
CHAPTER 1

PRESCRIPTION ERROR

Introduction

The art of writing a prescription is an essential skill required by doctors. Medications in prescriptions must be prescribed in such a way where the therapeutic benefits and the risk of harm are properly balanced. The clinical knowledge about drugs and proper process of prescription writing must be improvised at each and every time of writing a prescription. Faults in writing a prescription results in prescribing errors. Prescribing of medications is one of the most important parts of treatment and errors in any segment of prescribing process can significantly affect morbidity and mortality of patients. Although prescribing errors are not always fatal, they can lead to the development of serious adverse events which delays recovery of patients. Before going into the details, different terms like “Prescription”, “Prescribing”, “Prescription Errors”, “Adverse drug events” must be properly distinguished.

*A **prescription** (\mathcal{R}) is a health-care program implemented by a physician or other qualified practitioner in the form of instructions that govern the plan of care for an individual patient^[1].*

***Prescribing** is the process of deciding what to prescribe and naming it and the act of writing a prescription^[2].*

*A definition states that ‘a clinically meaningful **prescribing error** 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 when compared with generally accepted practice^[3]*

An adverse drug event is an injury from a drug related intervention^{[4][5]}.

With rapid development of new drug molecules the prevalence of prescribing errors is increasing enormously. Of all types of medication errors, prescribing error is the most serious. Once an error has been made, unless detected, it will be systematically applied and can result in significant harm or death^[6]. Inappropriate Prescribing is particularly an important type of medication error. Prescribing errors occur

simultaneously both in hospitals and in general practice. A recent review of the literature concerning prescriptions made by junior doctors in hospitals found the range of reported error rates to be 2-514 per 1000 items prescribed and 4.2-82% of patients or charts reviewed^[7]. In United Kingdom hospitals, prescribers make errors in 1.5% of prescriptions^[8]; and in primary care errors occur in upto 11% of prescriptions.

Types of Prescription Errors

Prescription errors are generally two types. Mistakes in writing a prescription and ignoring several factors (drug-drug interactions, potentially dangerous adverse drug reactions, contraindications), while using a drug both causes prescription errors.

- **Errors in prescription writing:** The act of writing a prescription is not always as careful as it should be. As prescriptions are considered a permanent and unambiguous record of patient's treatment, it should be written properly and clearly. Errors frequently occur while writing dose, route, quantity, frequency and name of drugs.

Errors in naming of drugs: Various instances show errors in prescribing due to confusion of drug names. As a drug can be available in various trade names, use of brand names instead of approved generic names during prescribing can create confusion and contribute to errors.

Errors in dose: Writing a dose of a drug without mentioning its unit (for example- 5 instead of 5 mg or 5 gm or 5 ml) is an error. Drugs that are prescribed in very low or high doses suffer this problem. For example levothyroxine, given as 25 µg or 0.25 mg and piperacillin + Tazobactam as 4.5 gm). For this type of medicine if the dose is not properly written life threatening adverse reactions can occur. Lack of usage of exact strength of dose of a tablet / capsule can also confuse the patient and produce unintentional errors.

Errors in frequency and route: Frequency and route of administration of drugs are occasionally found omitted in prescription.

Errors in quantity: Errors of quantity are not very common. Forgetting to state the quantity of dosage form or providing wrong number of medicines often occur.

- **Errors in use of drugs:** Every drug has its own standard dose, route and frequency in specific indications along with contraindications and drug-drug interactions. Any incompliance with standard regimen while using a drug can cause error in drug use. Miscalculation of dosage frequently occur for elderly and young patient. Though many drug-drug interactions are found in literature, the importance of them in causing life threatening reaction is sometimes doubtful. Ignoring a potentially harmful interaction can generate errors. Use of a drug without considering the contraindication can cause exacerbation of existing disease.

Why Prescription Errors do Occur?

Prescription errors are typical events that derive from slips, lapses, mistakes^[9]. Several other factors contribute to prescription errors. The main focus of discussing the reasons behind occurrence of prescription errors should be on the prevention of adverse drug events.

