

## STREAMLINING MEDICATION MANAGEMENT IN HOSPITALS

<sup>1</sup>D. SHREEDEVI & <sup>2</sup>V. KOTI REDDY

<sup>1</sup>Associate Professor, Apollo Institute of Hospital Administration, Hyderabad, AP

<sup>2</sup>Assistant Professor, Apollo Institute of Hospital Administration, Hyderabad, AP

### ABSTRACT

Medications play a primary role in increasing life expectancy and improving quality of life. Thus, it is a big challenge for the hospitals to utilize services efficiently to serve maximum patients with the present infrastructure. This study will help the stakeholders of medication management process in taking proper measures in reducing the turn around time of medication, dispensing system and rule out the causes of medication errors. In this study the data collected have been analyzed to identify the present trend, find out root causes, identified causes for delay in all sub stages and proposed recommendations for improvement. It is examined that lack of proper communication between pharmacist, nurses, doctors, and ward boys is the reason for higher turnover time. This study has sought to contribute to the improvement of the medication management system and alert health care professionals to its potential and problems. The study also focused on various sub process of medication management system through FMEA which includes prescription, order entry, dispensing, storage, administration of medication to patient and documentation.

**KEYWORDS:** FMEA, Medication Errors, Medication Management Process, Failure Modes

### INTRODUCTION

Medication management is one of the major components of health care in which many people are prescribed/administered medications to support and improve their health conditions. Various health care workers like physicians, nurses, pharmacist, quality managers and health care administrators have a major role to play in the medication management process. Medication errors in hospitals are common. Medication errors are those preventable acts that may cause or lead to inappropriate medication use or patient harm. Such events may be related to professional practice, health care products, procedures and systems. Therefore, controlling of medication errors are an important function for patient safety interventions. Implementing safety norms, organised and efficient medication management system is essential for controlling errors and assuring that the medical prescription is safely followed.

### Review of Literature

Arun D. Butt<sup>1</sup> examined that adverse drug reactions are the most common cause of death in US, accounting for more than 1,00,000 deaths per year. For India the extrapolated figures are more than 4,00,000 per year and incidence of serious Adverse Drug Reactions is 6.7% and fatal ADR's are 0.3%. León Villar J et al<sup>2</sup> conducted a prospective, descriptive and cross-sectional study for a period of three year duration on total number of errors reported.

The largest number of errors was reported by the nursing staff with 54.08% followed by the pharmacist with 39.55% and the doctor 4.47%. Prescription errors were the most frequent, followed by validation and preparation errors. There was an increase in errors year after year during that study period.

Burnett, Franklin et al<sup>3</sup> have conducted a study on prescribing errors in hospital inpatients. The results showed that the error rates on medical admissions wards were significantly higher than that on surgical wards. The contributing factors for medical errors are lack of feedback on errors, poor documentation and communication of prescribing decisions and lack of information about patients' medication histories from primary care. They have concluded that there were variations among wards, organizations and specialties in error rates and how quickly they were rectified. Burman<sup>4</sup> conducted an exploratory study on reducing medication errors through naming, labeling and packaging. The results showed that up to 25% of all medication errors are attributed to name confusion and 33% to packaging and or labeling confusion.

The study recommends developing systems that may reduce the occurrence of such errors. Westbrook, Wood et al<sup>5</sup> conducted an observational study on association of interruptions on medication administration errors. They found the association between interruptions and clinical errors was independent of hospital and nurse characteristics. Error severity increased with interruption frequency.

### **Objectives of the Study**

The main aim of the study is to identify the causes of medication errors and to streamline the medication management system in hospitals:

- To identify the root causes and suggest suitable workable solutions to improve the process flow for medication management system.
- To study the causes and effects of medication errors in medication management system through FMEA.
- To identify which sub-processes of the medication management process has the highest *Risk Priority Number* and recommend solutions to improve the sub processes

### **Limitations of the Study**

- The study was only limited to inpatient pharmacy. It does not cover OT pharmacy and OP pharmacy.
- The study does not include the analysis of billing time for the ordered medicines.
- Time taken for the administration of drugs by the nurse after receiving the ordered medicines is not considered.

