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Original Research

Assessing the impact of drug-related problems on disease prognosis in a tertiary care hospital -an observational study

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ABSTRACT:
Background: Drug-related problems (DRPs) are a major contributor to adverse clinical outcomes, especially in tertiary care settings where polypharmacy is common. This study aimed to evaluate the prevalence and impact of DRPs on disease prognosis across multiple hospital departments. **Methods:** A prospective observational study was conducted over six months in a tertiary care hospital in Hyderabad. A total of 180 inpatient prescriptions were reviewed. DRPs were identified, classified, and correlated with clinical prognosis using predefined scales. Data were analyzed descriptively. **Results:** Among 180 cases, 140 (77.77%) were found to have DRPs. The most common DRPs were drug interactions (31.66%), inappropriate doses (20%), and incorrect strength (14.44%). Prognostic outcomes revealed that 62.77% of patients had a moderate prognosis, 36.11% weak, and 10.55% severe impact due to DRPs. General Medicine, Gynaecology, and Orthopaedics departments reported the highest DRP burden, while Ophthalmology had the lowest. **Conclusion:** DRPs significantly affect disease outcomes, increasing morbidity and hospital stay duration. Targeted pharmacist-led interventions, prescriber education, and electronic drug monitoring systems are essential to reduce DRPs and improve patient prognosis.
Keywords: Drug-related problems, prognosis, tertiary care, clinical pharmacy, medication safety

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INTRODUCTION

Drug-related problems (DRPs) represent a significant concern in clinical pharmacotherapy, encompassing any event or circumstance involving drug therapy that interferes with the desired health outcomes of patients. These may arise due to inappropriate prescribing, dispensing errors, drug-drug interactions, non-adherence, or adverse drug reactions, ultimately impacting disease progression, prognosis, and patient safety [1]. DRPs are of particular concern in tertiary care settings where patients often present with complex comorbidities and are exposed to polypharmacy, thus increasing the likelihood of such issues [2].

Adverse drug reactions (ADRs), one of the most frequently encountered DRPs, range from mild manifestations like rashes and gastrointestinal discomfort to severe events such as hepatic injury, renal failure, or cardiovascular complications [3]. They contribute substantially to patient morbidity and are among the leading causes of hospital admissions globally. These ADRs are often preventable through appropriate therapeutic monitoring, but their underrecognition continues to challenge healthcare systems [1,4].

Drug interactions constitute another prominent category of DRPs. These occur when the pharmacodynamic or pharmacokinetic properties of a drug are altered due to the presence of another, leading to reduced efficacy or enhanced toxicity. In particular, medications like warfarin, digoxin, and certain antibiotics are highly susceptible to dangerous interactions that can lead to outcomes such as internal bleeding, cardiac arrhythmias, or organ dysfunction

[5]. Studies have emphasized the complex nature of these interactions and the need for proactive detection systems to mitigate their impact in hospitalized patients [6].

Medication errors, defined as preventable events that may cause inappropriate medication use or patient harm, can occur at any stage of the drug-use process—prescribing, transcribing, dispensing, administration, or monitoring [4]. Such errors can be as simple as prescribing the wrong dosage or as serious as administering contraindicated drugs. These errors, while often human in origin, are also influenced by systemic factors such as poor communication, lack of electronic health records, and inadequate clinical decision support systems [7].

Patient non-adherence to prescribed regimens is another commonly reported DRP. This may occur due to high drug costs, lack of awareness, forgetfulness, or adverse effects. Non-adherence compromises the effectiveness of therapeutic interventions and leads to disease progression, increased hospitalizations, and even mortality [8]. For chronic diseases like diabetes, hypertension, and HIV/AIDS, maintaining high adherence levels is vital to achieving disease control and avoiding complications [2,8].

The Pharmaceutical Care Network Europe (PCNE) classification system provides a standardized approach for identifying and categorizing DRPs, facilitating their systematic evaluation and enabling healthcare professionals to intervene effectively [9]. Similarly, the Naranjo algorithm is often employed in clinical studies to determine the probability that an adverse event is drug-related. These tools support evidence-based interventions by clinical pharmacists and healthcare teams to reduce the occurrence of DRPs and improve patient outcomes [3,9].