- **Inadequate drug knowledge:** Lack of clinical knowledge about drugs, their indications, contraindications, appropriate dose, different dosage forms, routes, interactions with other drugs can give rise to errors which results in ineffective therapy or in adverse drug reactions.
 - **Drug-drug interactions:** Insufficient knowledge or competence and incomplete information about drugs initiate drug-drug interactions to happen. These can have serious consequences. Polypharmacy or the use of five or more medications in single prescription can induce drug-drug interactions. There are many medications which should be used cautiously with each other. Some of them are given below.

TABLE 1.1

Some potential drug-drug interactions

First Drug	Second Drug	Possible result of Interaction
Amiodarone	Beta-Blockers (Propranolol, Metoprolol)	Bradycardia, Ventricular fibrillation and asystole on abdominal application
	Calcium channel Blockers	Sinus arrest and aeriuous hypotension occurs

TABLE 1.1 *Contd...*

First Drug	Second Drug	Possible result of Interaction
Disopyramide	Rifampicin	May cause marked reduction in serum levels on concurrent use.
Aminoglycoside antibiotics (Amikacin)	Cephalosporins (Cefuroxime, cefepime, cefoperazone)	Nephrotoxic effects can be increased by concurrent use.
Isoniazide	Antacids	Absorption of isoniazid may be reduced by concurrent use.
Cefuroxime	Pantoprazole	Absorbtion of cefuroxime is delayed.

Often simultaneous use of prescription drugs and other self-prescribed medicines can cause drug-drug interactions.

Drug-drug interactions can be reduced by updating knowledge about drugs and patient's records.

- **Dosing errors:** Proper dosing is of particular importance in special population of patients like elderly and children. Both in case of elderly and children drugs are dosed based on body surface area, age etc. In case of children, several guidelines are available which states the dose of drug/kg/day. Use of adult dose in children derives potentially harmful adverse drug events. For example-the pediatric dose of amoxicillin is 50 mg/kg/day which can be divided to 6 hours or 8 hours. Care in prescribing drugs for older patients must be taken by doctors. Dosing error occur in elderly patients at the initiation of therapy. For example, an initial dose of hydrochlorothiazide at 6.25 mg/day is effective in elderly but they are often treated with 25 or 50 mg/day which leads to development of side effects like orthostatic hypotension^{[10][11]}.

Errors in dosing occur frequently for patients with impaired renal functions and in hepatic failure patients. Drugs whose active forms are renaly cleared, doses of those drugs need to be altered. Renal impairment modifies the effects of many drugs mainly by increasing their effects in the body. Dosing in renal failure patients is done by calculating the glomerular filtration rate / Creatinine Clearance (Creatinine Clearance is calculated by using Cockcroft-gault reaction). Miscalculations of dose in such patients cause accumulation of drugs in the body leading to potential toxicity followed by adverse drug reactions. Hence

prescribing of dose in this type of patients need to be proper to prevent harm.

Dose calculation for patients with hepatic failure is more difficult than for patients with impaired renal function. As metabolism of drugs is mainly done by liver, modification of dosing of those drugs need to be remembered. No such formula is available for calculating hepatic dose of drugs. But careful prescribing should be done in patients with liver dysfunction to avoid errors.

- **Errors in indications and contraindications:** During prescribing correct indication of a drug and the particular medical condition in which the drug cannot be prescribed must be known by the prescriber. Prescriber who do not have clear idea about indications and contraindications can cause misuse of drugs.

Misuse defines the use of drugs that results in unnecessary complications^{[11][12]}.

For example: Aspirin, a popular non-steroidal anti-inflammatory drug and also an anti-platelet drug is Contraindicated in patients with peptic ulcer and also in pediatric population due to risk of development of Reye's syndrome. Caution is needed for prescribing of aspirin in such type of patients.

- **Errors due to use of 'Banned' drugs:** Numerous drugs that cause life threatening phenomenon on prolong use are banned for use either in whole population or in special population. List of banned drugs vary from country to country. In some countries banned drugs are available in the market for sale. Lack of updated knowledge about such kind of drugs may cause illegal use of the drugs by prescriber leading to errors.

➤ **Insufficient patient's information:** Inadequate information related to patients can results in errors leading to adverse drug reactions. Poor maintenance of patient's record containing incomplete or wrong history of allergy and medications work as good source of errors.

