

INCIDENCE OF POLYPHARMACY AND DRUG RELATED PROBLEMS AMONG ELDERLY IN TERTIARY CARE HOSPITAL – A DESCRIPTIVE STUDY**TABITHA SHARON¹, CHAITHRA VEMPARALA², SRI VASAVI KANDUKURI³, MADHURI KOMATI⁴, BHARGAVI GOTTAPU⁵**¹Assistant Professor, Vijaya Institute of Pharmaceutical Sciences for Women, Vijayawada, Andhra Pradesh, India. ²Clinical Research Coordinator, Andhra Hospitals, Vijayawada, Andhra Pradesh, India. Email: sherilsharon@gmail.com*Received: 10 March 2022, Revised and Accepted: 28 June 2022***ABSTRACT**

Objective: Drug-related problems are most common in Geriatrics. The increasing number of available drugs and drug users as well as more drug regimens led to many drug related problems which increases the health-care cost, mortality, morbidity, and also decreases the quality of life. The main objective of this study is to assess the incidence of polypharmacy and drug-related problems among elderly admitted in tertiary care hospital.

Methods: The study was conducted in a tertiary care hospital after obtaining ethical clearance from the Institutional Ethical Committee. The medication information along with medical data and patient demographics such as name of the patient, age, sex, chief complaints, laboratory data, diagnosis along with therapeutic data such as name of the prescribed drugs, dose, dosage, frequency, route of administration, duration of treatment, and any new or existing drug-related problems were noted in a case collection form by bed-side counseling, case sheets, laboratory reports and were documented. The drug-related problems (DRPs) were categorized using Pharmaceutical Care Network Europe classification v 9.0 classification. Statistical analysis was done using Chi-square test.

Results: of 151 Participants considered for the study 97 (64.24%) were males and 54 (35.76%) were females. The incidence rate of DRPs was found to be 86.09% and 1.45 DRPs per patient. In a total number of sample population, patients with DRPs were 120 and without DRPs were 21.

Conclusion: DRPs mostly observed in geriatric population as they receive multiple medications for multiple disease conditions and active role of clinical pharmacist is necessary to identify and resolve them. DRPs identified must be accepted by the physicians and cooperation of patients and physician is necessary to resolve DRPs. Further studies are required to prove that the polypharmacy plays a major role in developing DRPs.

Keywords: Drug-related problems, Polypharmacy, Geriatrics, Length of stay, Prescription, Patient counseling.

© 2022 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2022v15i9.44618>. Journal homepage: <https://innovareacademics.in/journals/index.php/ajpcr>

INTRODUCTION

A drug-related problem (DRP) is an event involving drug therapy that really or potentially interferes with desired health outcomes. Annually, it has been estimated that DRPs account for 17 million emergency department visits, 76.6 billion dollars in hospital costs, and 8.7 million hospital admissions. The majority of reported DRPs were preventable and an effective medication review can be utilized for successful detection of DRPs [1]. Factors responsible for DRPs in patients are age (>65 years), comorbidities, polypharmacy, lack of proper laboratory and therapeutic drug monitoring, medication non-adherence, medication errors, and patient-related factors. Patient counseling can be an effective intervention to reduce the incidence of DRPs [2]. Potentially inappropriate medication (PIM) prescribing may cause preventable adverse drug events, with serious consequences for patients [3]. The drug-related problems such as adverse drug reactions (ADRs), drug-drug interactions, and drug disease interactions are predisposed in older adults due to alteration of age-related pharmacokinetics and pharmacodynamics [4]. Adverse events, drug interactions, inappropriate dose, and indication may be due to medication error and cause significant mortality and morbidity [5]. Medication errors may be committed by both inexperienced and experienced persons such as doctors, dentists, patients, manufacturers, pharmacists, and other health-care providers [6]. Non-adherence is complex process and it should be understood through qualitative research prospective [7]. The rapport with older patients, ease of communication, and patient-centered pharmaceutical care can improve the adherence toward the medication [8]. An adverse reaction to a drug is an unwanted and undesirable effect of a medication that occurs during usual clinical use [9]. The prevalence of ADRs in West Bengal reported that among 529 prescriptions analyzed, there were 287 suspected ADRs observed

in the study [10]. A drug interaction is a change in the action of the drug occurred by concomitant administration of drug with a food, beverage, supplement, or other drug [11]. The assessment of prevalence and patients at risk for clinically important DDIs at visit will be useful in minimizing medication-related problems and improving pharmaceutical care [12].

