Original Article

DOI: 10.7860/JCDR/2021/46513.14515

An Analysis of Drug-Drug Interactions in a Tertiary Care Hospital in Kerala: A Retrospective Study

Pharmacology Section

JIHANA SHAJAHAN

ABSTRACT

Introduction: Concomitant use of several drugs for a patient is often necessary for achieving therapeutic response. Understanding the profile of Drug-Drug Interactions (DDI) will help health care providers to optimise therapy for better patient outcomes, reinforcing the concept of rational drug use.

Aim: To analyse the frequency, mechanisms and severity of DDIs in a tertiary care hospital at Kerala.

Materials and Methods: A retrospective cross-sectional study among 350 inpatients of a tertiary care hospital in Kerala from August 2020 to September 2020. Prescriptions containing ≥3 drugs were collected from inpatient medical records. A drug interaction check was performed using the Lexicomp drug interaction checker software.

Results: DDIs were present in 74.6% of prescriptions and the average number of interactions was found to be 2.78. Most number for interactions was in the age group 61-80. Average number of DDI was significantly high among patients >60 years. Percentage of prescriptions with DDI and average number of DDI was found to be increasing with increase in number of drugs. Average number of interactions were maximum (5.01) in the group >10. Drug groups most commonly involved in interactions were antiplatelets, oral hypoglycaemic agents, bronchodilators, antibiotics, diuretics, insulin, statins, beta blockers, Proton Pump Inhibitors (PPI) and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). The most common interventions for minimising the impact of DDIs were changing the timing of drug administration, monitoring for symptoms/signs/lab values/drug levels or both. There was a significant positive correlation between duration of hospital stay and number of DDI.

Conclusion: This study threw light upon the pattern and profile of DDIs among inpatients of a tertiary care hospital in Kerala. Elderly people (>60 years) were most prone for DDIs. Percentage of prescriptions with DDI and average number of DDIs was found to be increasing with increase in number of drugs. There was a positive correlation between duration of hospital stay and number of DDI.

Keywords: Inpatients, Mechanism, Polypharmacy, Severity

INTRODUCTION

The DDIs can be defined as modification of response of one drug by other when they are administered simultaneously or in quick succession. This may be through pharmacokinetic or pharmacodynamic influences [1]. The likelihood of DDI increases with the number of drugs taken by the patient [2]. Concomitant use of several drugs for a patient is often necessary for achieving therapeutic response or in cases when the patient is suffering from more than one disease. Adverse consequences of drug interactions have been shown in various studies [1,3,4]. Optimisation of drug therapy by preventing drug related problems such as DDI, may save lives and enhance patient's quality of life and reduce health expenses [4].

The factors which are significantly associated with potential interactions include, taking five or more medicines (polypharmacy), age of 60 years or older and multiple concomitant diseases [2]. Increase in the use of multiple medications comes with an increased risk for negative health outcomes such as higher healthcare costs, Adverse Drug Events (ADEs), drug-interactions, medication nonadherence, decreased functional status and geriatric syndromes [5]. DDI are a concern for health care providers, as polypharmacy is becoming more common in managing complex diseases or comorbidities [6]. The term polypharmacy often suggests indiscriminate, unscientific, or excessive prescription [7]. Many authors define it as the use of five or six medications [8].

Drug interactions are a common cause of iatrogenic disease in geriatric patients [2]. Among European population, older adults (age more than 65 years) are prescribed an average of 5.3-6.9 drugs [9]. For older people, age-related changes in pharmacokinetics and pharmacodynamics further increase the risk of adverse events [10].

Pharmacokinetic and pharmacodynamic interactions are important types of DDIs based on mechanism of origin [5]. According to severity, DDIs are classified as major, moderate and minor [11]. In major interactions the effects are potentially life threatening or capable of causing permanent damage. In moderate DDI the effects may cause deterioration in patient's clinical status and extension of hospital stay. The effects are usually mild and do not result in significant troublesome outcomes in case of minor interactions [11].

DDIs are estimated to account for 6-30% of all the adverse drug events, and they continue to pose a significant risk to the health outcomes and a considerable economic burden on the health care system [12]. In order to plan interventions to minimise DDI, there is a need to understand the profile of interactions. The significance of a study on DDI will never come down, as novel therapeutic targets are explored and new drugs reach the market on everyday basis. Very few studies have been conducted to address the concern of DDIs in hospitals of South India [11,13]. With this background, the aim of this study was to analyse the profile of DDI among inpatients of a tertiary care hospital in Kerala. This work will help health care providers to have a better understanding regarding DDI and take decisions to optimise therapy for better patient outcomes, reinforcing the concept of rational drug use.

