RESEARCH PAPER

ASSESSMENT OF POLYPHARMACY AND ITS CLINICAL CONSEQUENCES AMONG GERIATRIC PATIENTS: A PROSPECTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Polypharmacy is a common and clinically significant problem in geriatric patients, arising from the presence of multiple chronic conditions and predisposing to drug–drug interactions (DDIs), adverse drug reactions (ADRs), potentially inappropriate medications (PIMs), and poor medication adherence.

Objective: To evaluate Poly-pharmacy and its associated clinical consequences among geriatric patients, including DDIs, ADRs, PIMs, medication adherence assessed using the General Medication Adherence Scale (GMAS), and risk stratification using the GerontoNet ADR risk score.

Methods: A prospective, observational, cross-sectional study was conducted among 313 geriatric patients at a tertiary care hospital. Demographic, diagnostic, and prescription data, along with DDIs, ADRs, PIMs, GerontoNet risk scores, and GMAS adherence levels, were recorded and analyzed using the Chi-square test, Mann–Whitney U test, Kruskal-Wallis test, Spearman correlation, and multiple linear regression.

Results: The mean patient age was 72.64 ± 6.58 years, and polypharmacy was highly prevalent. DDIs were observed in the majority of patients, with a strong positive correlation between the number of medications and DDI occurrence ($\rho = 0.68$, $p < 0.001$). ADRs occurred in 44.1% of patients and were significantly more frequent among those receiving PIMs ($p = 0.002$), with a moderate positive correlation between medication count and ADRs ($\rho = 0.42$, $p < 0.001$). Medication adherence declined with increasing medication burden ($\rho = -0.49$, $p < 0.001$ between GMAS score and medication count), and regression analysis identified the number of medications as the strongest predictor of adherence.

Conclusion: Polypharmacy is highly prevalent among geriatric patients and is significantly associated with increased DDIs, ADRs, PIM use, and reduced medication adherence. Rational prescribing, regular medication review, and the use of validated tools such as GMAS and GerontoNet can improve patient outcomes and enhance medication safety.

Keywords: Polypharmacy; Geriatric patients; Drug–drug interactions; Adverse drug reactions; Potentially inappropriate medications; Medication adherence; GerontoNet score

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INTRODUCTION

The global elderly population (aged ≥60 years) is projected to rise from 1 billion in 2020 to 2.1 billion by 2050, with India's geriatric population expected to reach 319 million over the same period. This demographic shift is accompanied by a rising burden of multimorbidity cardiovascular disease, diabetes mellitus, neurological disorders, and respiratory illness which frequently necessitates the concurrent use of multiple medications, a practice termed polypharmacy and conventionally defined as the use of five or more drugs. Age-related pharmacokinetic and pharmacodynamic changes further heighten the vulnerability of elderly patients to medication-related harm, making polypharmacy both clinically necessary and inherently risky in this population.

Globally, polypharmacy affects an estimated 37–59% of older adults, with community-dwelling elderly showing lower rates (30–50%) than hospitalised patients (60–80%), and hyperpolypharmacy concentrated in long-term care settings (20–40%).[55] This burden is amplified by the ongoing epidemiological transition toward chronic disease.[1] India exhibits some of the highest global rates, driven by multimorbidity, healthcare fragmentation, and self-medication: a landmark meta-analysis reported pooled prevalences of 49% for polypharmacy, 31% for hyperpolypharmacy, and 28% for PIM use.[26] Regional disparities are pronounced, with South India bearing a

disproportionately high hyperpolypharmacy burden,[26] and prevalence patterns varying by ruralurban setting and healthcare sector.[54]