### **Research Methodology**

The study is basically exploratory in nature. It explores the potential medication dispensing, administration and documentation functions which are day-to-day operational activities of a corporate hospital. The information is collected from various sources like case sheets, ward indenting system, pharmacy department, and nurse stations. Direct observation method of data collection has been used.

The observational data has been collected from Cardiac Intensive Unit, AMCU, Female General Ward, Orthopaedic ward and Pharmacy. The data has been obtained through simple random sampling. The sample size includes 200 samples from pharmacy and 50 samples are collected from wards and ICU's. The relevant secondary data has also been collected from medical records, books, journals, articles published and the websites.

### **Analysis and Interpretation**

For analysis of the collected data the quality tools like Process Mapping, Check List and Failure Mode Effect Analysis are used. Medication errors can occur in hospitals, at the pharmacy, in the doctor's office, and even due to patient. Problems can include adverse reactions and interactions with other medications, and also basic administrative errors such as patient being given the wrong medication or wrong dosage medication. Percentage of errors occurring at different stages of medication management process is shown in the following table.

**Table 1: Percentage of Errors**

39%	12%	11%	38%
Ordering	Order Verification	Preparation & Dispensing	Administration
Physician	Pharmacist	Pharmacy technicians & nurses	Nurses
Contradiction	Contradiction	Similar looking drugs	Wrong patient
Bad handwriting	Wrong dosage	Wrong drug	Wrong drug
Wrong dosage	Drug interactions	Wrong dosage	Wrong time or omitted
Wrong dose	Intervention		Wrong dosage

Medication error is one of the major crises faced by many hospitals. Ordering error is the mostly occurred error, followed by administration error, then order verification error and finally preparation and dispensing error.

## TYPES OF ERRORS

Medication errors can be classified into intercepted and actual errors. Prescription errors that are corrected and prevented by Prescription Audit Team are called as intercepted errors. (On the basis whether drug reaches the patient or not) Both types of errors are further divided as:

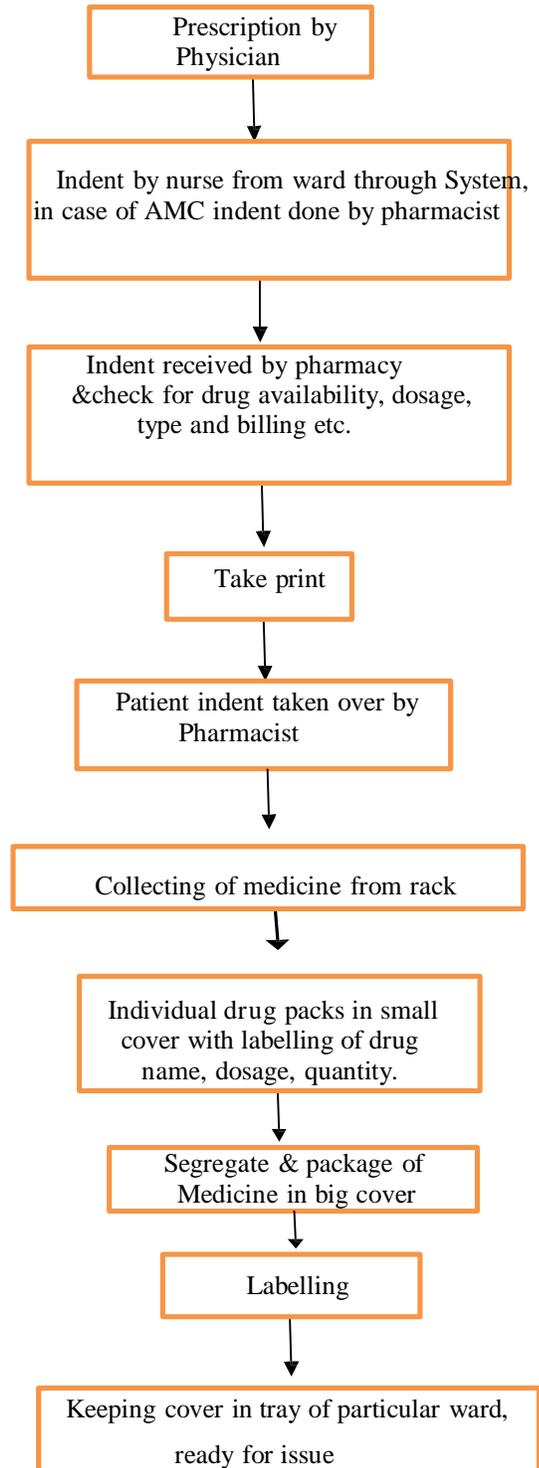
1. Prescription Error                      Orders that are not legible, without specified route, without indication, inappropriate dose, and without/incomplete frequency.
2. Transcribing Error                      Orders that transcribed incorrectly and with no allergy documentation.
3. Dispensing Error                         Dispensing of wrong drug/dilution with wrong method of preparation.
4. Administration error                      Missed dose, administration without physicians order, and non-documentation of the medication administration.

