A RETROSPECTIVE STUDY ON ASSESSMENT OF DRUG RELATED PROBLEMS AND CLASSIFICATION ACCORDING TO APS-DOC CLASSIFICATION SYSTEM AMONG THE INPATIENT OF A TERTIARY CARE HOSPITAL

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ABSTRACT

A drug-related problem (DRP) is a situation or condition that involves drug therapy that interferes, either directly or indirectly, with anticipated health objectives. The goal of the current study was to evaluate and categorise different DRPs among patients admitted to the specialty department using the APS-Doc classification system, as well as to determine the most often prescribed medicines involving in the occurrence of DRPs. 6 month long retrospective research including 151 inpatients was carried out. According to the requirements of the study, a patient data collecting form and a DRP documentation form were created. The patients' relevant sociodemographic information as well as information on their medication regimen was documented. A DRP was found, classified using the APS-Doc classification system, and further examined. The statistical package for the social sciences (SPSS) 26.0 was used to analyse the data. Among 151 patients enrolled, 125 (82.8%) presented a total of 358 DRPs. Among the various categories of DRPs, the highest identified were drug-drug interactions as indicated by literature 84 (23.5%), followed by inadequate monitoring 28 (7.8%). Ondansetron 29 (9.0%) was identified as the drug associated with the highest number of DRPs. Variables including gender (p=0.002), age (p=0.382), length of hospital stay (p=0.36), smoking (p=0.05) were found to have statistically significant association with DRP. Cerebrovascular diseases (p=0.00), asthma (p=0.237) and anemia (p=0.00) among various comorbidities presented by patients also had significant association. The study came to the conclusion that pharmacists play a crucial role in enhancing patient care and encouraging wise and safe pharmaceutical usage.

KEY WORDS: APS-Doc classification, DRP, Ondansetron, DDI, ADR

1. INTRODUCTION

A drug is a chemical compound that normally has a known structure and when given to a living being exerts a biological effect. According to world health organisation (WHO), "*a drug refers to any substance with the potential to prevent or cure disease or enhance physical or mental welfare*". Drugs have been demonstrated to have advantages as well as drawbacks, including increased morbidity and mortality as well as decreased quality of life. *A drug-related*

*problem (*DRP*) is an occurrence or condition involving drug treatment that interferes with desired health outcomes, either directly or indirectly".*

DRP is described as an occurrence that could potentially have an impact on a patient's health results. DRPs may be caused by a lack of follow-up and revaluation of therapy outcomes and can first be identified during the prescribing to dispensing stage. Drug-related issues (DRPs) have a significant impact on morbidity and mortality and are statistically associated with patient outcomes, healthcare expenditures, and quality of life. DRPs entail more doctor visits and hospital stays, which hurt patients and raise healthcare costs, causing avoidable suffering as well as significant societal costs.[1]

Medication errors (MEs), adverse drug events (ADEs), and adverse drug responses (ADRs) are all included in the term DRP. needs extra drug therapy, unnecessary drug therapy, inefficient drug therapy, dosages that are too low or high, a lack of knowledge about the medication, missing information, a patient who is not adhering to treatment, drug interactions, adverse drug reactions (ADR), polypharmacy, and noncompliance are all examples of drug therapy problems. During the time that the medicine is under the control of the patient, healthcare professional, or consumer, a ME is defined as "any preventable event that may cause or lead to inappropriate medication use or patient harm." An injury, whether or not it is causally connected to drug use, is what is meant by an ADE. Any undesirable medication reaction that occurs at levels typically used in humans for disease prevention, diagnosis, treatment, or alteration of physiological functioning is referred to as an adverse drug reaction (ADR).[2]

Different definitions of polypharmacy exist. A number of researchers have distinguished between minor (two medications) and significant (more than four drugs) polypharmacy, which has been described as the contemporaneous use of numerous pharmaceuticals. Others have described it as the use of more pharmaceuticals than are clinically necessary or too many inappropriate medications, as well as the use of two or more drugs from the same chemical class to treat the same ailment. The phrase "polypharmacy" has a negative connotation, presumably as a result of the observation of frequent hospitalization and poor health outcomes brought on by drug-related problems (DRPs).[3] Each year, 7000 hospital deaths in the United States are recorded as a result of pharmaceutical errors, 5.2 million incidents in India are reported annually as the result of medication errors and harmful effects. Medication errors decrease patient confidence while increasing morbidity, mortality, and financial burden. The American Hospital Association has compiled a list of common prescription problems, including insufficient patient information, misunderstandings of drug orders, and a lack of drug information. These problems can be brought on by poor handwriting, the incorrect use of decimal points and zeroes, a lack of understanding of metric and other dosing units, incorrect abbreviations, and improper labelling when a medication is prepared and repackaged into smaller units.[4]

Drug-related issues might be both real and hypothetical. Clinical symptoms (such as a drug-related rash or an adverse drug reaction) or therapeutic failure as a result of insufficient dosage are signs that a real issue exists. Although a possible issue is not yet apparent, if it is not

addressed, the patient could suffer drug-related harm.[5] Every stage, from admission through discharge, is susceptible to DRP. DRP may also be influenced by drugs used in particular treatment groups and variations in healthcare workers' pharmacology understanding.[6]

The precise risk factors that promote the occurrence of DRPs are of great interest because DRPs are a serious problem and many of them can be avoided. Numerous risk factors for DRPs have been identified by prior investigations. The use of oral anticoagulants and diuretics, female sex, polypharmacy, medications with a restricted therapeutic range or renal elimination, age over 65, and these characteristics were all found in a literature study as relevant risk factor for ADEs and ADRs. Risk factors, such as four or more comorbidities, polypharmacy, dependent living circumstances, poor cognition, impaired renal function, and non-adherence to medication regimen, are major and independent risk factors that may be to blame for avoidable hospital admission. Patients, general practitioners, and community pharmacists participated in qualitative interviews by Howard et al., who came to the conclusion that communication breakdowns and knowledge gaps at various phases of the medication process are significant risk factors for avoidable drug-related admissions.[7]

Drug-related problems (DRPs) have a statistically significant impact on cardiovascular patients' clinical outcomes, healthcare expenses, and quality of life. They also cause significant morbidity and mortality. The majority of drug-related hospitalizations in adults and older patients were related to cardiovascular medications. Age (>65 years), polypharmacy, co-morbid medical conditions, concurrent medications, noncompliance by the patient, inadequate laboratory and therapeutic drug monitoring, pharmacogenetic variations, medication errors, and patient-related factors are some of the factors linked to medication-related issues in these patients.[8]

