System & Process of Prescribing, Supplying and Administering Medication to Patients and Its Impact on Medication Safety

Internship Training
At
Delhi Heart and Lung Institute

By
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Under the guidance of
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Post Graduate Diploma in Hospital & Health Management
2012–14

Institute of Health Management Research
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TO WHOMSOEVER MAY CONCERN

This is to certify that Dr. Shilpa Sharma student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from Institute of Health Management Research, Jaipur has undergone internship training at Delhi Heart And Lung Institute from February 1, 2014 to April 30, 2014.

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all his future endeavors.

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Date: 5th May 2014

CERTIFICATE OF INTERNSHIP

This Certificate is awarded to ***Dr. Shilpa Sharma*** in recognition of having successfully completing her ***Three Months of Internship on 30th April 2014*** in the department of ***Administration & Operations*** and has successfully completed her project study on ***"Systems and Processes for Prescribing, Supplying and Administering Medicine to Inpatients and ICU Patients and its impact on Medication Administration Safety in Delhi Heart & Lung Institute"***

During her internship, she comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning. She remained involved in her work dedicatedly. She is motivated to take initiative and had been a quick learner and a devoted worker.

We wish her all the best for future endeavors.

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled SYSTEM AND PROCESSES OF PRESCRIBING, SUPPLYING AND ADMINISTERING MEDICATION TO PATIENTS AND ITS IMPACT ON MEDICATION SAFETY and submitted by Dr. Shilpa Sharma Enrollment No IIHMR/PGDHM/2012-14/17-1374 under the supervision of Prof. P.R.Sodani for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from February 1, 2014 to April 30, 2014 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Signature: Shilpa
Date: 26-5-2014

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ABSTRACT

Systems and processes for prescribing, supplying and administering inpatient medications can have substantial impact on medication administration errors (MAEs). However, little is known about the medication systems and processes currently used in the hospital. This presents a challenge for developing interventions to increase medication safety. We therefore conducted an observational study of medication systems and processes in Delhi Heart & Lung Institute to address this knowledge gap.

The research design used will be descriptive type in nature because the purpose of the study was to provide hospital with information on the extent to which medication errors can occur and the presence of factors that generally increase the chance of medication errors which ultimately compromises the patient safety. The data will be collected by direct observation of the patient records, prescription, dispensing and during medication administration. Observation of the storage of the drug at bedside and in the nursing station is done. The study results will be recorded in self developed excel sheet.

We detected a total of 83 breaches in 176 opportunities for errors (47.2%). The most common types of error throughout the medication process were: missed dose, wrong time of administered, wrong dose and some miscellaneous causes. Other factors were also analyzed compromising the medication safety.

There is a need for quality improvement, as almost 32.5% of all errors in doses and prescriptions in the medication process were caused by missing actions. We assume that the number of errors could be reduced by simple changes of existing procedures or by implementing automated technologies in the medication process.

Keywords: medication safety, medication process, quality improvements, automated technologies

ACKNOWLEDGEMENT

"Nothing stops a man who desires to achieve, every obstacles is simply a course to develop his achieve muscle it's strengthening of his powers accomplishment" Eric Butterworth.

My internship started off with a mission in my mind to be accomplished. And my mentors and guides incorporated this motivation into me. Our long and extended thank you note would start with thanking few but most important people during my three months of internship. I would also like to acknowledge with much appreciation the crucial role of the Dr. Sunil Kumar Khetarpal, who gave the permission to do this project in Delhi Heart and Lung Institute and trusting my capabilities. Ms. Dipti Halwasiya for inspiring me towards a meaning full learning and directing my thoughts goals and objectives towards the attitude that drives to achieve, exploring profundity and other aspects that one as a novice needs to be acquainted with.

My sincere thanks towards my guide Prof. P.R.Sodani for his helpful attitude and valuable suggestions.

I am highly grateful to the staff of the hospital for giving me time in spite of their hectic schedule. Without their active cooperation and participation it would not have been possible to accomplish this task.

LIST OF TABLES AND GRAPHS

LIST OF ABBREVIATIONS

ADE: Adverse Drug Events

ADR: Adverse Drug Reactions

CCU: Critical Care Unit

CDSS: Clinical Decision Support System

CPOE: Computerized Physician Order Entry

DHLI: Delhi Heart and Lung Institute

Disp: Dispensing

E: Economy Ward

HDU: High Dependency Unit

ICU: Intensive Care Unit

IOM: Institute of Medicine

LASA: Look Alike Sound Alike

MAR: Medication Administration Record

RFID: Radio Frequency Identification Device

S: Single Room

LIST OF ANNEXURES

INTRODUCTION

One of the important missions of the healthcare providers is to help patients make the best use of medications and very importantly, strive to ensure patient safety. The goal of drug therapy is the achievement of defined therapeutic outcomes that improve a patient's quality of life while minimizing patient risk. There are inherent risks, both known and unknown, associated with the therapeutic use of drugs (prescription and nonprescription) and drug administration devices. The incidents or hazards that result from such risk have been defined as drug misadventuring, which includes both adverse drug reactions (ADRs) and medication errors.

The definition of a medication error as approved by The National Coordinating Council for Medication Error and Prevention 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.

Medication safety is one of the major components in patient safety but unfortunately medication errors do occur and often go undetected. Some medication errors may result in serious patient morbidity and mortality, thus we need to further strengthen the current system with a mechanism to monitor and make recommendations for remedial actions when errors occur and are reported. We need to be able to discuss errors openly, encourage reporting of errors and maintain a culture that is non-punitive and blamelessness. With this, healthcare providers will be able to learn from the errors. The Institute of Medicine's 1999 report suggested that medical errors accounted for 44,000-98,000 deaths each year. These deaths exceed the eighth leading cause of death in the United States **[1]**.

It is estimated that the total cost of medical errors is $17 billion-$29 billion annually. Although the percentage of drug-related medical errors in ambulatory settings is unknown, drugs are the most common cause of medical errors in hospitals, affecting 3.7% of patients. Clearly, medication errors are a significant component of medical errors in hospitals (USA) **[1, 2]**.

