



Received on 18/05/2012;

Revised on 23/05/2012;

Accepted on 05/06/2012

Pharmacists Interventions and Pharmaceutical Care in an Indian Teaching Hospital: A Prospective Study

Y. Achyuth Kumar, V. Raghu Kumar, Akram Ahmad*, G. P. Mohanta, P. K. Manna
Department of Pharmacy Practice, Annamalai University, Annamalai Nagar, Chidambaram 608002,
Tamil Nadu, India



Corresponding Author:

Name: Akram Ahmad

PharmD (P.B.) Intern

Department of Pharmacy Practice, Annamalai University, Annamalai Nagar-608002

E mail: akrampharma67@gmail.com

ABSTRACT

BACKGROUND: Drug therapy has become so difficult that no one professional is expected to optimize the drug therapy and control drug related problems (DRPs) alone. Despite excellent benefits and safety profile of most medications, DRPs pose a significant risk and adversely affect quality of life of patients. Pharmacists seek to implement pharmaceutical care and measure their effects on patient outcomes.

OBJECTIVE: The objective of the study was to identify DRPs amongst inpatients, and the clinical outcome derived from pharmaceutical reactive intervention and passive interventions.

METHODOLOGY: The prospective study involves collection of medication details of all the patients and reviewed independently by the pharmacist to identify DRPs and discussed with the physician and suitable reactive interventions were provided and each intervention was graded based on the expected clinical outcome. Similarly passive interventions involved provision drug information services to health care professionals.

RESULTS: A total of 386 interventions were made of which 261 were reactive interventions (261 DRPs were identified from 189 patients) and 125 were passive interventions. The most common DRPs was drug use without indication (18%) and most common reactive intervention was cessation of drug (20%) and the most frequent passive intervention (drug information query) was related to education and recent advances (51.2%).

CONCLUSION: The study demonstrates that reactive interventions of clinical pharmacist improved the patient outcome and passive interventions influenced physicians' decision making in drug therapy.

KEY WORDS: Drug therapy, Drug related problems, Pharmacist, Interventions, Pharmaceutical Care.

(Research Article)**INTRODUCTION**

Pharmacy practice has evolved dramatically over the last four decades. In many settings, the pharmacist's role has shifted from a primary focus on medication dispensing to a focus on providing patient care. Historically, the practice of pharmacy has been that of interpreting, evaluating, and implementing medical orders and dispensing medications. [1] However, the practice of pharmacy has expanded to include determining optimal evidence-based medication management, monitoring for adverse drug events, educating patients and caregivers on medication use, and collaborating with physicians and other health professionals in the management of acute and chronic diseases.^{1,2}

Pharmacists seek to implement pharmaceutical care and measure their effects on patient outcomes.³ Successful processes - ones that lead to better patient outcomes must be defined and adopted for pharmacists to succeed using this new practice model. ^{4,5}

The primary activities involved in pharmaceutical care are generally well known. They include the following: ^{6,7}

1. Assessment, such as taking a medication history and identifying real and potential drug-related problems (DRPs).
2. Pharmacy care plan development, such as making and implementing recommendations and monitoring parameters to resolve and prevent DRPs.
3. Evaluation, such as following up to determine whether clinical outcomes have been achieved.

Drug therapy enhances health related quality of life for most of the diseases.² Despite excellent benefits and safety profile of most medications, drug related problems pose a significant risk to patients which adversely affect quality of life, increases hospitalization and overall healthcare cost.^{9,10} However, optimization of drug therapy can eliminate DRPs, Potentially save lives and enhance quality of life of patients.⁸⁻¹⁰ Increased use of medication and availability of new drug therapies potentially increase the risk of patient for iatrogenic adverse drug events in hospitals.^{11,12} Iatrogenic adverse drug events are important for consideration because it can not only prolong the length of stay in the hospital but also increase overall healthcare expenditure.