Elderly people were found to use nearly three times as many medications as younger patients did for the treatment of chronic disorders. They therefore have a larger chance of developing drug-related issues. DRP are linked to an elevated risk of hospital readmissions, morbidity, and mortality in older patients with comorbidities and utilizing multiple medicines. Another significant risk factor for DRP is the discharge of patients from the hospital setting to home care.[9]

The detection, resolution, and prevention of drug-related issues are fundamental components of clinical pharmacy. Research has demonstrated that the detection of DRPs increases when hospital pharmacists are included in multidisciplinary teams. Clinical pharmacists must employ evidence-based medicine to ensure that patients take the right medications and to identify, prevent, and resolve DRPs in order to meet therapeutic goals and enhance patient quality of life.[10] Through collaboration with patients and other healthcare professionals, clinical pharmacists can play a significant part in diagnosing and treating DRPs. Medication profile reviews can detect potential and actual DRPs, and monitoring therapy strategies can stop these issues from happening.[11] With patient counselling and the right clinical pharmacy treatments, many real DRPs can be treated. The rational use of pharmaceuticals would be improved by

greater awareness of the nature and frequency of DRPs and feedback to pharmacy staff, physicians, drug producers, and patients.[8]

However, in actual clinical practice, activities are not uniform nor structured, and it is unusual to collect data on the occurrence or characteristics of DRPs. The primary goal ought to be to reduce drug-related morbidity. One way to measure a pharmacist's contribution to the optimization of drug therapy is to count the number of drug-related issues they have solved or avoided, or to evaluate the clinical results for the patients. These metrics are respectively indirect and direct. Due to the significant risk of iatrogenesis, daily clinical practice, particularly in hospital medical wards, is especially interested in the detection and characterisation of DRPs, the investigation of their causes, and the evaluation of the associated therapies.[12]

To recognize DRP in elderly individuals with chronic conditions, a number of explicit criteria have been created. To conduct pharmaceutical reviews, explicit criteria are occasionally supplemented with other metrics. The Beers' criteria for medications inappropriate for older patients were first introduced in the US in 1991, and they have since been modified and improved in a number of other nations. The Beers' criteria had a number of issues that have been addressed by the STOPP (Screening Tool of Older Person's Prescriptions)/START (Screening Tool to Alert doctors to Right Treatment) criteria, including the identification of undertreatment, the inclusion of medications that are not available outside of the US, and the absence of physiologic categorization.[9] Explicit criteria, including guidelines and lists of medications with cautionary measures, are crucial in this regard, although they have generated some debate because they do not catch all instances of possibly incorrect prescribing. The clinical evaluation of individual therapy requires implicit review.[13] The current study's objectives include examining the occurrence of DRPs in routine clinical pharmacy, characterizing them, and identifying the factors that increase the risk of DRPs in a hospital setting.

The drug-related problems (DRPs) found among hospitalized patients in a hospital setting can be categorized using the APS-Doc method. There are 48 sub-categories and 10 categories in the APS-Doc classification system. A complex procedure, pharmacological therapy selection and optimization involves a number of dangers, including the possibility of DRPs. As a result, a sizable amount of effort must be put into identifying and treating DRPs at the time of hospital admission, during the transition period, and after discharge. Many DRPs are avoidable, and clinical and hospital pharmacists are essential in recognizing, avoiding, and treating them. In order to evaluate the therapeutic impact of this effort by pharmacists, a categorization system to record, identify, and analyse the obtained data has become essential.[1] DRPs can be quickly detected and interpreted with the help of a comprehensive classification scheme like APS-Doc.

2. AIM AND OBJECTIVES

2.1. AIM

- To assess the DRPs among the patients admitted in the speciality department of a tertiary care hospital.

2.2. OBJECTIVES

- To identify and categorise the DRPs among the patients using APS-Doc classification system.
- To identify the drugs most frequently associated with DRPs.
- To find out the association of various variables with the presence of DRPs among the patients.

3. METHODOLOGY

3.1. STUDY DESIGN

A Retrospective study

3.2. STUDY SITE

KUMARAN MEDICAL CENTER, kurumbapalayam, s s kulam, saravanampatti, Coimbatore 641107.

3.3. DURATION OF STUDY

Six months (May 2022- October 2022)

3.4. ETHICAL APPROVAL

The study was approved by Institutional Ethics Committee, CHERRAAN COLLEGE OF PHARMACY, Coimbatore (REF: CCP/IHEC/20/2022-05-30). The permission letter to conduct the study is enclosed as Annexure I.

3.5. SAMPLE SIZE

A sample size of 150 was calculated by taking into the consideration of the availability of patients during the study period at the study site.

3.6. SUBJECTS

Inpatients of all the speciality department of kumaran medical center.

3.7. STUDY CRITERIA

3.7.1. Inclusion criteria

Patients of either gender, aged above 18 years, who were admitted in all the speciality department of hospital between October 2021 and September 2022 and prescribed with at least one drug.

3.7.2. Exclusion criteria

Medical records with incomplete information

3.8. DATA SOURCES

All the relevant and necessary data was collected from

- Patient case sheets along with treatment chart
- Relevant laboratory investigation reports

3.9. MATERIALS USED

- APS-Doc classification system for DRPs
- Patient data collection form
- DRP documentation form
- Drug interaction checking form
- Medication error reporting form
- ADR reporting form
- Medication side effect reporting form

3.10. STUDY PROCEDURE

3.10.1. Design of Data Collection Form

To collect and record the data, a suitable data collection form and DRP documentation form were developed as per the APS-Doc classification system. Gender, age, social habits, domiciliary status, comorbidities, diagnosis and length of hospital stay were included in the data collection form. The data collection form also had the provision to note down the patients' drug therapy details such as the name of the drug, dose, dosage form, route of administration, and the period of treatment.

3.10.2. Patient Selection and Enrolment

Medical records of the patients who were admitted in all the speciality department satisfying the inclusion criteria were enrolled as participants into the study.

3.10.3. Data Collection and documentation

During the study period, the medical records of the enrolled patients were reviewed by the study pharmacists to collect the socio-demographic details and therapy related information. Once a DRP was identified on thorough evaluation of the case sheets, it was categorized based on APS-Doc classification system which has 10 main categories and 48 sub-categories. The main categories include drug, dosage form/dosage strength, dosage, indication, contraindication, drug-drug interaction (DDI), ADR, administration/compliance, and application. The DRPs identified were confirmed by the academic pharmacist and then communicated to the concerned staff to prevent or to reduce similar incidences in the future.