In a review, 20 different types of classification have been identified and modified. Among those classifications, the most common and widely used is Pharmaceutical Care Network Europe classification (PCNE). Documentation of DRPs by pharmacists must be done to minimize the incidence of DRPs [13]. The DRP is always a better option to be prevented than to make it worse and life-threatening. Half of the percentile of patients does not adhere to medication which leads to significant DRPs. Dispensing problems are also noticed but neglected. Other causes for DRPs include misinterpreting the physicians' handwriting, lack of drug use review, dose, and dosage errors [14]. Polypharmacy is one of the reasons for the occurrence of DRPs. Polypharmacy is most prevalent in the elderly and the consequences associated are increased healthcare costs, adverse drug events, drug interactions, medication non-adherence, functional status, cognitive impairment, urinary incontinence, and nutrition. All these consequences are listed under DRPs [15]. In the elderly, medications are frequently used to improve their quality of life but they fail to adhere to the prescribed medications leading to various drug related problems [16].

The present research study targets the incidence of DRPs, polypharmacy, and the relationship between DRPs and polypharmacy. As geriatrics is a highly affected population, the study is conducted among geriatrics (more than 60 years of age) using PCNE classification.

METHODS

Study procedure

The study was conducted in the tertiary care hospital after obtaining ethical clearance from the Institutional Ethical Committee. The patients who are not willing to participate in the study were excluded. Follow-up was done for 6 months and the collected data were analyzed using statistical analysis.

Source of data

The patient details were collected and entered in designed data entry form.

Design of data collection form and DRPs questionnaire

The data collection form designed by the need of subject demographic details and the data were analyzed for DRPs such as ADRs, PIMs, drug duplications and medication errors. PIMs were identified using BEER's criteria. Medication errors and drug duplications were assessed by direct observation and analysis of prescriptions. The total number of DRPs was assessed using PCNE version 9.0.

Study design

Study site

The study was conducted at Government General Hospital (GGH), Vijayawada.

Study duration

The study was carried out for a period of 6 months.

Study design

This was a prospective and descriptive study.

Study criteria

The study was carried out by considering the following criteria

Inclusion criteria

The following criteria were included in the study:

- Patients age >60 years, both male and female.
- Patients who are taking more than five drugs and minimum 3 days of hospital admission.
- Patients who were suffering from chronic diseases were included.
- Patients admitted in general medicine department.

Exclusion criteria

The following criteria were excluded from the study:

- Patients <60 years of age.
- Patients with malignancy.
- Incomplete patient case sheet.
- Emergency and intensive care unit patients.
- Death of patients before being discharged.

Ethical approval

This study was approved by the Institutional Ethical Committee of GGH, Vijayawada. Ethical approval number - IEC/2019/096D/SMC

Study procedure

The study was conducted in a tertiary care hospital after obtaining ethical clearance from the Institutional Ethical Committee. The medication information along with medical data and patient demographic such as name of the patient, age, sex, chief complaints, laboratory data, diagnosis along with therapeutic data such as name of the prescribed drugs, its dose, dosage, frequency, route of administration, duration of treatment, and any new or existing drug related problems were also noted in a case collection form by bed-side counseling, case sheets, and laboratory reports and were documented. The DRPs were categorized using PCNE classification.

Data analysis

All the collected data were analyzed to assess the DRPs occurred in the tertiary care hospital. All patients were monitored from the day of admission to the day of discharge. The patient data were collected and documented in the prepared IP data collection forms. The DRPs were assessed using PCNE Version 9 classification. The ADRs were analyzed according to PCNE classification.

Statistical analysis

Statistical analysis was performed using Chi-square test.

The p-value is 0.07244 ($p < 0.05$) – For the analysis of length of days with or without DRPs

The p-value is 0.000042 ($p < 0.05$) – For the analysis of polypharmacy with or without DRPs.