Drug therapy has become so difficult that no one professional is expected to optimize the drug therapy and control DRPs alone.^{13,14} Today there exists due problem in medical care that urgently requires expert attention namely drug related morbidity and mortality.^{6,10}

A drug-related problem (DRP) is defined as an event or circumstance that actually or potentially interferes with desired health outcomes. DRPs can lead to ineffective pharmacotherapy and may cause drug-related morbidity and mortality. Most DRPs are avoidable and clinical pharmacists are assuming an active role in preventing and solving DRPs. Drug-related problems (DRPs) such as inappropriate prescription, clinically relevant drug-drug interactions, non-adherence, adverse drug reactions, are the most commonly encountered DRPs. These problems could be well prevented or minimized by initiating changes in the drug therapy through clinical pharmacy services.¹⁰

Interventions in prescribing by the pharmacist can be done in following ways: ¹⁵

(Research Article)

1. Active campaigns.
 2. Reactive interventions.
 3. Passive interventions.
- **Active campaigns** have sought to alter prescribing in a specific area. The use of guidelines, particularly when backed up by the personal visits reduces inappropriate use of antibiotics, parenteral nutrition therapy and other classes of drugs. The effect of such targeted interventions may be transient and requires regular reviews. In India guidelines for drug use are non-existent and thus such programme could be only possible after framing of guidelines of the drug in question.
 - **Reactive interventions** are also called Pharmacist initiated interventions and is defined as unsolicited advice to Physician if, it was thought that a change in drug, dose, frequency, route or any aspect of drug therapy was considered advisable.
 - **Passive interventions** involves provision of drug information to health care professionals on various aspects of drug ranging from dose, route of administration to adverse event and drug interactions.

The objective of the study was to identify DRPs amongst inpatients, and the clinical outcome derived from pharmaceutical reactive intervention and passive interventions.

MATERIALS AND METHODS:

The prospective study was conducted at 1425 bed tertiary care teaching hospital in cuddalore district of Tamil Nadu over a period of one year (July 2011 to April 2012). Inpatients of either sex of any age [$>18y$] undergoing treatment in

medicine ward were included in the study. The exclusion criterion was patients receiving treatment on outpatient basis. The interventions were made by Pharm. D. [Post- baccaureate] student. The medication details of the patient who are admitted in the ward were collected and documented in a suitable data collection form. The intervening pharmacist to identify the drug related problems reviews the data collected independently. Finally the nature of each DRP was categorized based on categories described by Helper and Strand.⁶

Reactive interventions: DRPs identified were brought to the notice of the concerned physician for remedial action and the primary reason for initiating reactive intervention was recorded. In addition appropriate interventions were provided to physician at the earliest possible time. The clinical significance of intervention was assessed by the intervening pharmacist and later recorded. The acceptance of level physician for the particular intervention was recorded as either accepted or rejected. Similarly whether or not there is change in drug therapy was noted. In addition total time taken by the intervening pharmacist in preparing and undertaking interventions was recorded. At the time of the patient discharge the intervening pharmacist documented the actual changes to drug therapy and patients' outcome relating to the intervention. The involvement of the of pharmacist in therapeutic decision making was rated according to Campagna decision making model.

Passive interventions: Drug information service was provided to clinicians, nurses and other health care professionals. The interventions were evaluated for: type of inquirer, category of query, and number of queries per month.

(Research Article)**RESULTS**

A total of 386 interventions were made of which 261(67.61) were reactive interventions and 125 (32.38) were passive interventions.

Reactive interventions

A total of 3315 cases were followed and reviewed in the medical ward over five months

period. Of the cases reviewed 261 drug related problems were identified from 189 patients. The incidence of DRPs was found to be 7.9 per 100 patients followed. Average DRPs per prescription was 1.4 [range:1-5]. Majority of the patients were males [n-109(57.8%)].the average age of the patients was 49.8±13. Majority of DRPs occurred in age group of 41-60years. The demographic details of the patient were summarized in table- 1.

Table 1: Demographic details of patients.