3.11. STATISTICAL ANALYSIS

Frequency and percentage were used to summarize the socio-demographics, comorbidities, diagnosis, distribution pattern of various DRPs, etc. Mean with standard deviation was used to summarize the age and the duration of hospital stay of the patients. Data analysis was carried out using statistical package for the social sciences (SPSS 26.0).

4. RESULTS & DISCUSSION

4.1. Subjects are allocated according to their gender.

A total of 151 patients admitted in specialty department were enrolled. Out of which 88 (58.3%) were males and 63 (41.7 %) were females. Details described in Figure 1 & Table 1.

Figure 1: Gender wise distribution of subjects

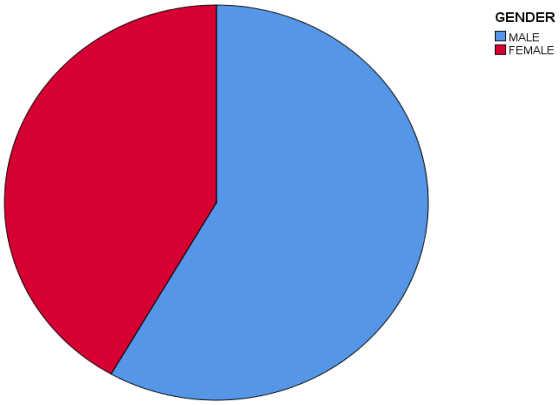


Table 1: Gender wise distribution of subjects

GENDER	FREQUENCY (n)	PERRCENTAGE (%)	CUMULATIVE PERCENTAGE
MALE	88	58.3	58.3
FEMALE	63	41.7	100.0
TOTAL	**N = 151**	**100.0**	

4.2. Subjects are allocated based on their ages.

The mean age in year of the subjects were found to be 50.34 ± 16.91 standard deviation. Most of the subjects were found within the age group of 60-69 years, 27 (17.9 %); followed by 18-29 years, 24 (15.9 %) & 40-49 years, 24 (15.9 %). Details summarized in Figure 2 & Table 2.

Figure 2: Age wise distribution of subjects

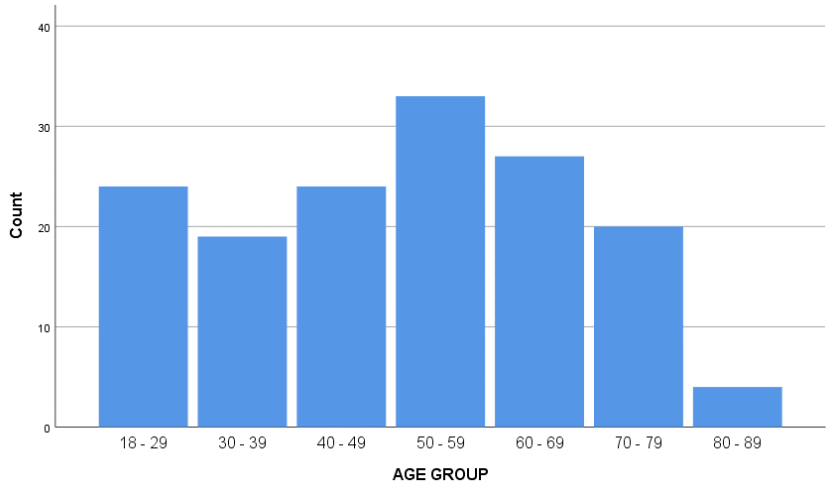


Table 2: Age wise distribution of subjects

AGE GROUP (IN YEARS)	FREQENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
18 - 29	24	15.9	15.9
30 - 39	19	12.6	28.5
40 - 49	24	15.9	44.4
50 - 59	33	21.9	66.2
60 - 69	27	17.9	84.1
70 - 79	20	13.2	97.4
80 - 89	4	2.6	100.0
TOTAL	**N = 151**	**100.0**	

4.3. Subjects are allocated according to their domiciliary status

Out of 151 subjects enrolled, 80 (53.0%) belonged to rural backgrounds and 71 (47.0%) belonged to urban backgrounds as shown in Figure 3 & Table 3.

Table 3: Domiciliary Status of subjects enrolled

DOMICILIARY STATUS	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
RURAL	80	53.0	53.0
URBAN	71	47.0	100.0
TOTAL	**N = 151**	**100.0**	

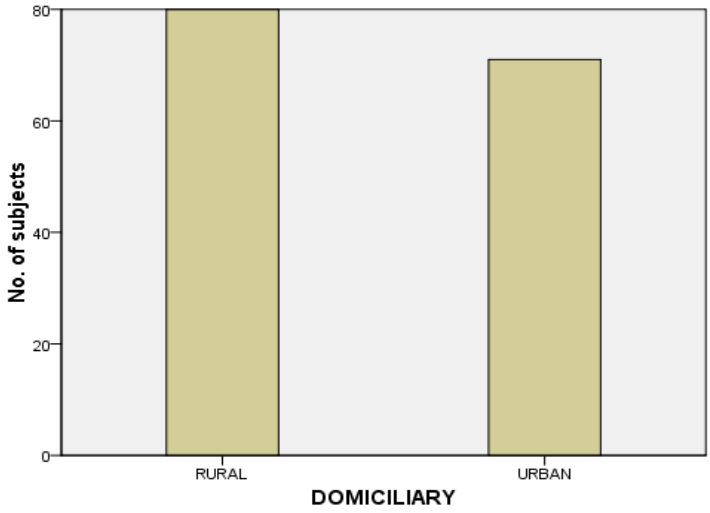


Figure 3: Domiciliary Status of subjects enrolled

4.4. Subjects are allocated based on their social habits

Among the total subjects in the study, 40 (26.5%) were found to have at least one social habit. Out of this, 13 (8.6%) had the habit of smoking, followed by 9 (6.0%) patients with the habit of alcohol consumption. The details are summarized in the Table 4 & Figure 4.