- **Undocumented allergy:** Mentioning the allergy profile (either drug or food allergy) of a patient in prescription chart helps to prevent prescribing errors. Previously developed allergy of a patient on application of a drug need to be documented on the drug chart of that particular patient. If drug allergy remains

undocumented, the drug can be repeated by prescriber and can become error. It was found in a study that about 12.1% of prescribing errors occur due to inadequate patient history of allergy to the same medication class prescribed repeatedly by prescriber^[13]. Antibiotics like Penicillin, Azithromycin, Amoxicillin, Psychotropic drugs, NSAIDs are common allergenic drugs. Allergic skin tests are frequently performed before administration of drugs but this is only practiced for antibiotics than other classes of drugs. Known allergic condition of a patient limits the option for treatment. Allergy history requires confirmation before prescribing procedure. If the patient is not in condition to inform it can be asked to the member authorized by the patient. The original circumstances and the complete event of adverse drug reaction that occurred after application of medication also need to be confirmed because the information of allergy may necessitate further investigation.

- **Unreviewed medication history:** Taking care of the medication history is important to avoid prescription errors. Both for inpatients or hospitalized patients and outpatient's previous drug history is required for further treatment. Drug history or regularly used home medicine has its importance particularly in elderly patients with several co-morbid conditions. Numerous common co-morbidities like hypertension, diabetes, Benign hypertrophy of prostate in males, gout or arthritis and any previous medical intervention or surgery are associated with the use of various drugs. Both the knowledge about patient's home medicine and proper documentation of them is required to prevent errors like occurrence of adverse drug reactions or drug-drug interactions. Apart from allopathic medicines other forms of medicines used by the patient needs inclusion.

Sometimes, discrepancies are found between the drugs that are documented in medication history review chart and drugs that are originally taken by the patients. Such type of incomplete medication history also causes potential errors. Certain drugs like cardiovascular drugs require continuation even with the newly prescribed drugs. Improper medication history can cause discontinuation of them leading to worsening of existing medical condition of patient. The patient himself or any authorized relative of patient can be asked about the home medicine of patient. They can also be called to bring the

medications during visit to hospital or clinics. Outpatient medical records can be a good source of patient's drug history though it is not always reliable. Maintenance of an updated list of drugs can be sometimes helpful. Medical reconciliation is a relatively new, time saving and trustful procedure to gather information about drug history followed by prevention of prescription errors.

- **Miscommunication or communication error:** Errors are frequently made by medical professionals (not only doctors but also nurses, pharmacists and other medical staff) because they fail to communicate properly. Illegible handwriting, verbal orders or communication, unnecessary use of unapproved abbreviations, symbols, punctuations, drug names pave the way of producing errors.

Illegible handwriting of the prescriber or of the person who is responsible updating the medication chart day to day can have serious effects on producing errors. In a multidisciplinary care system, the busy schedule and the workload due to multiple number of patients forces a doctor to become negligent about writing a prescription. Unclear handwriting in a prescription is often misread by pharmacists and nurses. On other hand, instructions to patients that are little understood require further confirmation by the prescriber. All these type of accidents due to sloppy handwriting either delays the process of treatment or insists dispensing error or administration error to happen.

Ambiguous and incomplete prescription is another common reason of prescription error. Incomplete prescriptions may cause ambiguity which increases the chances of errors. Errors occur when ambiguous instructions provide information that is different from what the prescriber intended. Apart from causing prescribing errors inadequate information contained in prescription can also cause dispensing error as the pharmacist donot get complete information from the prescriber.

In case of medical emergencies, verbal orders are often taken. When instructions about medicines are given through telephone or any other form of communicator, the person receiving the information either a pharmacist, a nurse or a doctor, even a patient himself donot clearly understand. Secondly even if it is appropriately received by the listener errors can occur during transcribing the information. Misinterpretation of the verbal orders produces errors. There is

several sound alike drugs which belong to completely different classes. For example - Clonidine, a sympatholytic drug used to treat hypertension can be misinterpreted as klonopine (also known as clonazepam) which is a psychotropic drug. Another example is Amiodarone, a potassium sparing diuretic is often confused with Amrinone. Even brand names of medicines are so confusing and similar that they are difficult to understand through verbal communication. The person taking verbal orders should spell the order properly while reading it back to the person giving orders.

