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Assessment of role of clinical pharmacist in the evaluation of prescriptions in a tertiary care teaching hospital: a prospective observational study

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Abstract

Background: Prescribing of medicines is an integral part of the provision of health care. For effective and safe treatment, it is essential that prescribing and administration of drug should be evaluated from time to time. Prescription errors account for 70% medication errors that could potentially results in adverse drug reactions.

Aim and objectives: The purpose of the study to identify errors, major factors which are responsible for the occurrence of medication errors, and to analyse the role of clinical pharmacist in medication errors and to observe the adverse drug reactions.

Methodology: A Prospective observational study was conducted in MNR medical College and Hospital, Sangareddy district. The data was collected from the inpatients of General Medicine department by using standard case report form through direct patient interview and collected data was analysed to identify medication errors and adverse drug reactions.

Results: 500 prescriptions were analysed, in that 300 prescriptions presented with different types of medication errors. For medication errors the prevalence of females is more than males. Age group between 31-50 showing medication errors. 141 were found to be prescribing errors, 62 administration errors, 69 dispensing errors and 28 monitoring errors. Incidence of dose and strength errors (50.35%), wrong time administration errors (51.61%), wrong drug administration errors (21.73%), monitoring not requested (50%). Prescribing errors were more common in general medicine department. Essential and non-essential drugs, level of severity, were found to be statistically significant (P value <0.05).

Conclusion: Clinical pharmacist should act as an effective medical staff by conducting awareness and education programs for nursing staff and other health care professionals regarding detection, reporting and occurrence of medication errors.

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Introduction

A medication (a medicinal product) is 'a product that contains a compound with proven biological effects, plus excipients or excipients only; it may also contain contaminants; the active compound is usually a drug or prodrug, but may be a cellular element' [1].

An error is 'something incorrectly done through ignorance or inadvertence; a mistake, e.g., in calculation, judgement, speech, writing, action, etc. or a failure to complete a planned action as intended, or the use of an incorrect plan of action to achieve given aim [2].

Medication error is defined as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of a health care professional, patient or consumer [3].

Classification of Errors

There are four broad types of medication errors.

1. Knowledge-based errors (through lack of knowledge) — for example, giving penicillin, without having established whether the patient is allergic [4].

2. Rule-based errors (using a bad rule or misapplying a good rule)—for example, injecting diclofenac into the lateral thigh rather than the buttock [5].

3. Action-based errors (called slips)—for example, picking up a bottle containing diazepam from the pharmacy shelf when intending to take one containing diltiazem. (6) So-called 'Tall Man' lettering (mixing upper- and lower-case letters in the same word) has been proposed as a way to avoid misreading of labels [7].

4. Memory-based errors (called lapses)—for example, giving penicillin, knowing the patient to be allergic, but forgetting [5].

Types of Medication Errors

1. Prescribing Error:

Selecting improper drug (based on indications, contraindications, known allergies, drug-class duplications, and drug-drug interactions [DDIs]), dose, dosage form, quantity, route of administration, concentrations, rate of administration, or instructions for the use of a drug product ordered by a physician [8]. Prescribing faults and Prescription Errors are major problems among medication errors [9]

- Dose (Or) Strength Error
- WRONG TIME ERROR
- WRONG Frequency
- Wrong Drug
- Unauthorized Drug Error
- WRONG ROUTE
- Wrong Monitoring [8]

2. Administration Error

Inappropriate procedure or improper technique in the administration of a drug other than wrong route. (8)

- Wrong Dose
- Wrong Dosage Form
- Wrong Time
- Wrong Frequency
- Omission Error
- Wrong Route
- Wrong Drug [8]

3. Dispensing Error

A dispensing error is a discrepancy between a prescription and the medicine that the pharmacy delivers to the patient

Wrong Drug

Wrong Strength Error [8]

4. 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.

They are:

- monitoring requested but not done
- monitoring not requested
- results not available
- results not acted upon (8)

***According to McGovern the ten golden rules for the safe administration of medication are**

- Administer the right drug
- Administer the drug to the right patient
- Administer the right dose
- Administer the drug by the right route
- Administer the drug at the right time
- Teach the patient about the drugs they are receiving
- Take a complete patient drug history
- Find out if the patient has any allergies
- Be aware of potential DDIs
- Document each drug administered [10]

What Causes of Medication Errors?