Figure 4: Social habits of subjects enrolled

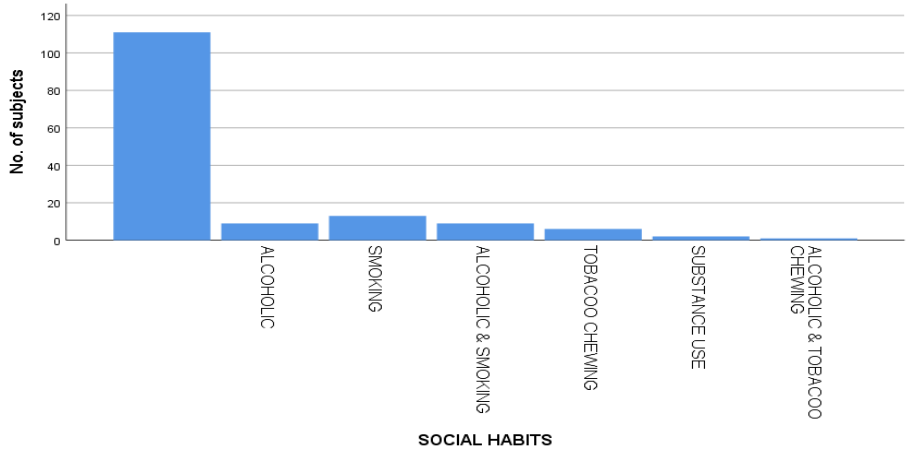


Table 4: Social habits of subjects enrolled

SOCIAL HABITS	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
SUBJECTS WITH NO SOCIAL HABITS	111	73.5	73.5
SMOKING	13	8.6	88.1
ALCOHOLIC	9	6.0	79.5
ALCOHOLIC & SMOKING	9	6.0	94.0
TOBACOO CHEWING	6	4.0	98.0
SUBSTANCE USE	2	1.3	99.3
ALCOHOLIC &TOBACOO CHEWING	1	.7	100.
TOTAL	**N = 151**	**100.0**	

4.5. Subject allocated based on specialty departments

Total of 151 subjects were selected from different specialty department, out of which 31 (20.5%) subjects selected from cardiology department, followed by 29 (19.2 %) selected from neurology department. Details described in Table 5 & Figure 5.

Figure 5: Distribution of subject based on department

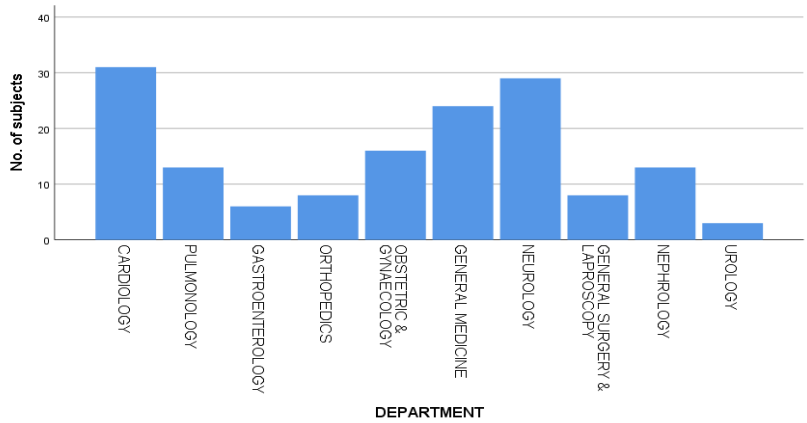


Table 5: Distribution of subjects based on departments

DEPARTMENTS	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
CARDIOLOGY	31	20.5	20.5
NEUROLOGY	29	19.2	84.1
GENERAL MEDICINE	24	15.9	64.9
OBSTETRICS & GYNAECOLOGY	16	10.6	49.0
PULMONOLOGY	13	8.6	29.1
NEPHROLOGY	13	8.6	98.0
ORTHOPEDICS	8	53	38.4
GENERAL SURGERY & LAPROSCOPY	8	5.3	89.4
GASTROENTEROLOGY	6	8.6	29.1
UROLOGY	3	2.0	100.0
TOTAL	**N = 151**	**100.0**	

4.6. Subject allocated based on co-morbidities

Among the 151 subjects enrolled, out of the total co-morbidities, diabetic mellitus 35 (32.7%) were the highest, followed by hypertension, 31 (29.0%). The details are referenced in Table 6.

Table 6: Distribution of co-morbidities among subjects

CO – MORBIDITIES	FREQUENCY (n)	PERCENTAGE (%)
DIABETIC MELITUS	35	32.7
HYPERTENSION	31	29.0
CORONARY ARTERY DISEASES	5	4.7
ASTHMA	5	4.7
HYPOTHYROIDISM	4	3.7
GESTATIONAL DIABETIC MELITUS	3	2.8
THYROID	3	2.8
CEREBROVASCULAR ACCIDENT	2	1.9
PEDAL EDEMA	2	1.9
OLIGURIA	2	1.9
CHRONIC KIDNEY DISEASES	2	1.9
ACUTE CHORONARY SYNDROME	2	1.9
MIGRAINE	1	0.9

ANEMIA	1	0.9
OSTEOARTHRITIS	1	0.9
CONSTIPATION	1	0.9
H. PYLORI INFECTION	1	0.9
SEIZURE	1	0.9
PERIFERAL VASCULAR DISEASES	1	0.9
THROMBOCYTOPENIA	1	0.9
DYSLIPIDEMIA	1	0.9
CARDIOVASCULAR DISEASES	1	0.9
CELLULITIS	1	0.9
TOTAL	**N = 107**	**100.0**

4.7. Subject allocated based on diagnosis

Among the study subjects, viral fever was found to be the most commonly diagnosed with a frequency of 14 and a percentage of 9.4%. This was followed by gestation 12 (8.1%). The details are summarized in Table 7.

Table 7: Distribution of subjects based on diagnosis

DIAGNOSIS	FREQUENCY (n)	PERCENTAGE (%)
VIRAL FEVER	14	9.4
GESTATION	12	8.1
CEREBROVASCULAR ACCIDENT	10	6.7
ANTERIOR WALL MIOCARDIAL INFRACTION	8	5.4
ROAD TRAFFIC ACCIDENTS	6	4.0
FRACTURES	5	3.4
INFERIOR WALL MIOCARDIAL INFRACTION	5	3.4
ACS- NSTEMI	5	3.4
ACUTE PULMONARY EDEMA	4	2.7
CHRONIC KIDNEY DISEASES	4	2.7
CORONARY ARTERY DISEASES	4	2.7

ACUTE KIDNEY INJURY	4	2.7
LIVER ABCESS	3	2.0
ABDOMINAL PAIN	2	1.3
ACUTE PANCREATITIS	2	1.3
ASTHMA	2	1.3
APPENDICITIS	2	1.3
COVID - 19	2	1.3
ACUTE GASTROENTERITIS	2	1.3
URINARY TRACT INFECTION	2	1.3
DIABETIC KETOACIDOSIS	2	1.3
OVARIAN CYST	2	1.3
RESPIRATORY TRACT INFECTION	2	1.3
OTHER[#]	1	0.7
TOTAL	**N = 151**	**100.0**

4.8. Distribution of class of drugs prescribed among subjects

A total of 1078 drugs were prescribed among the study subjects. The most common class of drug prescribed was found to be gastric acid suppressants, 124 (11.5%), followed by antibiotics 95 (8.8%), and nutritional supplements 70 (6.5%). The details are summarized in Table 8 and Figure 6.

