


**AN EPIDEMIOLOGICAL STUDY OF MEDICATION RECONCILIATION AND  
MEDICATION ERRORS IN SECONDARY CARE**
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**ABSTRACT**

**Background:** A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient or consumer. Medication process involves 5 broad stages: Prescription, administration, transcription, monitoring, dispensing. medication errors, defined as any error in the medication process regardless of whether a patient experiences an adverse consequence, can occur at any step. Medication reconciliation is the process of creating the most accurate list possible of all medications a patient is taking including drug name, dosage, frequency and route and comparing that list against the physicians admission, transfer, and/or discharge orders, with the goal of providing the correct medications to the patient at all transition points with in the hospital. **Aim:** An Epidemiological study of Medication Reconciliation and Medication Errors in Secondary. Care Hospitals. **Methodology:** Multi-center, prospective, observational study, a total of 187 cases with medication errors were taken and analysed. **Results:** A total of 187 cases having medication errors were evaluated among which medication reconciliation process was assessed whether obtained or not. Results showed in 51 cases medication reconciliation was not taken and in 136 cases it was taken, out of which only illness history was taken for 44 cases, both illness history and drugs were taken for 32 cases(23.52%) and in 60 cases there was no significant past illness in the patient. Out of 136 cases where medication reconciliation was obtained, hypertension condition was found in 33 cases, type2 diabetes mellitus in 27 cases. Here we are mainly concentrating on prescribing errors and administration errors. Out of 187 cases 327 errors were found. In that 320 medication errors were prescribing errors and remaining were administration. In that 320 prescribing medication errors, wrong/no indication accounted for 179errors (55.93%) ranking at first and actual drug-drug interactions which affect the patient were seen in 1 case accounting for least number. drugs which are inappropriately prescribed causing medication errors. Out of 187 cases ceftriaxone was inappropriately prescribed in 72 cases (31.85%) ranking first, erythromycin(0.44%), linezolid(0.44%), and fluconazole(0.44%) are used one in each case accounting last ranked drugs. Mild category accounted for 180 cases(96.25%) followed by moderate 7 cases(3.74) and there were no case under severe category. there were 167 cases(89.30%) with significant category followed by 9 cases of hospitalised & serious medication error each. there were no life threatening and fatal medication errors. **Conclusion:** Most of the errors are clinically significant and it can be prevented by working together in a healthcare team. We experienced that most of the medication error was mainly due to poor prescription writing. Clinical Pharmacist can play major role in the early detection and prevention of medication errors and thus can improve the quality of care to the patients. This study clearly shows the need for a clinical pharmacist to work full-time at the Medicine ward and to develop Hospital formulary, drug protocols and prescription policies in the hospital, ward-based clinical pharmacist can prevent negative consequences related to medications. This study recommends the need for additional resources and educational initiatives for the health care professionals to improve medication reconciliation. results are evident for the need of medication reconciliation and participation of clinical pharmacist in the pharmaceutical care plan for minimizing the medication errors.

**KEYWORD:** A medication error is any minimizing the medication errors.

**INTRODUCTION**

**Medication errors:** A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient or

consumer. Medication errors are among the most common medical errors, harming at least 1.5million people every year, says a new report from the institute of medicine of the national academics.<sup>[1]</sup>

If medical error was a disease, it would rank as the third leading cause of death in the US.<sup>[2]</sup> Medication process involves 5 broad stages: prescription, administration, transcription, monitoring, dispensing. Medication errors, defined as any error in the medication process regardless of whether a patient experiences an adverse consequence, can occur at any step.<sup>[2]</sup>

**In pediatrics:** in children, the risk of medication errors is often exacerbated by the need of calculation to determine the dose. Prescribing errors are particularly important in this age group as they can lead to significant morbidity and mortality.<sup>[5]</sup>

**Interventions for reducing prescribing errors in pediatrics:** Action to reduce the risks of prescribing in paediatrics should focus on training and competence assessment in drug dose and infusion rate calculations in addition to improved availability of aidesmemoire where validated computed software is not available.<sup>[5]</sup>

3 broad approaches have been used to reduce prescribing errors in literature Provision of training to develop competence Expansion of professional roles, such as having pharmacists reviewing in patient drug charts to identify and rectify errors Development of tools/equipment, such as electronic prescribing and computerized support systems, to improve prescribing process.<sup>[5]</sup>

#### Types of medication errors

- ✓ Prescribing errors.
- ✓ Administration errors.
- ✓ Transcription errors.
- ✓ Monitoring errors.
- ✓ Dispensing errors.