Most common causes of medication errors include prescribing errors, drug-drug interactions, dose miscalculations, incorrect drug administration and lack of patient education. Other factors that can contribute are job-related stress; improper training or education; sound-alike brands and look alike packaging of medications [11].

According to some studies the major barriers involved in an error free drug therapy at the levels of prescribing as well as administration are-

1. Inappropriate prescribing.
2. Inappropriate regimen (Inappropriate drug, dosage form, dose, route, dosage interval, or duration).
3. Unnecessary regimen.
4. Drug not available when needed because of economic barriers, biopharmaceutical barriers, sociological barriers and inappropriate delivery. (11)

Medication Error and Outcome:

Many ME's are probably undetected that occurs mostly because of the outcome(s) of ME's will not be clinically significant and will not adversely affect the patient but some ME's results in serious morbidity and mortality. Thus, ME's must not be taken lightly and effective system should be established to safeguard and prevents the occurrence of them [11].

NCCMERP (National Coordinating Council for Medication Error Reporting and Prevention.) recommends that medication error information be collected and reported as soon as possible, while the information is still fresh. In selecting the patient outcome category, select the highest-level severity that applies during the course of the event.

For example, if a patient suffers a severe anaphylactic reaction (Category H) and requires treatment (Category F) but eventually recovers completely, the event should be coded as Category H. Only one category which best fits patient's profile should be selected for outcome assessment.

No Error

Category I: An error occurred that resulted in the patient's death

Error, No Harm

Category B: An error occurred but the error did not reach the patient (An "error of omission" does reach the patient.)

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

Category D: An error occurred that resulted in the need for increased patient monitoring but no patient harm.

Error, Harm

Category E: An error occurred that resulted in the need for treatment or intervention and caused temporary patient harm.

Category F: An error occurred that resulted in initial or prolonged hospitalization and caused temporary patient harm.

Category G: An error occurred that resulted in permanent patient harm.

Category H: An error occurred that resulted in a near death event. (e.g.: anaphylaxis, cardiac arrest)

ERROR, DEATH: An error occurred that resulted in a death [11].

Role of Clinical Pharmacist in Prevention of Medication Errors

Pharmacists are the experts to provide pharmaceutical care through their knowledge and skills in Pharmacotherapeutics and clinical practice. In a hospital a clinical pharmacist has a liaison between the patients as well as with the healthcare professionals. The pharmacist plays an important role in accessibility of medicines to the healthcare professionals and their move will provide learning to persons other than pharmacists [12].

The WHO reports states "*Effective medicine can be practiced only where there is efficient drug management". Only when the pharmacist has been accepted as a vital member of the healthcare team can the necessary supporting services be organized with the professionalism that they demand*".[28]

Monitoring error, compliance error, drug duplication, incorrect drug selection, drug use without indication, improper dose,

Wrong duration and wrong administration are the common causes of ME's found in tertiary healthcare setting. (11)

Pharmacist is a healthcare professional who is trained to provide counselling sessions to patients with minor illnesses and often to those who are suffering from chronic conditions as well as the patients on established maintenance therapy: they provide liaison between the duties of prescribing and selling medicines and in so doing they dispose of any perceived or potential conflict of interest between these two functions. (11)

The role of pharmacist in health care is only towards manufacturing and distribution of drugs but the role of Pharmacist is more than meets the eye but there are numerous Hurdles because of which, pharmacist have not been able to pursue their international mandate in our country which includes; Lack of understanding of the role of pharmacist in healthcare; Lack of identification of "Health-care-team" as a policy concept and center-stage role only to medical professionals in the maintenance of health; More stress on curative measures rather than preventive measures for health related issues; Lack of national objectives of professional education being reflected in policy implementation. (11)

MEs in hospitalized patients can be prevented if patient's medical history is taken properly and patients are properly followed. A Clinical Pharmacist can play an important role by conducting awareness and education programs for nursing staff and other health care professionals regarding detection and reporting of ME's can minimize the frequency of the same. A Clinical Pharmacist can also conduct Drug Utilization Evaluation studies in order to prevent the irrational prescribing of drugs. Appropriate team work from all HCPs can certainly reduce occurrence of MEs in hospitalized patients (11)

Materials and Methods

Study design: Prospective Observational study

Study duration and site: This study was conducted for a period of 4 months, conducted at MNR Medical College and Hospital, Sangareddy district, Telangana, India.