Table 8: Distribution of class of drugs prescribed

DRUG CLASS	FREQUENCY (n)	PERCENTAGE (%)
GASTRIC ACID SUPPRESSANTS	124	11.5
ANTIBIOTIC	95	8.8
NUTRITIONAL SUPPLEMENTS	70	6.5
ANTIEMETICS	68	6.3
ANALGESICS	48	4.5
LIPID LOWERING AGENTS	47	4.4
ANTIPYRETIC AGENTS	45	4.2
ANTIPLATELET AGENTS	41	3.8
NSAIDs	39	3.6
ANTIHYPERTENSIVE AGENTS	35	3.2
BENZODIAZEPINES	34	3.2
BRONCHODILATORS	33	3.1

CORTICOSTEROIDS	32	3.0
ANTICOAGULANTS	32	3.0
DIURETICS	30	2.8
ADRENERGIC RECEPTOR ANTAGONIST	28	2.6
ANTIANGINAL AAGENTS	28	2.6
LAXATIVES	24	2.2
ANTIHISTAMINES	21	1.9
ANTICONVULSANTS	17	1.6
ANTIDIABETIC AGENTS	13	1.2
PROBIOTICS	12	1.1
COGNITION ENHANCERS	11	1.0
LEUKOTRIENE RECEPTOR ANTAGONIST	11	1.0
MUCOLYTIC AGENTS	10	0.9
PROKINETICS	10	0.9
ANTIDEPRESSANT AGENTS	10	0.9
ANTISPASMODIC AGENTS	9	0.8
BILE ACID PRODUCTS	8	0.7
ANTITUSSIVE	8	0.7
SEDATIVE – HYPNOTICS AGENTS	7	0.6
ANTIVIRAL AGENTS	6	0.6
THYROID PRODUCTS	5	0.5
ANTIPSYCHOTIC AGENTS	5	0.5
ANTIOXIDANTS AGENTS	4	0.4
NASAL DECONGESTANT	4	0.4
MUSCLE RELAXANTS	3	0.3
VASOPRESSIN RECEPTOR ANTAGONIST	3	0.3
ANTIARRHYTHMICS AGENTS	3	0.3
ANTIPARASITIC AGENTS	3	0.3
VACCINES	3	0.3
ANTIPARKINSONIAN DRUGS	3	0.3
ANTIPROTOZOAL AGENTS	3	0.3
ANTHELMINTIC AGENTS	2	0.2
ANTICHOLINERGIC AGENTS	2	0.2
ANTIFIBRINOLYTIC AGENTS	2	0.2
HEPATOPROTECTIVE AGENTS	2	0.2
POLYOLS	2	0.2
ANTIDIARRHEAL AGENTS	2	0.2
ANTIMUSCARINIC AGENTS	2	0.2

OTHERS#	1	0.1
TOTAL	**N = 1078**	**100.0**

AMINOACIDS, CNS DEPRESSANTS, ANTIDIURETICS, OPHTHALMIC MEDICATION, URINE ALKALIZERS, ANTIGOUT, IMMUNOSUPRESSANTS, ADRENERGIC AGONIST, BLOOD THINNERS, HEMORHEOLOGIC AGENTS, LOCAL ANESTHETICS, DIGESTIVE ENZYMES, ANTICOLINERGIC, EMOLLIENTS, HEMATINICS, PLASMA EXPANDERS

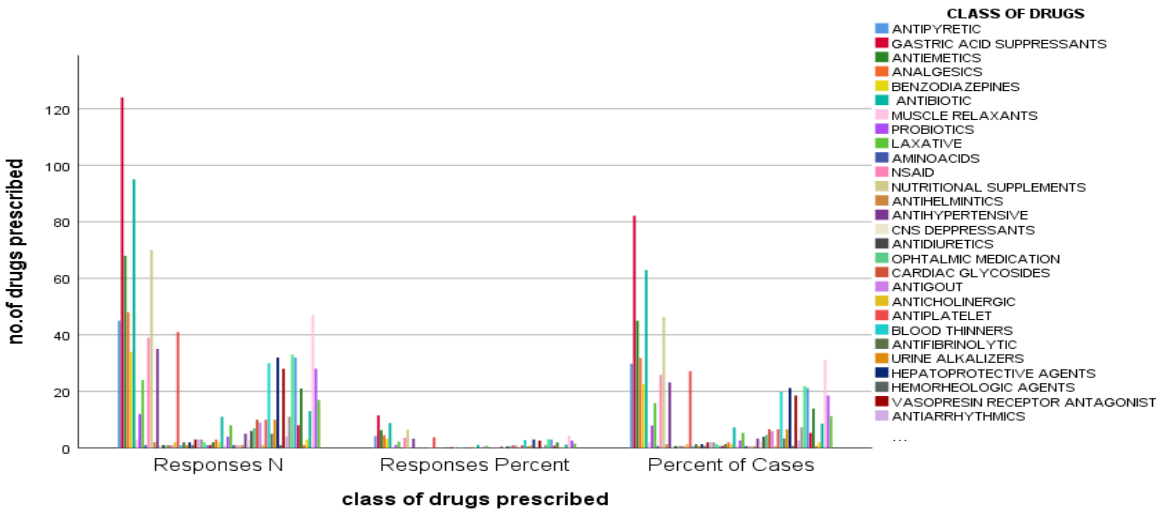


Figure 6: class of drugs prescribed

4.9. Subject allocated based on length of hospital stay

The mean duration of hospital stay in days was 3.62 ± 1.61 standard deviation. Out of the total subjects, 85 (56.3%) were admitted for a period of 1-3 days, followed by 56 (37.1%) patients for 4-6 days. The details are illustrated in Figure 7 & Table 9.