**Prescribing errors:** A prescribing errors occurs when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant reduction in the probability of treatment being timely and effective or increase in the risk of harm.<sup>[6]</sup> Five main categories of prescribing errors:

- ✓ Wrong patient
- ✓ Wrong drug
- ✓ Wrong dose/strength/frequency
- ✓ Wrong drug formulation
- ✓ Wrong quality

**Administration errors:** These errors can be classified as either acts of commission or omission and may include.<sup>[7]</sup>

- Wrong drug
- Wrong route
- Wrong dose
- Wrong patient
- Wrong timing of drug administration

A contraindicated drug for that patient

- Wrong site
- Wrong drug form
- Wrong infusion rate
- Expired medication date

Prescription error Such errors occur in either as intentional or unintentional manner.<sup>[7]</sup>

Nurse drug administration errors are a cause of morbidity and mortality.<sup>[7]</sup> Distractions and interruptions during hospital drug round can affect concentration, resulting in medication error.<sup>[7]</sup>

**Transcription errors:** Error was defined as any deviation in transcribing medication order from the previous step (order on the order sheet, administration nursing note or/and cardex, documentation of the order in the pharmacy database).<sup>[8]</sup>

**Omission:** When prescribed medications by the physician was not reached to the patient.

**Wrong dose/interval:** When the dose and/or interval, etc prescribed by the physician were not reached to the patient correctly.

**Requesting drug more than required:** Requests from the pharmacy more than required according to the physician order.

**Alternative drug:** Medications that were replaced by another medication by the pharmacy without physicians approval.

**Unauthorized medications:** These medications that were administered but could not be found in physicians order.

**Monitoring errors:** In order for medication to be prescribed effectively and safely, many medications require monitoring. Medication monitoring may involve blood tests but can also include other monitoring such as blood pressure, weight or electrocardiogram. Monitoring can be required before initiating medication, soon after starting or regularly over the course of treatment. Ensuring that this monitoring has been undertaken is an important part of medication review involving repeat prescribing.<sup>[10]</sup>

Appropriate monitoring of medication includes.<sup>[10]</sup> Ensuring a medication is monitored and reviewed correctly after initiation or a change in dosage. e.g.: angiotensin-converting enzyme inhibitors.

Ensuring all necessary monitoring is scheduled and undertaken for medications that are prescribed in the longer term. E.g.: checking renal function and blood pressure.

Ensuring medication is not continued longer than necessary. E.g.: iron supplementation.

Ensuring medication is prescribed at the optimal dosage to obtain the required clinical effect. E.g.: antihypertensive therapy.

When monitoring is necessary, it is important to undertake the appropriate tests at the correct intervals. The frequency required may change with the clinical situation or the diagnosis.

**Causes of medication errors:** Medication errors are associated with inexperienced physicians and nurses, new procedure, extremes of age and complex or urgent care, poor communication, improper documentation, illegible handwriting, inadequate nurse to patient ratios, similar named medications contribute to problems.

**Health care complexity:** complicated technologies, powerful drugs, intensive care & prolonged hospital stay  
**Competency, education & training:** variations in healthcare provider training and experience and failure to acknowledge the prevalence and seriousness of medical errors also increase the risk.

**Human factors and ergonomics:** practitioner risk factors include fatigue, depression, burnout. Factors related to clinical setting include diverse patients, unfamiliar settings, time pressures and increased patient to nurse staffing ratio increases.

Drug names that look alike or sound alike also a problem. **Medication reconciliation:** Medication reconciliation is the process of creating the most accurate list possible of all medications a patient is taking including drug name, dosage, frequency, and route and comparing that list against the physicians admission, transfer, and/or discharge orders, with the goal of providing the correct medications to the patient at all transition points within the hospital.<sup>[11]</sup>

#### **Points of transition that require special attention are.<sup>[12]</sup>**

Admission to hospital Transfer from the emergency department to other care areas (wards, intensive care or home) Transfer from the intensive care unit to ward. From the hospital to home, residential aged care facilities or to another hospital Implement a process for obtaining and documenting a complete list of the patients current medications upon the patients admission to the organization and with the involvement of the patient and to communicate a complete list of the patients medications to the next provider of service when a patient is referred or transferred to another setting, service, practitioner or level of care within or outside the organization.<sup>[13]</sup>

#### **Process of medication reconciliation.<sup>[14]</sup>**

Obtaining the most complete and accurate list possible of the patients current regularly taken medications, known as the BPMH (best possible medication history).