Although the frequency of medication errors has been documented, there has been little study of the factors associated with the root causes of these errors. Unfortunately, nearly all studies of medication errors involved a small number of sites (hospitals or pharmacies) or a limited number of patients. Little is known about what factors might be associated with medication errors in a large population of hospitals. More studies assessing the risk of medication errors are needed to determine the best methods for reducing these errors. This study employed to assess factors associated with the medication administration safety of the inpatients in Delhi Heart and Lung Institute, Delhi.

Associations and correlations between hospital staffing (specifically nurses), prescription orders of doctors and copying of that order on to the medication chart (MAR) by the nurse, number of medication prescribed, storage of medication at bedside etc. with the medication administration safety of the patients at bedside. A detailed analysis was done to know the factors compromising the medication administration safety of the patient.

The goal of the drug therapy is the achievement of defined therapeutic outcome that improves patient quality of life while minimizing patient risk **[3]**. Breach in medication safety compromises the patient confidence in the health care system and health care cost both to hospital as well as the patient.

Defect in the medication safety is a multidisciplinary and multifactorial. There are various personnel involve in the medication use process which include doctors/physicians, nurses, pharmacist, ward boys, administrators/ managers, patient, attendant. Nursing staff potentially play a key role in intercepting all types of medication errors and thus preventing patient harm; however nurses are also themselves susceptible to making errors **[4, 5]**. Inadequate nurse staffing (numbers, skill mix, knowledge and experience) is a major potential patient safety concern.

The incidence medication error is indeterminate; valid comparison of various studies on medication error is extremely difficult because of differences in variables, measurements, populations and methods **[2]**. Many medication errors are probably undetected. And sometimes the outcome of these errors may be minimal with few or no consequences that adversely affect the patient. But some medication errors have serious patient morbidity and mortality. So an effective system of prescribing, ordering, dispensing and administrating need to be established.

TYPES OF MEDICATION ERROR-[3]

1. Prescribing error: Incorrect drug selection (based on indications, contraindications, known allergies, existing drug therapy, and other factors), dose, dosage form, quantity, route, concentration, rate of administration, or instructions for use of a drug product ordered or authorized by physician (or other legitimate prescriber); illegible prescriptions or medication orders that lead to errors that reach the patient.

2. Omission error: The failure to administer an ordered dose to a patient before the next scheduled dose, if any.
3. Wrong Time Error: Administration of medication outside a predefined time interval from its scheduled administration time (this interval should be established by each individual health care facility).
4. Unauthorized drug error: Administration to the patient of medication not authorized by a legitimate prescriber for the patient.
5. Improper dose error: Administration to the patient of a dose that is greater than or less than the amount ordered by the prescriber or administration of duplicate doses to the patient, i.e., one or more dosage units in addition to those that were ordered.
6. Wrong dosage-form error: Administration to the patient of a drug product in a different dosage form than ordered by the prescriber.
7. Wrong drug-preparation error: Drug product incorrectly formulated or manipulated before administration.
8. Wrong administration-technique error: Inappropriate procedure or improper technique in the administration of a drug.
9. Deteriorated drug error: Administration of a drug that has expired or for which the physical or chemical dosage-form integrity has been compromised.
10. Monitoring error: Failure to review a prescribed regimen for appropriateness and detection of problems, or failure to use appropriate clinical or laboratory data for adequate assessment of patient response to prescribed therapy.
11. Compliance error: Inappropriate patient behavior regarding adherence to a prescribed medication regimen.
12. Other medication error: Any medication error that does not fall into one of above predefined categories.

Common Causes of Medication Errors:

1. Ambiguous strength designation on labels or in packaging
2. Drug product nomenclature (look-alike or sound-alike names, use of lettered or numbered prefixes and suffixes in drug names)
3. Equipment failure or malfunction
4. Communication barriers
5. Illegible handwriting
6. Improper transcription
7. Inaccurate dosage calculation
8. Inadequately trained personnel
9. Inappropriate abbreviations used in prescribing
10. Labeling errors
11. Excessive workload
12. Lapses in individual performance
13. Medicine unavailable

Communication barriers can result in medication errors during every step within the medication administration process. In many cases, the physicians orally give medication orders, which can create errors due to the fact that many drug names sound alike and can be mispronounced. Doctors often write medication orders, and the nurses transcribe, by hand, the information. Messy and illegible handwriting, by both the physicians and nurses, can result in errors, such as wrong patient, incorrect medication, incorrect dose, and/or incorrect route.

The organizations have struggled to address two questions: how to initiate and sustain a process for improvement and how to identify where improvements are needed. Change must start with a commitment from the leaders, and safety must be incorporated into the organizations strategic plan. Certainly, if patient safety was not a regular agenda item before To Err is Human, it began appearing more frequently thereafter. From the executive suite to front lines, a culture of safety was taking root – in some communities more frequently than others.

The release of the Institute of Medicine's (IOM) report To Err is Human, 2 in November of 1999, was a turning point in health care. The community of providers devoted to delivering medical care was faced with an opportunity to create, from within, systems that reduce medical error and improve patient care. Would the community step forward and acknowledge that there are deaths from medical errors? Would the community identify causes and support change in the name of improved patient care? Or would it shy away from the results and continue practicing as usual? In a follow-up report, crossing the Quality Chasm, the IOM Committee presented a set of principles for change with the caveat that "Trying harder will not work, Changing systems of care will" **[3]**.

Technological solutions will continue to emerge as healthcare continues with efforts to improve safety and quality in all aspects healthcare delivery. Although there is evidence of benefits and improvements in care due implementing such systems, questions continue to arise. Much has been written illustrating the business case for the use of these products (CPOE, CDSS). To realize full benefit of any of these interventions implementation must be coupled with sufficient training and support, employed at all levels, easy to use, compliment

existing tools and protocols within the institution and be just one part of a comprehensive Quality Improvement/Quality Care program.