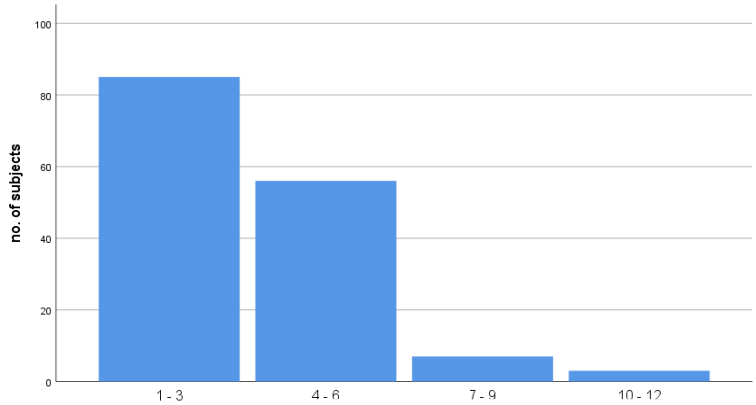


Figure 6: Distribution of class of drugs prescribed

Figure 7: Distribution of subject based on length of stay

Table 9: Distribution of subject based on length of stay

OCCURRENCE OF DRP	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
PATIENT WITH DRPs	125	82.8	82.8
PATIENT WITHOUT DRPs	26	17.2	100.0
TOTAL	**N = 151**	**100.0**	

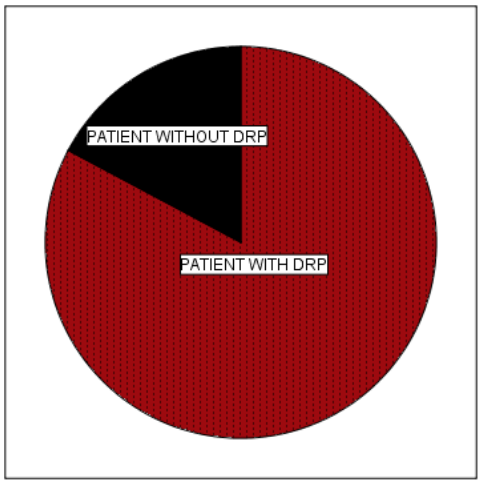
4.10. Subject allocated based on occurrence of DRPs

Out of 151 subjects, 125 (82.8%) presented a total number of 358 DRPs. The details are given in Figure 8 & Table 10.

Table 10: Distribution of subject based on occurrence of DRP

Figure 8: Distribution of subject based on occurrence of DRP

NO. OF DAYS	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
1 - 3	85	56.3	56.3
4 - 6	56	37.1	93.4
7 - 9	7	4.6	98.0
10 - 12	3	2.0	100.0
TOTAL	**151**	**100.0**	



4.11. Distribution of DRPs according to the APS-Doc classification system

The most common DRP was found belonging to the category of drug-drug interaction as indicated by literature 84 (23.5%), followed by inadequate monitoring 28 (7.8%). Table 11 summarizes the details of DRPs.

Table 11: Distribution of DRP according to APS-Doc

CLASSIFICATION OF DRPs	SUB CLASS OF DRPs	DESCRIPTION OF DRPs	FREQUENCY (n)	PERCENTAGE (%)
DRUG	Rx 1	INCORRECT SPELLING OF THE TRADE NAME	12	3.4
	Rx 3	PRESCRIPTI OUTSIDE THE FORMULARY	1	0.3
	Rx 4	PRESCRIPTION MADE OUT TO WRONG PATIENT	2	0.6
	Rx 8	TRANSCRIPTION ERROR/ UNINTENDED DISCONTINUATION OF DRUG THERAPY	20	5.6
	Rx 9	UNINTENTED PRESCRIBING OF THE SAME DRUG	6	1.7
	Rx 10	UNINTENTED PRESCRIBING OF A PRODUCT FROM THE SAME CLASS OF DRUGS	4	1.1
	Rx 11	NO/ INADEQUATE DRUG MONITORING	28	7.8
	Rx 12	PATIENT IS RECEIVING WRONG MEDICATION	1	0.3
DOSAGE	DOS 1	PATIENT DOES NOT KNOW HIS DOSAGE	4	1.1

	DOS 2	PRESCRIPTION OF AN INCORRECT DOSAGE OR NO DOSAGE PRESCRIBED	3	0.8
	DOS 5	INAPPROPRIATE ADMINISTRATION INTERVAL	7	2.0
INDICATION	IND 2	NO INDICATION	1	0.3
	IND 3	DRUGS MISSING OR SUBOPTIMAL DOSAGE	1	0.3
DRUG-DRUG INTERACTION	DDI 1	DRUG-DRUG INTERACTION AS INDICATED BY LITERATURE	84	23.5
	DDI 2	SYMPTOMS OF A DRUG-DRUG INTERACTION	27	7.5
DOSAGE FORM/ DRUG STRENGTH	DS 1	WRONG DOSAGE FORM PRESCRIBED	1	0.3
	DS 2	NO DOSAGE FORM PRESCRIBED, WHEN DIFFERENT DOSAGE FORMS ARE AVAILABLE	2	0.6
	DS 4	NO DRUG STRENGTH PRESCRIBED, WHEN DIFFERENT DOSAGES ARE AVAILABLE	2	0.6
ADVERSE DRUG REACTION	ADR 1	SYMPTOMS OF AN ADVERSE DRUG REACTION	27	7.5
	ADR 2	PATIENT FEAR OF AN ADVERSE DRUG REACTION	1	0.3
ADMINISTRATION/ COMPLIANCE	AC 1	LACK OF PATIENT KNOWLEDGE	1	0.3

		ABOUT CORRECT ADMINISTRATION		
	AC 2	PATIENT DOES NOT TAKE THE DRUG	45	12.6
	AC 4	INAPPROPRIATE DURATION	12	3.4
	AC 5	INAPPROPRIATE TIME OF ADMINISTRATION	18	5.0
	AC 6	ADMINISTRATION NOT PRESCRIBED/ DOCUMENTED	46	2.8
APPLICATION	AP 2	DOSAGE FORM MAY NOT BE DIVIDED	2	0.6
TOTAL			**N = 358**	**100.0**

4.12. Distribution of DRPs according to the drugs prescribed

Among the various drugs prescribed, ondansetron 29 (9.0%) was found associated with the highest number of DRPs, followed by paracetamol 16 (4.9%) and pantoprazole 12 (3.7%). The distribution of drugs associated with DRPs is summarized in Table 12.

