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A Study on Medication Administration Errors during Hospital Ward Rounds in a Government General Hospital

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ABSTRACT

Medication errors may contribute to morbidity, mortality and increased health care expenses. Medication administration errors are recognized as one of the important basis which accounts for 34% of all medication errors. In 2007, National Patient Safety Agency (NPSA) statistics shows that 59.3% of medication errors occur during the administration stage. This was a Prospective Observational study conducted during four months period and was examined by the use of two methods—direct observation and chart review. National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) taxonomy was used to classify and categorize the medication administration errors. This study reveals that the frequency rate of medication administration errors were 26.87%. The major types of errors occurred were Omission errors (37.58%), wrong time (14.42%), and wrong strength (12.41%), wrong drug errors (9.39%) respectively. Medication administration errors belongs to the Category B (n=174), C (n=69), D (n=37) and E (n=18). Medication administration record system, proper training and increasing and motivation of nurses will help in reducing the medication administration errors. Frequent interruptions and distractions, knowledge and performance discrepancy were the leading hazard factors causative for medication administration errors. Introducing medication error reporting system within the hospital will help preventing these medication errors.

Keywords: *Medication Administration Errors (MAEs), Prospective Observational study, National Patient Safety Agency (NPSA), National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) taxonomy.*

INTRODUCTION

Errors in drug administration to patients are associated with increased complication of prescribing were reported in the 1960s. This lead to the development of new systems of prescribing and recording drug administrations. A standard drug chart and ward pharmacy system came into widespread use after publication of the Gillie report in 1970 [1].

Medication use in hospitals is a complex process as a result of the increasing number of medications available, new routes of administration and depends on successful interaction among health care professionals functioning at different areas. Errors may occur at any stage of prescribing, documenting, dispensing, or administration.

Medication errors may contribute to morbidity, mortality and increased health care costs. In 2007, National Patient Safety Agency (NPSA) statistics shows that 59.3% of medication errors occur during the administration stage [2]. As part of National Health Service (NHS) risk management plans, it is likely that they would wish to organize drug administration errors as an indicator of the effectiveness of their prescribing, supply, and administration chain.

Drug administration errors are defined as any deviation from the physician's medication order as written on patient's treatment chart during medication administration to patient. The plan for administering a drug begins with identifying the patient, drug, dose, route, and time.

In 1995, the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) classified administration errors into wrong drug, wrong route, wrong dose, wrong patient, wrong timing of drug administration, contra-indicated drug, wrong site, wrong dosage form, wrong infusion rate and expired medication. Such errors may occur intentionally or unintentionally. Nursing staff is considered as essential in drug administration process. Nurses find themselves as the last link in the drug therapy chain where an error can reach the patient. The literature review states that poor adherence to protocols and poor knowledge of medication is the important reason leading to drug administration errors.

Medication errors contribute significantly to the number of patient adverse events [3]. Its widely accepted that the five fundamental rules of medication delivery are:

1. A patient should only receive specifically prescribed medications
2. A patient's identification should be verified prior to the administration of any medication
3. Medications should always be administered at the prescribed time
4. All medications administered should adhere to the prescribed dosage
5. Medications should only be administered by the prescribed route.

Registered health care professionals have a commitment to make sure these rules are adhered to at all times, for all patients.

Factors contributing to medication errors are often divided into two subgroups – those resulting from individual professional issues include skill level, workloads, education and those from system errors relate to complexities within the health care environment [4-6].

Hospital medication errors occur in 3-6.9% of inpatients. The error rate for inpatient medication orders was reported to be 0.03-16.9%. One investigation dogged that 11% of medication errors in hospitals were pharmacy dispensing errors related to the wrong drug or strength. [7] Recent systematic reviews of medication administration error (MAE) incidence in healthcare settings found that they were common, with one reporting an estimated norm of 19.1 % of 'total opportunities for error' in hospitals [8]. A significant proportion of MAEs are associated with actual or potentially harmful effects. The key to implementing a

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successful intervention that minimizes MAEs is to understand how and why they occur.

Whereas drug related errors occur frequently in hospitals, many of these errors apparently do not result in patient harm. Although the frequency of medication errors has been documented, there has been little study of the factors associated with the core causes of these errors.