Aim of the study was to analyse the frequency, mechanisms and severity of DDIs in a tertiary care hospital, Kerala.

The primary objective was to estimate the frequency of DDIs; analyse the mechanism and severity of DDIs. The secondary objective was to identify the drug groups frequently involved; diseases with potential for DDIs and interventions required for minimising the impact of DDIs.

MATERIALS AND METHODS

This was a retrospective cross sectional study which was carried out among inpatients of a tertiary care hospital in Kerala for two months (August-September 2020). The study was conducted after obtaining approval from the Institutional Ethics Committee (IEC Reg No: ECR/1299/Inst/KL/2019). Written informed consent was taken from each participant before accessing their medical records and the prevailing national ethical guidelines were followed [14].

Inclusion criteria: Inpatients receiving ≥3 drugs with duration of hospital stay of at least ≥3 days were included in the study.

Exclusion criteria: Patients with known drug allergies or history of drug abuse and emergency/intensive care unit patients were excluded from the study.

Sample Size Calculation

Sample size was calculated as 350 using the formula, $n=z^2 pq/d^2$, with 5% margin of error on either sides. Reference values for sample size calculation were obtained from the study done by Soherwardi S et al., among inpatients of tertiary care hospital [1].

Patients visited by the investigator were from inpatient locations like pay wards and general wards. Patients willing to take part were included as per inclusion criteria. Details required from each patient were name, unique identification number, age, sex, and diagnosis, details of drugs with dose, frequency and time of administration. All the relevant details collected were documented in data collection form. A drug interaction check was performed by the investigator using the Lexicomp drug interaction checker software powered by leading medical information suppliers Wolters Kluwer. The mechanisms of interaction can be subdivided into pharmacokinetic and pharmacodynamic. Pharmacokinetic interactions are those which can affect the processes by which drugs are absorbed, distributed, metabolised and excreted. Pharmacodyanamic interactions are those where the effects of one drug are changed by the presence of another drug at its site of action [4]. Prescriptions were reviewed again by the investigator before discharge of the patient, for any changes in therapy made by treating doctor to minimise the impact of DDI. Variables were coded and entered in Microsoft excel worksheet.

Percentage of prescriptions with DDI, total number of DDIs and average number of DDI per prescription were calculated as indicators of frequency. Mechanism behind each DDI were identified and documented. Drug interactions were categorised into major, moderate or mild based on severity. Major drug groups involved in interactions and the diseases with potential for DDI were identified. The changes in therapy advised by the doctor either by his/her own review or after receiving notifications regarding DDI were analysed and categorised.

STATISTICAL ANALYSIS

Data were entered into Microsoft excel sheet and were analysed using Statistical Package for Social Sciences (SPSS) version 16. Descriptive statistics such as frequency, percentage, mean and Standard deviations were used. Chi-square test and independent sample t-test were used to find the statistical significance. A p-value of <0.05 was taken as statistically significant. Relation between duration of hospital stay and number of DDI was studied with Pearson correlation test.

RESULTS

I. **Frequency of Drug-Drug Interactions (DDI):** Total 350 prescriptions were evaluated during the study. Total number of interactions were 974 with an average of 2.78 DDI per prescription. Among the 350 prescriptions, 261 (74.6%) had at least one DDI. Results are tabulated in [Table/Fig-1].

Number of DDI	Number of prescriptions n=350	Percentage of prescriptions (%)
1-5	201	57.4
5-10	53	15.1
>10	7	2.0
No interactions	89	25.4

[Table/Fig-1]: Categorisation of prescriptions based of number of DDI.

II. **Age wise distribution of Drug-Drug Interactions (DDI):** Age group most prone for DDIs was 61-80 years. There was a significant difference between average number of DDI among patients ≤60 years and patients >60 years. Results are detailed in [Table/Fig-2].

Age group (years)	No. of prescriptions (n)	No of prescriptions with DDI (n)	Percentage of prescriptions with DDI (%)	No. of DDI (n)	Average no. of DDI
<18	32	11	34.4	21	0.66
19-40	66	39	59.1	83	1.26
41-60	99	82	82.8	314	3.17
61-80	140	117	83.6	516	3.69
>80	13	12	92.3	40	3.08

[Table/Fig-2]: Age wise distribution of DDI.