The clinical impact of DRPs extends beyond immediate adverse events. Their effect on disease prognosis is substantial. Patients experiencing DRPs may face increased length of hospital stay, added symptoms, treatment failure, or even death in severe cases. For instance, inappropriate dosing of insulin in diabetic patients could lead to life-threatening hypoglycemia or hyperglycemic crises. Likewise, missing anticoagulant doses in patients with atrial fibrillation raises the risk of thromboembolic events like stroke or myocardial infarction [10].

According to global data, DRPs contribute significantly to healthcare burden. Budnitz et al. reported that in the United States alone, more than 700,000 emergency department visits and 120,000 hospital admissions annually are linked to adverse drug events [5]. Moreover, the World Health Organization estimates that millions of people are affected by medication errors each year, many of which are preventable [6]. Despite this, DRPs remain underreported due to lack of documentation and structured surveillance, especially in resource-constrained settings.

In the Indian healthcare context, where resource limitations and patient overload are common, the burden of DRPs is likely to be underestimated. Clinical pharmacists are increasingly being recognized as pivotal members of the healthcare team in mitigating these problems. Their role in medication reconciliation, patient counseling, and therapeutic monitoring is essential to improving drug safety and treatment outcomes [1,10].

This study aims to assess the impact of drug-related problems on disease prognosis in a tertiary care hospital setting. By identifying and categorizing DRPs across multiple departments, and correlating their presence with disease outcomes, the study seeks to generate evidence to inform targeted interventions, guide rational prescribing, and ultimately enhance the quality of patient care.

MATERIALS AND METHODS

Study Design and Setting

This was a **prospective observational study** conducted over a **six-month period** from February to July 2023 in a tertiary care teaching hospital located in Hyderabad, Telangana, India. The study was carried out in multiple inpatient departments (IPDs) across various specialties, including General Medicine, Gynaecology, Ophthalmology, Paediatrics, Orthopaedics, Nephrology, General Surgery, Dermatology, Pulmonology, and ENT.

Ethical Approval

The study protocol was submitted to and approved by the Institutional Ethics Committee (IEC) of Geethanjali College of Pharmacy. Ethical clearance was granted under reference number **GCPK/PD23/04** dated 22nd August 2023. Informed consent was obtained verbally from all patients or their caregivers before inclusion in the study.

Study Population

A total of **180 inpatients** were included in the study using a **consecutive sampling technique**. Patients were screened for eligibility based on the following criteria:

Inclusion Criteria

- Patients of all ages and both genders.
- Patients admitted to the IPD of the participating departments.
- Patients receiving at least one medication during hospitalization.

Exclusion Criteria

- Patients from the Emergency and Outpatient departments.
- Patients from the Oncology department due to complex regimens and ethical considerations.
- Patients with active COVID-19 infections due to isolation protocols.

Sample Size Determination

The sample size was calculated using **Raosoft sample size calculator**. Based on an estimated DRP prevalence of 87%, a 95% confidence interval, and a 5% margin of error, the required sample size was determined to be **174**. Allowing for a 5% non-response rate, the final sample size was increased to **180** patients.

Data Collection

Data were collected using a structured data collection form designed for this study. Information was obtained from patient medical records, medication charts, and prescription copies. The collected data included:

- Demographics (age, gender)
- Diagnosis and comorbidities
- Prescribed medications (drug name, dose, frequency, duration)
- Observed or suspected DRPs
- Associated clinical outcomes (hospital stay duration, new or worsened symptoms)

Classification of Drug-Related Problems

DRPs were identified and classified using standard clinical guidelines, reference texts, and published literature. Categories included:

- **Indication-related** (e.g., unnecessary drug therapy, untreated condition)
- **Effectiveness-related** (e.g., ineffective drug, incorrect dosage form)
- **Safety-related** (e.g., adverse drug reactions, unsafe medications, interactions)
- **Adherence-related** (e.g., noncompliance, misunderstanding instructions)

Each DRP was verified by a clinical pharmacist in collaboration with treating physicians.