ADVANTAGES OF CPOE SYSTEMS COMPARED WITH PAPER BASED SYSTEMS

1. Free of handwriting identification problems
2. Faster to reach the pharmacy
3. Less subject to error associated with similar drug names
4. More easily integrated into medical records and decision-support systems
5. Less subject to errors caused by use of apothecary measures
6. Easily linked to drug-drug interaction warnings
7. More likely to identify the prescribing physician
8. Able to link to ADE reporting systems
9. Able to avoid specification errors, such as trailing zeros
10. Available and appropriate for training and education
11. Available for immediate data analysis, including post marketing reporting
12. Claimed to generate significant economic savings
13. With online prompts, CPOE systems can

- Link to algorithms to emphasize cost-effective medications
- Reduce under prescribing and overprescribing
- Reduce incorrect drug choices

So the current study was done to check the status of medication safety in Delhi Heart & Lung Institute and to produce appropriate recommendations for increasing the medication safety as applicable in the Hospital context as one of the means of improving patient's safety in the inpatient/ICU settings of the DHLI.

LITERATURE REVIEW

Medication errors defined as any error in the prescribing, dispensing or administration of a drug whether there are adverse consequences or not, are the single most preventable cause of patient injury. These errors can occur at any stage in the drug use process from prescribing to administration to the patient. A recent report by the Institute of Medicine (IOM) estimated that errors in medical management cause between 44,000 and 98,000 deaths each year in USA hospitals.3 In the USA it has been suggested that the rate of serious medication error is approximately 7%. Medication errors are not confined to the hospital setting. Reports from the Medical Defence Union and the Medical Protection Society revealed that 25% and 19%, respectively, of legal claims against general practitioners related to medication errors.

The occurrence of medication errors can compromise patient confidence in the healthcare system and in addition, increase healthcare costs. Economic consequences may include the award of damages to the patient, extension of a patient's stay in hospital and the potential financial support required for long term care of a patient who suffers permanent injury. In the USA, it has been estimated that the cost of adverse drug events, a proportion of which are due to medication errors, was $5.6m per year for a 700 bed teaching hospital **[6]**.

Barker and McConnell compared the effectiveness of incident reports and voluntary reports to direct observation of nurses as error detection methods **[7]**. Thirty-six errors were documented by incident reports during the year studied. By comparison, two weeks worth of data collected by direct observation when extrapolated over the same one year

period indicated that 51,200 errors may have occurred (including 600 wrong time errors). This figure is 1,422 times the number identified by incident reports. Other studies have confirmed the difference between the two methods **[8, 9, 10, 11, 12]**.

There is a wide acknowledgment that the number of medication errors is underreported. The reported medication error rate ranges from 1.6% to 38% of all medications administered, and it is estimated that only 25% of errors are reported **[13].**

According to a study there were 616 medications errors (5.7%) or 55 medication errors per 100 admissions **[14]**. A studied even showed that "pharmacist confirmed 457 of the 2556 comparison doses to be error, producing a true error rate of 17.9%" **[15]**.

Medication administration errors were used by researchers studying the quality of the output of drug distribution systems back in the 1960's when the unit dose drug distribution system was being developed.**[16]**. Such errors are recognized as an important indicator of quality of drug therapy from the patient's perspective. Research on the effect of automated drug dispensing devices on errors has been performed, **[17]** showing that errors have not been eliminated by technology. Errors of omission and errors of commission were used in one study **[18]**. "Drug misadventure" is a broad label applied to adverse drug reactions, prescribing errors, and medication errors **[19, 20]**.

"Adverse drug events" are defined as an injury from a drug-related intervention, which can include prescribing errors, dispensing errors and medication administration errors - this term has been used in the medical literature in particular**[21]**. 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."

Ongoing quality improvement programs for monitoring medication errors are needed. The difficulty in detecting errors has long been recognized as one of the barriers to studying the problem effectively **[22]**. If the studies referenced by the IOM are extrapolated to the national population, the expected number of deaths nationwide attributable to substandard care actually decreases from 92 000 in 1984 (based on New York data) to 25 000 in 1992. Whatever the accurate figures with regard to mortality are, it is clear that patient safety can be improved **[23]**.

In 2006 costs of preventable adverse drug events are estimated to cost the nation approximately $3.5 billion dollars. Medication errors are often caused by a complex series of system problems. The systemic nature of these problems requires a multi-disciplinary approach. Solutions proposed in the medical literature require the participation of pharmacists, drug manufacturers, information systems (hardware/software, personnel), and the communication efforts of hospital personnel to reduce medication errors. The American Academy of Orthopedic Surgeons (AAOS) recommends the following tools when prescribing, transcribing, dispensing, administering and monitoring patient medications: computerized physician order entry (CPOE); clinical decision support systems (CDSS); computerized monitoring of adverse drug events; pharmacist assisted rounds; high-risk drug protocols; and verbal order verification. These tools have significantly reduced medication errors, improved the quality of care and patient management capabilities, increased reimbursement, and have decreased billing time **[24]**.

METHODOLOGY

Research Questions:

1. What are the incidences, causes and type of preventable medication errors in Delhi Heart & Lung Institute?
2. What is the relation of medication safety with number of medication administered, number of patient assigned to the nurse, work experience of the nurse and acuity and vulnerability of patient?

Hypothesis

HYPOTHESIS 1: Medication safety is found to be inversely proportional to number of medication administered.

HYPOTHESIS 2: There is a direct relation between medication safety and work experience of the assigned nurse.

HYPOTHESIS 3: Medication safety has a relation with the workload of the assigned nurse.

HYPOTHESIS 4: Medication safety has a relation with the acuity and vulnerability of patient.

HYPOTHESIS 5: Medication safety is more if LASA drugs are stored in a separate container at bedside.

HYPOTHESIS 6: Medication safety is enhanced if patient and attendant are educated and participated in their medical treatment.

Objectives

- To find the number of compromises with the medication safety.
- To find the main cause of error in the process of medication administration.
- To find the various nursing variable related to medication safety.
- To provide necessary recommendations.

Research Design

The study was performed in Delhi Heart & Lung Institute. The targeted populations for this research are patients both in patients and ICU. The research design was a descriptive research design. The descriptive survey design was used because the purpose of the study was to provide hospital with information on the extent to which medication errors can occur and the presence of factors that generally increase the chance of medication errors which ultimately compromises the patient safety.