PARAMETER	CHARACTERISTIC	NUMBER (%) N=189
Age(years)	18-29	10(5.3)
	30-40	31(16.4)
	41-50	50(26.4)
	51-60	50(26.4)
	61-70	42(22.2)
	71-80	6(3.2)
Sex	Male	109(57.8)
	Female	80(42.3)
Number of drugs received per patient	1-5 drugs	54(28.6)
	5-7 drugs	116(61.4)
	>7 drugs	19(10)
Co- morbidities	Nil	56(30)
	1-2	95(50)
	3-4	31(16)
	>4	7(4)

(Research Article)

The most common DRPs was drug use without indication which accounted for 18% (n= 47) of the total drug DRPs followed by improper drug

selection 14% (n= 36) and sub therapeutic dose 14% (n=36). The types DRPs are summarized in table-2.

Table- 2: Drug related problems

Drug related problem	Number (%) N=261
Drug use without indication	47(18)
Improper drug selection	36(14)
Sub therapeutic dose	36(14)
Drug interaction	31(12)
Overdose	28(11)
Adverse drug reaction	21(8)
Untreated indication	19(7)
Failure to receive drug	14(5)
Others	29(11)

Others= class duplication (n=12), drug duplication,(n=10), dispensing error (7)

followed by significance level minor (29%). The significance level of DRPs is represented in table-3.

Of the total interventions made, significance level of moderate was found to be high (60%)

Table-3: Significance level of drug related problems

Significance	Number (%) N=261
Minor	75(29)
Moderate	157(60)
Major	29(11)

The most frequent intervention provided by the intervening pharmacist was cessation of drug 20% (n=53) followed by addition of drug 14% (n=37). Change of drug dose accounted for 13% (n=33) of the total suggestions provided.

Suggestions related to pharmaceutical aid was found to be least 2% (n=4). Various suggestions provided by the intervening pharmacist are summarized in table-4.

(Research Article)**Table-4:** Interventions of the Pharmacist

Intervention	Number (%) N=261
Cessation of drug	53(20)
Addition of drug	37(14)
Change in drug dose	33(13)
Change in duration of therapy	31(12)
Change in frequency of administration	28(10.67)
Change in route of administration	17(6.5)
Change in dosage form	12(5)
Pharmaceutical aid	4(2)
Others	20(7.66)

Others- need laboratory investigation- 1, need patient counseling- 9, annotation changes- 7, and availability of drugs- 3

The acceptance rate of intervening pharmacist's suggestion was found to be 87% (n=227). Of these, changes in the drug therapy

was observed in 81% (n=183) of accepted suggestion. In the total interventions made 46% (n=118) belonged to drug therapy decision making level – 1(corrective) followed by level- 4 (proactive) accounting for 30% (n= 79). The pharmacist involvement in drug therapy decision making is presented in table-5.

Table 5: Pharmacists involvement in decision making

Decision	Number (%) N=261
Annotative- level -1	42(16)
Corrective- level-2	118(46)
Consultative- level-3	22(8)
Proactive –level-4	79(30)

The total time spent by the intervening pharmacist in preparing, undertaking and documenting all interventions was 106hours and 25minutes. The average time spent for each intervention is 12.5 minutes. [Range -2 to 60minutes]

Passive intervention

There were 125 passive interventions forming 32.38% of the total interventions. The types of

inquiries are from Doctors (76.8%), P. G. students (10.4%), Pharmacists' (8%), nurses (4.8%) Type of queries received were education/ recent advances (51.2%), drug therapy (11.2%), administration (4%), adverse drug reactions (7.2%), interactions (5.6%), availability and cost (3.2%), poisoning (3.2%), indications and contraindications (4%), pharmacokinetics (4%), pregnancy(5.6%) and efficacy(0.8%). The different types of queries are summarized in table- 6.

(Research Article)**Table 6:** Type of queries or category of questions (Passive interventions)

Query	Number (%) N= 125
Education/recent advances	64(51.2)
Drug therapy	14(11.2)
Administration	5(4)
Adverse drug reaction	9(7.2)
Drug interactions	7(5.6)
Availability and cost	4(3.2)
Poisoning	4(3.2)
Indications and contraindications	5(4)
Pharmacokinetics	5(4)
Pregnancy	7(5.6)
Efficacy	1(0.8)

The number of queries received in July were 12.6%, August 30.4%, September 24.8%, October 20%, and November 12.2%.