Using BPMH when writing admission, transfer and discharge medication orders comparing the BPMH with the admission, transfer, or discharge medication orders, identifying and bringing any discrepancies to the attention of the team and if appropriate, making changes to the orders and documenting all changes.

#### **Goals of medication reconciliation<sup>[14]</sup>**

Ultimate goal is to prevent adverse drug events at all interfaces of care (admission, transfer & discharge) for all patients to eliminate undocumented intentional discrepancies and unintentional discrepancies  
**Undocumented intentional discrepancies:** occurs when the prescriber intentionally adds, changes or discontinues a medication the patient was taking prior to admission but this not clearly documented in the patient's medical record. **Unintentional discrepancies:** occurs when the prescriber unintentionally changes, adds or omits a medication the patient was taking prior to admission.

#### **Preventing of medication errors<sup>[14]</sup>**

Types of medication errors that can be prevented by reconciling medication may include. Failure to prescribe clinically important home medications while in hospital. Incorrect doses or dosage forms. Missed or duplicated doses resulting from inaccurate medication records.

Failure to clearly specify which home medications should be resumed and/or discontinued at home after hospital discharge.

Duplicate therapy at discharge (result of brand/generic name combinations or hospital formulary substitutions)  
In situations they strive for the same goal which is to avoid all types of medication errors that can negatively affect their patients. Here are some common mistakes that can be made.<sup>[15]</sup>

Medications can be accidentally listed multiple times or not at all.

Some drugs can be listed that patients never have taken before or their medical practitioner never prescribed.

Medication can also have the wrong dose, route, frequency and time.

In some cases they may not be appropriate for the patient due to drug allergies or they are irrelevant to the patient's current situation.

From any of these mistakes, the patients can end up taking the wrong medication or not receiving the right drug they need to take care of their health condition.

## METHODS

It is a Single-center, Prospective, Observational study which was conducted at Vijay Marie Hospital, Chintal basti, Khairatabad for a period of 6 months. Data collection form was designed. A total of 187 records of patients who were Admitted in various department of hospital, were collected and analyzed. The data was categorized based on types of errors like prescribing errors and administration errors. Again prescribing errors are divided into various types like wrong/no indication, wrong/no dose, drug allergy, drug-drug interactions, wrong dosing schedule. Therapeutic duplication, ADRs and contraindicated errors.

## RESULTS

A total of 187 cases having medication errors were evaluated among which medication reconciliation process was assessed whether obtained or not. Results showed in 51 cases medication reconciliation was not taken and in 136 cases it was taken, out of which only illness history was taken for 44 cases, both illness history and drugs were taken for 32 cases(23.52%) and in 60 cases there was no significant past illness in the patient. Out of 136 cases where medication reconciliation was obtained, hypertension condition

was found in 33 cases, type2 diabetes mellitus in 27 cases.

Here we are mainly concentrating on prescribing errors and administration errors. Out of 187 cases, 327 errors were found. In that 320 medication errors were prescribing errors and remaining were administration. In that 320 prescribing medication errors, wrong/no indication accounted for 179 errors (55.93%) ranking at first and actual drug-drug interactions which affect the patient were seen in 1 case accounting for least number. drugs which are inappropriately prescribed causing medication errors.

Out of 187 cases ceftriaxone was inappropriately prescribed in 72 cases (31.85%) ranking first, erythromycin (0.44%), linezolid (0.44%) and fluconazole (0.44%) are used one in each case accounting last ranked drugs. Mild category accounted for 180 cases(96.25%) followed by moderate 7 cases(3.74) and there were no case under severe category. There were 167 cases(89.30%) with significant category followed by 9 cases of hospitalized & serious medication error each. there were no life threatening and fatal medication errors.

## DEMOGRAPHIC PROFILE OF STUDY POPULATION

Table: 1 Sex Wise Distribution.