The data were collected by direct observation of the patient records, prescription, dispensing and during medication administration. Observation of the storage of the drug at bedside and in the nursing station is done. The study results will be recorded in self developed excel sheet.

Sample selection:

The study was done by direct observation of the drug administration to the inpatients and ICU patients. The drug administration event during the morning dose hours was selected randomly in any of wards. Due to occupancy of around 40 percents (100 bedded hospital) during the study period a sample 176 drug administration was collected.

Sample size: 176 Medication Administrations

Research Tool:

For collecting the necessary data a performa was developed on Microsoft excel. **Annexure 1**. The data were stored in the excel sheet by directly observing the drug administration process and by auditing the files of patients, and studying the process of dispensing of drug from pharmacy to ward and it storage at the bedside and nursing station.

Data Collection Procedure

The data were collected during the working hours of hospital i.e. between 8AM to 6PM. The data collection period lasted for 20 days. (April 1, 2014 to April 20, 2014). Direct observation of the medical records, the administration process and the storage of the drugs both at nursing station and bedside was done and transported into the self developed data collection instrument.

Data Analysis Plan

The information retrieved from direct observation of the drug administration, patient's charts and prescriptions were transported to the Statistical Package for Social Sciences (SPSS version 16.0) for analysis. Descriptive analysis was performed to describe data for frequency. Further analysis was done to correlate different data variables to assess the areas of magnitude contributing factors. All the other data nurses experience, number of patients assigned, patient vulnerability etc. were coded and put together as combination data for analysis. The combination data was created to give a general analysis of the items since the recommendation is to be used for a general policy strategy for the hospitals.

RESULT

TABLE 4.1

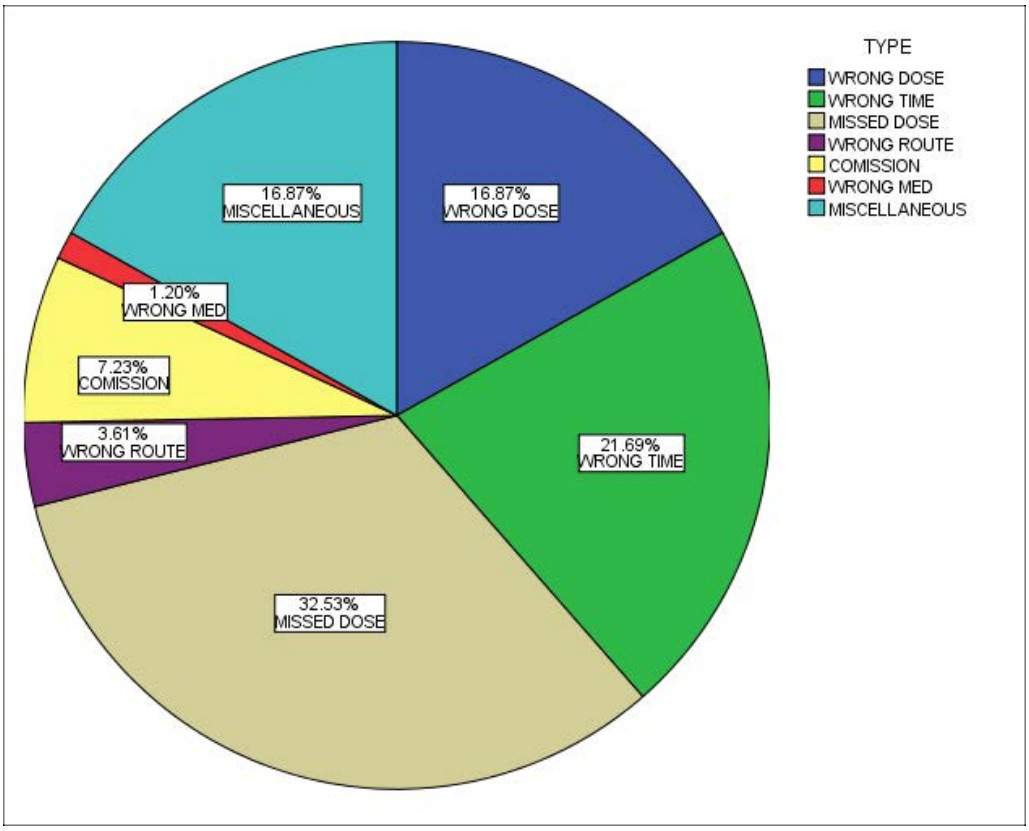
TOTAL NUMBER OF COMPROMISES IN MEDICATION SAFETY

Compromise in Medication Safety	Frequency	Percent
YES	83	47.2
NO	93	52.8
Total	176	100.0

Out of the total administration observed during the study almost in every second administration an incident did occurred as explained by the table given below. As in 47.2% cases (83) some or the other incident occurred which breached or compromised the medication administration safety of the patient. Multiple factors were observed to influence the administration of medication to the patient at bedside.

GRAPH 4.1

TYPE OF EVENTS WHICH CAN COMPROMISE THE MEDICATION SAFETY



The causes of breach in medication safety were mainly due to either missing of a dose (32.53%), or due to wrong time of the administration (21.69%). Other causes are wrong dose, and some other factors like: Brand name different as prescribed, dose as per the reports, incorrect date on prescription, OT Nurse doing the ward duty, revised order not written etc. Minor causes were wrong medicine, wrong rote and commission of a drug stopped by the doctor verbally.

TABLE 4.2

DOSE AND ROUTE MENTIONED IN PRESCRIPTION BY DOCTOR

Dose and Route Mentioned in Prescription By Doctor	Frequency	Percent
YES	153	86.9
NO	23	13.1
Total	176	100.0

In 13.1% of the cases doctors didn't write the dose and route in the prescription. Mentioning of dose and route of the medication to be administered should be mandatory as drugs are available in multiple doses and can be given by different routes which do effect the therapeutic action of the drug on the body.