III. **Gender wise distribution of Drug-Drug Interactions (DDI):** Out of 350 patients included in the study there were 156 males and 194 females. There was no significant difference between males and females regarding distribution of DDIs. Results are detailed in [Table/Fig-3].

Parameters	Group	N	Mean number of DDI	SD	p-value*
Gender	Male	156	2.88	2.778	0.570
	Female	194	2.70	3.171	
Age group	≤60 years	197	2.12	2.353	0.001
	>60 years	153	3.63	3.496	

[Table/Fig-3]: Gender and age wise distribution of DDI.
*Independent sample t-test; p<0.05 considered as statistically significant

IV. **Relationship between number of drugs and number of DDI:** Number of drugs per prescription ranged from 3 to 20 with an average of 8.90. Prescriptions were categorised into three groups according to the number of drugs. Maximum number of prescriptions was in the group 6-10. Percentage of prescriptions with DDI and average number of DDI were maximum in the group >10. Details are given in [Table/Fig-4].

Number of drugs (n)	No. of prescriptions (n)	No. of prescriptions with DDI (n)	Percentage of prescription with DDI (%)	No of DDI (n)	Average number of DDI
3-5	46	13	28.3	17	0.37
6-10	210	156	74.3	486	2.31
>10	94	92	97.8	471	5.01

[Table/Fig-4]: Relation between number of drugs and number of interactions.

V. **Mechanisms and Severity of Drug-Drug Interactions (DDI):** Out of the 974 interactions studied 306 (31.4%) were through pharmacokinetic mechanisms and 668 (68.6%) were through pharmacodynamic mechanisms. Most number of interactions was of moderate severity, followed by mild category. There is a significant difference in the frequency of major, moderate and mild interactions between pharmacokinetic and pharmacodynamic groups. Pharmacodynamic mechanisms were behind 72.7% of major and 73.7% of moderate interactions. Details are given in [Table/Fig-5].

Drug groups most commonly involved in interactions were antiplatelets, oral hypoglycaemic agents, bronchodilators, antibiotics, diuretics, insulin, statins, beta blockers, PPIs and NSAIDs. Details are given in [Table/Fig-6].

Mechanism	Severity n (%)			Total n (%)	Chi-square test	p-value*
	Major	Moderate	Mild			
PD	16 (72.7%)	597 (73.7%)	55 (38.7%)	668 (68.6%)	68.754	0.001
PK	6 (27.3%)	213 (26.3%)	87 (61.3%)	306 (31.4%)		
Total	22 (100%)	810 (100%)	142 (100%)	974 (100%)		

[Table/Fig-5]: Mechanism and severity of interactions.
*Chi-square test; p<0.05 considered as statistically significant
PD: Pharmacodynamic; PK: Pharmacokinetic

Drug groups	Number of DDI (n)	Percentage of DDIs (%)
Antiplatelets	256	26.28
OHA	132	13.55
Bronchodilators	118	12.11
Antibiotics	116	11.91
Diuretics	110	11.29
Insulin	73	7.49
Statins	69	7.08
Beta blockers	67	6.88
PPI	50	5.13
NSAIDs	46	4.72

[Table/Fig-6]: Drug groups involved in DDI.
OHA: Oral hypoglycaemic agents; PPI: Proton pump inhibitors; NSAIDs: Non-steroidal anti-inflammatory drugs

Diseases most commonly associated with interactions were hypertension, diabetes mellitus, dyslipidaemia, coronary artery disease, cerebrovascular accidents, respiratory tract infections and chronic kidney disease. Details are given in [Table/Fig-7].

Disease	No. of prescriptions	No. of prescriptions with interactions (n)	Percentage of prescriptions with interactions (%)
Hypertension	155	136	87.7
Diabetes mellitus	136	119	87.5
Dyslipidaemia	70	61	87.1
CAD	61	58	95.1
CVA	44	37	84.1
Respiratory tract infections	46	34	73.9
CKD	13	11	84.6

[Table/Fig-7]: Diseases associated with interactions.
CAD: Coronary artery disease; CVA: Cerebro vascular accident; CKD: Chronic kidney disease

One or more interventions were taken by doctor for minimising the impact DDIs. Most commonly taken steps were changing the timing of drug administration, monitoring for symptoms/signs/lab values/drug levels or both. Details are provided in [Table/Fig-8].

Analysis of the relation between duration of hospital stay and number of DDI showed a significant positive correlation with Pearson correlation value 0.406. Details are provided in [Table/Fig-9,10].