Study population: Initially 500 cases were considered and after exclusion of missing data 300 cases were finalized for analysis.

Source of data and materials: The prescriptions of the selected patients were collected from inpatient general medicine department, paying attention to inclusion and exclusion criteria and were evaluated prospectively.

Study tool: Data was collected from General Medicine Department using Patient Profile Form. A separate data entry format for incorporating inpatient details was designed it includes demographic details, family history, medical history, diagnosis, medication errors (prescribing error, administration error, dispensing error, monitoring error) occurred.

Selection Criteria

Inclusion Criteria:

- Patients with any disease admitted in general medicine department.
- Patients of age between 11-80 years.
- Both male and female patients.

Exclusion Criteria:

- Patients below 10 years.
- Patients undergone any surgery.
- Patients diagnosed with chronic complication like oncology case

Ethical consideration: For obtaining the clearance certificate and application along with study protocol which include the proposed title, study site, inclusion and exclusion criteria, objective and methodology about the work to be carried out was submitted to chairman of institutional ethical committee of MNR Medical College and Hospital. The study was approved by committee by issuing ethical clearance certificate

STATISTICAL ANALYSIS

Statistical uncertainty was expressed by 95% confidence interval. Descriptive statistics were used to summarize patient demographics. Statistical interpretation was done by using Student's t test two tailed analysis & ANOVA and obtained level of significance. Statistical significance was considered at $p < 0.05$. All analyses were performed by using SPSS Software version.

RESULTS

1. DEMOGRAPHIC DETAILS:

Age: The age group included in our study were from 11 – 80 years. The patients in between age group of 11-30 years were found to be 91 (30.33%).The patients in between age group of 31-50 years were found to be 121 (40.33%).The patients in between age group of 51-70 years were found to be 60 (20.00%).The patients in between age group of 71 - 80 years were found to be 28 (9.34%).

Table 1: Age group representing number of patients and percentage

S.no	Age	Number of people	Percentage
1.	11-30 years	91	30.33%
2	31-50 years	121	40.33%
3	51-70 years	60	20.00%
4	71 – 80 years	28	9.34%

Gender: A total of 300 patients in the study, female patients were about 170 (56.67%) and male patients were about 130 (43.33%)

Table 2: Gender distribution among the patients

S.no	Description	Number of patients	Percentage
1.	Female	170	56.67%
2	Male	130	43.33%

2. AVERAGE NUMBER OF DRUGS PRESCRIBED PER PRESCRIPTION.

A Total of 300 prescriptions, 1864 drugs are prescribed. Around 89 prescriptions are having < 5 drugs (267 drugs), 191 prescriptions are with 6-10 drugs (1337 drugs) and 20 prescriptions are with 11 and above drugs (260 drugs).

Table 3: Average and Number of drugs prescribed per prescription

S.no	Number of drugs	Number of prescriptions	Total no. of drugs	Average
1	<5 drugs	89	267	3.00
2	6-10 drugs	191	1337	7.00
3	11 and above drugs	20	260	13.00

Percentage of Drugs Prescribed In Essential and Non-Essential

A total of 300 prescriptions, 1864 drugs are prescribed. Among which, essential drugs were about 1601 (85.89%) and non-essential drugs were about 263 (14.10%)

Table 4: Number of drugs prescribed in essential and non-essential drugs

S.no	Category	Total no. of classified drugs	Percentage	P value
1.	Essential drugs	1601	85.89%	0.0145
2.	Non-essential drugs	263	14.10%	

Level of significance at 95% confidential interval and S.D.

Sample t test	
t = 18.66	df = 0.1
P value (two tailed)	0.0145
P value summary	*
Significant	
(Alpha 0.05)?	Yes
S.D	91.66
	431.1 to
95% C.I	201.2

4. TYPE OF ERROR:

A total of 300 prescriptions were analysed, among them prescribing errors were about 141, administration errors were about 62, dispensing errors were about 69 and monitoring errors were about 28.