Table 12: Distribution of DRP according to drugs prescribed

DRUGS	FREQUENCY (n)	PERCENTAGE (%)
ONDANSETRON	29	9.0
PARACTAMOL	16	4.9
PANTOPRAZOLE	12	3.7
ASPIRIN	12	3.7
FUROSEMIDE	11	3.4
ROSUVASTATIN	10	3.1
CEFTRIAXONE	9	2.8
RAMIPRIL	9	2.8
CLOPIDOGREL	8	2.5
ESOMEPRAZOLE	8	2.5
TRAMADOL	8	2.5
SPIRONOLACTONE	7	2.2
CEFUROXIME	6	1.9

AMIKACIN	6	1.9
PIPERACILLIN &TAZOBACTAM	6	1.9
TICAGRELOR	6	1.9
HEPARIN	6	1.9
CHLORDIAZEPOXIDE	5	1.5
IBUPROFEN & PARACETAMOL	5	1.5
TELMISARTAN	5	1.5
METRONIDAZOLE	5	1.5
ENOXAPARIN	5	1.5
CEFUROXIME	4	1.2
TORSEMIDE	4	1.2
LEVOFLOXACIN	4	1.2
ISOSORBIDE DINITRATE & HYDRALAINE	4	1.2
CARVEDILOL	4	1.2
BUDESONIDE	4	1.2
DICLOFENAC	3	0.9
BACLOFEN	3	0.9
TOLVAPTAN	2	0.6
HYDROCORTISONE	2	0.6
OTHERS[#]	1	0.3
TOTAL	**N = 372**	**100.0**

GLICLAZIDE & METFORMIN, CLINIDIPINE, POTASSIUM CHLORIDE, ACECLOFENAC, RUTOHEAL, AMOXICILLIN, CARVEDILOL PHOSPHATE, OFLOXACIN, BIFILAC, RABEPRAZOLE, RENERVE PLUS, LEVODOPA, NIFEDIPINE, LINSOL, TAMSULOSIN, ATORVASTATIN & CLOPIDOGREL

4.13. Subject allocated based on DDIs

Among the total subjects, 85 (56.3%) were found to have DDIs. The details are described in Figure 9 & Table 13.

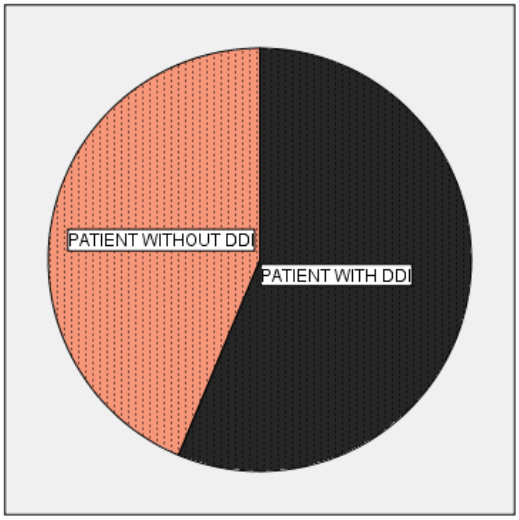


Figure 9: Distribution of subject based on occurrence of DDI

Table 13: Distribution of subject based on occurrence of DDI

OCCURRENCE OF DDI	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
PATIENT WITH DDIs	85	56.3	56.3
PATIENT WITHOUT DDIs	66	43.7	100.0
TOTAL	**N = 151**	**100.0**	

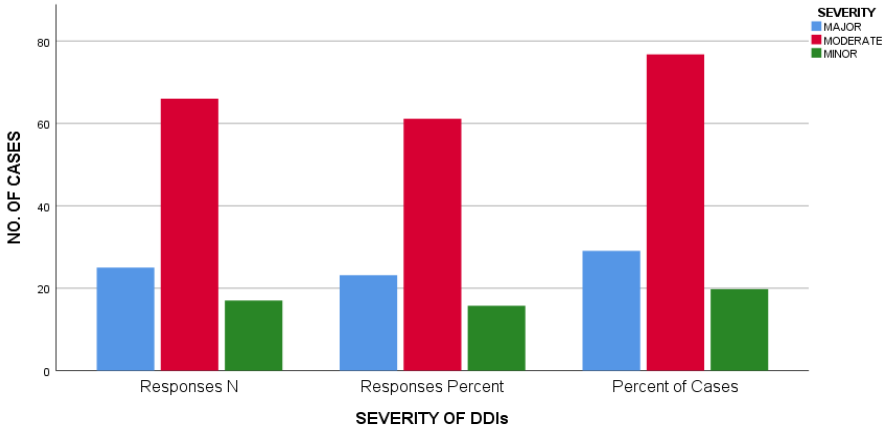
4.14. Distribution of DDIs according to its severity

According to the degree of severity, the DDIs identified were categorised as major moderate and minor. Out of 108 DDI present, major 25 (23.1%), moderate 66 (61.1%) and minor 17 (15.7%). The details are summarised in Figure 10 & Table 14.

Table 14: Distribution of subject based on DDI severity

SEVERITY OF DDIs	FREQUENCY (n)	PERCENTAGE (%)
MAJOR	25	23.1
MODERATE	66	61.1
MINOR	17	15.7
TOTAL	**N = 108**	**100.0**

Figure 10: Distribution of subject based on DDI severity



4.15. Distribution of DDIs according to its pattern observed among the study population

A total of 108 DDIs were identified in 85 subjects. Among this, the combination of Tramadol + Ondansetron was observed 4 (3.3%) times, followed by the combination of atorvastatin + ticagrelor, 4 (3.3%). The details are summarised in Table 15.

Table 15: Distribution of DDI among the subjects

DDI PATTERNS	FREQUENCY (n)	PERCENTAGE (%)
ONDANSETRON + TRAMADOL	4	3.3
ATORVASTATIN + TICAGRELOR	4	3.3
CLOPIDOGREL + ESOMEPRAZOLE	4	3.3
PARACETAMOL + ONDANSETON	3	2.4
ASPIRIN + HEPARIN	3	2.4
METRONIDAZOLE + ONDANSETRON	3	2.4
CILNIDIPINE + CLOPIDOGREL	2	1.6
CEFTRIAXONE + AMIKACIN	2	1.6
TRAMADOL + ONDANSETRON	2	1.6
ENOXAPARIN + TICAGRELOR	2	1.6
RAMIPRIL + SPIRONOLACTONE	2	1.6
ASPIRIN + SPIRONOLACTONE	2	1.6
OTHER[#]	1	0.8
TOTAL	**N = 146**	**100.0**

4.16. Subject allocated based on occurrence of ADRs

Among 151 subjects, 31 (20.5%) were identified with at least one ADR. The details are summarised in Figure 10 and Table 16.

