

IMPACT OF PHARMACIST-LED MEDICATION REVIEW AND PATIENT EDUCATION ON DRUG-RELATED PROBLEMS AND COMPLIANCE AMONG HOSPITALIZED CARDIOVASCULAR PATIENTS: AN INTERVENTIONAL STUDY

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Abstract

Objective: This study aimed to evaluate the impact of pharmacist-led medication review, identify and resolve drug-related problems (DRPs) and improve patient compliance before and after counselling among cardiovascular inpatients in a tertiary hospital in Sindh, Pakistan.

Methods: A prospective interventional study was conducted at the National Institute of Cardiovascular Diseases, Sukkur, Sindh from November 2023 to November 2024. A total of 385 cardiovascular inpatients aged 18 years or older were enrolled. DRPs were assessed using PCNE classification V9.1. Patient compliance was measured using the Medication Adherence Rating Scale (MARS) by comparing before and after counselling. Data were analyzed using SPSS version 24.

Results: Of 385 patients, 61% were male and 39% female. Out of which 696 drug related problems were identified. Among 696, 223 (58%) adverse drug reaction, 190 (49.4%) drug interaction, 62 (16%) duration of treatment too short, 54 (14%) untreated indication, 39 (10%) drug use without indication, 31 (8%) drug dose too low, 27 (7%) duration of treatment too high, 23 (6%) drug dose unclear, 19 (5%) drug dose too high, 16 (4%) inappropriate drug form, 12 (3%) too many drugs prescribed for an indication. For 696 DRPs identified and provided with 223 interventions which includes 64 (28.7%) drug withdrawal, 49 (21.8%) symptomatic treatment, 79 (35.6%) addition of new drug, 5 (2.3%) dosage form altered, 18 (8%) dose altered and 8 (3.4%) others. Patient compliance improved from 53% before counselling to 73% post counselling.

Conclusion: Pharmacist-led interventions significantly identify and resolve DRPs and improved patient compliance. Hence the study addresses the importance of clinical pharmacist into the hospital is highly recommended.

INTRODUCTION

Cardiovascular disease (CVD) is one of the primary causes of illness and death on a global scale, leading to approximately 17.9 million deaths each year, which is about 32% of all deaths worldwide (the World Health Organization, 2023). In lower and middle-income countries like Pakistan, the burden of CVD is rapidly increasing due to a rise in risk factors, a lack of awareness, and insufficient healthcare access (Ahmed et al., 2019; Zafar et al., 2018).

The effective management of heart disease necessitates complex pharmacotherapy, often involving multiple medications over extended durations. This complexity increases the risk of drug-related problems (DRP), including misinformation, adverse drug reactions (ADRs), drug interactions, and non-compliance with medication (Hepler & Strand, 1990; Bashi et al., 2014). Research has shown that DRP not only compromises patient safety but also contributes to hospital readmissions, longer hospital stays, and rising healthcare costs (Lajrao, Pomerranz and Kori, 1998; Z et al., 2008).

A significant factor contributing to Drug-Related Problems (DRP) is non-compliance. According to the World Health Organization (2003), it is estimated that adherence to long-term medication for chronic illnesses is merely 50% in developed nations, and even lower in developing countries. Non-compliance can arise from various factors, such as inadequate health literacy, complicated dietary requirements, fear of adverse effects, and insufficient patient involvement (Brown and Busel, 2011).

To evaluate patient compliance, the Medication Adherence Rating Scale (MARS) is recognized for its validity across diverse patient groups. It integrates behavioral, cognitive, and attitudinal components to assess adherence more comprehensively (Thompson et al., 2000; Fialco et al., 2008). Its application has proven effective in both psychotherapy and general medical conditions, including patients with heart diseases (Chan et al., 2015).

Pharmacists are increasingly acknowledged as vital members of the healthcare team, particularly in managing chronic diseases. They can identify and address DRP through medication reviews, thereby enhancing patient compliance (Tong et al., 2017; Meconen et al., 2016). Evidence from various

traditional studies indicates that pharmacist-led services significantly improve therapeutic outcomes and patient satisfaction (2016; Toucht et al., 2014).

This study aims to assess the impact of pharmacist-led medication review to identify and resolve DRPs and counselling in hospitalized cardiovascular patients at a tertiary care hospital in Pakistan.

Methodology

A prospective interventional study was carried out at the National Institute of Cardiovascular Diseases (NICVD), located in Sukkur, Sindh, from November 2023 to November 2024. A total of 385 hospitalized patients with cardiovascular conditions were selected through non-probability purposive sampling. Data collection was performed using structured instruments, including PCNE V9.1 for the classification of drug-related problems (DRP) and the Medication Adherence Rating Scale (MARS) to evaluate patient compliance both before and after counseling.