DISCUSSION

DDIs could be identified in 74.6% prescriptions collected for the study and the average number of interactions was 2.78. This is high when compared to the values observed by Soherwardi S et al., (66%) and Bollu M (57.44%) in tertiary care hospitals [1,4]. But in the study done by Kulkarni V et al., among south Indian population 91% prescriptions were found to have interactions [13].

Similar result could be seen the study done by Soherwardi S et al., [1]. In that study number of drugs per prescription ranged from 5 to 18, with an average of 7.8. The number of drugs per prescription was ranging from 3 to 10 with an average 6.00 in the study by Ahmad A et al., [15].

Out of 350 patients included in the study there were 156 males and 194 females. There was no significant difference between the

Management of interactions	No of interactions (n)	Percentage of interactions (%)
Avoided the pair	24	2.5
Changed one drug in the pair	79	8.1
Changed the frequency	3	0.3
Changed the dose	19	2.0
Changed the timing	214	22.0
Monitoring for symptoms/signs/lab values/drug levels	152	15.6
Changed one drug in the pair+Changed the timing	5	0.5
Changed one drug in the pair+Monitoring for symptoms/signs/lab values/drug levels	5	0.5
Changed the frequency+Monitor for symptoms/signs/lab values/drug levels	2	0.2
Changed the timing+Monitor for symptoms/signs/lab values/drug levels	111	11.4
No interventions	360	37.0

[Table/Fig-8]: Interventions to minimise impact of DDIs.

Duration of stay (days)	Number of prescriptions (n)	Prescriptions with DDI (n)	Chi-square value	p-value*
3-5	241	166 (68.9%)	15.016	0.002
6-8	85	73 (85.8)		
9-11	15	15 (100%)		
>12	9	7 (77.8%)		
Total	350	261 (74.6%)		

[Table/Fig-9]: Relation between duration of hospital stay and number of prescriptions with DDI.
*Chi-square test; p<0.05 considered as statistically significant

Variables	N	Pearson correlation	p-value*
Duration of hospital stay	350	0.406	0.001
Total interactions	350		

[Table/Fig-10]: Correlation between duration of hospital stay and with number of DDI.
*Pearson correlation test; p<0.05 considered as statistically significant; The parameters for co-relation are same as it is in [Table/Fig-9]

frequency of DDI between males and females. In the study done by Salwe KJ et al., 62% were males and 38% were females but in the study by Ahmad A et al., among inpatients of a tertiary care hospital 53% patients were males and 47% patients were females [15,16].

For the evaluation of age wise distribution of DDIs, the participants were divided into five age groups. The age group with maximum number of patients and most number for interactions was found to be 61-80 years. There is a significant difference between average number of DDI among patients ≤60 years and patients >60 years. Soherwardi S et al., also have done an analysis of age wise distribution of DDIs with contradictory results [1]. In that study maximum number of patients were in the age group 56-65 years but there was no significant difference between the different age groups. In the study by Ahmad A et al., 71.7% patients belong to age group <60 years [15]. But Mallet L et al., had clearly demonstrated that elderly patients (>65 years) are most vulnerable for DDIs [17].

Maximum number of prescriptions had 6-10 drugs in list. Percentage of prescriptions with DDI and average number of DDIs was found to be increasing with increase in number of drugs. Average number of interactions were maximum (5.01) in the group >10. Similar pattern could be seen in the study done by Kulkarni V et al., [13]. In that study 85% prescriptions were in the group 6-10 and average number of DDI were maximum (9.40) in the group >10. Ahmad A et al., had categorised prescriptions in a different way (2-4, 5-7, and 8-10). Most number of prescriptions were in the group 5-7 [15].

Kulkarni V et al., had described three types of mechanisms underlying DDIs [13]. Apart from pharmacokinetic and pharmacodynamic mechanisms an unknown mechanism has also been described. A total of 42% interactions were pharmacokinetic, 24% interactions were due to pharmacodynamic mechanisms and 34% were considered as due to unknown mechanisms.

In the current study, 2.26%, 83.16%, 14.58% interactions were included in major, moderate and mild category respectively. It clearly shows that most number of interactions were of moderate severity. There is a significant difference in the frequency of major, moderate and mild interactions between pharmacokinetic and pharmacodynamic groups. Major interactions were more due to pharmacodynamic mechanisms and mild interactions were more due to pharmacokinetic mechanisms. Similar results could be seen in the study by Kulkarni V et al., with 2%, 70%, 28% DDIs in major, moderate and mild categories, respectively [13]. Ahmad A et al., demonstrated a different pattern with 31.65%, 53.95% and 4.38% DDIs in major, moderate and mild categories [15].