Assessment of Prognosis

Disease prognosis was evaluated based on clinical parameters, additional symptoms, and hospital stay as per the defined **Prognosis Impact Scale**:

- **Not Affected**: No changes in hospital stay or symptoms.
- **Weak**: 1-day increase in stay and mild symptoms.
- **Moderate**: 2-day increase and moderate symptom persistence.
- **Severe**: >2-day increase with severe symptom manifestation.

The impact of DRPs on prognosis was determined by matching identified DRPs with clinical outcomes recorded in patient charts.

Statistical Analysis

The data were entered and analyzed using **Microsoft Excel**. Descriptive statistics (percentages, frequencies) were used to summarize the prevalence of DRPs and their corresponding effect on disease prognosis. No inferential tests were applied as this study focused on observational trends across departments.

RESULTS

Table 1: Prevalence of DRPs in IP Department

Out of 180 prescriptions, a total of 140 irrational cases were observed. The most frequent DRP identified was **drug interactions (31.66%)**, followed by **inappropriate dose (20%)** and **incorrect strength (14.44%)**. Other notable DRPs included **untreated condition (9.44%)**, **inappropriate dosage form (9.44%)**, and **non-drug therapy indicated (6.11%)**. No cases were recorded for allergic reactions, unsafe drugs, or incorrect administration. fig 1

Table 1:

DRUG-RELATED PROBLEMS	% OF DRPs IDENTIFIED
NO MEDICAL INDICATION	0
DUPLICATE THERAPY	6.66
NON-DRUG THERAPY INDICATED	6.11
TREATING AVOIDABLE ADVERSE DRUG REACTION	0
ADDICTIVE/RECREATIONAL USE	0
UNTREATED CONDITION	9.44
PREVENTIVE/PROPHYLACTIC	2.22
SYNERGISTIC/POTENTIATING	0
MORE EFFECTIVE DRUG AVAILABLE	0
CONDITION REFRACTORY TO DRUG	0
DOSAGE FORM INAPPROPRIATE	9.44
INAPPROPRIATE DOSE	20
INCORRECT STRENGTH	14.44
NOT EFFECTIVE FOR CONDITION	5.55
UNDESIRABLE EFFECT	0
UNSAFE DRUG FOR PATIENT	5
DRUG INTERACTION	31.66
INCORRECT ADMINISTRATION	0
ALLERGIC REACTION	0

NO DRP	22.22

Table 2: Prevalence of Prognosis in IP Departments
The prognosis impact analysis showed that **62.77%** of the patients experienced a **moderate impact**, followed by **36.11% weak prognosis**, while **22.22%** showed **no effect**. **Severe prognosis** was reported in **10.55%** of the cases, indicating a moderate overall influence of DRPs on patient outcomes. Fig 2

Table 2:

IMPACT OF PROGNOSIS	PERCENTAGE
NOT AFFECTED	22.22
WEAK	36.11
MODERATE	62.77
SEVERE	10.55

Table 3: Prevalence of DRPs in Various Departments
DRPs were most frequently observed in **General Medicine**, **Gynaecology**, **Orthopaedics**, and **Pulmonology** departments. Notable observations included **high rates of drug interactions** in **Nephrology (80%)**, **Pulmonology (60%)**, and **Gynaecology (54.54%)**. Incorrect dose and strength were also prevalent in multiple departments, while Ophthalmology had the **highest rate of rational prescriptions** with 77.77% showing **no DRP**.

Table 3

DRUG-RELATED PROBLEMS	% IN GM	% IN GYN	% IN OPHTH	% IN PAED	% IN ORTHO	% IN NEPH	% IN GS	% IN DERM	% IN PULM	% IN ENT
DUPLICATE THERAPY	11.59	0	0	11.76	0	0	12.5	0	10	0
INAPPROPRIATE DOSE	20.28	36.36	0	11.76	32.14	20	0	0	0	33.33
INCORRECT STRENGTH	17.39	4.54	0.11	35.29	3.57	0	25	0	30	0
DRUG INTERACTION	15.94	54.54	0.11	5.88	50	80	25	33.33	60	66.66
NO DRP	14.49	27.27	77.77	5.88	25	20	25	50	20	16.66

Table 4: Prevalence of Prognosis in Various Departments
The **worst prognosis** (moderate to severe) was observed in **Pulmonology (60% moderate, 0% severe)** and **ENT (66.66% moderate)**. **Ophthalmology** had the best outcomes with **77.77% of cases unaffected** by DRPs. The **General Medicine** department showed a high incidence of **moderate prognosis (68.11%)** with **8.6% severe**.