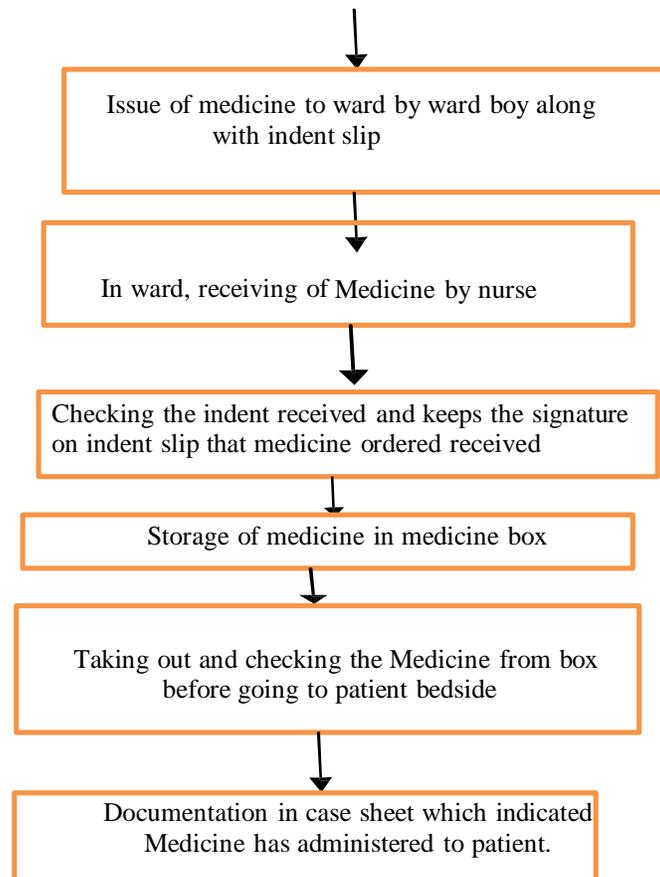
## Medication Management Process in IP Pharmacy

A process is a set of actions or steps, each of which must be accomplished properly in the proper sequence at the proper time to create value for a customer or patient. For understanding and improving patient flow, identifying the critical paths to minimize delays and resources utilization and to maximize quality of care is a must.

One of the most extensively used facilities by a hospital is the pharmacy department. The objective of the department is to provide authenticated quality drugs to the patients. There are computerized indents that are used to receive the indents from the wards and ICUs, where drug requisition is placed every minute.

#### MEDICATION PROCESS FLOW





The data observed from 50 samples regarding turnaround time for receiving medicine to wards is very high with an average time of more than one hour. Similarly, the time taken for dispatching indent to wards is also high in certain cases out of 200 samples observed with an average turnaround time of more than 2 hours 45 minutes. In order to identify the reasons for increased time, an FMEA analysis is also used to identify the sub processes and the failure modes involved in the medication management process, and recommend corrective action.

### **FAILURE MODE AND EFFECT ANALYSIS**

FMEA (Failure Mode and Effects Analysis) is a proactive tool, technique and quality method that enables the identification and prevention of process or product errors before they occur. Within healthcare, the goal is to avoid adverse events that could potentially cause harm to patients, families, employees or others in the patient care setting.

#### **FMEA Procedure**

The process for conducting an FMEA is outlined below

1. Creation of a multi-disciplinary team involving Medical Superintendent, Hospital Administrator, Nursing Superintendent, Assistant Nursing Superintendent, Supervisor Nurses, ICU In-charge, Pharmacologist and Pharmacists.