Polypharmacy substantially increases the risk of DDIs, which have been reported in 8.3–100% of hospitalised elderly globally, rising to 80.5–90.5% in geriatric units.[7] Indian data confirm DDI prevalence of 68–91%,[36] with aspirin–furosemide and aspirin–enalapril among the most frequent high-risk pairings.[35] ADRs occur at rates two to seven times higher in geriatric than younger patients,[4] with in-hospital incidence around 11.5% globally[6] and cardiovascular medications a leading cause in Indian cohorts.[5] PIMs, identified using the Beers criteria, affect 28–65% of Indian geriatric patients and are associated with reduced quality of life[3] and higher hospitalised PIM rates.[9] The GerontoNet ADR risk score, developed and externally validated across multiple populations,[49,50,51,52,53] offers a practical bedside tool for ADR risk stratification, particularly relevant given India's high hospitalised polypharmacy prevalence.[26] Medication non-adherence, assessed using the GMAS scale, affects 40–60% of geriatric patients globally, with polypharmacy consistently identified as the strongest predictor of poor adherence in Indian studies.[41,42,43,44] Clinical pharmacistled interventions have demonstrated substantial benefit, reducing PIM burden and hospitalisation risk through medication review and deprescribing.[29,30,33,34]Despite this body of evidence, a critical gap persists: no single South Indian inpatient study has simultaneously evaluated polypharmacy degree, DDIs, ADRs, PIMs, medication adherence, and GerontoNet-based ADR risk within the same patient cohort using validated tools.[26,3,36,4,41,51] Existing research remains largely cross-sectional and parameter-specific, without prospective, integrated assessment or validation of GerontoNet- or Beers-guided deprescribing approaches, despite South India's disproportionately high hyperpolypharmacy burden.[26,48] Ruralurban pharmacovigilance disparities and pharmacist-led deprescribing interventions also remain largely unstudied in South Indian geriatric populations.[17,28]The present study was therefore undertaken to comprehensively assess polypharmacy and its associated clinical consequences including DDIs, ADRs, PIMs, medication adherence, and GerontoNet-based ADR risk among geriatric patients in a South Indian tertiary care setting.

Materials and Methods

A prospective, observational, cross-sectional study was conducted in the Departments of General Medicine and other associated wards at the Government General and Super Specialty Hospitals, Anantapur, Andhra Pradesh, India, over a period of six months. The prospective design enabled active data collection on prescribing patterns, and follow-up for ADRs and medication adherence.

A total of 313 geriatric patients were enrolled. Patients were included if they were aged above 60 years, were receiving five or more medications (inpatient or outpatient), were on chronic medication therapy (e.g., for diabetes mellitus, hypertension, or cardiovascular disease), had complete medical and prescription records available, and were willing and able to provide informed consent (or proxy consent in the case of cognitive impairment). Patients below 60 years of age, those receiving terminal/palliative or hospice care, and those with psychiatric illness precluding reliable self-report (unless caregiver-derived data were available) were excluded.

Data were collected using a structured case record form. Potential drug–drug interactions were evaluated using validated drug interaction databases, including Lexicomp and Micromedex. Potentially inappropriate medications were identified according to the American Geriatrics Society Beers Criteria and the STOPP/START criteria. The risk of adverse drug reactions was assessed using the GerontoNet ADR Risk Score, while medication adherence was evaluated using the General Medication Adherence Scale (GMAS). Demographic information, including age, gender, education, marital status, and address, was recorded for each participant. Clinical information comprising the primary diagnosis and comorbid conditions such as hypertension, diabetes mellitus, and chronic kidney disease was also documented. Prescription-related data included the drug name, dose, dosage form, route, frequency, indication, prescribing department, and the total number of prescribed medications, including regular, pro re nata, over-the-counter, and dietary supplements. The degree of polypharmacy, clinically significant drug–drug interactions, potentially inappropriate medications, adverse drug reactions with their onset, severity, and outcomes, and medication adherence scores were subsequently analysed.

DDIs were identified using Lexicomp® and Micromedex® and classified as minor, moderate, or major based on clinical severity. The total number of DDIs per patient and the most frequently occurring drug pairs were recorded.ADRs were identified through active clinical monitoring and case record review during patient follow-up. Each suspected ADR was documented with a description of onset, severity, and outcome.PIMs were identified using the American Geriatrics Society Beers Criteria 2019.[8] The number of PIMs per patient and the most frequently prescribed inappropriate agents were recorded.The GerontoNet ADR Risk Score was applied to stratify patients into low (0–3 points), moderate (4–6 points), and high-risk (>7 points) categories based on the presence of polypharmacy, age, renal impairment, hepatic impairment, prior ADR history, frailty, cognitive impairment, narrow

therapeutic index drugs, high-risk medications, and number of comorbidities.[51]Medication adherence was assessed using the General Medication Adherence Scale (GMAS), a validated 19-item patient-reported tool that measures adherence across three domains: patient behaviour-related non-adherence, additional disease and pill burden, and cost-related non-adherence. Scores were categorised as high adherence (≥26), moderate adherence (20–25), and low adherence (<20).[44]

Data were entered and managed in Microsoft Excel. Descriptive statistics are presented as mean ± standard deviation (SD) for continuous variables and as frequencies with percentages for categorical variables. Between-group comparisons for categorical variables were performed using the Chi-square test or Fisher's exact test. For non-normally distributed continuous variables, the Mann–Whitney U test (two groups) and Kruskal–Wallis test (three or more groups) were applied. Spearman's rank correlation coefficient (ρ) was used to assess relationships among continuous variables. Multiple linear regression analysis was performed to identify independent predictors of medication adherence (GMAS score). A p-value of <0.05 was considered statistically significant for all analyses.