RESULTS AND DISCUSSION

A prospective and observational study included the assessment of drug-related problems using PCNE classification. A total of 189 patients were included in the study in which at least 130 patients have one DRP. A total of 416 DRPs were identified in which on an average, there were 2.2 DRPs per patient. The results led to a conclusion that pharmacist led interventions in resolution of DRPs are needed for developing countries like India [2].

This study was carried out in GGH, Vijayawada. The study was approved by the Institutional Ethical Committee, GGH, Vijayawada. A total of 151 geriatric patients were involved in the study and classified as patients with and without DRPs. The data were collected for a period of 6 months. DRPs were classified using PCNE Version 9 classification and analyzed using Chi-square test. The incidence of DRPs was 1.45 DRPs per patient and the incidence rate was 86.09% in the study population.

Age-wise distribution of study population

Age-wise distribution of study population and percentage of males and females among the study population is represented in Table 1 and Fig. 1. It states that according to age-wise categorization, the majority of patients were found between the age group 60–70, followed by 71–90. Mean age of patients was found to be 70.26 ± 7.89 years.

Gender-wise distribution of study population

Gender-wise distribution of males and females with and without DRPs is represented in Table 2 and Fig. 2. It states that during the study period, a sample of 151 geriatric patients was observed among which the male population was 97 (74.62%) and female was 54 (41.54%). Of them,

Table 1: Age-wise distribution of the study population

Age (years)	Males	Females
60–69	47	32
70–79	40	17
80–89	10	5
Total	97	54
Percentage	64.24	35.76

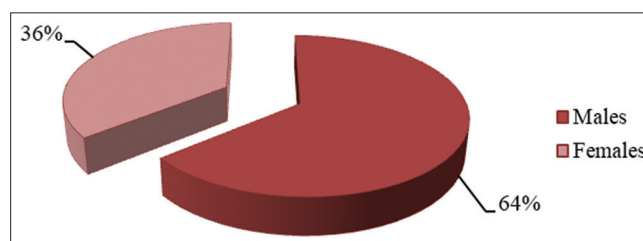


Fig. 1: Percentage of males and females in study population

130 (86.09%) patients were identified with DRPs and 21 (13.91%) patients were without DRPs. A total of 219 DRPs were identified in 151 patients and out of them, 146 (66.67%) in male and 73 (33.33%) in female were observed.

Duration of stay

Duration of stay of patients is represented in Table 3 and Fig. 3. It states that among total sample size of 151 patients, the duration of stay of patients was mostly found between 6 and 10 days followed by <5 and 11–15 days. Mean length of stay of patients was found to be 7.66±0.12 days.

Duration of stay with and without DRPs

Duration of stay in sample population with and without DRPs is represented in Table 4 and Fig. 4. It states that the duration of stay in sample population was differentiated into <5 days, 6–10 days and above up to 20 days. It was categorized as with and without DRPs and it was found that patients with DRPs were seen mostly in 6–10 days of duration followed by <5 and 11–20 days. Table 3 represents that the statistical analysis was performed using Chi-square test. The test was applied to compare length of stay with DRPs. The test was done to analyze if there was any association between the length of stay and DRPs. The null hypothesis was considered as there was no significant association between length of stay and DRPs. The Chi-square calculated value for comparison of length of stay and DRPs was 5.25 at 5% level of significance and 1 degrees of freedom. The table value was 3.841. Calculated value was more than the test value, hence we reject null hypothesis which reveals that there was significant association between the length of stay and patients with DRPs.

Polypharmacy

Age-wise distribution of polypharmacy in sample population is represented in Table 5 and Fig. 5 which states that 6–10 drugs were mostly prescribed followed by 11–15 drugs in the age group 60–69. Mean number of medications received per prescription was 10.61±0.1.

Polypharmacy with and without DRPs

Polypharmacy with and without DRPs is represented in Table 6 and Fig. 6. It states that patients with DRPs were mostly seen with prescription of 6–10 drugs followed by 11–15 and 16–20 drugs. Table 5 represents that the statistical analysis was performed using Chi-square test. The test was applied to compare polypharmacy with DRPs. The test was done to analyze if there was any association between polypharmacy and DRPs. The null hypothesis was considered as there was no significant association between polypharmacy and DRPs. The Chi-square calculated value for comparison of polypharmacy and DRPs was 20.174 at 5% level of significance and 1 degrees of freedom. The table value was 3.841 and calculated value was more than test value. Hence, we reject null hypothesis which reveals that there was significant association between polypharmacy and patients with DRPs.