2. Listing of all the steps in the medication management process, and creation of a process flow diagram, after the brain storming sessions. This shows the logical relationships of components and establishes a structure around which the FMEA can be developed.
3. Identification of the failure modes i.e., any component, subsystem, process could potentially fail to meet the design intent.
4. Describing the effects of those failure modes. For each failure mode establishing a numerical ranking for the severity of the effect. The industry standard scale uses 1 to represent no effect and 10 to indicate very severe.
5. Identifying the causes for failure mode. The potential causes for each failure should be identified and documented. A numerical weight should be assigned to each cause that indicates how likely that cause is. Industry standard scale uses 1 to represent not likely and 10 to indicate inevitable.
6. Determining the likelihood of detection, the score between 1-10, and 10 being most unlikely to be detected.
7. Calculation of Risk Priority Number (RPN) which is a product of severity, probability and detection sub-scores.
8. Pareto analysis of the failure modes as regards their Risk Priority Number and identification of failure modes that require urgent intervention and designing preventive measures for these failure modes.

The above mentioned procedure of FMEA has been conducted on medication management process in IP pharmacy on ten sub process and RPNs are calculated. After the recommended actions the RPNs are reduced, which is shown in table 2.

**Table 2: Failure Mode Effective Analysis on Medication Management Process**

SN	Process or sub process	Potential failure mode	Potential failure effect	SEV	Potential Causes	OC	Current Controls	DET	RNP	Recommended actions	SEV	OC	DET	RNP
1	Prescription by physician	Illegible hand writing	Nurse may not be able to follow the prescription	3	By nature	7	Nil	10	210	Nurse verifying the orders immediately after the orders are documented	2	1	1	2
			Nurse may indent wrong medication	6	By nature	7	Verification of orders in discussion with DMO	1	42	Nurse verifying the orders immediately after the orders are documented	2	1	1	2
		Incomplete medication orders	Indent process may be delayed	3	Negligence	6	Nurse verify complete details with DMO	1	18	Verification of complete details in discussion with DMO	2	1	1	2
	Indent placed by nurse / pharmacist	Wrong medication is indented	Patient may receive wrong medicine	6	Not checking the case sheet/medication orders properly while keeping indent	6	Double checking of indent before finalizing with case sheet	1	36	Instruct the nurse that double check the case sheet/medication order carefully while indenting	3	2	1	6

2		Incomplete medication indenting	Medication dispensing from pharmacy delayed	2	Checking of the indent before finalization not done	5	Double checking of indent before finalizing	1	10	Nurse should double check the medications before indenting for its completeness like drug name, dosage	2	1	1	2
		Wrong patient indent	Medicine is billed on wrong patient	6	Negligence	4	Double checking of indent before finalizing	1	24	Nurse should check for patient details like name, IP number before indenting	2	2	1	4
		Repeat indenting	Unnecessary billing is done	3	Negligence	6	Verification of previous indent	2	36	Should check previous indents properly before sending another indent for same patient	2	2	1	4
3	Indent reaches pharmacy	Indent may not reach the pharmacy	Delay in dispensing may occur	3	Failure of system	1	EDP department available for maintenance	1	3	IT department to be informed	2	1	1	2
4	Billing of the medications	All medications may not be billed	All the required medicine are not dispensed to ward	3	Not verifying the bill against indent ordered	6	Nil	10	180	Pharmacist double check all the medications bill before finalizing/printing	2	5	1	10
5	Required medications are arranged from racks as per the invoice	Wrong medication may be arranged	wrong medication may be dispatched to ward	6	Negligence	4	Arranged medicines are checked by other pharmacist against indent	2	48	Pharmacist double check the indent slip carefully while collecting medicine from rack	3	2	1	6
		Incomplete medications may be arranged	All required drugs not dispensed to ward	5	Negligence	5	Checking all the medications along with indent slip before final packing	2	50	Pharmacist should check all the medications received from rack before packing along with indent slip	2	2	1	4
		Repeat medications may be arranged	Nurse may receive extra medicine which create confusion	2	Negligence	3	Double check done by second pharmacist before final packing	1	6	Double check to be done before final packing of medications.	1	2	1	2
	Packing of drugs and labelling	Wrong drug may be packed	wrong medicine is dispatched to ward	5	Negligence	2	Double check done by second pharmacist before final packing	1	10	Double check to be done along with indent slip before final packing of medications.	3	1	1	3
		Incomplete drug packing	Nurse may receive incomplete medications	3	Double check may not be done before packing	6	Double check done by second pharmacist before final packing	1	18	Before final packing, all medications should check by second pharmacist.	2	5	1	10