- **Use of abbreviations:** Misinterpretation of abbreviations used by prescriber generate a cascade of errors that can lead to an adverse drug reactions. There are several unapproved abbreviations, symbols and punctuations that get confused with the original ones. Nurses and pharmacists fail to understand such unacceptable abbreviations and commence errors. Table 1.2 and 1.3 contains list of such abbreviations, symbols and punctuations that cause errors.

TABLE 1.2

List of drug name abbreviations causing errors

Abbreviations	Actual Meaning	Misinterpretation
AZT	Zidovudine	Azathioprine or Aztreonam
MTX	Methotrexate	Mitoxantrone
PCA	Procainamide	Patient Control Anaesthesia
HCT	Hydrocortisone	Hydrochlorothiazide
MSO ₄	Morphine Sulfate	Magnesium Sulfate
TAC	Triamcinolone	Tetracaine, Cocaine
CPZ	Compazine	Chlorpromazine
HCL	Hydrochloride/ Hydrochloric Acid	Misinterpreted as potassium chloride ('H' is missed as 'k')

The above list is adapted from “**List of Error prone Abbreviations, symbols and punctuations**” of Institute for safe medication practices, 2003.

TABLE 1.3

List of symbols and punctuations causing errors

Abbreviations	Actual Meaning	Misinterpretation
µg	Microgram	Miligram/mg
IJ	Injection	“IV” or Intrajugular

TABLE 1.3 *Contd...*

Abbreviations	Actual Meaning	Misinterpretation
IN	Intranasal	“IM” or “IV”
qhs	Nightly at bedtime	‘qhr’ or every hour
UD	As directed (ut dictum)	Unit dose
QId	Daily	q.i.d/ four times a day
BT	Bedtime	BID/ Twice daily
AD/AS	Right ear/Left ear	OD/OS (right eye/left eye)
Zero After decimal point (eg: 5.0 mg)	5 mg	50 mg as decimal point is not seen
< or >	Greater than and Less than	Often mistaken as opposite of intended
×3 d	For 3 days	3 doses

The above list is adapted from “**List of Error prone Abbreviations, symbols and punctuations**” of Institute for safe medication practices, 2003.

PROPOSED FORMAT OF DOCUMENTING PRESCRIPTION ERROR

PRESCRIPTION ERROR REPORTING FORM

TYPES OF PRESCRIPTION ERROR

- Patient’s name missing YES NO
- Home Medication chart (incomplete or absent) YES NO
- Dosage Form Missing YES NO
- Rote of Administration Missing YES NO
- Use of unapproved Abbreviations or symbols YES NO
- Omission of dose, route, frequency or dosage unit YES NO
- Missing information about diluent to be used YES NO
- Missing information about strength of dose YES NO
- Any unreadable/ incomplete description (Related to
- dose, route, frequency, duration, dilution
- of current medicine) YES NO
- Errors of formulation YES NO
- Others YES NO

**WHO INITIALLY DISCOVERED THE ERROR?
(more than one can be selected)**

- Physician Nurse Pharmacist
- Family members of patient Unable to determine other

OUTCOME OF THE ERROR

DESCRIPTION OF THE ERROR (Who, when, what and how)

.....

.....

.....

.....

.....

.....

DID THE ERROR CAUSE HARM TO PATIENT?

- YES (If yes them mention the type of harm) NO

.....
Signature of Prescriber

.....
Signature of Clinical Pharmacist

Systems Implemented to avoid Prescription Error

➤ **Computerized entry of physician’s medication order:** In the past the handwritten and verbally communicated orders have led to produce errors and injuries to patient. Electronic prescription or CPOE is relatively new implementation to avoid this type of errors.

“Computerized provider order entry (CPOE) refers to any system in which clinicians directly enter medication orders (and, increasingly tests and procedures) into a computer system, which then transmits the order directly to the pharmacy”^[14].