DISCUSSION

Clinical pharmacy is an emerging discipline in India.¹⁰ Clinical pharmacy service optimizes patient outcome by promoting rational use of medicines. [16] Since clinical pharmacy is more of a concept rather than a practice in India, an attempt has been made to carry out the work to the best of the abilities of clinical pharmacists' involved.

A few studies described clinical pharmacy activities that reduce DRPs, related hospitalizations, probability of readmission and cost of drug therapy.^{9, 10} The results were described under two broad categories: reactive intervention and passive intervention. Reactive intervention involved direct patient care activities, whereas passive interventions were in the form of drug information services which influenced the physician's therapeutic decision.

Reactive interventions:

In our study DRPs were high in patients aged between 41- 60 years (52.8%). Of the 189 patients DRPs commonly observed in male patients (57.8%). This finding might be due to increased medication use owing to their multiple co-morbidities. Majority of the patients received 5-7 drugs (61.4%) and hence increased risk of DRPs. Regular review of patients' medication use can potentially decrease DRPs. [16] Drug use without indication [18%(n=47)] was the most common DRP observed, followed by improper drug selection [14%(n=36)]. This observation is in contrast to the study conducted by Gurumurthy Parthasarathi et al.¹⁰ in which inappropriate dosing accounted for the highest (31%) followed by improper drug selection (17%). Few drugs often used without indication included Rabeprazole, Ranitidine and Paracetamol. Although antisecretory agents are often used as prophylaxis especially in patients with a previous history of peptic ulcer disease, the agents were prescribed while there was no such indication. A study conducted by David L. Whaley et al.¹⁷ reported that gastrointestinal agents were the major class of drugs prescribed in a hospital. In

(Research Article)

our study, the use of proton pump inhibitors was to prevent the possible gastritis associated with the use of antibiotics and NSAIDs. However, where appropriate after intervening by the pharmacist Rabeprazole was withdrawn from patient's drug therapy.

Improper drug selection (14%) was the second most common DRP observed. This finding coincides with a similar study conducted by Gurumurthy Parthasarathi et al.¹⁰

Where it was reported that improper drug selection (17%) was the second most common DRP. The high incidence of improper drug selection was attributed to lack of standard treatment protocol in the hospital, poor history taking. In one incidence hypertensive patients with Diabetes was administered Beta- blocker owing to lack of documentation of patient's medication history. Later when the intervening pharmacist reviewed the case it was observed that the patient is Diabetic and appropriate intervention was made as Beta blockers may mask glycemic effect of antidiabetic drugs. Failure to receive drug was accounted for [5% (n=14)] of the total DRPs. In few cases, it was due to economic constrains of the patients that led to non- procurement of the of the prescribed medicines while in other cases it was due to shift of nursing staff and reluctance of the patients to take medicines for unknown reasons. Other types of DRPs including drug duplication and class duplication were majority due to availability of more than 80,000 formulations of drugs in Indian market with different brand names leading to confusion.^[10] This error can be minimized by prescribing generic names and also by reviewing and rechecking of medication order prior to drug administration.

Of the 261 DRPs, 29% (n=75) were rated to the minor 60% (n=157) were moderate and 11% (n=29) were major significance of interventions. This finding correlates with a study^[10] that reported 49% of interventions as moderate significance. The moderate significance level is the level of problems requiring adjustments, which are expected to enhance effectiveness of drug therapy producing minor reduction in patient morbidity or treatment costs. In our study, for example, patient experienced severe diarrhea [presence of signs of dehydration with abdominal pain and cramps] after receiving Clindamycin induced diarrhea and sought for the cessation of drug. Thus the timely intervention by intervening pharmacist might have resulted in reduction in hospital stay and hence the cost involved in the management of adverse drug reaction.