Table 5: Types of Medication Error

S.no	Type of error	Number of prescriptions with errors
1.	Prescribing error	141
2.	Administration error	62
3.	Dispensing error	69
4.	Monitoring error	28

a) Prescribing error

A total of 141 Prescription Errors, it was found that dose/strength error were encountered in 71 prescriptions (50.35%), followed by duplication error 12 (8.51%), frequency error 13 (9.21%), generic/brand name error 4 (2.83%), unnecessary drug 8 (5.67%), timing error 15 (10.63%) wrong route 8 (5.67%) and incorrect drug 10 (7.09%). **Table 6: Medication Error due to Prescribing**

S. No	TYPE OF ERROR	Number of errors	Percentage
1	Dose/ Strength Error	71	50.35%
2	Duplication Error	12	8.51%
3	Frequency Error	13	9.21%
4	Generic/ Brand name error	4	2.83%
5	Unnecessary Drug	8	5.67%
6	Timing Error	15	10.63%
7	Wrong Route	8	5.67%
8	Incorrect Drug	10	7.09%

b) **Administration error:**

Among 62 administration errors, it was found that wrong time error was about 32 (51.61%) followed by omission errors 06 (9.67%), wrong duration 8 (12.90%), wrong route 12 (19.35%) and wrong drug 04 (6.45%).

Table 7: Types of Administration errors

S. No	TYPE OF ERROR	Number of errors	Percentage
1	Wrong Time	32	51.61%
2	Omission Error	6	9.67%
3	Wrong Duration	8	12.90%
4	Wrong Route	12	19.35%
5	Wrong Drug	4	6.45%

c) Dispensing Error:

A total of 69 Dispensing errors, wrong drug/ form selected error were found to be 15 (21.73%), wrong quantity error 42 (60.86%), wrong strength error 12 (17.39%) and dispensing an expired medicine were found to be 0 (0%).

Table 8: Types of dispensing errors

S. No	Type of Error	Number of errors	Percentage
1	Wrong Drug/Form selected	15	21.73%
2	Wrong Quantity Error	42	60.86%
3	Wrong Strength Error	12	17.39%
4	Dispensing an Expired Medication	0	0

d) Monitoring errors:

Among 28 Monitoring errors, it was found that requested but not done about 10 (35.71%) followed by monitoring not requested 14 (50.00%), results not available 04 (14.28%) and results not acted upon 0 (0%).

Table 9: Types of monitoring errors

S.no	Type of Error	Number of errors	Percentage
1.	Requested but not done	10	35.71%
2	Monitoring not requested	14	50.00%
3	Results not available	04	14.28%
4	Results not acted upon	0	0