TABLE 4.3

NAME/TIME/DATE/SIGNATURE BY DOCTOR IN PRESCRIPTION

Name/Time/Date/Signature By Doctor In Prescription	Frequency	Percent
YES	122	69.3
NO	54	30.7
Total	176	100.0

In 30.7% of the prescriptions doctors missed to write all or any of the following:

- Name
- Time
- Date
- Signature

This decreases the chances of liability of the person responsible for any error and also lead to increase in medication error due to confusion created. As if the drug was stopped or started by a doctor but he/she has not written the time, date, signature and name than there was not a single person responsible in case of any drug misadventuring during the administration.

TABLE 4.4

NAME/TIME/DATE/SIGNATURE BY NURSE ON THE MAR SHEET

Name/Time/Date/Signature By Nurse On The MAR Sheet	Frequency	Percent
YES	9	5.1
NO	167	94.9
Total	176	100.0

Nurses usually (94.9% cases) didn't sign and updated the time and date in the MAR sheet after giving medicine. This obviously increases the chances of medication error. First there was not a single nurse to take the liability of drug administration error due to shift duty and then it became very difficult to know the exact time of drug given which compromises the safety of drug to be administered in later hours due to time gap between the drugs and drug reactions.

TABLE 4.5

CORRELATION OF DOSE AND ROUTE MENTIONED BY DOCTOR ON PRESCRIPTION AND OCCURRENCE OF AND EVENT

			Event during administration		Total
			YES	NO	
Dose and route mentioned	YES	Count	68	85	153
		% within Dose and route mentioned	44.4%	55.6%	100.0%
		% within Event during administration	81.9%	91.4%	86.9%
	NO	Count	15	8	23
		% within Dose and route mentioned	65.2%	34.8%	100.0%
		% within Event during administration	18.1%	8.6%	13.1%
Total		Count	83	93	176
		% within Dose and route mentioned	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

It was found that in total number of events in the cases when doctor didn't mentioned the dose and route in the prescription was 65.2% which means a correlation between an incident during administration and writing of dose and route in the prescription by doctor. On the other hand the 81.9% of the events which occurred during the administration were found in the cases

when dose and route was mentioned. Many other factors must be there influencing the incident during drug administration.

TABLE 4.6

CORRELATION OF NAME/TIME/DATE/SIGNATURE MENTIONED BY DOCTOR ON PRESCRIPTION AND OCCURRENCE OF A DRUG ADMINISTRATION EVENT

			Event during administration		
			YES	NO	Total
Name/Time/Date/Sign	YES	Count	58	64	122
		% within Name/Time/Date/Sign	47.5%	52.5%	100.0%
		% within Event during administration	69.9%	68.8%	69.3%
	NO	Count	25	29	54
		% within Name/Time/Date/Sign	46.3%	53.7%	100.0%
		% within Event during administration	30.1%	31.2%	30.7%
Total		Count	83	93	176
		% within Name/Time/Date/Sign	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

Out of total administration of drugs; name, time, date and signature of the doctors in the prescription didn't really contribute to the breach in medication safety as can be seen in the table 2.4.6 that out of total events 69.9% occurred when doctor did write the their name, time, signature and date.

TABLE 4.7

CORRELATION OF NUMBER OF DRUGS AND EVENT DURING ADMINISTRATION

Number of drugs prescribed:

1= 1-3 drugs

2= 4-6 drugs

3= 7-9 drugs

4= 10-12 drugs

5= 13-15 drugs

			Event during administration		Total
			YES	NO	
Number of drugs prescribed	1	Count	18	32	50
		% within Number of drug range	36.0%	64.0%	100.0%
		% within Event during administration	21.7%	34.4%	28.4%
	2	Count	30	37	67
		% within Number of drug range	44.8%	55.2%	100.0%

		% within Event during administration	36.1%	39.8%	38.1%
	3	Count	27	18	45
		% within Number of drug range	60.0%	40.0%	100.0%
		% within Event during administration	32.5%	19.4%	25.6%
	4	Count	7	6	13
		% within Number of drug range	53.8%	46.2%	100.0%
		% within Event during administration	8.4%	6.5%	7.4%
	5	Count	1	0	1
		% within Number of drug range	100.0%	.0%	100.0%
		% within Event during administration	1.2%	.0%	.6%
Total		Count	83	93	176
		% within Number of drug range	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

As per the analysis the administration where more number of drugs was given at a time more was the breach in the medication safety. In the category of maximum drug being prescribed to the patient there was 100% occurrence of an event. Less number of incidents in the higher category out of the total was due to less number patient being prescribed that much number of drugs in the given study. It proved a negative correlation between number of drugs prescribed and occurrence of an event during drug administration.

TABLE 4.8

CORRELATION OF DOCTOR AND NURSE NOTES VARIATION AND EVENT DURING DRUG ADMINISTRATION

			Event during administration		Total
			YES	NO	
Variations in doctor and nurse notes	YES	Count	31	2	33
		% within Variations in dr and nurse notes	93.9 %	6.1%	100.0%
		% within Event during administration	37.3 %	2.2%	18.8%
	NO	Count	52	91	143
		% within Variations in dr and nurse notes	36.4 %	63.6%	100.0%
		% within Event during administration	62.7 %	97.8%	81.2%
Total		Count	83	93	176
		% within Variations in dr and nurse notes	47.2 %	52.8%	100.0%
		% within Event during administration	100.0 %	100.0%	100.0%

There was a positive correlation between the occurrence of an error and the variation in the doctor and nurse notes. Whenever a nurse copy a drug name, dosage, route, time etc. on to the MAR sheet it was followed till the patient stay in the hospital because nurse in maximum

cases use copy the drug details from the MAR sheet rather than studying the whole file and filling the MAR sheet. As per the study in case of variation between the doctors and nurse orders incident did occurred in 93.9% of the cases.

