ORIGINAL ARTICLE CODEN: AAJMBG

Polypharmacy and Drug–drug interactions among geriatric patients: A cross-sectional study in a tertiary care hospital

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Received: 13th June 2025; ***Accepted:*** 22nd December 2025; ***Published:*** 01st January 2026

Abstract: *Background:* Ageing is a natural process. Drug interaction refers to modification of response to one drug by another when they are administered simultaneously or in quick succession. The possibility of drug interactions always increases with the number of drugs used and the severity of interactions in most of the cases are unpredictable. So, it was proposed to conduct a study on geriatric patients to analyze the impact of polypharmacy and drug-drug interactions. *Objective:* To estimate the prevalence of polypharmacy and analyze potential drug-drug interactions among geriatric patients attending out-patient department of a tertiary care center. *Methodology:* This cross sectional, observational study among geriatric patients (age >65yrs) attending medicine OPD was conducted in a tertiary care hospital at south Tamil Nadu for a period of two months (Feb-March 2020). Eligible & willing participants were enrolled and collected data were entered into Microsoft Office Excel and were analyzed using SPSS. *Results:* out of 100 participants, 50 were male and 50 were female. The maximum number of people were in the age groups of 65-74 years of age. It was observed that majority of participants (58) were consuming more than 7 drugs per day followed by 5 to 7 drugs (39), less than 4 drugs (3). 71 participants had moderate drug interactions while 5 participants developed major drug interactions. *Conclusion:* The study revealed the increased prevalence of polypharmacy and drug-drug interactions among elderly patients. It is essential to harmonize drug policy and regulatory measures to prevent the undesirable impact of polypharmacy.

Keywords: Polypharmacy, Drug interactions, Beers's criteria, Tertiary care hospital.

Introduction

Ageing is a natural process. In India, Size of elderly population is growing rapidly with 5.6% of total population in 1961 to 12.4% by 2026 [1]. It is not unusual for older people to have multiple chronic diseases [2]. Multimorbidity leads to use of multiple drugs, a condition known as polypharmacy. A simple definition would be the administration of more medicines than are clinically indicated [3]. With such many medications, there is always an increased risk for drug interactions.

Drug interaction refers to modification of response to one drug by another when they are administered simultaneously or in quick succession. The possibility of drug interactions always increases with the number of drugs used. Although, the severity of interactions in most of the cases is unpredictable [4]. Many geriatric patients used to get medicines from a health care center or take medicines over the counter for a variety of short-term illness, despite their routine medicines like drugs for diabetes mellitus, hypertension, dyslipidemia and coronary artery diseases.

Drug-drug interactions (DDI) can lead to life-threatening complications, particularly in elderly patients with altered pharmacokinetics and pharmacodynamics due to age-related changes in drug metabolism. Despite the growing concern, awareness regarding potential DDIs and inappropriate polypharmacy is often inadequate among healthcare providers, caregivers, and patients. Inappropriate prescribing can be identified and prevented through medication reconciliation, deprescribing strategies and

regular review of prescriptions. Existing studies highlight variations in prescribing patterns and DDI risks across different healthcare settings and regions. A cross-sectional study assessing the prevalence and impact of polypharmacy and DDIs among geriatric patients can help identify risk factors, prescribing trends, and preventive strategies to improve medication safety. The findings of this study will provide valuable insights to implement rational prescribing guidelines, medication review protocols and patient education programs.

Aim and objective: To estimate the prevalence of polypharmacy and analyze potential drug-drug interactions among geriatric patients attending out-patient department of a tertiary care center.

Material and Methods

*Study design:*Cross sectional, observational study.

Study population: Geriatric patients attending out-patient department.

Study center: A Tertiary care hospital in south Tamil Nadu.

Study Duration: Two months (Feb-March 2020)

Sample size: 100 patients

Sample Size calculation: As per the reference article[15], assuming prevalence of polypharmacy (p) to be 50%. Standard formula used for estimating a single proportion:

$$N = \frac{Z_{1-\alpha/2}^2 \, p \, q}{l^2}$$

Where:

$Z_{1-\alpha/2} = 1.96$ for 95% confidence,

$p =$ expected prevalence (as a proportion),

$q = 1 - p$,

$l =$ absolute precision (margin of error).

Assumed prevalence p = 50% (0.5)

q = 1–p = 0.5

Z = 1.96

Calculated N ≈ 96. Hence computed to 100 participants.

Inclusion criteria:

1. Patients of age 65 years and above attending outpatient department.
2. Patients who were willing to participate.

Exclusion criteria:

1. Patients of age 65 years and above admitted as In-patients.
2. Patients with serious systemic illness and malignancy
3. Patients not willing to participate.