SEX	NO.OF PATIENTS	PERCENTAGE
MALE	91	48.66
FEMALE	96	51.33

## DISTRIBUTION BASED ON MEDICATION RECONCILIATION

Table: 2 Age Wise Distribution.

AGE GROUP(in years)	NO.OF CASES	PERCENTAGE
0-5	28 (M-16,F-12)	14.97
6-15	24 (M-16,F-8)	12.83
16-25	24 (M-16,F-16)	17.11
26-35	30 (M-14,F-16)	16.04
36-55	41 (M-19,F-22)	21.92
>55	32(M-12,F-19)	17.11

Table: 3 Distribution Based on Length of Stay.

LENGTH OF STAY	NO.OF CASES	PERCENTAGE
<2 DAYS	26	13.90
3-5 DAYS	116	62.03
>5 DAYS	45	24.06

Table: 4 Number of Drugs Given Per Patient.

NO.OF DRUGS	NO.OF CASES	PERCENTAGE
0-1	0	0
2-3	9	4.81
4-6	51	27.27
>6	127	67.91

**Table: 5 Distribution Based on Medication Reconciliation.**

MEDICATION RECONCILIATION	NO.OF CASES	PERCENTAGE
TAKEN	136	72.72
NOT TAKEN	51	27.27

**Table: 6 Medication Reconciliation Obtained Categories.**

TAKEN	NO.OF CASES	PERCENTAGE
ONLY HISTORY	44	32.35
HISTORY+DRUGS	32	23.52
NO SIGNIFICANT ILLNESS	60	44.11

**Table: 7 Medication Reconciliation Observation.**

DISEASE CONDITION	ONLY HISTORY	HISTORY+DRUGS
HYPERTENSION	21	12
DIABETIS MELLITUS	18	9
THYROID DISORDER	1	3
CKD	1	0
EPILEPSY	2	3
OTHERS	9	17

**Table: 8 Different Type of Medication Error.**

TYPE OF ERRORS	NO.OF CASES	PERCENTAGE
PRESCRIBING ERRORS	178	95.18
ADMINISTRATION	7	3.74
ERRORS		

**Table: 9 Categorized Prescription Error.**

TYPE OF ERROR	NO.OF ERRORS	PERCENTAGE
WRONG INDICATION	179	55.93
WRONG DOSE	30	9.37
DRUG ALLERGY	2	0.62
WRONG DOSING SCHEDULE	14	4.37
THERAPEUTIC DUPLICATION	21	6.56
DRUG-DRUG INTERACTION	1	0.31
ADR	56	17.5
CONTRAINICATION	17	5.31

**TABLE: 10 Percentage of Drugs Inappropriately Used.**

DRUG	NO.OF CASES	PERCENTAGE
AMOXICILLIN/CLAVULANATE	24	10.61
AMIKACIN	6	2.65
CEFPODOXIME	6	2.65
METRONIDAZOLE	9	3.98
CIPROFLOXACIN	7	3.09
LEVOFLOXACIN	3	1.32
CEFTRIAXONE	72	31.85
OFLOXACIN	19	8.4
CEFUROXIME	2	0.88
AZITHROMYCIN	4	1.76
ERYTHROMYCIN	1	0.44
LINEZOLIDE	1	0.44
FLUCONAZOLE	1	0.44
CEFOTAXIME	18	7.96
ARTESUNATE	4	1.76
OTHER DRUGS	49	21.68

**TABLE: 11 Distribution Based on Severity.**

SEVERITY	NO.OF CASES	PERCENTAGE
FATAL	0	0
LIFE THREATENING	0	0
SERIOUS	9	4.81
HOSPITALISED	9	4.81
SIGNIFICANT	167	89.30

**Table: 12 Distribution Based on Scoring.**

SCORING	NO.OF CASES	PERCENTAGE
MILD(<5 ERRORS/CASE)	180	96.25
MODERATE(6-10)	7	3.74
SEVERE(>10)	0	0

## DISCUSSION

Further categorization was done based on no.of days a patient was admitted in the hospital is as follows 3-5 days were 116 cases (62.03%) is the highest followed by >5 days were 45 cases (24.06%) and then 6 drugs in 127 cases. By this poly-pharmacy was observed in 67.91% of cases which increase the risk of medication errors in prescription. Medication reconciliation: After demographical evaluation, medication reconciliation process was assessed whether done or not done. If done whether only illness history was taken, or both history and drugs were taken or there was no particular illness in the patient.