DRPs classified based on PCNE Version 9 classification

More than 60% of the world population constitutes the elderly people [3]. A questionnaire can be used to analyze the medication related problems which is developed on the basis of clinical medication review known as PCNE [17].

Classification of DRPs according to PCNE V9.0 is represented in Table 6 states that PCNE classification is divided into five classes where problems, causes, interventions, acceptance, and status of DRPs can be identified. The problems contain three main categories regarding treatment effectiveness, treatment safety, and others. The relevant causes were identified and interventions were done according to the problems identified. The problem mostly identified was P1-treatment effectiveness (49.31%) in which P1.3 (unclear problem or complaint) was mostly seen (20.09%) followed by P1.2 effect of drug treatment not optimal (15.53%) and P1.1 no effect of drug treatment (13.7%). P2 (adverse event possibly occurring) was found in 33 patients (15.07%). P3 was found in 78 patients (35.61%). The most observed causes were

Table 2: Gender-wise distribution of sample with and without DRPs

Age (years)	Male		Female	
	With DRP	Without DRP	With DRP	Without DRP
60–69	79	1	43	5
70–79	53	7	22	4
80–89	14	2	8	2
Total	146	10	73	11

DRP: Drug-related problems

Table 3: Duration of stay in males and females

Duration of stay	Male	Female	Total	Percentage
<5	14	20	34	22.52
6–10	66	29	95	62.91
11–15	16	4	20	13.25
16–20	1	1	2	1.32
Total	97	54	151	100

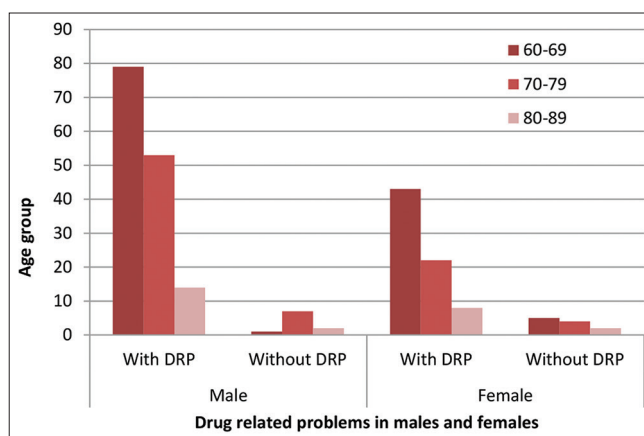


Fig. 2: Gender-wise distribution of males and females with and without drug-related problems

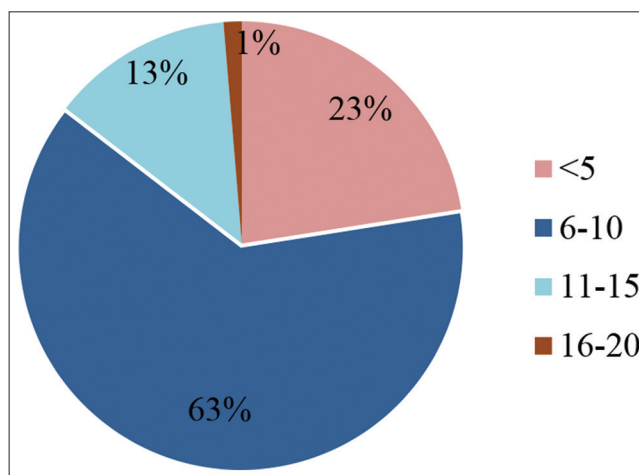


Fig. 3: Pie diagram representing gender-wise distribution of duration of stay in patients

C1 (28.31%) drug selection followed by C7 (15.99%) patient related and C8 (12.33%) patient transfer related. In C1, C1.6 (6.85%) which is no or incomplete drug treatment in spite of existing condition was mostly observed. The interventions were mostly at prescriber level I1 (39.27%) followed by patient level (34.25%) and drug level (26.48%).