LEVEL OF SEVERITY

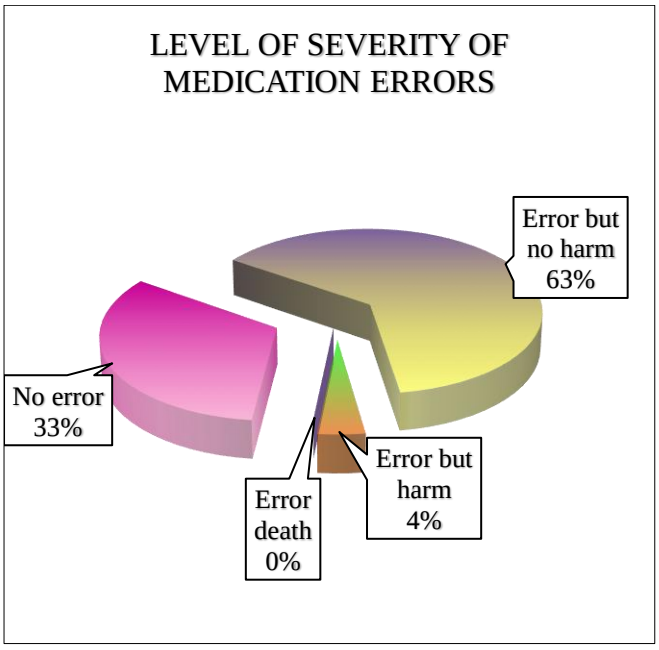

Figure 1: Graph representation of level of severity of

Medication errors in percentage

According to NCC MERP scale, errors are again subcategorised. **No error** i.e., circumstances or events have a capacity to cause error were about 99 (33.33%), **error, no harm** is again categorised into B, C, D such as an error occurred, but the medication did not reach patient 93 (31%), an error occurred that reached patient but did not cause any harm 42 (14.00%), an error occurred that resulted in the need for increased patient monitoring but no patient harm 54 (18%) respectively. **Error, harm** is also sub categorised in to E, F, G, H such as an error occurred that resulted in need for treatment or intervention that caused temporary patient harm 4 (1.33%), an error occurred that resulted in initial or prolonged hospitalisation and caused temporary patient harm 1 (0.33%), an error occurred that resulted in permanent patient harm 5 (1.66%),an error occurred that resulted in a near-death event(e.g. anaphylaxis, cardiac arrest) 2 (0.66%) respectively and **error, death** i.e., an error occurred that resulted in patient death are found to be 0 (0%

Table 10: Level of severity according to NCC MERP scale

Category	Description of category	Number of errors	Percentage
No error			
A	Circumstances or events that have the capacity to cause error	99	33.00%
Error, no harm			
B	An error occurred, but the medication did not reach the patient	93	31%
C	An error occurred that reached the patient but did not cause patient harm	42	14.00%
D	An error occurred that resulted in the need for increased patient monitoring but no patient harm	54	18.00%

Category	Description of category	Number of errors	Percentage
No error			
A	Circumstances or events that have the capacity to cause error	99	33.00%
Error, no harm			
B	An error occurred, but the medication did not reach the patient	93	31%
C	An error occurred that reached the patient but did not cause patient harm	42	14.00%
D	An error occurred that resulted in the need for increased patient monitoring but no patient harm	54	18.00%

Discussion

Prescribing of medicines is an integral part of the provision of healthcare. It represents a safe, effective and inexpensive mode of treatment. For an effective and safe treatment, it is essential that the prescribing and administration of drugs should be evaluated from time to time. Unfortunately, incorrect prescribing of medicines may occur. Prescription Errors account for 70% of Medication errors that could potentially result in Adverse Drug Reactions.

Data was collected from 500 prescriptions of patients coming to tertiary care hospital. From this, 300 prescriptions have shown different forms of Medication Errors.

The present study shows that the majority of the patients involved with Medication Errors were female patients 170 (56.6%) and male patients were about 130 (43.3%). This shows that there was the domination of females over males in Medication Errors is clearly visible, but this is contrast to the study conducted by Sandip Patel, Ashita Patel et al., who has concluded that males are more prone to Medication Errors than females.

Out of 500 prescriptions, a total of 300 prescriptions having Medication Errors and 91 (30.33%) were in age group of 11-30 years; 121 (40.33%) were in age group of 31-50 years above; 60 (20%) were in age group of 51-70 years; 28 (9.3%) were in age group of 71 and above, but this is contrast to the study conducted by Pramod Kumar, Pratibha et al., who has stated that most of the Medication Errors are seen in the patients of age group 21-30 (21.9%).

In this study 89 prescriptions show less than 5 drugs; 191 prescriptions show between 6-10 drugs; and 20 prescriptions shows 11 and above more drugs The total number of drugs prescribed in the 89 prescriptions are 267 drugs and 191 prescriptions include 1337 drugs and 20 prescriptions include 260 drugs. The total number of drugs included in all the prescriptions is about 1864. These results are in similar with the study conducted by Narne Akhil et al., who concluded that 6-10 prescribed drugs give maximum number of Medication Errors.

In present study, for 300 prescriptions a total number of 1864 drugs have been prescribed. From those Essential drugs are about 1601 (85.89%) and non-Essential drugs are about 263 (14.10%). Additionally, our study has shown that the Essential drug usage is greater than non-Essential drugs. For this, the P value is 0.0145, it is found to be significant.

Classification of Medication Errors were done according to the World Health Organization classification which describes the Medication Errors into: Prescribing errors, Administration errors, dispensing errors and monitoring errors. Furthermore, we have also considered severity according to the National Coordinating Council of Medication Error Reporting and Prevention (NCC MERP).

In this study, 141 prescriptions have shown the Prescribing errors, 62 Prescriptions have shown the Administration errors, 69 Prescriptions have shown the Dispensing errors and 28 Prescriptions have shown the Monitoring errors, which is in accordance to study by Syamprashanth Pedada, Jyotsna Allamsetty et al.