Nearly all studies of medication errors involved a small number of sites (hospitals or pharmacies) or a limited number of patients. Slight 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 [9].

In order to determine the cause of error, one must appreciate the intentions of the person responsible for it. There are numerous methods designed to capture MEs, including self-report, incident report, chart review, direct observation, and trigger tool. However, a study using direct observation to detect medication errors in the dispensing and administration stage assessed 20% of the identified errors as potential adverse drug events. Thus, relevance of appropriate methods for identifying drug errors and assessing potential adverse drug events are important in the detection of valid and useful information. Criticisms of the direct observation method include being labor intensive and expensive and also being prone to modifications of behavior.

The literature on medication errors lacks universally accepted definitions of medication errors as well as different methods and criteria, leaving us with an incomplete knowledge of the actual rate of medication errors. At present, no studies have investigated medication errors in more stages of the process in the same population including discharge summaries [10]. Although significant improvements have occurred since the initial Institute of Medicine report, medical errors remain problematic in the high-workload environment of current medical care [11].

There are still other studies that do not clearly differentiate. The belief is that MAEs are the most practical initial end point for most hospitals interested in establishing an ongoing program in ME quality improvement. Improvement in ME prevention systems requires accurate reporting, regular analysis, and protection of reporters. An optimal detection system would be accurate, inexpensive, and involving technology and practices readily available to the majority of hospitals. The ability to understand and apply ME research to practice has been limited by inconsistencies between study methods, which have led to variability in ME rates.

MATERIALS AND METHODS

Study Setting:

The present study was conducted at a Government General hospital for a period of four months during February 2014 and May 2014 in inpatient wards of pediatric, general medicine and surgery departments. The present study was approved by the Institutional Human Ethics Committee.

Study procedure:

This was a Prospective Observational study and was examined by the use of two methods—direct observation and chart review. The study population consisted of: (i) hospital inpatients; (ii) nurses dispensing and administering medications; (iii) physicians prescribing drugs into the medical record.

A suitably designed data collection form was used to analyze the types, frequency and factors responsible for medication administration errors and the data was collected from the case notes, treatment charts, medication administration records and interviewing the in-patients admitted to surgery and general medicine wards. Demographic details of the patients, diagnosis and treatment recommended were documented. Medication administration of the in-patients was followed up on daily basis to identify the administration errors. Frequency of medication administration errors was analyzed by using the following formula.

The frequency of errors (fe) was calculated by dividing the number of administrations with one or more errors (ne) by the sum of the number of observed medication administrations (whether ordered or not) (nA) and the number of medicines observed to be omitted (no). Thus:

$$Fe = ne / (nA + no).$$

The error frequency was reported as a percentage (fe ×100%).

NCCMERP taxonomy was applied to analyze the frequency and types of medication administration errors. The types of medication administration errors were classified in to omission error, wrong medication, wrong strength, wrong dosage form, wrong technique, wrong route of administration, wrong rate, wrong time, wrong patient, improper dose and other types.

Omission errors consisted of errors regarding not giving the medication to the patient, who can arise by forgetting the administration or by giving the medication to the wrong patient (the patient for which the medication was prescribed is not given the medication in that case). Wrong medication administration consists of virtually the same problems: either picking a medication from the stock that is not meant for the patient (e.g., because it looks like the medication the patient is supposed to have) or giving the medication to the wrong patient (here the wrong patient has an unordered medication administration error). Wrong administration technique errors comprised all errors concerning the administration technique: crushing errors (crushing a tablet that should not be crushed, e.g., because it is enteric coated), wrong technique for administering inhalation preparations (e.g., not shaking the pressurized metered inhaler before use), wrong technique for dissolving effervescent tablets (crushing instead of dissolving in water and administering after all bubbles have disappeared).

Wrong dose errors consisted of administering the wrong strength of the medication or the wrong number of dosage forms. A wrong time error was defined as the administration of medication at least 60 minutes earlier or later than prescribed or as a wrong time in relation to food intake (e.g., for thyroid preparations, which should be taken on an empty stomach).

