tablets combine both computing and communication features in a single device that can be held in hand or stored in a pocket, allowing easy access and use at the point of care. With the advancements, MCA's have become handheld computers.

f. Automated Dispensing Machines [21]

Are decentralized medication distribution systems that provide computer-controlled storage, dispensing, and tracking of medications.

g. Smart Devices [22]

Smart devices have built-in drug libraries and dose error reduction system (DERS), which allow the users to choose the desired medication from an approved list and input the required patient information, after which the smart devices calculate the infusion rate. Drug libraries contain the most commonly used IV medications and the DERS alerts the user if the calculated infusion rate exceeds the normally accepted dosing limits. These dosing limits can be expressed as either hard dose limits (i.e. cannot be bypassed by the users thereby preventing users from starting the programmed infusion) or soft dose limits (which provide a warning that the dose may be too high but will still allow users to start the infusion as programmed after the limits are acknowledged).

h. Bar-code Assisted Drug Dispensing (BCDD) System [23]

The BCDD System consists of a barcode printer, a barcode reader, a mobile computer (with Wi-Fi), a computer server and software. Each drug in the hospital is labelled with a unique barcode. When a patient is prescribed medication it is faxed, sent electronically or hand delivered to the hospital's pharmacy and entered into the computer system by a pharmacist. The pharmacist dispenses the barcoded dose of the drug to the patient's floor. When it's time for the clinician to administer the medication, he uses handled device to scan the barcodes on his identification badge, the patient's wristband and the drug. If the barcode point-of-care system (BPOC) cannot match the drug to be given with the order in the system, it alerts the clinician with a visual warning. Each patient's barcode holds all the information about the patient and his medication. The BPOC system is designed to make sure that the right drug is given to the right patient via the right route in the right amount and at the right time. This is referred to as the "Five Rights."

Advantages of Technological Interventions[14–18,20–24]

- Standardizes the medication order.

· Eliminates the illegibility of hand written prescriptions.

· Eliminates verbal orders.

· Minimizes human errors.

· Increases evidence- based practice.

· Helps in decision making and selecting drugs as per patient's needs.

· Decrease Medication error.

Limitations of Technological Interventions

· Large capital is required for installation of the systems.

· Successful implementation depends on user attitudes and acceptance of technology.

B. Improving the Quality of Hand-Written Prescriptions

Following Strategies should be incorporated to improve the quality of Hand-Written Prescriptions

i. Using Standard Prescription Formats [25].

j. Using 'one write' non-carbon prescription forms that generate an instant copy [26].

k. Using standard approved abbreviations [25,26].

l. Introduction of 'Do Not Use' list of error-prone abbreviations [27–29].

m. Teaching medical undergraduates universal prescribing standards [30].

C. Marking Or Labelling Of Storage Facility [31,32]

All Drug Storage facilities (small or large) should have proper markings or labels; whether it is related to Pharmacy, Nursing Station, Operation theatre, Wards, emergency drug trays, etc, this will help in avoiding medication errors while handling look-alike medicine ampoules, vials or drug packagings. Unique identification marks or colour codes can be used.

Syringes in anaesthesia departments also can be labelled or different colour codes can be used to prevent medication errors.

D. Preparing Check List And Judicious Follow Up By Second Person [31]

Standard check list should be prepared and judiciously followed by the healthcare provider team. For e.g. in operation theatre before starting any procedure, the operation theatre technician should check operation theatre against standard check list and emphasize on issues related to technical details, after that sister in-charge should do the same and emphasize on issues related to her services, later junior doctor and senior doctor of respective specialty should do the same before starting the procedure. This helps in eliminating errors at each level.

E. Detailed Referral Notes

All referral cases should have comprehensive referral note. The note should contain essential information in relation to patient's past history, as well as medication administered and procedures carried out at primary level. This will alarm the treating doctor regarding the patient's condition and prevent repetition of any error if at all it has occurred.

Incident reporting:

With the advancements in the field of education and technology, patient's awareness and knowledge about diseases and their management is also increasing, so healthcare providers need to be more vigilant to avoid unfortunate outcomes and medico-legal claims. All efforts should be invested in reporting and prevention of medication errors.

Annie et al in their survey in India found that fear of medico legal issues (43.3%), fear of judgment from colleagues (23%) and unavailability of a system or an authorized person to report (20.2%) were reasons for not reporting errors[32].

"Culture of blame" and a notion that an error can be a sign of inability on the part of the physician were identified as barriers to incident reporting in various studies [33,34]. Without reporting there can be no data and without data there can be no analysis and without analysis active and latent conditions will remain undiscovered and may influence future occasions.

Data regarding incident reporting in the developing world is scare which is indirectly increasing burden on healthcare providers; so following strategies should be incorporated.

1. Establishment of blame free, non-punitive environment where errors are openly reported and discussed without fear of retribution, penalties or loss of employment.

2. Empowerment of all medical personnel to voice concerns when they believe actions may lead to patient harm. This technique is known as a "hard stop" where any healthcare professional can call for an immediate cessation of the process if they believe harm could result to the patient.

3. Quadruple learning. Means using feedback to learn local lessons and make local changes at the level of individual practitioner or team; using that information to also make changes at level of institutions or hospitals, while simultaneously feeding the reports into a national system and being able to share the national information at international level.

Conclusion

Healthcare providers being humans make errors from time to time. Medication error being 14th cause of death all over the globe becomes concern for healthcare fraternity. There are various causes of medication errors and numerous preventive measures to avoid them. It is of utmost importance to accept that error can occur at any and every stage of drug administration and the healthcare providers should be vigilant enough to identify the error, report them in a blame free environment, analyse the root cause and take measures to change the procedures as per the lessons learnt and continue the monitoring process. All the healthcare organizations should be vigilant to implement the technological advancements as well as training of professionals for same to ameliorate the existing facilities and improve patient safety.

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