Recommendations to prevent prescribing errors have been developed by a number of organizations ^[15]. To reduce the complexity in writing a prescription automated prescribing process has been included in various recommendations. Computerized entry of physician’s order is an effective tool to reduce errors. Every decision regarding prescribing process like drug selection, checking of drug-drug interactions, and calculation of dose can be supported by clinical decision support system to help the prescriber. Compared to

paper based prescribing, electronic prescribing can enhance patient's safety and medication compliance by improving accuracy and reduce costs of patients by averted adverse drug events^[16]. This system is very fruitful as it reduces time in completion of medical orders. Errors related to handwriting and transcribing can also be reduced by this process. Electronic prescribing also reduces the need of verbal communications and also the time spent on this type communication through phone calls between the prescriber and any other medical staff like nurse, pharmacist, other physician and subsequently the errors produced from oral communications. Even if a single medication chart is aided by an electronic prescribing system it helps to develop an immediate feedback control between prescriber and other medical staff helps through collaboration^[17]. The only risk behind using CPOE is that it can introduce new type of errors. Inexperience prescriber can cause slower entry of medications and in emergency condition computerized entry can be slower than person to person communication. Proper training and practical skill is needed to avoid the risk related to CPOE.

- **Medical reconciliation:** Medical reconciliation is relatively new term. It is very helpful in preventing adverse drug reactions and drug-drug interactions that arise from improper history taking by prescriber.

According to the joint commission “*Medical reconciliation is the process of comparing a patient's medication orders to all of the medications that the patient has been taken*”^[18].

It is done by preparing two lists and comparing them. One list contains the current medications of the patient and the other list contains the medications to be prescribed for the patient. When a patient is admitted to a hospital with several comorbidities he is already prescribed with several medications. A new health related problem forces him to take other medications prescribed by the prescriber in hospital. When the patient gets discharged from the hospital prescribers often forget to allow them to continue the required home medicines. Medical reconciliation fill the gap between the home medications and patient's current medications in hospital. A home care department of one hospital found that about in their hospital about 77% patients were discharged with inadequate medical instructions^[19]. Medical reconciliation is repeatedly performed and updated during admission, transfer, any surgical procedure and even at the time of discharge of patient. In case of patients who do not require hospital stay or patients who only comes

to visit doctors in clinics due to relatively minor health problem, medical reconciliation is effective to prevent any unwanted adverse drug reaction and drug-drug interaction. It is very healthy process which includes the physician, nurse, pharmacist, family members of patient and even the patient himself. Errors of mission, errors of drug dosing, therapeutic duplication can be prevented by medical reconciliation. Not only prescription errors, medical reconciliation can prevent the subsequent administration and dispensing errors also. An accurate and complete medical reconciliation require proper communication between the patient and prescriber, proper and updated knowledge about medicine and also sufficient time. Though the process of medical reconciliation is not as straight forward as it sounds, it can be taken as a challenge towards reducing medical errors.

- **Error reporting system:** Monitoring and reporting of errors are final steps of reducing the rate of prescribing errors. In order to reduce incident of adverse drug reactions and drug interactions resulting from prescription errors identification of errors is needed first. Detection is very crucial step in error reporting. After proper identification it should be informed. Due to heavy workload errors are often overlooked by doctors and nurses. Even when they are checked by one of the medical staffs' information do not reach to the prescriber due to communication failure. A study has showed that spontaneous reporting is atleast 10 times less effective in detecting errors and adverse drug reactions than active, system oriented error-reporting process^[20]. A clinical pharmacist is an authorized person who can be responsible for reviewing and reporting of errors. He is also responsible for informing the prescriber about error and making them aware. Error reporting is voluntary and confidential^[17]. Special computerized monitoring and error reporting system can be implemented.

Audit is another important tool for reducing errors. It is official inspection. Audit is relatively bigger concept and usually done by experts. After several months of monitoring and error reporting audit should be done to check if the monitoring and reporting process was correct or not. Audit also helps to know that if the reporting system has improved the quality of prescribing or not. The reduction rate of prescribing errors can also be detected through audit. Prescription audit helps to understand the drug utilization pattern in a hospital.