Medication administration errors were categorized into various categories as A, B, C, D, E, F, G, H and I categories based on NCCMERP. Current NCCMERP categorizes medication administration errors in to the 9 following categories [12, 13].

Category A: Circumstances or events that have the capacity to cause an error

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

Category C: An error has occurred that reached the patient, but did not cause harm to patient

Category D: An error has occurred that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to preclude harm.

Category E: An error has occurred that may have contributed to or resulted in temporary harm the patient and required intervention

Category F: An error has occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization

Category G: An error has occurred that may have contributed to or resulted in permanent patient harm

Category H: An error has occurred that required intervention necessary to sustain life

Category I: An error has occurred that may have contributed to or resulted in the patient's death.

All medicines were classified according to the anatomical therapeutic chemical (ATC) code.

RESULTS

328 patient's medication records were received and 298 medication administration errors were observed in 253 patients who received 1954 doses. Among the 253 patients, 167 were male patients and 86 were female patients. The frequency rate of medication administration error as found to be 26.87%.

Out of 298 medications administration errors, 67 errors (22.48%) were observed in surgery department, 176 errors (59.06%) were observed in both male and female general medicine department and 55 errors (18.45%) were observed in pediatrics department.

According to NCCMERP taxonomy, the medication administration error types were analyzed. Types of medication administration errors details are given in **Table 1**. Omission errors (n=112) (Failure to record the administration or failure to administer) are the most common types of errors observed followed by wrong time (n=43) (dose was given in noon instead of morning), wrong strength (n=37), wrong drug (n=28) (other than the prescribed one), wrong route (n=22), wrong duration (n=18), Improper dose/quantity (n=16), Wrong dosage form (n=5) and others (n=17) specify that patient refusal to take medication/Unable to swallow medication etc.

Details of categories of medication administration errors according to NCCMERP categorization are presented in **Table 2**. Category B (n=174) are the majority administration errors followed by Category C (n=69), Category D (n=37) and Category E (n=18).

Table 3 presented the system related factors responsible for MAEs. Frequent interruptions and distractions (42%) are the major System related factors responsible for medication administration errors, followed by inadequate staffing (19%), lack of training (17%), lack of communication between health care professionals (9%), and high noise level (2%) and others (11%).

Table 4 represents the human factors responsible for MAEs. Leading factors responsible for MAE were recognized as Knowledge and Performance deficit (57.70%) which is more than half of the total, stress (15.83%) and remaining contains the other factors. Fig 1 represents the types of dosage forms predominantly involved in MAEs were tablets (n=899), injections (n=538) and syrups (n=276).

DISCUSSION

Medication use in hospitals is a complex process which involves successful communication among health care professionals functioning at different areas. Errors may occur at any stage of prescribing, documenting, dispensing, or administration during patient care. Medication errors may contribute to morbidity, mortality and increased health care expenses.

Due to the prescriber's medication order divergence MAEs may takes place at the instance of administration. As per NHS, medication errors may affect 850,000 people each year. National Patient Safety Agency (NPSA) shows that 59.3% of errors occur at management stage having high probable for morbidity and mortality and increased health care expenses. Administration errors are one of the most frequent types of medication errors affecting around 5 percent of all administered doses.

During our study period, frequency of MAEs was calculated as 26.87%. In many studies, the frequency of medication administration errors range from 14 to 59%. In a prospective cohort study, the frequency of medication administration errors was found as 38%. Error frequency rate in this study closely matches with the result of the international studies. The higher the incidence of MAEs occur results in higher probability of morbidity and mortality in the patients.

In this study the most common types of errors observed were Omission errors (n=112) (Failure to record the administration or failure to administer) are the most common types of errors observed followed by wrong time (n=43) (dose was given in noon instead of morning), wrong strength (n=37), wrong drug (n=28) (other than the prescribed one), wrong route (n=22), wrong duration (n=18), Improper dose/quantity (n=16), Wrong dosage form (n=5) and others (n=17) specify that patient refusal to take medication/Unable to swallow medication etc. which is supported by Ramesh A *et al.,*.