For 141 Prescribing errors, out of this the number of Dose or Strength errors are 71, Duplication errors are 12, Frequency errors are 13, Generic/Brand name error are 4, Unnecessary drug error are 8, Timing error are 15, Wrong route error are 8 and Incorrect drug error are 10. For this, the P value is 0.474, it is found to be significant.

A total of 62 Administration errors were found, out of this the Number of Wrong time error is 32 (51.61%); Omission error is 6 (9.67%); Wrong duration error is about 8 (12.90%); Wrong route error is 12 (19.35%) and Wrong drug error is 4 (6.45%).

A total of 69 Dispensing errors, we found that Wrong drug/form are 15 (21.73%), Wrong quantity error is 42 (60.86%), Wrong strength error is 12 (17.39%) and dispensing as expired medication are 0.

A total of 28 Monitoring errors were found, out of that requested but not done is about 10 (35.71%), monitoring not requested are 14 (50%), results not available are 4 (14.28%) and results not acted upon are 0.

Prescribing errors were the most frequent category of Medication Errors occurred in patients followed by monitoring errors. High rate of prescribing errors might be due to peak hour and patient load leading to lack of attention by the healthcare team, which could affect the patient treatment, increase the hospital stay, and further cause an economic burden to hospital as well as patients. The results of the study were in contrast with the study carried out by Patel et al., who has stated that administration errors were common type of Medication Errors.

The level of severity of Medication Errors is calculated based on the NCC MERP scale. No error was occurred in 99 (33%); Error but no harm occurred in 189 (63%); Error but harm occurred in 12 (4%); Error death was not occurred. For this, the P value is 0.031, it is found to be significant.

According to NCC MERP, risk assessment of Medication Errors out of 300 prescriptions, the errors have been subcategorized. Circumstances or events that have the capacity to cause error are about 99 (33.00%); an error occurred but medication didn't reach the patient are about 93 (31%); an error occurred that reached the patient but did not cause patient harm are about 42 (14%);an error occurred that resulted in the need for

increased patient monitoring but no patient harm are about 54 (18%); an error occurred that resulted in the need for treatment and caused temporary patient harm are about 4 (1.33%);an error occurred that resulted in initial or prolonged Hospitalization and caused temporary patient harm are about 1 (0.33%),1an error occurred that resulted in permanent patient harm are about 5 (1.66%);an error occurred that resulted in an near death event are about 2 (0.66%); an error occurred that result in patient death are 0. These results are contrast with the study carried out by Syamprashanth Pedada, Jyotsna Allamsetty et al., where our study shows that category-B errors were more identified when compared to them.

This effort was found to be significantly positive in order to administer the medications on time to patients and avoid the wrong drug and wrong dose errors by health care team. As far as our knowledge goes, this is the study conducted for comprehensive evaluation of medication according to the World Health Organization and National Coordinating Council for Medication Error Reporting and Prevention [NCC MERP].

Conclusion

Present study has concluded that the medication errors occur at each stage of medication use, along with severity assessment of medication errors. These medication errors may potentially result in adverse drug reactions. Medication errors must be reported immediately to the practitioner who has ordered the medication. Records of episodes should be become part of the patient's chart and pharmacy records.

Present study highlights the importance of clinical pharmacist in identifying, rectifying and modifying the medication errors which are a cynosure for emerging pharmacy practice education in India and thus assure to the patient safety by rendering his services.

Thus, Clinical pharmacists are requested by the medical state authorities to develop a written procedure for recording, reporting and interviewing of patients to determine if the sign and symptom observed is likely from a drug. This can provide active feedback information which can be used to prevent the occurrence of medication errors.

Some of the principles should be followed to prevent the occurrence of medication errors:

- One should be knowledgeable about patient's medications. (e.g.: allergy to drugs, duplication of drugs with similar pharmacological activity)
- When medication is prescribed, it is important to have thorough understanding of its pharmacology (to prevent drug interactions)
- One should be knowledgeable concerning characteristics of patient (e.g.: age concomitant disease)

These significant contributions by clinical pharmacist help in improving the efficacy and decreasing errors in drug therapy.

Clinical pharmacist should also conduct awareness and education programs for nursing staff and other health care professionals regarding detection and reporting of Medication errors, this can minimize the risk to benefit ratio of drugs prescribed. Continuous monitoring of medications in hospital setup will definitely reduce the occurrence of medication errors and improves the patient's safety

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