Antibiotics (21%) were the most commonly implicated drug class in DRPs. This observation was coinciding with observations made by different studies.^{18,19}

Ahuva lusting found antibiotics (38.7%) as the most prevalent class of drugs prescribed in hospital.^[18]Inappropriate antibiotic usage may provoke the emergence of bacterial resistance and increased health care lost. Similar finding was reported in a study conducted by Carlos Bantar et al.¹⁹ In our study, patients were either receiving high dose of antibiotics or antibiotics were prescribed without any valid indication. Of the 261 DRPs, 17%and 15% of DRPs were found in patients treated for cardiovascular disorders and respiratory disorders respectively. These observations correlated with the Michael J. Dooley et al.⁹ study conducted in Australia in our study, it may be perhaps due to high occupancy rate of patients with cardiovascular disorders and respiratory disorder in medical ward resulting in use of more medication in these patients, thus leading

(Research Article)

to potential DRPs. Cessation of drug (20%) and addition of drug (14%) were the interventions most frequently provided. This finding differs from observation made in an Indian study where in change in drug dose was reported as the most common suggestion made.¹⁰ and correlates with another study by Brown G et al where cessation of drug was frequently provided intervention²⁰ Other interventions made in our study included change in drug dose, duration of therapy, frequency of administration and substitution of drug etc. Addition of drug was suggested in case of untreated indications that required treatment. Few of the untreated conditions included anemia, cough. In most cases, the change in drug dose was sought in patients with renal/hepatic impairment enquiring dosage reduction. In our study, the major reasons for cessation of drug were due to drug use without indication and improper drug selection. Few examples that warranted the cessation of drugs in our study included use of beta blockers in Asthma patient, steroids in Diabetes and Paracetamol in afebrile condition. These findings of our study indicate that there is a scope for pharmacist to suggest issues related to rational drug therapy and emphasize the importance of involvement of pharmacist in healthcare delivery. The acceptance rate of intervening pharmacist's suggestions was found to be high (87%). This observation correlates with other published studies Hawkey C. J. et al.²¹ Of the 87% of interventions accepted, 81% of interventions lead to the changes in drug therapy. The remaining 19% of interventions that did not lead to drug therapy might perhaps be due to lack of information to strengthen the suggestions provided. In few cases, experienced physicians did not change their routine prescribing pattern despite the presence of DRPs, especially, DRPs of minor significance. For example, a suggestion for use

of Domperidone instead of Ondansetron for vomiting was rejected.

The total time spent by the pharmacist in preparing, undertaking and documenting all interventions was 106h and 25 mins. The average time spent for each intervention was 12.5 mins (range: 2 to 60mins). This observation was contrast to Dooley Michael J et al study where 9.6 mins was spent to develop each intervention.^[9] This difference may be attributed to the fact that unlike India patient medication history was available in developed countries like Australia. In addition, unlike our study involvement of experienced clinical pharmacist would have lead to high acceptance rate and also reduction in time spent for each intervention.

Passive interventions

A total of 125 queries were received at an average of 25 queries per month and the majority of the queries were related to education (51.2%), this indicates that most of the queries served to update the knowledge of healthcare professionals. Other queries include drug therapy, adverse reactions, interactions, availability and cost, poisoning, indications and contraindications, pharmacokinetics, pregnancy and efficacy.

Pharmaceutical care provided by the clinical pharmacist can positively influence the patient outcome. Review of patient drug therapy by the clinical pharmacist will optimize the drug therapy. In our study the acceptance rate of reactive intervention developed by the pharmacist is high and passive interventions rendered to health care professionals was found be beneficial and proves the fact that pharmacist has an enormous role to play in a health care team through quality use of medicines.

(Research Article)**LIMITATIONS**

1. Firstly, any intervention entails judgment by the pharmacist, and the recording of an incident is inevitably one sided.
2. Secondly, the study concentrated only on faults in prescribing. It had no power to record or measure the extent of prescribing excellence or its rate compared with poor prescribing.
3. A third and related problem is that the study did not measure the number of errors missed by the pharmacist when an intervention should have been made.

ACKNOWLEDGEMENT

The authors like to thank the Dr. R. Manavalan, Professor and Head, Department of Pharmacy and staff, Chidambaram, for their support and encouragement.