Inclusion criteria included patients of both gender above 18 years of age admitted to hospital with cardiovascular diseases along with co-morbidities or without co-morbidities, consent was granted verbally from patients to participate in the study. Patients were excluded if they discharged against medical advice, medico-legal cases and patients who were not willing or not granted to participate in the study.

Interventions led by pharmacists included individualized medication reviews and counseling. Pre- and post-intervention data were analyzed by using the chi-square test in SPSS version 24, with statistical significance established at $p < 0.05$.

Results

In this study, 385 patients were selected through a non-probability purposive sampling technique and were then evaluated. The demographic details of the patients are presented in Table 1. It was noted that there were 247 male patients (61%) and 138 female patients (39%). The age distribution among the patients indicated that 108 (28%) belonged to the 18-30 age group, 98 (25.3%) were in the 31-40 age group, 102 (26.7%) were in the 41-50 age group, and 77 (20%) were in the 51-60 age group. A total of 154 (40%) patients were from urban areas, while 231

(60%) were from rural areas. The educational levels of the patients were as follows: 141 (36.7%) were illiterate, 95 (24.7%) had completed primary education, 85 (22%) had completed matriculation,

46 (12%) had completed higher secondary education, and 18 (4.7%) had graduated. Out of the total patients, 221 (53.3%) were employed, and 164 (42.7%) were unemployed.

Table: 1 Demographic Characteristics of Study Participants (n = 385)

Variable	Frequency	Percentage
Gender		
Male	247	61%
Female	138	39%
Age Group		
18-30	108	28%
31-40	98	25.3%
41-50	102	26.7%
51-65	77	20%
Locality		
Urban	150	40%
Rural	231	60%
Education		
Illiterate	141	36.7%
Primary	95	24.7%
Matric	85	22%
Higher-Secondary	46	12.0%
Bachelors	18	4.7%
Occupation		
Employed	221	53.3%
Unemployed	164	42.7%

Distribution of patients according to cardiovascular diseases

Among the 385 patients, the most commonly diagnosed conditions included Ischemic Heart Disease (IHD) in 166 cases (43%), Myocardial

Infarction (MI) in 89 cases (23%), Valvular disease in 61 cases (16%), Acute coronary syndrome (ACS) in 49 cases (13%), and Chronic heart failure (CHF) in 20 cases (5%) are describe in the following table no 2

Table 2: Diseases of patients

Heart Disease	Frequency (n)	Percentage
Ischemic Heart Disease (IHD)	166	43%
Myocardial Infaction (MI)	89	23%
Valvular disease	61	16%
Acute coronary syndrome (ACS)	49	13%
Chronic heart failure (CHF)	20	5%
Total	385	100

PCNE V9.1 classification of drug related problems

The outcome of the study involving 385 patients showed that there were 696 Drug-Related Problems (DRPs) identified. Among these, the most prevalent

were 223 (58%) adverse drug reactions, 190 (49.4%) drug interactions, 62 (16%) cases of treatment duration being too short, 54 (14%) untreated indications, 39 (10%) drug use without an

indication, 31 (8%) drug dose too low, 27 (7%) duration of treatment too high, 23 (6%) drug dose unclear, 19 (5%) drug dose too high, 16 (4%)

inappropriate drug forms, and 12 (3%) multiple drugs prescribed for a single indication, as described in the table no 3.

Table 3: PCNE V9.1 classification of drug related problems

PCNE Code V9.1	Type of DRP	Frequency	Percentage
C1	Drug Selection		
C1.2	Drug use without indication	39	10%
C1.5	Untreated indication	54	14%
C1.6	Too many drugs prescribed for an indication	12	3%
C2.1	Drug Form		
	Inappropriate drug form for this patient	16	4%
C3	Dose Selection		
C3.1	Drug dose too low	31	8%
C3.2	Drug dose too high	19	5%
C3.5	Drug dose unclear	23	6%
C4	Treatment Duration		
C4.1	Duration of treatment too short	62	16%
C4.2	Duration of treatment too high	27	7%
P2.1	Adverse Drug Event		
	Patients suffers from side effects	223	58%
P9.1	Other cause(Drug Interaction)	190	49.4%

DRUG SELECTION

The table below outlines the categorization of drug-related issues concerning drug selection. The data indicates that 39 (10%) of cases involved drug use without indication, 54 (14%) of cases involved in untreated indication and 12 (3%) of cases involved multiple drugs prescribed for an indication described in the following table no 4