		Wrong labelling	May cause misinterpretation in administration of drug by care givers/nurse	7	Negligence	2	Verification done by second pharmacist before final packing	1	14	Labelling should be complete like patient name, IP number, drug name, dosage	4	2	1	8
7	Packed medicines are arranged in trays for dispatch	Medicines kept in wrong tray	Delay in receiving medicine to the respective ward	3	No proper segregation of trays	7	keeping separate trays for each ward with labelling	2	42	Segregate the trays for each ward with clear labelling	2	4	1	8
			misplacement of medicine may occur	3	No proper segregation of trays	6	keeping separate trays for each ward with labelling	2	36	Pharmacist check for tray labelling before placing packed medicine into the tray.	1	4	1	4
		Medicines packed may be left on the packing table	Delay in dispatch	3	Negligence	2	Nil	10	60	Should check the medication packing table before dispensing medicine to ward	2	1	1	2
8	Medicines are dispatched to wards	All medications to be dispatched to a particular ward may not be dispatched	patient may receive wrong medicine	6	Ward boy may not take/miss some medications to be dispatched to the particular ward	4	Allotting wards to each ward boy separately for dispensing medicine	2	48	Training to be provided to the ward boy in areas of transport, dispensing	2	2	1	4
		Damage of medications during transport	Nurse may receive damaged medications	3	Negligence	3	Sensitization of boys	4	36	Ward boy should carry the tray with delicate medicines like vials and ampoules carefully while dispensing to wards	2	2	1	4
		Missing of medications during transport	Nurse may not receive all the medications ordered	3	Ward boy may miss some medications during transport	2	Sensitization of boys	4	24	Ward boy should carry tray with limited medicine each time	2	2	1	4
9	Receiving and verification of medications in ward	Wrong medications may be received by nurse	Wrong medication administration may occur	7	Nurse may not verify the medications received as per the invoice	7	After receiving medication nurse verifies and keeping signature on indent slip and sending a copy back to pharmacy	2	98	Nurse must verify the medications received with indent slip for patient name, i.p number, drug name, dosage	4	3	1	12

10	Storage of medicine in patient individual medicine box	Misplacement in other box	Nurse may administer medication to wrong patient	7	Negligence	5	Storing in patient medicine box with labelling of patient room number and IP number	1	35	Nurse should check patient name, i.p number before keeping medication in individual medicine box	2	4	1	8
		Improper storage against manufacturer recommendations	Drug effect may change due to improper storage	7	lack of knowledge	6	Nil	10	420	Nurse should read the manufacturer recommendations properly for storage of medications	2	4	1	8

After the brain storming sessions among the inter-disciplinary team members, throughout the process mapping and failure mode analysis steps, it was realized that FMEA has brought in a high level of objectivity in designing preventive actions. It also became clear that the actions should be aimed at the system defects, and not at individuals. These would also be measurable and hence amenable to control.

A checklist prepared relating to medication storage and administration among the nursing staff in the wards revealed the following compliance score which is shown in table 3.

**Table 3: Nursing Parameter Compliance**

S N	PARAMETERS	SAMPLE SIZE	COMPLIANCE SCORE	COMPLIANCE %
1	A. Storage	50	45	99
2	B. Labelling	50	44	88
3	C. Patient Identification	50	44	88
4	D. Drug Verification	50	47	94
5	E. Dose Verification	50	38	76
6	F. Route Verification	50	46	92
7	G. Time Verification	50	41	82
8	H. Documentation	50	40	80

The non compliance in storage is on account of misplacement of medicine to other patient medication box due to improper labelling. Patient medication storage boxes are not labelled with patient name and IP no., instead they are labelled with bed number and room number in few cases. Patients are not verified for their name and IP number before administering the drugs in few cases. Patient medication chart is not checked completely before preparing medicine tray. Few time's dosage is not verified with medication chart before administering to a patient. Medications are sometimes administered 1-2 hours late.