In the current study, drug groups most commonly involved in interactions were found to be antiplatelets, oral hypoglycaemic agents, bronchodilators, antibiotics, diuretics, insulin, statins, beta blockers, PPIs and NSAIDs. More or less similar observations could be seen in most of the studies referred [4,15]. Ahmad A et al., observed that NSAIDs, Antibiotics, PPIs and Corticosteroids were the most prone drug groups for interactions [15]. In the prospective study done by Bollu M the most common drugs involved were furosemide, ceftriaxone, paracetamol, atorvastatin, pantoprazole, atenolol and ampicillin [4].

Diseases most commonly associated with interactions were hypertension, diabetes mellitus, dyslipidaemia, coronary artery disease, cerebrovascular accidents, respiratory tract infections and chronic kidney disease. Most reference studies follow organ system wise categorisation of comorbidities. In the study by Ahmad A et al., fever, respiratory disease, cardiovascular disease, GI diseases and diabetes mellitus were found to be the prevalent comorbidities associated with DDIs [15]. Comorbidities of cardiovascular system, respiratory system, neurological system, GI system and endocrine system were most prone for DDIs in the study by Kulkarni V et al., [13].

The most common interventions for minimising the impact of DDIs were changing the timing of drug administration, monitoring for symptoms/signs/lab values/drug levels or both. Contradictory findings could be seen in the study done by Kulkarni V et al., and Bergk V et al., [13,18]. In those studies the most common management strategy was dose adjustments.

Analysis of the relation between duration of hospital stay and number of DDI showed a significant positive correlation with Pearson correlation value 0.406. Number of interactions was found to be increasing with increase in duration of hospital stay. Salwe KJ et al., had done a similar analysis and observed a positive correlation between duration of hospital stay and number of DDI [15]. There was an increase in number of DDI by a factor of 0.296 with one day increase on duration of stay in that study.

This study helped to find out the profile of DDIs, common drug groups and diseases associated with DDIs and the correlation between duration of hospital stay and number of DDIs among inpatients of a tertiary care hospital in Kerala.

Limitation(s)

The current study was conducted for a short duration. The investigator has not done any interventions to optimise therapy by minimising DDIs. No evaluation was done to assess impact of DDIs in the clinical condition of the patient. Extend of patient harm caused by DDIs were not studied.

Investigator bias might have happened. Investigator who is well aware of analysis plan herself had collected data. Interventional studies are needed to evaluate the clinical significance of DDIs and whether management of DDIs can reduce drug-related morbidity or mortality.

CONCLUSION(S)

This study threw light upon the pattern and profile of drug-drug interactions among inpatients of a tertiary care hospital in Kerala. At least one DDI could be seen in 74.5% of prescriptions. Elderly people (>60 years) were found to be more prone for DDIs. Chance of DDI was found to be increasing with increase in number of drugs. Most number of interactions was of moderate severity, followed by mild category of interactions. Great effort need to be taken to minimise impact of DDIs for patients receiving antiplatelets, oral hypoglycaemic agents, bronchodilators, antibiotics, diuretics, insulin, statins, beta blockers, PPIs and NSAIDs. Diseases most commonly associated with interactions were hypertension, diabetes mellitus, dyslipidaemia, coronary artery disease, cerebrovascular accidents, respiratory tract infections and chronic kidney disease.

The easiest intervention for minimising the impact of DDIs is changing the timing of drug administration and close monitoring of the patient. There is a significant positive correlation between the number of interactions and duration of hospital stay.

Evaluation of the impact of DDIs on clinical and economic parameters needs to be done in upcoming research works. The effectiveness of different interventions in minimising patient harm due to DDIs is also a potential area for future research.

Acknowledgement

We extend our sincere thanks to all the participants, the institutional ethics committee, statistics expert and the management for their support.