TABLE 4.9

CORRELATION OF NURSE WORK EXPERIENCE AND DRUG ADMINISTRATION EVENT

Nurse Work Experience:

1= 0-8 months

2= 9-17 months

3= 18-26 months

4= 27-35 months

5= 36-44 months

6- 45-53 months

7= 54-62 months

8= 63-71 months

			Event during administration		
			YES	NO	Total
Nurse work		Count	27	34	61

experience		% within Nurse work exp range	44.3%	55.7%	100.0%
		% within Event during administration	32.5%	36.6%	34.7%
		Count	40	41	81
		% within Nurse work exp range	49.4%	50.6%	100.0%
		% within Event during administration	48.2%	44.1%	46.0%
		Count	11	11	22
		% within Nurse work exp range	50.0%	50.0%	100.0%
		% within Event during administration	13.3%	11.8%	12.5%
		Count	2	0	2
		% within Nurse work exp range	100.0%	.0%	100.0%
		% within Event during administration	2.4%	.0%	1.1%
		Count	3	2	5
		% within Nurse work exp range	60.0%	40.0%	100.0%
		% within Event during administration	3.6%	2.2%	2.8%
		Count	0	1	1
		% within Nurse work exp range	.0%	100.0%	100.0%
		% within Event during administration	.0%	1.1%	.6%
		Count	0	4	4
		% within Nurse work exp range	.0%	100.0%	100.0%
		% within Event during administration	.0%	4.3%	2.3%
Total		Count	83	93	176
		% within Nurse work exp range	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

Experience of nurse and event during administration did had a correlation but many other factors influences the occurrence of incidents during an administration like sometimes number

of patient assigned to the experienced nurses were more, which increases the workload on nurses and the chances of an incident during administration.

TABLE 4.10

CORRELATION BETWEEN THE TYPE OF WARD AND THE EVENT OCCURRING ADMINISTRATION

			Event during administration		
			YES	NO	Total
Ward	CCU	Count	18	31	49
		% within Ward	36.7%	63.3%	100.0%
		% within Event during administration	21.7%	33.3%	27.8%
	HDU	Count	12	19	31
		% within Ward	38.7%	61.3%	100.0%
		% within Event during administration	14.5%	20.4%	17.6%
	E	Count	34	26	60
		% within Ward	56.7%	43.3%	100.0%
		% within Event during administration	41.0%	28.0%	34.1%
	S	Count	19	17	36
		% within Ward	52.8%	47.2%	100.0%
		% within Event during administration	22.9%	18.3%	20.5%
Total		Count	83	93	176
		% within Ward	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

Maximum compromises with the medication safety were found in the economy ward (41%) and than in the single ward (22.9%) which suggests that

in critical care more attention was given to the care of patient due to more staff-patient ratio despite being that the condition of patient were more vulnerable in the critical care setup and the pressure on the nursing and other staff was also more.

TABLE 4.11

CORRELATION OF NUMBER OF PATIENT ASSIGNED TO NURSES AND EVENT DURING THE ADMINISTRATOR

			Event during administration		
			YES	NO	Total
Patient assigned to nurse	1	Count	2	5	7
		% within Patient assigned to nurse	28.6%	71.4%	100.0%
		% within Event during administration	2.4%	5.4%	4.0%
	2	Count	23	37	60
		% within Patient assigned to nurse	38.3%	61.7%	100.0%
		% within Event during administration	27.7%	39.8%	34.1%
	3	Count	20	19	39
		% within Patient assigned to nurse	51.3%	48.7%	100.0%
		% within Event during administration	24.1%	20.4%	22.2%
	4	Count	21	15	36

		% within Patient assigned to nurse	58.3%	41.7%	100.0%
		% within Event during administration	25.3%	16.1%	20.5%
	5	Count	12	9	21
		% within Patient assigned to nurse	57.1%	42.9%	100.0%
		% within Event during administration	14.5%	9.7%	11.9%
	6	Count	2	4	6
		% within Patient assigned to nurse	33.3%	66.7%	100.0%
		% within Event during administration	2.4%	4.3%	3.4%
	7	Count	3	4	7
		% within Patient assigned to nurse	42.9%	57.1%	100.0%
		% within Event during administration	3.6%	4.3%	4.0%
Total		Count	83	93	176
		% within Patient assigned to nurse	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

Maximum compromises with the medication safety were occurring when the number of patient assigned to nurse was more except in the highest category for which one reason could be that more experienced nurse was assigned that much high number of patients.

TABLE 4.12

CORRELATION BETWEEN NURSE WORK EXPERIENCE AND NAME/TIME/DATE/SIGNATURE BY THE NURSE

			Name time date and signature		Total
			YES	NO	
Nurse work exp range	1	Count	8	53	61
		% within Nurse work exp range	13.1%	86.9%	100.0%
		% within Name time date and signature	88.9%	31.7%	34.7%
	2	Count	1	80	81
		% within Nurse work exp range	1.2%	98.8%	100.0%
		% within Name time date and signature	11.1%	47.9%	46.0%
	3	Count	0	22	22
		% within Nurse work exp range	.0%	100.0%	100.0%
		% within Name time date and signature	.0%	13.2%	12.5%
	4	Count	0	2	2
		% within Nurse work exp range	.0%	100.0%	100.0%
		% within Name time date and signature	.0%	1.2%	1.1%
	5	Count	0	5	5
		% within Nurse work exp range	.0%	100.0%	100.0%

		% within Name time date and signature	.0%	3.0%	2.8%
	7	Count	0	1	1
		% within Nurse work exp range	.0%	100.0%	100.0%
		% within Name time date and signature	.0%	.6%	.6%
	8	Count	0	4	4
		% within Nurse work exp range	.0%	100.0%	100.0%
		% within Name time date and signature	.0%	2.4%	2.3%
Total		Count	9	167	176
		% within Nurse work exp range	5.1%	94.9%	100.0%
		% within Name time date and signature	100.0%	100.0%	100.0%

Name/time/date/signature by the nurses on the MAR sheet should be a mandatory requirement because of the consequences which can occur due to this. It was found that as the experience of nurses was increasing: the name, time, date and signature updating on to the MAR sheet after every administration decreases. One reason for this could be reluctant nature of the senior nurses to update the MAR sheet.