Sometimes documentation is done by a nurse in medication chart even before the medication is administered to the patient. These were some of the reasons for non-compliance according to the study conducted.

### **Suggestions and Recommendations**

From the study undertaken, the following suggestions can be taken into account like instead of indenting a single drug; nurse can indent total number of particular medicine needed for complete day, so that they can reduce the indent number to the pharmacy. Nurse should verify the indented slip and case sheet while receiving medicine from pharmacy to avoid wrong drug and dose. Double check to be done by other pharmacist before packing of medicine, so that it can reduce the incomplete and wrong medication dispensing to ward. Constant monitoring of the pharmacy boy has to be done by the pharmacy supervisor.

### **CONCLUSIONS**

Medication management is very necessary and it is worth the factor to apply for a better living. Implementing safe, organised and efficient medication management system is essential for controlling errors. An appropriate drug ordering, dispensing, storage, administration systems are important for the prevention and reduction of medication errors in hospital.

### **REFERENCES**

1. Butt D. Arun, "Incidence of Medication Errors", Express Health Care Management, June 2002.
2. Leon Villar J, Aranda Garcia A, Tobaruela Sotom et al, "Analysis of the Errors associated with the Prescription, Preparation and Administration of Cytostatic drugs", Farm Hosp. 2008; 32(3):163-9
3. Burnett, S., Franklin, B.D., Moorthy, K., Cooke, M.W. and Vincent, C. (2012) How reliable are clinical systems in the UK NHS? A study of seven NHS organisations. *BMJ Qual. Saf*, Jun; 21(6), pp. 466-72.
4. Berman A, "Reducing medication errors through naming, labelling, and packaging". *J Med Syst* 2004; 28:9-29.
5. Westbrook JI, Woods A, Rob MI, Dunsmuir WTM, Day RO. "Association of interruptions with an increased risk and severity of medication administration errors", *Arch Intern Med*. 2010;170:683-690.
6. Croskerry P et al. (2004), Profiles in Patient Safety: Medication Errors in the Emergency Department, *Acad Emerg Med*, Vol.11, No.3, pp.289-99.
7. Franklin, B.D., Rosa, M.B., Miller, G. and Jacklin A. (2012) The evaluation of a novel model of providing ward pharmacy services. *Int J Clin Pharm.*, Aug; 34(4), pp. 518-23.
8. Franklin, B.D., Shebl, N.A. and Barber, N. (2012) Failure mode and effects analysis: Too little for too much? *BMJ Qual. Saf.*, Jul; 21(7), pp.607-11.
9. David C. Classen and Jane Metzger. (2003). *International Journal of Quality in Health Care*.
10. Scott M. Mark. (2007), *Developing a Medication Patient Safety Program, Part 2: Process and Implementation*, Wolters Kluwer Health, Inc.
11. Anacleto TA, Perini E, Rosa MB, Cesar CC, Drug Dispensing Errors in the hospital pharmacy clinic. (2007). 243-50.

12. Kaushal R, Bates D W, Landrigan C, MCKenna K J, Clapp M D, Federico F et al. (2001) Medication Errors and Errors and Adverse Drug Events in Patients. JAMA, Vol.285, PP.2114-20.
13. Erin C. Hendricks. (2007). Wolters Kluwer Health, Inc. 916-920.
14. Lesar TS, Briceland L, Stein D S (2007), Factors Related to Errors in Medical Prescribing, JAMA, Vol. 277, pp.312-7.
15. <http://www.skymark.com/resources/tools/cause.aspgement>.
16. [http://www.asq.org/learnaboutquality/datacollection\\_analysis\\_tools/overview/controlchart.html](http://www.asq.org/learnaboutquality/datacollection_analysis_tools/overview/controlchart.html).
17. <http://ncbi.m.nih.gov/pubmed>.
18. <http://Aje.oxford.org/cgi/content/abstract>.