Table 4: Duration of stay in sample population with and without DRPs

Length of stay	With DRP	Without DRP	Chi-square value
≤5	26	8	5.25
6-10	84	9	
11-15	18	2	
16-20	2	2	
Total	130	21	
Percentage	86.09	13.91	

DRP: Drug-related problems

Table 5: Age-wise distribution of polypharmacy in sample population

Age (years)	Polypharmacy					
	6-10		11-15		16-20	
	Male	Female	Male	Female	Male	Female
60-69	28	23	24	10	3	1
70-79	16	6	15	8	2	1
80-89	5	3	3	1	1	1
Total	49	32	42	19	6	3

Table 6: Polypharmacy in sample population with and without DRPs

No. of drugs	With DRP	Without DRP	Chi-square value
6-10	69	12	20.174
11-15	56	4	
16-20	5	5	
Total	130	21	
Percentage	86.09%	13.91%	

DRP: Drug-related problems

Table 7: Classification of DRPs according to PCNE Version 9.0 classification

Classification	Code	DRPs (percentage)
Problems	P1 (Treatment effectiveness)	108 (49.31)
	P2 (Treatment safety)	33 (15.07)
	P3 (Other)	78 (35.61)
Causes	C1(Drug selection)	62 (28.31)
	C2(Drug form)	0 (0.00)
	C3(Dose selection)	18 (8.22)
	C4(Treatment duration)	23 (10.5)
	C5(Dispensing)	16 (7.31)
	C6(Drug use process)	24 (10.96)
	C7(Patient related)	45 (15.99)
	C8(Patient transfer related)	27 (12.33)
	C9(Other)	14 (6.39)
Planned intervention	I0(No intervention)	0 (0.00)
	I1(At prescriber level)	86 (39.27)
	I2(At patient level)	75 (34.25)
	I3(At drug level)	58 (26.48)
Acceptance of intervention	I4(Other)	0 (0.00)
	A1(Intervention accepted)	93 (42.47)
	A2(Intervention not accepted)	71 (32.42)
Status of DRP	A3(Other)	55 (25.11)
	O0(Problem status unknown)	54 (24.66)
	O1(Problem solved)	16 (7.31)
	O2(Problem partially solved)	53 (24.20)
	O3(Problem not solved)	96 (43.85)

DRP: Drug related problems

In the acceptance of interventions, A1 (42.47%) was mostly observed which is acceptance of intervention followed by A2 (no acceptance of intervention (32.42%)) and A3 (other (25.11%)). The status of DRP

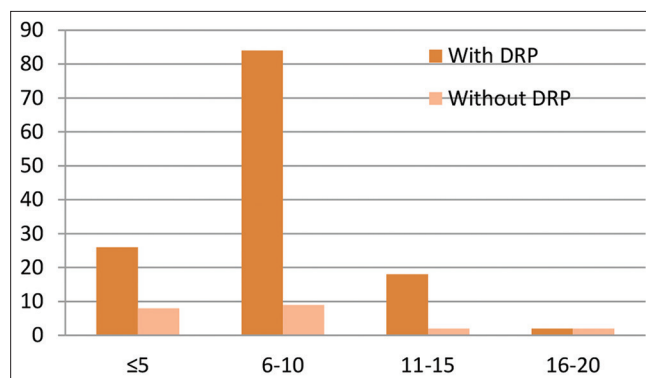


Fig. 4: Duration of stay in sample population with and without drug-related problems