Table 4

DEPARTMENT	NOT AFFECTED	WEAK	MODERATE	SEVERE
General Medicine	14.49	31.88	68.11	8.6
Gynaecology	27.27	22.72	59.09	22.72
Ophthalmology	77.77	0	22.22	0
Paediatrics	5.88	47.05	88.23	11.76
Orthopaedics	25	50	67.86	14.29
Nephrology	20	40	80	0
General Surgery	25	37.5	25	25
Dermatology	37.5	25	16.66	0
Pulmonology	20	60	60	0
ENT	16.66	50	66.66	0

Table 5: Prevalence of DRPs and Prognosis in General Medicine
In the General Medicine department (n=69), the most frequent DRPs were **inappropriate dose (20.28%)**, **incorrect strength (17.39%)**, and **drug interactions (15.94%)**. Among prognosis outcomes, **68.11% of cases**

had a moderate prognosis, **31.88% had weak prognosis**, and **8.6% severe**. Notably, **no DRPs resulted in "not affected" prognosis**, except for the "No DRP" category.

Table 5:

DRUG-RELATED PROBLEMS	NO. OF DRPs	% OF DRP	PROGNOSIS NOT AFFECTED	WEAK PROGNOSIS	MODERATE PROGNOSIS	SEVERE PROGNOSIS
NO MEDICAL INDICATION	0	0	0	0	0	0
DUPLICATE THERAPY	8	11.59	0	0	8	0
NON-DRUG THERAPY INDICATED	3	4.34	0	0	3	0
UNTREATED CONDITION	7	10.14	0	1	5	1
DOSAGE FORM INAPPROPRIATE	8	11.59	0	5	3	0
INAPPROPRIATE DOSE	14	20.28	0	9	5	0
INCORRECT STRENGTH	12	17.39	0	3	9	0
NOT EFFECTIVE FOR CONDITION	8	11.59	0	0	7	1
UNSAFE DRUG FOR PATIENT	5	7.24	0	0	0	5
DRUG INTERACTION	11	15.94	0	4	7	0
NO DRP	10	14.49	10	0	0	0

Table 6: Prevalence of DRPs and Prognosis in Gynaecology

In the Gynaecology department (n=22), **drug interactions (54.54%)** and **inappropriate dose (36.36%)** were the leading DRPs. Prognosis outcomes showed a **moderate impact in 59.09%**, with **22.72% experiencing severe prognosis**. "No DRP" was found in 27.27% of patients, all of whom had unaffected prognosis.

Table 6:

DRUG-RELATED PROBLEMS	NO. OF DRPs	% OF DRP	PROGNOSIS NOT AFFECTED	WEAK PROGNOSIS	MODERATE PROGNOSIS	SEVERE PROGNOSIS
UNTREATED CONDITION	1	4.54	0	0	1	0
INAPPROPRIATE DOSE	8	36.36	0	1	5	2
INCORRECT STRENGTH	1	4.54	0	1	0	0
UNSAFE DRUG FOR PATIENT	1	4.54	0	0	0	1
DRUG INTERACTION	12	54.54	0	3	7	2
NO DRP	6	27.27	6	0	0	0