TABLE 4.13

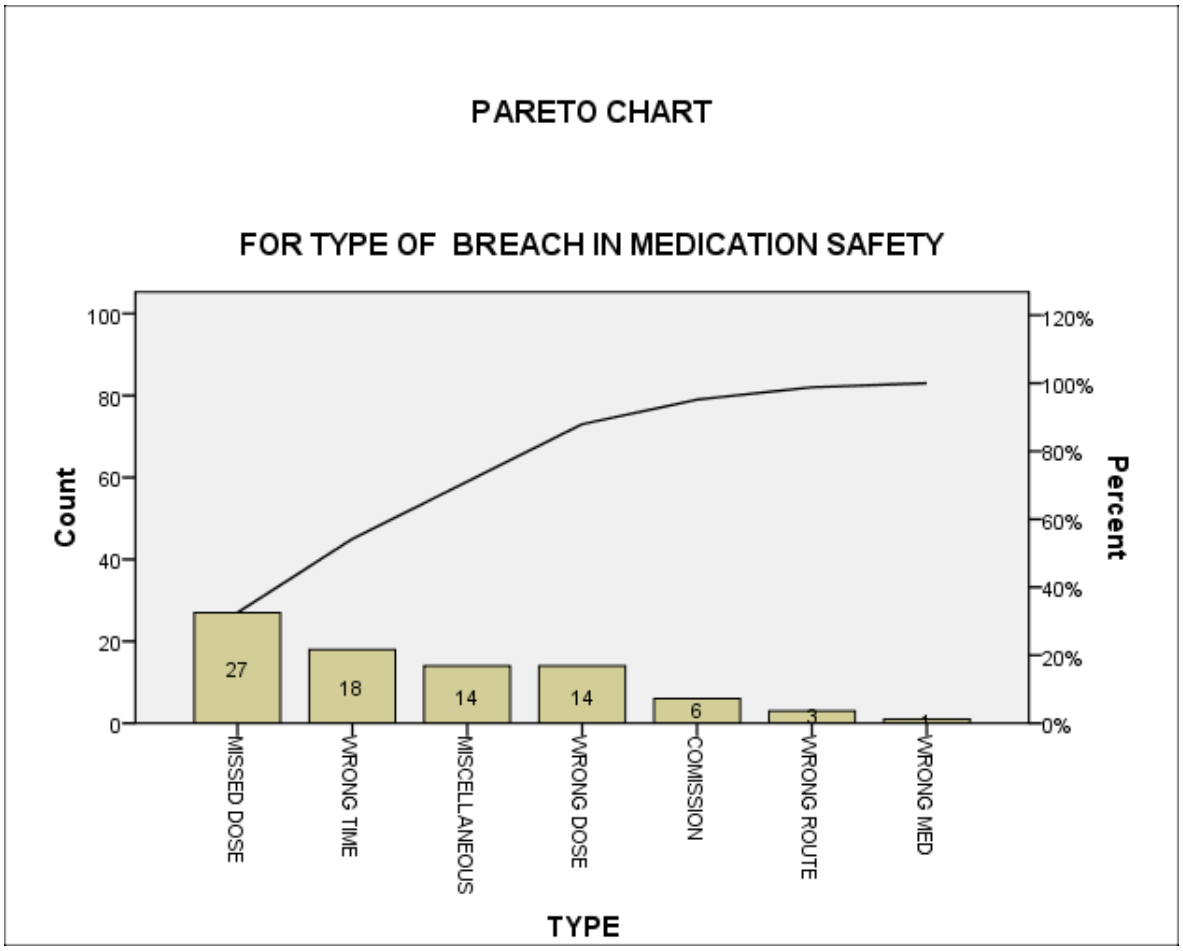
CORRELATION OF VULNERABILITY OF PATIENT AND EVENT DURING ADMINISTRATION

			Event during administration		
			YES	NO	Total
VULNERABILITY		Count	42	54	96
		% within VULNERABILITY	43.8%	56.2%	100.0%
		% within Event during administration	50.6%	58.1%	54.5%
		Count	41	39	80
		% within VULNERABILITY	51.2%	48.8%	100.0%
		% within Event during administration	49.4%	41.9%	45.5%
Total		Count	83	93	176
		% within VULNERABILITY	47.2%	52.8%	100.0%
		% within Event during administration	100.0%	100.0%	100.0%

It was found that vulnerability was not affecting the medication administration safety as in both the patients the occurrence of an incident was almost the same.

GRAPH 4.2

PARETO CHART TO KNOW THE MAIN CAUSES OF BREACH IN THE MEDICATION SAFETY



As we can see the main causes of breaches in the medication safety were missed doses, wrong time, wrong dose and some miscellaneous causes. Miscellaneous causes include OT nurse doing ward duty, dose as per the repots written by the doctor, and sometimes doses were missed because patient planned for the discharged but doses were missed as patient file had gone for the discharge summary.

DISCUSSION

In total 176 opportunities for errors or total administration were registered of which 83(47.2%) breach in the medication safety or errors were detected. The medication administration safety was found to be related to multiple factors. Storage of LASA drugs at bedside was never in the separate box which makes the effort of storing LASA drugs separately at pharmacy.

Study was done in all type of wards and ICU i.e. Economy wards, Single ward, ICU and HDU. More breaches were found in the economy ward for which there were many reasons like more nurse: patient ratio due to which work load on the nurses did increased. And one more reason which was found was revised order as in CCU and HDU revised orders were more frequently written as compared to economy and single ward where revised orders were not frequently written.

Based upon the study done we could accept our hypothesis 1 i.e. Medication safety is found to be inversely proportional to number of medication administered as we could see in table 2.4.7 that as the number of drug administered at a time increases the compromise in the medication safety increases.

There was a relation between the work experience of nurses and the occurrence of an event but many other factors were involved as the number of patient assigned was not constant to all nurses. So hypothesis 2 was also accepted.

As per table 2.4.11 we can accept hypothesis 3 also as the number of patient assigned were increasing the occurrence of an event during the administration also increases.

Hypothesis 4 was rejected as occurrence of an event in both vulnerable and non vulnerable patient was found to be same as seen in table 2.4.13.

The study could not make a relation between the storage of LASA drug at bedside and the education of patient/attendant with the incident during the administration as both the independent variable in above hypothesis 5 and 6 were found to be completely absent in the hospital.

The type of breaches were found to be of various types but the main was missing the dose to be given and usually it was missed because of prescription not being copied by the nurse to the MAR sheet. In few cases due to more of number drugs administered at a time some drugs got missed by the nurse while administration.