The study was approved by the Office of the Superintendent, Government General Hospital, Ananthapuram . Written informed consent was obtained from all participants prior to enrolment, with a bilingual consent form available in English and Telugu. Patient confidentiality was maintained throughout the study.

Results

A total of 313 geriatric patients were included in the study. The mean age of the study population was 72.64 ± 6.58 years, with a median age of 72 years (range 62–94 years). The majority of patients belonged to the 71–80-year age group (45.4%), followed by the 60–70-year group (38.7%) and those aged ≥81 years (16.0%). Male patients constituted 53.4% of the population and females 46.6%. Most patients were admitted under the General Medicine department (60.1%). Regarding polypharmacy degree, 65.2% of patients were classified under major polypharmacy and 34.8% under hyperpolypharmacy **(Table 1)**.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (n = 313)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	72.64 ± 6.58
	Median	72
	Range	62–94
Age groups	60–70 years	121 (38.7%)
	71–80 years	142 (45.4%)
	≥81 years	50 (16.0%)
Gender	Male	167 (53.4%)
	Female	146 (46.6%)
Department	General Medicine	188 (60.1%)
	Others	125 (39.9%)
Polypharmacy degree	Major	204 (65.2%)
	Hyperpolypharmacy	109 (34.8%)

The mean number of medications per patient was 8.92 ± 2.41. Medication burden increased with age, being highest among patients aged ≥81 years (9.88 ± 2.67), followed by those aged 71–80 years (9.05 ± 2.36) and 60–70 years (8.31 ± 2.12); this difference was statistically significant (Kruskal–Wallis H = 9.82, df = 2, p = 0.007). Females had a marginally higher mean medication count (9.12 ± 2.49) than males (8.75 ± 2.33), although this difference was not statistically significant (p > 0.05).

Table 2. Prescribing Pattern and Polypharmacy Analysis

Parameter	Value	Statistical test
Mean medications per patient	8.92 ± 2.41	—
Age group 60–70 years	8.31 ± 2.12	H = 9.82, df = 2, p = 0.007*
Age group 71–80 years	9.05 ± 2.36	

Parameter	Value	Statistical test
Age group ≥81 years	9.88 ± 2.67	
Male	8.75 ± 2.33	p > 0.05 (NS)
Female	9.12 ± 2.49	

DDIs were identified in 247 of 313 patients (78.9%), with a mean of 2.76 ± 1.84 DDIs per patient. Patients with hyperpolypharmacy had a markedly higher mean DDI count (3.98 ± 1.96) than those with major polypharmacy (2.11 ± 1.42). A strong positive correlation was observed between the number of medications and DDI count (Spearman's $\rho = 0.68$, $p < 0.001$). The most frequently occurring interaction pairs were aspirin + clopidogrel (n = 12, 3.8%), enalapril + spironolactone (n = 5, 1.6%), and tramadol + ondansetron (n = 3, 1.0%); no single pair predominated, indicating a heterogeneous distribution of DDIs across drug classes (Tables 3, 3A, 3B).

Table 3. Drug–Drug Interaction (DDI) Analysis

Parameter	Value
DDI prevalence	247 (78.9%)
Mean DDIs per patient	2.76 ± 1.84

Table 3A. Distribution of Drug–Drug Interactions by Polypharmacy Degree

Polypharmacy degree	Mean DDIs ± SD
Major	2.11 ± 1.42
Hyperpolypharmacy	3.98 ± 1.96

Table 3B. Top 10 Most Frequently Occurring Drug–Drug Interaction Pairs

S. No.	Drug pair	Frequency (n)	Percentage (%)
1	Aspirin + Clopidogrel	12	3.8%
2	Enalapril + Spironolactone	5	1.6%
3	Tramadol + Ondansetron	3	1.0%
4	Paracetamol + Serratiopeptidase	3	1.0%
5	IV + Oral Paracetamol	2	0.6%
6	Tramadol + Serratiopeptidase	2	0.6%
7	Mannitol + Labetalol	2	0.6%
8	Furosemide + Ceftriaxone	2	0.6%
9	Diclofenac + Naproxen	2	0.6%
10	Furosemide + Amlodipine	2	0.6%

ADRs were identified in 138 of 313 patients (44.1%), with a mean of 0.62 ± 0.91 ADRs per patient. Patients receiving PIMs had a significantly higher ADR burden than those without PIMs (Mann–Whitney $U = 6421$, $Z = -3.12$, $p = 0.002$). A moderate positive correlation was observed between the number of medications and ADR occurrence ($\rho = 0.42$, $p < 0.001$) (Table 4).