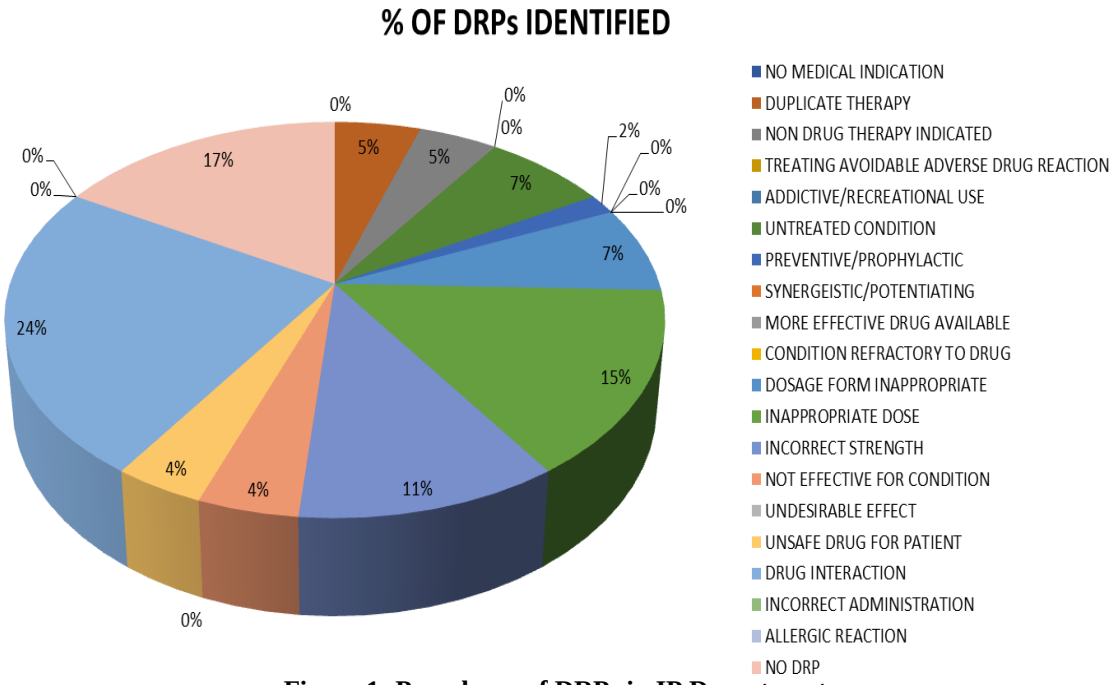

Figure 1: Prevalence of DRPs in IP Department

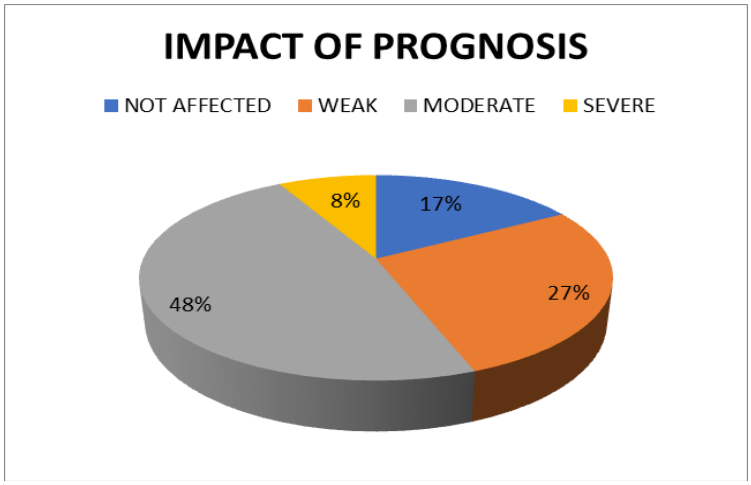

Figure 2: Prevalence of Prognosis in IP Department

DISCUSSION

This study aimed to assess the prevalence and impact of drug-related problems (DRPs) on disease prognosis in a tertiary care hospital setting. DRPs are known to significantly alter therapeutic outcomes by interfering with the pharmacological action of drugs, leading to disease progression, increased hospital stays, or in severe cases, mortality. Our findings reinforce the clinical importance of early identification and management of DRPs, particularly in settings where polypharmacy is common.