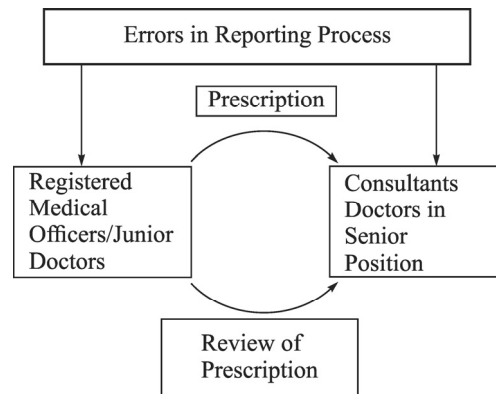


Fig. 1.1 Flow chart showing interventions required to reduce adverse drug reactions.

- **Training, education and organizational intervention:** Prescribing performance can only be improved by proper training and education of doctors prescribing them and also other ancillary medical staffs involved. The complex skill of prescribing requires complete knowledge of the prescriber about medicines and its pharmacology. The improvisational attitude of prescriber towards writing a good prescription is also aided by medical education and training. Education can be done through arrangement of classes on relevant topics. Senior doctors should be involved in teaching. Ancillary medical staff can be trained by junior doctors also. A proper rule of writing a prescription can be maintained which will be followed by every prescriber. All medical staff who deals with prescriptions should be made aware about the policies and guidelines related to medicine. The process of reviewing a prescription is also a concern for good prescribing process and persons responsible for reviewing should also be sufficiently educated. Polypharmacy requires special attention^[17]. Different e-learning sources should also be available for the doctors and other staff so that they can improve their professional knowledge about drugs.

Conclusion

Errors in prescription writing and faults in choosing drugs for prescription are preventable most of the times. Proper strategies made regarding the education, monitoring and reporting of errors can reduce errors most of the times. Errors in prescription do not injure the patient all

the time. Monitoring of adverse drug reactions concurrently with prescription review also help to prevent further error.

Case Study-1

A prospective observational study was performed by a student on incidence of medication errors in critical care unit in a tertiary care hospital.

He found that drug history error occurred in 10.71% of patients which could lead to prescribing errors. He found that among 196 errors, 21 cases were related to drug history error. He found out of 21 errors 8 (39.09%) were dosing errors. 10 (47.61%) errors were related to frequency and both dosing errors and frequency errors occurred in 3 cases (14.28%)

TABLE 1.4

Table showing errors related to patient's drug history

Frequency errors	47.61%
Dose errors	38.09%
Both	14.28%

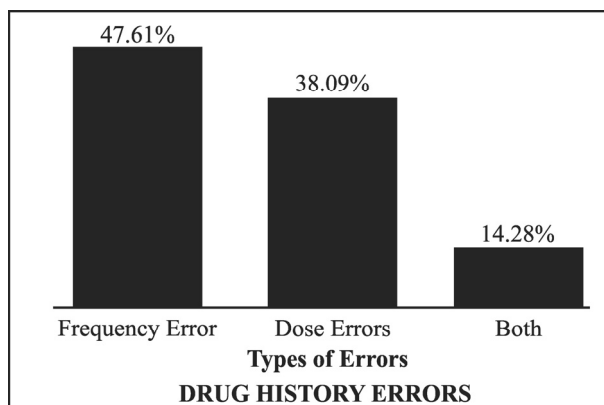


Fig. 1.2 Graph showing errors related to patient's drug history.

It was observed for different types of prescription errors. Among all the errors prescription errors were 20.91%. It was found medication errors happened in 12 cases (29.26%), Frequency errors in 14 cases (34.14%). Route was not mentioned in 13 (31.7%) cases and other types of errors were 4.87 % (2 cases)

TABLE 1.5

Table showing different types of prescription errors

Medication errors	Frequency error	Route not mentioned	Others
12 (29.26%)	14 (34.14%)	13 (31.7%)	2 (4.87%)