The study was conducted after getting approval from the Institutional Ethics Committee and was conducted in accordance with ICH-GCP guidelines & National ethical guidelines of ICMR. Only willing and eligible participants alone were enrolled in the study after getting their written informed consent. Data was collected and information regarding Name, age, sex, details of medical illness, name and number of drugs taken was noted down in a proforma. Drug interactions were assessed using computer-based checks online available on the internet (drugs.com interaction checker) [5].

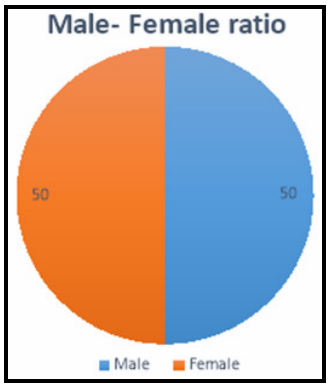
Drug interactions were entered into the database and studied as follows:

1. Name of drug
2. Drug interacting with
3. Severity of drug interactions as under:
   - *Mild:* Minimally clinically significant. Minimize risk. Assess risk. Consider alterations.
   - *Moderate:* Moderately clinically significant. Try to avoid. Use under special cases.
   - *Severe:* Highly clinically significant. Avoid combinations.

Results

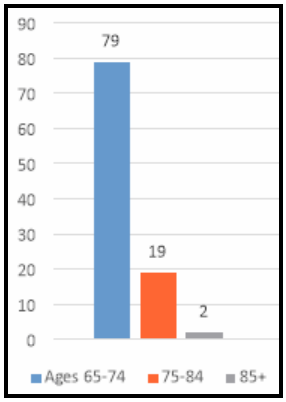
Collected data was entered in Microsoft Office Excel and analyzed using SPSS.

Fig-1: Sex Distribution



The ratio is 50 : 50 , which implies that 50 were male and 50 were female members included as subjects for this study (Fig-1).

Fig-2: Age Distribution

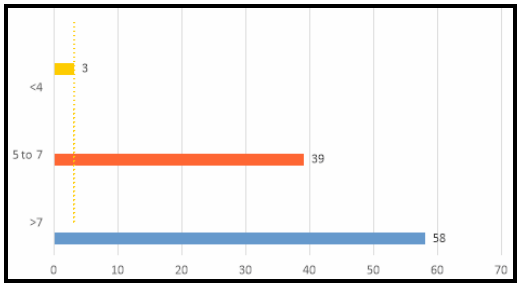


From the above graph we see that maximum number of people are present in the age groups of 65-74 years of age. 19 people are present in the age group of 75-84 years of age. 2 people are present in the age group of more than 85 years (Fig-2).

The above chart represents the number of drugs taken by the subjects. 58 people took more than 7 drugs. 39 people took 5 to 7 drugs.3 people took less than 4 drugs (Fig-3).

The above chart depicts the number of the interactions as observed by the study. 71 samples had moderate interactions. 23 samples had No interactions. 5 samples had Major interactions. 1 sample had Minor interaction (Fig-4).

Fig-3: Drug count



X- axis : Number of people
Y axis: Number of drugs

Fig-4: Drug interactions between drugs.

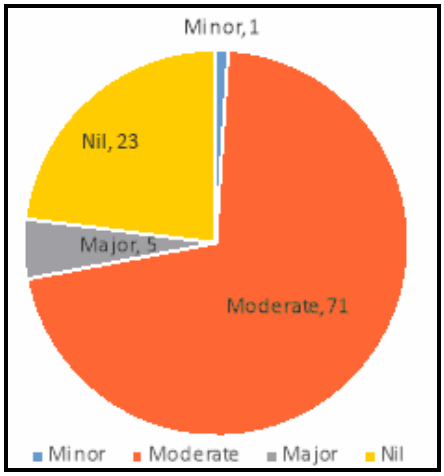


Table-1: Drug-drug Interactions frequency table

Sl. No	Drug 1	Drug 2	Therapeutic Combination	Severity of Interaction	Frequency (n)	Percentage (%)
1	Clopidogrel	Omeprazole	Antiplatelet + PPI	Moderate	18	23.4
2	Aspirin	Clopidogrel	Antiplatelet + Antiplatelet	Moderate	14	18.2
3	Digoxin	Furosemide	Cardiac glycoside + Loop diuretic	Moderate	10	13
4	Enalapril	Spironolactone	ACE inhibitor + K^+-sparing diuretic	Moderate	9	11.7
5	Escitalopram	Tramadol	SSRI + Opioid	Moderate	8	10.4
6	Diazepam	Tramadol	Benzodiazepine + Opioid	Moderate	6	7.8
7	Others	—	Various	Moderate	6	7.8
8	Warfarin	Aspirin	Anticoagulant + Antiplatelet	Major	3	3.9
9	Warfarin	Diclofenac	Anticoagulant + NSAID	Major	2	2.6
10	Amlodipine	Atorvastatin	CCB + Statin	Minor	1	1.3

PPI- Proton Pump Inhibitor, CCB- Calcium Channel blocker, SSRI- Selective Serotonin Reuptake Inhibitors.