Among the 180 inpatient cases evaluated, the most common DRPs identified included **drug interactions (31.66%)**, **inappropriate dosing (20%)**, and **incorrect strength (14.44%)**. These findings are consistent with several observational studies which have highlighted similar patterns. In a prospective study conducted by Howard et al., prescribing and monitoring errors contributed to 67% of drug-related hospital admissions, most of which were preventable through pharmacist interventions [14]. These errors align with our findings, where a considerable proportion of DRPs could have been avoided with appropriate dose verification and regimen review.

Department-wise analysis revealed significant variation in the prevalence and severity of DRPs. General Medicine reported a high frequency of multiple DRPs, particularly incorrect strength and inappropriate dose, both of which contributed to a **moderate prognosis in over 68%** of cases. Similarly, in the Gynaecology department, **drug interactions (54.54%)** and **inappropriate doses (36.36%)** were leading contributors to negative prognostic outcomes. This aligns with the observations by Vijayakumar et al., who emphasized the role of intravenous administration and improper dosing in raising the likelihood of DRPs, especially among patients receiving complex drug regimens [15].

In Ophthalmology, the number of DRPs was minimal, and **77.77% of cases reported no DRP**, which correlated with a better prognosis. This may be due to the nature of treatments in Ophthalmology being more localized with fewer systemic effects. Similarly, a study by Lenander et al. demonstrated that structured medication review interventions could effectively reduce DRP rates and maintain stable health outcomes in such focused specialties [16].

Paediatrics, however, showed a disproportionately high occurrence of **incorrect strength (35.29%)** and **untreated conditions (29.41%)**, leading to **moderate prognosis in 88.23%** of cases. These results are supported by findings from Saldanha et al., where pediatric populations were found to be highly susceptible to DRPs due to weight-based dosing complexities and communication barriers [17]. This vulnerability underscores the need for pediatric-specific drug monitoring systems and dosing calculators to minimize errors.

The presence of polypharmacy and comorbidities was a recurring risk factor across departments. Nilay Aksoy et al. reported a significant correlation between DRP occurrence and factors such as **age, renal function, and number of prescribed medications**, reinforcing the risk in elderly and systemically compromised patients [18]. Similarly, R Hour et al. emphasized that **88% of patients in their study experienced at least one DRP**, with anti-infectives and antithrombotics being the most implicated classes [19]. In our study, nephrology patients demonstrated an 80% prevalence of drug interactions, further supporting these associations.

The relationship between DRPs and disease prognosis was clearly established. Across the study sample, **moderate prognosis was the most frequent outcome (62.77%)**, suggesting that while DRPs may not always result in life-threatening consequences, they significantly delay recovery and extend hospitalization. These findings are aligned with the structured medication reviews conducted by Hellström et al., where active pharmacist interventions led to 80% of DRPs being successfully addressed and corrected [20].

The evidence from this study highlights the crucial role of clinical pharmacists in improving patient outcomes. Their involvement in therapeutic decision-making, medication reconciliation, and patient counseling has been shown to prevent DRPs and improve adherence. As the healthcare system becomes increasingly multidisciplinary, integrating pharmacists into the core clinical team becomes imperative.

Moreover, the results call for systemic improvements in hospital drug monitoring practices. The use of electronic prescribing systems, mandatory drug interaction checks, and automated alert systems may significantly reduce the incidence of preventable DRPs. Educational initiatives targeting prescribers and nurses are also essential to reinforce best practices in drug administration.

While the study offers valuable insights, it is not without limitations. Being conducted in a single tertiary care center, the findings may not be generalizable to smaller hospitals or primary care settings. Additionally, the study was observational, limiting causal inference between DRPs and prognosis outcomes. Despite these limitations, the study emphasizes the real-world impact of DRPs and the urgent need for preventive strategies.

CONCLUSION

This observational study underscores the significant impact of drug-related problems (DRPs) on disease prognosis in a tertiary care hospital. DRPs such as drug interactions, inappropriate dosing, and incorrect strength were the most prevalent, contributing to moderate and severe prognostic outcomes in a substantial proportion of patients. The findings emphasize the urgent need for systematic identification, classification, and management of DRPs. Integration of clinical pharmacists into patient care teams, routine medication reviews, and prescriber education are vital strategies to minimize DRPs, enhance treatment safety, and ultimately improve patient outcomes across various hospital departments.

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