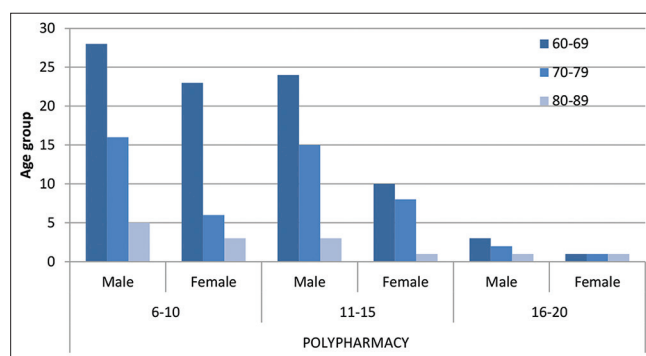


Fig. 5: Age-wise distribution of polypharmacy in sample population

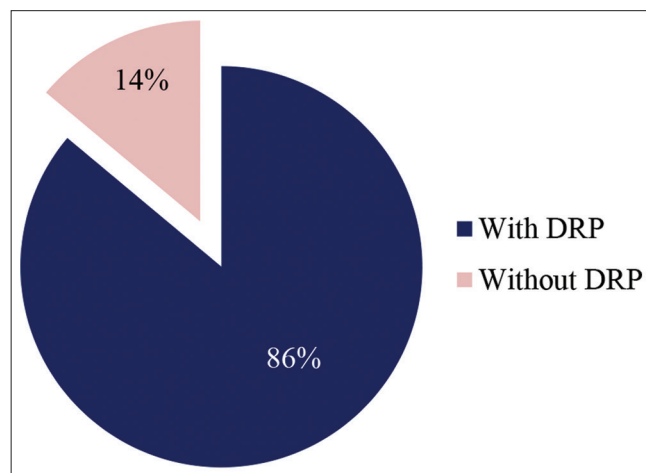


Fig. 6: Pie diagram representing polypharmacy with and without drug-related problems

was mostly not solved O3 96 (43.85%) followed by O0 54 (24.66%), O2 53 (24.20%), and O1 16 (7.31%).

Pharmaceutical care is mainly aimed at identifying and resolving DRPs associated with prescription orders. Most of the research has been conducted in western countries and clinical pharmacy service in the field of patient care is still in the developing stage in China, India, and other Asian countries (Zhu et al., 2019).

The therapeutic regimen aims to achieve better therapeutic outcomes with minimal DRPs. Untreated DRPs may result in drug-related morbidity and mortality that reflects in therapeutic malfunction. Most

of these problems are preventable and can be treated with optimum and genuine use of therapeutic agents [18].

In the present study, the DRPs were identified using PCNE Version 9.0 classification. According to the analysis, the incidence rate of DRPs was found to be more in the study population. The statistical analysis explains that there is significant association between polypharmacy and DRPs as well as length of stay with DRPs. The treatment effectiveness was most common identified problem and no or incomplete treatment in spite of existing condition was most common identified causes. The interventions were accepted and implemented but remained at prescriber level followed by patient and drug level. Hence, the status of DRPs was mostly unresolved. The lack of cooperation of prescriber and patient is the main cause for the unresolved DRPs.

CONCLUSION

The incidence rate of DRPs was found to be 86.09% and 1.45 DRPs per patient. In a total number of 151 sample population, patients with DRPs were 120 whereas without DRPs were 21. According to age-wise distribution of study population, the age group of 60–69 years (52.31%) was hospitalized followed by 70–79 years (37.74%). Among the study population, males were more affected with DRPs among age group of 60–69 years (52.31%). Based on the percentage of length of stay of patients, the most common duration of stay for patients was 6–10 days (62.91%) followed by <5 days (22.52%). The age group of 60–69 years was highly suffered with polypharmacy when compared to 70–79 and 80–89 years of patients. The incidence was more among males than females and the sample size also differed between males and females. The Chi-square distribution showed that there was significant association between polypharmacy and DRPs and length of stay and DRPs. The most common occurred problem for DRPs was treatment effectiveness (49.31%) and then followed by unclear problem or complaint (20.09%).

DRPs are mostly observed in geriatric population as they receive multiple medications for multiple disease conditions. The active role of clinical pharmacist is necessary in identifying and resolving the DRPs [19]. The DRPs identified must be accepted by the physicians and cooperation of patients and physician is necessary for resolving DRPs. Further studies are required to prove that the polypharmacy plays a major role in developing DRPs.

ACKNOWLEDGMENT

The authors thank Dr. Padmalatha Kantamneni for her support and guidance throughout the research project. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST STATEMENT

The authors declared that there is no conflict of interest in this study.

AUTHORS FUNDING

There was no funding from any organization for the study.

ETHICS COMMITTEE APPROVAL

This study was approved by the Institutional Ethical Committee of GGH, Vijayawada. Ethical approval number - IEC/2019/096D/SMC.