The other reason was wrong time of administration which may be early or delayed. Reason for delaying were many which include delayed in dispensing of drug from the pharmacy. And it was observed that nurses prefer to give dose of 8 AM, 9 AM and 10 AM together as they start administering the doses from one room which lead to early dose to some patient and delayed to others. One of the important reason could be dispensing of drugs from the pharmacy which was in single bag only to the whole ward and there nurses used to segregate them which obviously waste the time and increases the chances of error also.

This was done despite that sufficient number of bags were available in the hospital for the medicines. Sometimes delayed occurred in dispensing because when the indent was made by the nurses even when it was an emergency indent, it used to reached pharmacy quiet late.

Other causes of all the compromises in the medication safety were due to error in copying the medicines by nurses on to the MAR sheet. Revised orders were not written by doctors, which ultimately make the changes made more prone to be wrongly followed and implemented. A very common cause of all the errors was verbal orders given by the doctors for stopping or any change in the dose of medicine. Nurses usually didn't write the actual time of administration which increases the chances of drug adverse events and the gap between the administrations which should be actually present couldn't be judged.

The MAR sheet just had the column for drug name to be written so nurses sometimes didn't write the dosage, frequency, route, nurse/doctor signature whosoever write the drug on to the sheet. As it was found that cases where there was variation between the doctor and nurse order some or the other error did occurred in 93% of the cases. Medication safety also depends on number of patient assigned to the nurses and number of drug to be administered as workload and stress increases with increase in the number of patient assigned and number of drug to be administer.

It was observed that patient/attendant education regarding their medication was zero for which one reason may be vulnerability of the patient (54.5%) so not in condition to be aware of their medications and other was that staff was not aware to make their patient/attendant aware of the medication.

And as per our pareto chart i.e. Graph 1.2 it was very clear that 80% of the effect were due to just 4 main causes –

Missed dose, Wrong time, Wrong Dose and some miscellaneous causes like OT nurse doing ward duty, dose as per the repots written by the doctor, and sometimes doses were missed because patient planned for the discharged so doses were missed as patient file had gone for the discharge summary.

CONCLUSION

Each healthcare professional shares a responsibility for identifying contributing factors to medication errors and for using that knowledge to reduce their occurrence. Both experienced and inexperienced staff may be responsible for medication errors. A multidisciplinary approach to solving this problem should be promoted whereby all parties address the issue of reducing medication error occurrence. Development of a multidisciplinary approach has been slow, possibly due to the reluctance or unwillingness of the doctor, pharmacist or nurse to admit to a medication error. It is important that an attitude of “no blame” is adopted as incident reports in the past were often used as instruments of punishment, thereby creating a sense of unfairness and a fear of discipline.

Apart from ensuring the well-being of patients in their care, the increasing risk of medical litigation means that healthcare professionals cannot ignore a medication error when it occurs. Medication errors can be prevented by alterations in the system for ordering, dispensing and administration of drugs. Errors were observed in almost every second handling of medication in the present study. Quality improvements are required in most of the stages of the medication process.

To identify those who are responsible and take action against them would be difficult and a much better way which would be more effective and beneficial in the long run is prevention through the use of technology. Several of the identified errors and error types, at least in theory, could be avoided by automated solutions like computerized order entry, and bar code medication administration. The use of computerized physician order entry systems have been shown to reduce medication errors however the use of information technologies will not, on their own, solve the problem.

IT has made our lives simple in many aspects, healthcare being just one of those. Gadgets are replacing manual entries and ensuring the work is done quicker and recorded securely. RFID readers and tags, Barcode scanners and printers are few of the important ones. ***It is an investment towards future saving and not expenditure.***

Use of IT would be expensive and are not like ATMs that dispense money quickly, anytime. There has to be at least 5 year time frame till revenue on investment can be seen. All investment doesn't have to be made at one time; it can be made in phases just as how customization and modernization can be done phase wise. E.g. In the starting only the nursing station can be automated, which will improve staff efficiency and productivity and increases the medication safety. Tasks can be scheduled onto mobile devices carried by the nursing staff, so data collected from each task can be directly recorded onto the device by scanning barcodes or RFID tags at the point of activity which can be directly updated to HIS without any manual data entry.

Other methods of minimizing prescribing errors include:

- Ensuring knowledge of a drug before prescribing
- Capitalization of prescription written by doctor
- Ensuring an accurate drug history is taken
- Printing the drug name and patient details clearly on the prescription
- Including all details of drug therapy i.e. name of drug, dose, directions, duration of therapy
- Not leaving a decimal point "naked". A zero should always precede expression of values <1 e.g 0.1. Ten-fold errors in dose have occurred due to the use of a trailing zero.

- Avoiding the use of abbreviations e.g. AZT, ISMN, FeSO4, U
- Being aware of sound-a-like products
- Ensuring a safe dispensing procedure
- Using different brands or separating products that look-a-like
- Focusing on the task in hand, keeping interruptions to a minimum and maintaining their workload at a safe and manageable level
- Being aware of high risk drugs e.g. Potassium chloride, cytotoxic agents
- Introducing good housekeeping practices
- Checking patients identity
- Having dosage calculations checked independently by another healthcare professional before the drug is administered
- Having the prescription, the drug and the patient in the same place so they can be checked against one another
- Ensuring that medication is given at the correct time
- Separate bag dispensing of medicine from pharmacy to wards
- Storage of LASA drugs in separate box at bedside
- High risk drug storage in a separate cupboard
- Minimizing interruptions during drug rounds.

Other interventions must also be considered, i.e. evidence-based clinical guidelines for safe medication practice, modified medication charts, unambiguous recommendations for drug prescriptions. Separate bag dispensing should be made mandatory as it was a less investment

requiring change which can make a large difference to the process by decreasing the work load on nurses.

ANNEXURE 1

		Abbrev	Generic Name	Dose and route	Name TDS	No. of Medications	Variation in doctor and nurse Ord.	Separate bag disp	LASA in separate container	P/A education	Work Ex	Pt. assigned	Administration event	Name Time date signature	Monitoring Updated	Remarks

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