REFERENCES

[1] Soherwardi S, Chogtu B, Faizal P. Surveillance of the Potential Drug-Drug Interactions in the Medicine Department of a Tertiary Care Hospital. JCDR. 2012;6(7):1258-61.
[2] Costa AJ. Potential drug interactions in an ambulatory geriatric population. Fam Pract. 1991;8:234-36.
[3] Dubova SV, Reyes-Morales H, Torres-Arreola LP, Suárez-Ortega M. Potential drug-drug & drug-disease interactions in prescriptions for ambulatory patients over 50 years of age in family medicine clinics in Mexico City. BMC Health Serv Res. 2007;7(1):147.
[4] Bollu M. A prospective study on drug-drug interactions in the medication charts in general medicine wards, in a tertiary care hospital, Guntur, Andhra Pradesh and The Clinical Pharmacists Role. Int J Biolog Pharm Res. 2014;5(4):374-77.
[5] Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf. 2014;13(1):57-65.
[6] Juurlink D, Mamdani M, Kopp A, Laupacis A. Redelmeier D. Drug-drug interactions among elderly patients hospitalized for drug toxicity. JAMA. 2003;289:1652-58.
[7] Steinman MA, Landefeld CS, Rosenthal GE, Berthenthal D, Sen S, Kaboli PJ. Polypharmacy and prescribing quality in older people. J Am Geriatr Soc. 2006;54(10):1516-23.
[8] Good CB. Polypharmacy in elderly patients with diabetes. Diabetes Spec. 2002;15(4):240-48.
[9] Halvorsen KH, Selbaek G, Ruths S. Trends in potentially inappropriate medication prescribing to nursing home patients: Comparison of three cross-sectional studies. Pharmacoepidemiol Drug Saf. 2017;26:192-200.
[10] Corsonello A, Pedone C, Incalzi RA. Age-related pharmacokinetic and pharmacodynamic changes and related risk of adverse drug reactions. Curr Med Chem. 2010;17:571-84.
[11] Patel VK, Acharya LD, Rajakannan T, Surulivelrajan M, Guddattu V, Padmakumar R. Potential drug interactions in patients admitted to cardiology wards of a south Indian teaching hospital. Australas Med J. 2011;4(1):09-14.
[12] Mahmood M, Malone DC, Skrepnek GH, Abarka J, Armstrong EP, Murphy JE, et al. Potential drug drug interactions within the veteran affairs medical centers. Am J Health-Syst Pharm. 2007;64:1500-05.
[13] Kulkarni V, Bora SS, Sirisha S, Saji M, Sundaran S. A study on drug-drug interactions through prescription analysis in a South Indian teaching hospital. Ther Adv Drug Saf. 2013;4(4);141-46. DOI: 10.1177/2042098613490009.
[14] National Ethical Guidelines for Biomedical and Health Research Involving Human Participants; ICMR, 2017. Available from https://www.icmr.nic.in/sites/default/files/guidelines/IC.
[15] Hazari MAH, Rao KL, Tazneem B, Khanum SSA, Quadri H, Jabeen SK. Role of Neutrophil to Lymphocyte Ratio (NLR) In Conjunction with Coronary Artery Involvement as a Biomarker for the Magnitude of Current of Injury, Type of Intervention and Clinical Outcomes in STEMI. Asian Journal of Cardiology Research. 2020;3(1):01-07.

[16] Ahmad A, Khan MU, Haque I, Ivan R, Dasari R, Revanker M, et al. Evaluation of potential drug- drug interactions in general medicine ward of teaching hospital in southern India. J Clin Diagn Res. 2015;9(2):FC10-13.
[17] Salwe KJ, Kalyansundaram D, Bahurupi Y. A study on polypharmacy and potential drug-drug interactions among elderly patients admitted in department of medicine of a tertiary care hospital in Puducherry. Journal of Clinical and Diagnostic Research: JCDR. 2016;10(2):FC06-10.
[18] Mallet L, Spinewine A, Huang A. The challenge of managing the drug interactions in elderly people. Lancet. 2007;370:185-91.
[19] Bergk V, Gasse C, Rothenbacher D, Loew M, Brenner H, Haefeli W. Drug interactions in primary care: Impact of a new algorithm on risk determination. Clin Pharmacol Therapeut. 2004;76:85-96.

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Pharmacology, Travancore Medical College, Kollam, Kerala, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Jihana Shajahan,
Associate Professor, Department of Pharmacology, Travancore Medical College,
Umaya Nalloor, Thatta Malapo, Kollam-691020, Kerala, India.
E-mail: jihanajeem@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Sep 07, 2020
- Manual Googling: Dec 31, 2020
- iThenticate Software: Jan 19, 2021 (15%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Aug 28, 2020**
Date of Peer Review: **Nov 18, 2020**
Date of Acceptance: **Jan 01, 2021**
Date of Publishing: **Feb 01, 2021**