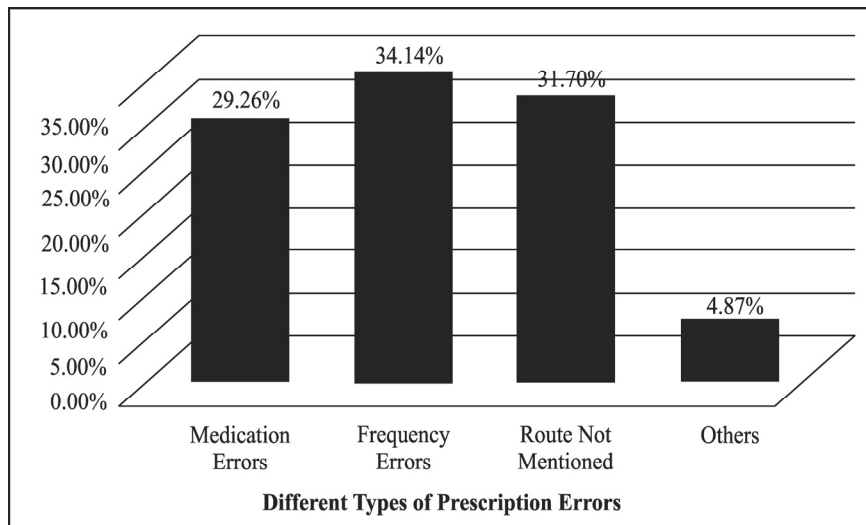


Fig. 1.3 Graph showing different types of prescription errors.

Case Study-2

Another study was also performed in the same hospital. It was prospective observational study on incidence of medication errors in general and surgical ward. Among all patients drug history was not taken in 40 patients (12.38%). Errors were found in medication history chart. 24 patients (14.54%) had drug error, 61 patients (36.97%) had dose error, 15 patients had timing error (9.09%) and 45 patients had combined errors (27.27%). 20 patients (12.12%) had other types of errors (errors in route of administration and duration error).

TABLE 1.6

Table showing errors related to patient’s drug history

Drug	Dose	Timing	Combined	Other
24 (14.54%)	61 (36.97%)	15 (9.09%)	45 (27.27%).	20 (12.12%)

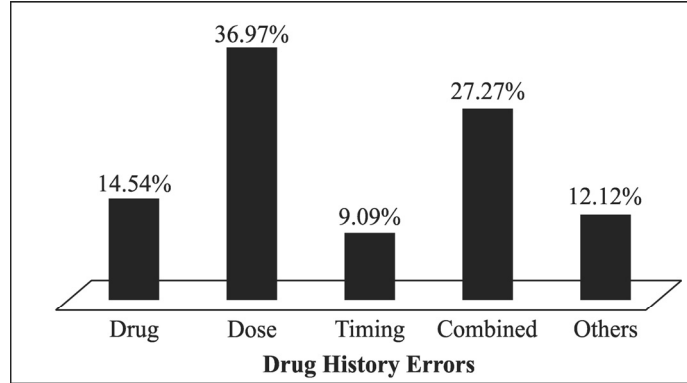


Fig. 1.4 Graph showing errors related to patient’s drug history.

In daily prescription chart errors were found. He observed that in medicine card 32 patients (37.20%) medication error, 19 patients (22.09%) had dosage errors, 22 patients (25.58%) had combined error and 13 patients had other types of errors.(15.11%).

TABLE 1.7

Table showing different types of prescription errors

Medication errors	Dosage errors	Combined errors	Others
32 (37.20%)	19 (22.09%)	22 (25.58%)	13 (15.11%)

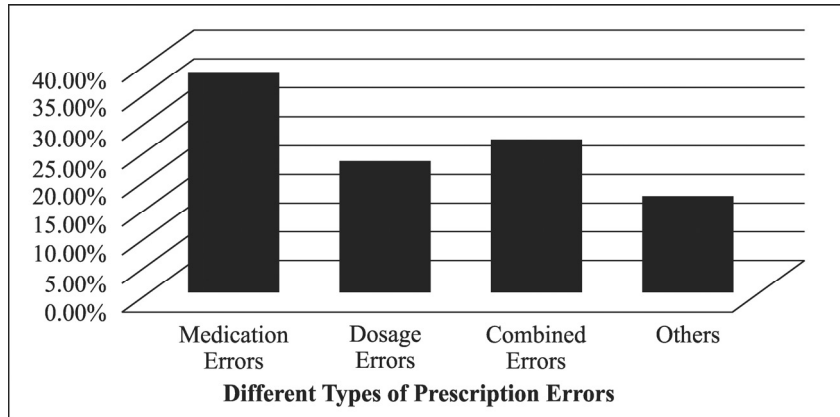


Fig. 1.5 Graph showing different types of prescription errors.

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