Table 4: Drug Selection

Drug Selection (DRPs)	Frequency	Percentage
Drug use without indication (n=39) 10%		
Metoclopramide	8	20%
Hydrocortisone	4	10%
Drotavarine	4	10%
Omeprazole	9	25%
Diazepam	6	15%
Tramadol	4	10%
Paracetamol	4	10%
Untreated Indication (n=54) 14%		
Diarrhea	4	7
Abdominal pain	8	14
Constipation	4	7
Dry Cough	11	20
Fever	11	20
Vomiting	8	14

Headache	8	14
Too many drugs prescribed for an indication (n=12) 3%		
Hypertension	8	66%
Dyslipidemia	4	34%

DRUG FORM

In this research, 4% of instances involve the incorrect drug form for patients. A patient experiencing acute chest pain ingests a Nitroglycerine 0.5 mg tablet rather than placing it under the tongue, which leads to a delay in pain relief and exacerbates ischemia. Consequently, it is essential to instruct the patient on the proper use of sublingual Nitroglycerine 0.5 mg tablets.

DOSE SELECTION

The table no 5 below outlines the categorization of drug-related issues concerning dose selection. The data indicates that 31 (8%) of the instances involved a drug dose that was insufficient, 19 (5%) pertained to a drug dose that was excessive, and 23 (6%) were classified as having an ambiguous drug dose.

Table 5: Drug Selection

Dose Selection (DRPs)	Prescribed Dose (mg)	Pharmaceutical care provided (mg)	Frequency	Percentage
Drug dose too low (n=31) 8%				
Atorvastatin	10	40	19	63%
Empagliflozin	5	10	4	12%
Apixaban	2.5	5	8	25%
Drug dose too high (n=19) 5%				
Carvedilol	25	3.125	7	40%
Aspirin	325	75-100	12	60%
Drug dose unclear (n=23) 6%				
Warfarin	5	Monitor INR for warfarin dose	11	50
Digoxin	0.25	0.125 with close monitoring of kidney function clearance and digoxin serum level	5	20
Furosemide	20	Dose depend upon severity, kidney function and fluid status	7	30

TREATMENT DURATION

The table no 6 below outlines the categorization of drug-related issues concerning treatment duration. The data indicates that 62 (16%) of the instances

involved duration of treatment too short and 27 (7%) of cases involved duration of treatment too high.

Table 6: Treatment duration

Treatment duration (DRPs)	Prescribed Dose (Days/Month)	Pharmaceutical care provided (Days/Month)	Frequency	Percentage
Duration of treatment too short n=62 (16%)				
Metoprolol	2 M	36 M	19	63%
Enoxaparin	2 D	10-14 D	4	12%
Moxifloxacin	3 D	7-10 D	8	25%
Duration of treatment too long n=27 (7%)				
Omeprazole	Long term	1-2 M	7	40%
Spironolactone	60 M	Stop without heart failure	12	60%

DRUG INTERACTIONS

Drug interactions accounts for 190 (49.4%) cases involved the concurrent use described in the following table no 7.

Table 7: Drug interaction

Interacting drug	Effects	Frequency (n=190)	Percentage
Aspirin+clopidogrel	Increase risk of bleeding	20	10%
Cefriaxone+Enoxaparin	Decreased prothrombin activity	10	5%
Digoxin+Omeprazole	Increased effect of digoxin	7	4%
Digoxin+metoprolol	Increased bradycardia	8	4%
Ramipril+Aspirin	Decreased renal function	11	6%
Digoxin+Spironolactone	Hyperkalemia	15	8%
Ramipril+Spironolactone	Hyperkalemia	13	7%
Omeprazole+Clopidogrel	Decreased effect of clopidogrel	9	5%
Clopidogrel+enoxaparin	Increase risk of bleeding	25	13%
Atorvastatin+diltiazem	Increase risk of rhabdomyolysis	22	12%
Amiodarone+carvedilol	Increased risk of bradycardia	15	8%
Warfarin+amiodarone	Increased risk of bleeding	18	9%
Furosemide+Digoxin	Increased risk of digoxin toxicity	12	6%
Furosemide+Amikaci	Ototoxicity and nephrotoxicity	5	3%
Total		190	100%

Adverse drug reaction

ADRs accounts for 223 (58%) of the total DRPs were observed. These patients were utilizing various

medication in different combination, which contributed to the side effects experienced by them described in the following table no 8.