Results showed in 51 cases medication reconciliation was not taken and in 136 cases it was taken out of which only illness history was taken for 44 cases, both illness history and drugs were taken for 32 cases(23.52%) and in 60 cases there was no significant past illness in the patient.

Medication reconciliation category Out of 136 cases where medication reconciliation was obtained, hypertension condition was found in 33 cases, type2 diabetes mellitus in 27 cases. Furthermore, in 33cases with hypertension condition only in 12 cases both history and drugs were obtained where as in 21 cases regular Rx was not mentioned. Similarly in diabetes mellitus out of 27 only in 9 cases both history and drugs were obtained remaining cases do not mentioned regular Rx.

In thyroid disorder out of 5 cases, 4 cases were with both history and drugs obtained, in epilepsy disorder out of 5 cases, 3 were with drugs and history were obtained and other illness were 27 cases, out of which 17 cases are with both history and drugs were obtained. In total, there were 44 cases where regular Rx were not obtained which leads to the increase risk of medication errors and harm to the patients.

A medication error was classified into following categories: prescribing errors, administration errors, transcription errors, monitoring errors, dispensing errors. Here we are mainly concentrating on prescribing errors and administration errors. Out of 187 cases 327 errors

were found. In that 320 medication errors were prescribing errors and remaining were administration. A total of 320 prescribing medication errors were found in 187 cases.

Prescribing errors were again sub classifies into following categories: wrong/no indication, wrong/no dose, wrong dosing schedule, drug allergy, therapeutic duplication, drug-drug interactions, adverse drug reactions and contraindicated. In that 320 prescribing medication errors, wrong/no indication accounted for 179errors (55.93%) ranking at first and actual drug-drug interactions which affect the patient were seen in 1 case accounting for least number. Other categories following wrong indication are adverse drug reactions were 56 errors (17.5%), wrong/no dose were 30 (9.37%), therapeutic duplication were 21(6.56), contraindicated drugs prescribed were 17(5.31%), wrong dosing schedule were 14(4.37) and drug allergy were 2(0.62%). Further categorization was based drugs which are inappropriately prescribed causing medication errors.

Out of 187 cases ceftriaxone was inappropriately prescribed in 72 cases (31.85%) ranking first, erythromycin(0.44%), linezolid(0.44%), and fluconazole(0.44%) are used one in each case accounting last ranked drugs, amoxicillin/clavulanate in 24cases(10.61%), ofloxacin in 19cases(8.4%), cefotaxime in 18 cases(7.96), metronidazole in 9cases(3.98%), ciprofloxacin in 7cases(3.09%), amikacin, cepodoxime in 6 each cases(2.65%), artesunate, azithromycin in 4 each cases(1.76%), levofloxacin in 3 cases(1.32%), cefuroxime in 2 cases(0.88%), other drugs were used in 49 cases(21.68%). Scoring was given based on the no.of error. Per prescription.

The categories are mild (10errors per prescription). Mild category accounted for 180 cases (96.25%) followed by moderate 7 cases (3.74) and there were no case under severe category. Severity of the medication errors was assessed based on the following categories: significant, hospitalized, serious, life threatening and fatal. Out of 187 cases, there were 167 cases (89.30%) with significant category followed by 9 cases of

hospitalized & serious medication error each. there were no life threatening and fatal medication errors.

### LIMITATIONS OF THE STUDY

Random selection of patients was done in our study. So, the results cannot be generalized to all the patients admitted in the hospital, as many cases might have been missed during night shifts and emergency discharge.

### CONCLUSION

Most of the errors are clinically significant and it can be prevented by working together in a healthcare team. We experienced that most of the medication error was mainly due to poor prescription writing. Clinical Pharmacist can play major role in the early detection and prevention of medication errors and thus can improve the quality of care to the patients. This study clearly shows the need for a clinical pharmacist to work full-time at the Medicine ward and to develop Hospital formulary, drug protocols and prescription policies in the hospital; ward-based clinical pharmacist can prevent negative consequences related to medications. This study recommends the need for additional resources and educational initiatives for the health care professionals to improve medication reconciliation. Results are evident for the need of medication reconciliation and participation of clinical pharmacist in the pharmaceutical care plan for minimizing the medication errors.

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