In our prospective observational study NCCMERP taxonomy was used to evaluate the categories of the medication administration errors. The medication administration errors of the present findings were analyzed and classified in to various categories. Category B (n=174) are the majority administration errors followed by Category C (n=69), Category D (n=37) and Category E (n=18). Our observations are in consistent with the findings of previous studies which contains Category C as majority administration error.

In the health care professional team, nurse is the key defective element for MAEs. Many International revision findings showed that performance deficit, poor calculation competency, poor adherence to protocols, poor knowledge of medications and of the nurses are the main reasons for medication administration errors. Other system related causes for administration errors include physicians poor hand writing, similar packing of medications. Then review of literature suggests limited research has been carried out in India in this area. The present study focus on scientific perceptive the MAEs in a government general hospital and to propose initiatives to improve the patient wellbeing.

Frequent interruptions and distractions (42%) are the major System related factors responsible for medication administration errors in this study, followed by inadequate staffing (19%), lack of training (17%), lack of communication between health care professionals (9%), and high noise level (2%) and others (11%). This was supported with the articles Zane Robinson *et al.,* and Ramesh A *et al.,* Other studies predictable lack of knowledge, abuse in protocols, heavy work load, stress and problems with handover process are the other important system related factors responsible for MAEs. [13]The common responsible human factors were also studied. Leading factors responsible for MAE were recognized as Knowledge and Performance deficit (57.70%) which is more than half of the total, stress (15.83%) and remaining contains the other factors. The types of dosage forms predominantly involved in MAEs were tablets (n=899), injections (n=538) and syrups (n=276). This is contrasted with the other studies.

Medication administration record system, proper training and increasing and motivation of nurses will help in reducing the medication administration errors. As that of Adverse drug reaction reporting system introducing medication error reporting system within the hospital will help in preventing the medication errors.

Table No. 1: Types of Medication Administration Errors

S. No.	Types of errors	Percentage (%)
1	Omission error	37.58
2	Wrong time	14.42
3	Wrong strength	12.41
4	Wrong drug	9.39
5	Wrong route	7.38
6	Wrong duration	6.04
7	Improper dose/quantity	5.36
8	Wrong dosage form	1.67
9	Others*	5.70

*Others include – Patient refusal to take medication/Unable to swallow medication etc.

Table No. 2: NCCMERP Categorization of MAEs

S. No.	Category	Percentage (%)
1	Category B	58.38
2	Category C	23.15
3	Category D	12.41
4	Category E	6.04

Table No. 3: Factors responsible for MAEs – System related

S. No.	Causative factors	Percentage (%)
1	Frequent interruptions and distractions	42.0
2	Lack of staffing	19.0
3	Inadequate training	17.0
4	Lack of communication between health care professionals	9.0
5	High noise level	2.0
6	Others*	11.0

*Others include – Patient refusal to take medication/Unable to swallow medication etc.

Table No. 4: Human factors responsible for MAEs

S. No.	Human Factors	Percentage (%)
1	Knowledge and Performance deficit	57.70
2	Stress	15.83
3	Lack of communication among health care professionals	6.49
4	Poor adherence to protocols	5.86
5	Miscalculation of dosage	4.02
6	Others*	10.10

*Others include – Patient refusal to take medication/Unable to swallow medication etc.

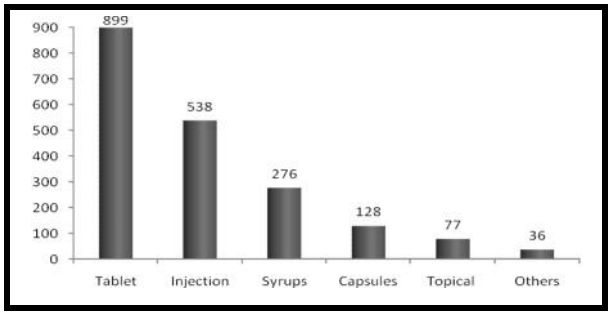

Fig. 1: Types of dosage forms involved in MAEs

CONCLUSION

The present study findings conclude that omission of the dose; wrong time and strength were identified as common medication administration errors. According to NCCMERP taxonomy Category B and Frequent interruptions and distractions and Knowledge and Performance deficit are the leading risk factors contributing for medication administration errors. Introducing medication error reporting system within the hospital will help in preventing the medication errors.

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