As cited in Table no 1 above, among the moderate interactions (n=71), interactions due to antiplatelet and PPI combination contributes to 18, followed by antiplatelet combinations (n=14), Cardiac glycoside and loop diuretic(n=10), ACE inhibitor and K+ sparing diuretic (n=9), SSRI and opioid(n=8), Benzodiazepine and opioids (n=6) and others (n=6). Among the major interactions (n=5), interactions due to Anticoagulant and antiplatelet contributes to 3 followed by Anticoagulant and NSAID combination (n=2). One minor interaction was due to interaction between CCB and statins.

Discussion

In this study, majority of elderly patients were in the age group of 65-74 years. Among them, 58 participants were consuming more than seven drugs, while 39 took between five and seven drugs. Notably, 71 participants experienced moderate drug interactions, and five developed major drug interactions. These findings align with studies conducted by Ali A et al. and Schuler J et al. [6-7] both of which reported polypharmacy in more than 55% of hospitalized elderly patients. Kaufman defines polypharmacy as the use of more than five medications [8]. The high prevalence of polypharmacy in this study may be due to patients not responding to initial treatments, leading physicians to prescribe additional medications and few are due to over-the-counter drugs.

An increased number of potential drug-drug interactions (DDIs) were observed in this study, with moderate interactions accounting for 71% of cases. Major drug interactions constituted 5% of the total DDIs. The prevalence of potential DDIs in this study was higher compared to the findings of Björkman IK et al., where interactions were observed in 46% of patients [9]. Similarly, Gosney M et al**.** reported potential DDIs in 33% of all prescriptions among hospitalized elderly patients [10].

The Beers Criteria, a widely used tool for assessing inappropriate medication use in older adults, was initially developed in 1999 and updated by the American Geriatrics Society in 2012 [11]. In this study, the most prescribed potentially inappropriate medications (PIMs) included benzodiazepines and anti-inflammatory drugs. While insulin is also classified as a PIM, it remains appropriate when prescribed using a sliding scale. Polypharmacy may be unavoidable, as elderly patients often suffer from multiple chronic diseases requiring complex medication regimens. However, it is unrealistic for clinicians to memorize all possible drug interactions and their clinical significance. While physicians often weigh the benefits versus risks of DDIs, continuous education and periodic updates on medication interactions are essential.

In a study done by Shamna et al on 'Prescription pattern of antidiabetic drugs in the outpatient departments of hospitals in Malappuram district, Kerala' it was found that 77% of diabetic patients were under more than 5 medications in which many were multidrug combinations [12]. Also a study done by Paradkar SG, Sinha SR on 'Drug utilization among hypertensive patients in the outpatient department of medicine in a tertiary care hospital they found between polypharmacy and hypertension that the average number of drugs taken by a hypertensive patient was 6 [13]. Another study done by Duttaet al on 'Prevalence and risk factors of polypharmacy among elderly in India: Evidence from SAGE Data' found out that the odds of having polypharmacy is more among elderly diagnosed with hypertension, which is similar to our study finding [14] .

To mitigate the risks of DDIs associated with polypharmacy, regular educational programs should be conducted for healthcare providers. Clinicians should follow best practices, such as, minimizing the number of prescribed medications, simplifying dosing schedules, reducing frequent medication changes, conducting periodic medication reviews at specific intervals. With advancements in healthcare technology, many hospitals now have access to computer-assisted drug interaction checkers. The implementation of regularly updated or online software can help detect and prevent potentially harmful DDIs, thereby enhancing patient safety [15].

Limitations: This study was conducted in a small population. To gain a more

comprehensive understanding, larger prospective hospital-based studies (in-patient) involving a broader elderly population and multiple specialties are necessary. Such studies will help improve the rationality of prescriptions in elderly patients.

Conclusion

This study highlights the prevalence of polypharmacy and drug-drug interactions among elderly patients. It is essential to harmonize drug policies and implement regulatory measures to control and prevent excessive medication use. Raising physician awareness and sensitizing higher authorities about polypharmacy and its associated risks can help curb irrational prescribing practices and enhance the safety of elderly patients in the future.

Financial Support and sponsorship: Nil

Conflicts of interest: There are no conflicts of interest.

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Cite this article as: Prakash M and Mahima Alicia M. Polypharmacy and drug–drug interactions among geriatric patients: a cross-sectional study in a tertiary care hospital. *Al Ameen J Med Sci* 2026; 19(1): 39-43.

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