Table 8: Adverse drug reaction

Side Effetcs	Frequency (n=223)	Percentage
Headache	38	17%
Nausea	32	14%
Vomiting	22	10%
Dizziness	22	10%
Constipation	21	9%
Diarrhea	22	10%
Dry Cough	11	5%
Hyperkalemia	13	6%
Hypokalemia	16	7%
Bleeding	17	8%

Bradycardia	9	4%
Total	223	100%

Pharmacist interventions

A total of 696 Drug-Related Problems (DRPs) were identified, accompanied by 223 interventions. These interventions comprised 64 cases (28.7%) of drug withdrawal, 49 cases (21.8%) of symptomatic treatment, 79 cases (35.6%) involving the addition of a new drug, 5 cases (2.3%) where the dosage form was altered, 18 cases (8%) with altered doses, and 8 cases (3.4%) categorized as others described in the following table no 9.

Table 9: Pharmacist interventions

Interventions	Frequency	Percentage
Drug withdrawal	64	28.7%
Symptomatic treatment	49	21.8%
Addition of new drug	79	35.6%
Dosage form altered	5	2.3%
Dose altered	18	8.0%
Other	8	3.4%
Total	223	100%

MARS-Based patient counselling before and After Counseling related to medication (n = 385):

Patient counseling was assessed through the MARS scale during the counseling session. The assessment utilized a standardized scoring method, where negatively worded items received a "No" response and positively worded items received a "Yes"

response. Before counseling, adherence was noted at only 53%, but this figure increased to 72% after counseling, indicating a marked improvement. The analysis of MARS responses before and after the pharmacist-led counseling demonstrated a substantial rise in medication adherence, from 53% to 72%, as presented in the table no 10.

Table 10: MARS-Based patient counselling before and After Counseling related to medication (n = 385):

S.No	MARS Question	Adherent Response	Before Counseling (n, %)	After Counseling (n, %)
1	Do you ever forget to take your medicine?	No	273 (71%)	328 (85%)
2	Are you careless at times about taking your medicine?	No	212 (55%)	312 (81%)
3	When you feel better, do you sometimes stop the medication?	No	223 (58%)	305 (79%)
4	Sometimes if you feel worse, do you stop taking the medication?	No	277 (72%)	318 (83%)
5	I take my medication only when I am sick	No	289 (75%)	323 (84%)
6	It is unnatural for my mind and body to be controlled by medication	No	262 (68%)	300 (78%)
7	My thoughts are clear on medication	Yes	42 (11%)	197 (51%)
8	By staying on medication, I can prevent getting sick	Yes	162 (42%)	285 (74%)
9	I feel weird, like a "zombie" on medication	No	350 (91%)	360 (94%)
10	Medication makes me feel tired and sluggish	No	343 (89%)	357 (93%)

	Total Adherent Responses	—	2033 (53%)	2785 (72%)
	Total Non-Adherent Responses	—	1817 (47%)	1065 (28%)

DISCUSSION

This study conducted at NICVD Sukkur highlight the significant role of clinical pharmacists in enhancing patient care through medication reviews and counseling. The investigation revealed that pharmacist intervention was effective in identifying and managing drug-related problems (DRPs), which significantly improved patient's medication adherence and knowledge.

Out of 385 patients, a total of 696 DRPs were identified. The most prevalent issues included adverse drug reactions (ADRs), drug interactions, and incorrect treatment durations. Many patients were not aware of these issues and did not report side effects to their health care provider. These problems were only uncovered when the pharmacist inquired during counseling, highlighting the importance of pharmacist engagement in direct patient care.

After the counseling sessions, adherence improved from 53% to 76%. These findings are supported by various other studies. Ruiz-Ramos et al. and Vinks et al. also identified frequent drug-related problems (DRPs) due to polypharmacy and insufficient awareness, especially in elderly or rural demographics. Lindenmeyer et al. illustrated how pharmacist counseling improved diabetes patients understanding, while Schnipper et al. discovered that adverse drug reactions (ADRs) decreased from 11% to 1% with pharmacist involvement. Similar outcomes were noted by Andreatza et al. and Kripalani et al. the role of hospital pharmacists in managing drug-related problems (DRPs) during inpatient care and post discharge.

In conclusion, this research validates that pharmacist-led services are vital in identifying and resolving DRPs and improving patient compliance. Increasing pharmacist participation in hospital can significantly improve patient safety and treatment outcomes.

Conclusion:

Our study identifies various categories of DRPs in patients suffered with multiple cardiovascular diseases. It highlight the importance of clinical

pharmacists in hospitals, working in conjunction with other healthcare professionals to detect and address DRPs. Furthermore, it concludes that by ensuring patient compliance, pharmacists can significantly lower the risk of DRPs.

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