REFERENCES

1. Brushwood D, From confrontation to collaboration: collegial accountability and the expanding role of pharmacists in the management of chronic pain. *J Law Med Ethics*. 2001, 29, 69–93.
2. Carmichael JM, Cichowlas JA. The changing role of pharmacy practice—a clinical perspective. *Ann Health Law*. 2001, 10, 179–90.
3. Singhal PK, Raisch DW, Gupchup GV. The impact of pharmaceutical services in community and ambulatory care settings. *Ann Pharmacother*. 1999, 33, 1336-55.
4. Farris KB, Kirking DM. Assessing the quality of pharmaceutical care. II: Application of concepts of quality assessment from medical care. *Ann Pharmacother*. 1993, 27, 215-23.
5. Lipowski E. evaluating the outcomes of pharmaceutical care. *J Am Pharm Assoc*. 1996, 36, 726-34.
6. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm*. 1990, 47, 533-43.
7. Cipolle RJ, Strand LM, Morley PC. The patient care process. In: *Pharmaceutical Care Practice*. New York, NY: McGraw-Hill; 1998, 121-75.
8. Salvesen Blix Hege, Reikvam Asmund, Anders Moger Tron, Jahren Hjemass Bodil et.al. The majority of hospitalized patients have drug-related problems: results from a prospective study in general hospitals. *Eur Clin Pharmacol* 2004, 60, 651-658
9. Dooley Michael J, Allen Karen M, Doecke Christopher J, Galbraith Kirsten J, Taylor George R. et.al. A prospective multicentre study of pharmacist initiated changes to drug therapy and patient management in acute care government funded hospitals. *British Journal of Clinical Pharmacology* 2004, 57(4), 513-521.
10. Parthasarathi G, Ramesh M, kumar JK, Madaki S. Assessment of drug-related problems and clinical pharmacists interventions in an Indian teaching hospital. *Journal of Pharmacy practice and Research* 2003, 33, 272-274.

(Research Article)

11. Einarson Thomas R. Drug-related hospital admission. The Annals of Pharmacotherapy 1993, 27, 832-840.
12. Roberts Michael S, Stokes Julie A, King Michelle A, Lynne Teresa A, et al: Outcomes of a randomized controlled trial of clinical pharmacy intervention in 52 nursing homes. British journal of clinical pharmacology, 2000, 51, 257-265
13. Bond CA, Raehi Cynthia, Franke Todd. Medication errors in United States hospitals. Pharmacotherapy; 2001, 21(9), 1023-1036.
14. Kaleemudin Mohammed, Sankham Rajendran D, Bojaraj Suresh. The role of clinical pharmacist in poison – related admission in a secondary care hospital. Australian journal of pharmacy, 2001, 31, 26-30
15. The society of hospital pharmacist of Australia committee of specialty practice in clinical pharmacy. Practice and standards: Standards of practice for clinical pharmacy. The society of hospital pharmacist of Australia. 1996, 2-16.
16. Dell Kale MO, Kuoukarelan Suzan. Impact of clinical pharmacist on readmissions in patients with acute coronary syndrome. The Annals of Pharmacotherapy. 2005, 39, 1427-32.
17. Whaley DL, Tomich DJ, Kelly PC, Tanner J et al: impact of clinical pharmacist-led guideline enforcement on drug costs, patient satisfaction. Formulary 1999, 34, 257-268.
18. Lusting Ahuva: medication errors prevention by pharmacist- an Israeli solution. Pharmacy world science 2000, 22(1), 21-25.
19. Bantar Carlos, Sartori Beatriz, Vesco Eduardo, Heft Claudia et al: A hospital wide intervention program to optimize the quality of antibiotic use: impact on prescribing practice, antibiotic consumption, cost savings and bacterial resistance. CID 2003, 37, 180-186.
20. Brown G: Assessing the clinical impact of pharmacist's interventions. American journal of hospital pharmacy. 1991, 48, 2644-7.
21. Hawkey C. J, Hodgson S, Norman A, Danshamed T. K: Effect of reactive Pharmacy interventions in quality of hospital prescribing. British medical journal. 1990, 300, 986-990.