REFERENCES

- Hsu WT, Shen LJ, Lee CM. Drug related problems vary with medication category and treatment duration in Taiwanese heart failure outpatients receiving case management. *J Formos Med Assoc* 2016;115:335-42. doi: 10.1016/j.jfma.2015.11.014, PMID 26774679
- Movva R, Jampani A, Nathani J, Pinnamaneni SH, Challa SR. A prospective study of incidence of medication related problems in general medicine ward of a tertiary care hospital. *J Adv Pharm Technol Res* 2015;6:190-4. doi: 10.4103/2231-4040.166502, PMID 26605161
- Ahmed B, Nanji K, Mujeeb R, Patel MJ. Effects of polypharmacy on adverse drug reactions among geriatric outpatients at a tertiary care hospital in Karachi: A prospective cohort study. *PLoS One* 2014;9:e112133. doi: 10.1371/journal.pone.0112133, PMID 25402452
- Rieckert A, Trampisch US, Drewelow E, Aneez E, Esmail A, Keller S, et al. Polypharmacy in older patients with chronic diseases: a cross sectional analysis of factors associated with excessive polypharmacy. *BMC Fam Pract* 2018;19:113.
- Dos Santos NS, Marengo LL, Moraes FD, Filho SB. Interventions to reduce the prescription of inappropriate medication in geriatrics. *Rev Saúde Publ* 2019;53:1-7.
- Patel S, Patel A, Solanki N, Patel V. Study of medication error in hospitalised patients in tertiary care hospital. *J Pharm Pract* 2018;11:32-6.
- Kvarnström K, Airaksinen M, Liira H. Barriers and facilitators to medication adherence: A qualitative study with general practitioners. *BMJ Open* 2018;8:e015332. doi: 10.1136/bmjopen-2016-015332, PMID 29362241
- Jin H, Kim Y, Rhie SJ. Factors affecting medication adherence in elderly people. *Patient Prefer Adherence* 2016;10:2117-25. doi: 10.2147/PPA.S118121, PMID 27799748
- Edwards IR, Aronson JK. Adverse drug reactions: Definitions, diagnosis and management. *Lancet* 2000;356:1255-9. doi: 10.1016/S0140-6736(00)02799-9, PMID 11072960
- Adhikari A, Bhattacharya N, Indu R, Ray M, Bhattacharya S. Evaluation of adverse drug reactions (ADRs) in tertiary care hospital of Kolkata, West Bengal, India. *J Young Pharm* 2017;9:311-4.
- Greco WR, Bravo G, Parsons JC. The search for synergy: A critical review from a response surface perspective. *Pharmacol Rev* 1995;47:331-85. PMID 7568331
- Kukarni V, Bora SS, Saji M, Sundaran S, Sirisha S. A study on drug-drug interactions through prescription analysis in a south Indian teaching hospital. *Ther Adv Drug Saf* 2013;4:141-6.
- Lim XY, Yea QQ, Kng GL, Chung WL, Yap KZ. Validation of a drug related problem classification system for the intermediate and long term care setting in Singapore. *Pharmacol (Basel)* 2018;6:109.
- Van Mil F. Drug related problems: A cornerstone for pharmaceutical care. *J Malta Coll Pharm Pract* 2005;5:5-8.
- Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. *Expert Opin Drug Saf* 2014;13:57-65. doi: 10.1517/14740338.2013.827660, PMID 24073682
- Oliveira MV, Buarquea DC. Polypharmacy and the use of potentially inappropriate medications among aged inpatients. *Geriatrgerontol Aging* 2018;12:38-44.
- Willeboordse F, Grundeken LH, van den Eijkel LP, Schellevis FG, Elders PJ, Hugtenburg JG. Information on actual medication use and drug related problems in older patients: Questionnaire or interview. *Int J Clin Pharm* 2016;38:380-7. doi: 10.1007/s11096-016-0258-9, PMID 26830412
- Harish CV, Belavigi D, Patil AN, Pattanaik S, Kakkar A, Kasudhan KS. Assessment of the impact of clinical pharmacology consultations provided to hospital clinicians from the drug information center an outcome research in a developing country. *J Pharm Pract* 2019;34:581-6.
- Zhu Y, Liu C, Zhang Y, Shi Q, Kong Y, Wang M, et al. Identification and resolution of drug related problems in a tertiary hospital respiratory unit in China. *Int J Clin Pharm* 2019;41:1570-7. doi: 10.1007/s11096-019-00922-3, PMID 31654364