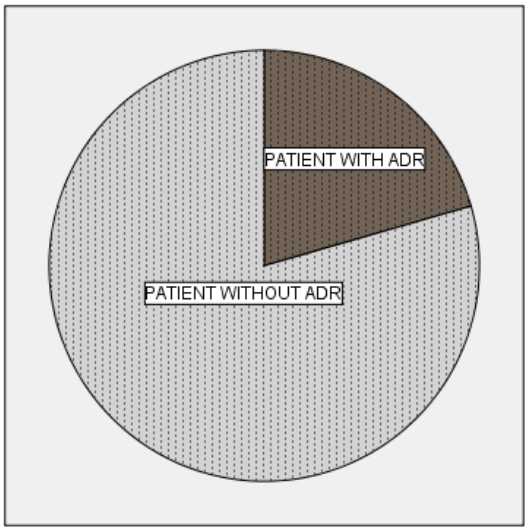


Figure 11: Occurrence of ADR among subjects

Table 16: Occurrence of ADR among subjects

OCCURRENCE OF ADR	FREQUENCY (n)	PERCENTAGE (%)	CUMULATIVE PERCENTAGE
PATIENT WITH ADRs	31	20.5	20.5
PATIENT WITHOUT ADRs	120	79.5	100.0
TOTAL	**N = 151**	**100.0**	

4.17. Distribution of ADRs according to its pattern observed among the study population

Among the total of 31 observed ADRs the most commonly experienced ADR is constipation 10 (41.7%). Details described in the Table 17.

Table 17: distribution of ADR patterns among subjects

ADRs	DRUGS	FREQUENCY (n)	PERCENTAGE (%)
CONSTIPATION	TRAMADOL (8), DICLOFENAC (2)	10	41.7
HYPONATREMIA	FUROSEMIDE	6	25.0
SKIN RASH	CEFTRIAXONE (2), PIPERACILLIN + TAZOBACTAM (1)	3	12.5
DIRRHOEA	CEFIXIME	2	8.3
DIFFICULTY URINATION	TELMISARTAN	2	8.3
HYPOGLYCEMIA	ISOPHANE INSULIN + HUMAN INSULIN	1	4.2
TOTAL	**N = 24**	**N = 24**	**100.0**

4.18. Significant factors associated with DRPs

A statistically significant association of DRPs with variables such as gender (p=0.002), age (p=0.382), length of hospital stays (p=0.36). Among comorbidities, migraine (p=0.00), anaemia (p=0.00) was identified as summarized in Table 18.

Table 18: significant factor associated with DRP

VARIABLES		NO. OF PATIENT WITH DRP	NO. OF PATEIENT WITHOUT DRP	P – VALUE
GENDER	MALE	80	8	0.002*
	FEMALE	45	18	
AGE	18 – 29	18	6	0.382
	30 – 39	14	5	
	40 – 49	21	3	
	50 – 59	29	4	
	60 – 69	24	3	
	70 – 79	17	3	
	80 – 89	2	2	
DOMICILIARY STATUS	URBAN	55	16	0.104
	RURAL	70	10	
SOCIAL HABITS	ALCOHOLIC	8	1	0.412
	SMOKING	12	1	
	ALCOHOLIC & SMOKING	7	2	

	TOBACCO CHEWING	4	2	
	SUBSTANCE USE	2	0	
	ALCHOHOLIC & TOBACOO CHEWING	1	0	
DEPARTMENTS	CARDIOLOGY	27	4	0.339
	PULMONOLOGY	9	4	
	GASTROENTEROLOGY	5	1	
	ORTHOPEDICS	7	1	
	GYNAECOLOGY	9	7	
	GENERAL MEDICINE	20	4	
	NEUROLOGY	26	3	
	GENERAL SURGERY	7	1	
	NEPHROLOGY	12	1	
	UROLOGY	3	0	
LENGTH OF HOSPITAL STAY	1 - 3	66	19	0.36
	4 - 6	49	7	
	7 - 9	7	0	
	10 - 12	3	0	
CO-MORBIDITIES				
MIGRAINE	PRESENT	1	0	0.00
	ABSENT	4	0	
ANEMIA	PRESENT	1	0	0.00#
	ABSENT	4	0	
DIABETIC MELITUS	PRESENT	29	6	0.374
	ABSENT	4	0	
HYPERTENSION	PRESENT	2	1	0.452
	ABSENT	4	0	
CEREBROVASCULAR ACCIDENT	PRESENT	2	0	0.00
	ABSENT	4	0	
CHORONARY ARTERY DISEASE	PRESENT	4	2	0.285
	ABSENT	3	0	
ASTHMA	PRESENT	3	2	0.237
	ABSENT	3	0	
GESTATIONAL DIABETIC MELITUS	PRESENT	2	1	0.317

	ABSENT	3	0	
CHRONIC KIDNEY DISEASE	PRESENT	3	0	0.00
	ABSENT	3	0	
SEIZURE	PRESENT	1	0	0.00
	ABSENT	3	0	
THYROID	PRESENT	3	0	0.00
	ABSENT	3	0	
ACUTE CHORONARY SYNDROME	PRESENT	1	1	0.221
	ABSENT	3	0	
CARDIOVASCULAR DISEASE	PRESENT	1	0	0.00
	ABSENT	3	0	

* Statistical significant using chi-square test

#statistical significant using kendalls tau_b test

5. CONCLUSION

Our study's objective was to evaluate the drug-related issues that the inpatients of the department of a tertiary care hospital were experiencing. Out of 151 patients participated, 125 (82.8%) were determined to have at least one DRP, according to the study's findings. DDIs 84 (23.5%) and insufficient drug monitoring 28 (7.8%) were the two most frequent DRPs found. Ondansetron, shown to be related with the most DRPs, was the medicine, with 29 (9.0%), followed by paracetamol, with 16 (4.9%).

The financial burden on patients has increased dramatically as a result of drug-related issues. Calculating the economic impact of DDIs and ADRs can be aided by proper monitoring followed by reporting of the DRPs. This may result in fewer hospital stays, encourage drug use that is reasonable, and be necessary for the patient's safety. As a result, the pharmacist is crucial in enhancing patient care and encouraging the wise and safe use of medications.

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