Table 4. Adverse Drug Reaction (ADR) Analysis

Parameter	Value
ADR prevalence	138 (44.1%)
Mean ADRs per patient	0.62 ± 0.91

Aspirin + clopidogrel, the most frequently observed interaction pair, was associated with the highest number of ADRs (n = 5), predominantly gastrointestinal bleeding, epistaxis, and anaemia. Enalapril + spironolactone (n = 5, 1.6%) commonly resulted in hyperkalaemia and generalised weakness (n = 3). Tramadol + ondansetron and paracetamol + serratiopeptidase (n = 3 each) were associated with dizziness, reduced analgesic efficacy, and

gastrointestinal disturbances. Although less frequent, diclofenac + naproxen showed a proportionally higher ADR occurrence, mainly gastritis and gastrointestinal irritation (Table 5).

Table 5. Frequency and Pattern of Common Drug–Drug Interactions and Associated Adverse Drug Reactions

S. No.	Drug pair	Freq. (n)	%	Common ADRs observed	ADR freq. (n)
1	Aspirin + Clopidogrel	12	3.8	GI bleeding, epistaxis, anaemia	5
2	Enalapril + Spironolactone	5	1.6	Hyperkalaemia, weakness	3
3	Tramadol + Ondansetron	3	1.0	Dizziness, reduced analgesic effect	2
4	Paracetamol + Serratiopeptidase	3	1.0	Gastritis, abdominal discomfort	2
5	IV + Oral Paracetamol	2	0.6	Hepatic enzyme elevation	1
6	Tramadol + Serratiopeptidase	2	0.6	Nausea, dizziness	1
7	Mannitol + Labetalol	2	0.6	Hypotension, electrolyte imbalance	1
8	Furosemide + Ceftriaxone	2	0.6	Electrolyte imbalance, dehydration	1
9	Diclofenac + Naproxen	2	0.6	Gastritis, GI irritation	2
10	Furosemide + Amlodipine	2	0.6	Hypotension, pedal oedema	1

PIMs were identified in 172 of 313 patients (54.9%), with a mean of 1.84 ± 0.93 PIMs among affected patients. PIM use was significantly associated with age group ($\chi^2 = 6.94$, df = 2, $p = 0.031$) and degree of polypharmacy ($\chi^2 = 14.21$, df = 1, $p < 0.001$), but not with gender ($\chi^2 = 1.82$, df = 1, $p = 0.177$). Patients receiving PIMs had significantly lower adherence scores than those without PIMs (Mann–Whitney U = 7012, Z = -2.88, $p = 0.004$) (Tables 6, 6A).

Table 6. Potentially Inappropriate Medication (PIM) Analysis

Parameter	Value
PIM prevalence	172 (54.9%)
Mean PIM number (among PIM patients)	1.84 ± 0.93

Table 6A. Comparison of PIM Use with Gender, Age Group, and Polypharmacy Degree

Comparison	χ^2	df	p-value
PIM vs Gender	1.82	1	0.177 (NS)
PIM vs Age group	6.94	2	0.031*
PIM vs Polypharmacy degree	14.21	1	<0.001*

Based on the GerontoNet risk scoring system, 47.0% of patients were classified as moderate risk, 29.4% as low risk, and 23.6% as high risk. Medication burden increased progressively across risk categories, from 7.12 ± 1.88 in the low-risk group to 9.04 ± 2.21 in the moderate-risk group and 11.02 ± 2.73 in the high-risk group (Kruskal–Wallis H = 38.51, df = 2, $p < 0.001$; post-hoc analysis confirmed significant differences between all groups). A significant association was also observed between GerontoNet risk category and PIM use ($\chi^2 = 12.33$, df = 2, $p = 0.002$) (Table 7).

Table 7. GerontoNet ADR Risk Score Analysis

Risk level	n (%)	Medications (Mean ± SD)	ADRs (Mean)
Low	92 (29.4%)	7.12 ± 1.88	0.31
Moderate	147 (47.0%)	9.04 ± 2.21	0.64

Risk level	n (%)	Medications (Mean ± SD)	ADRs (Mean)
High	74 (23.6%)	11.02 ± 2.73	1.12

Using the GMAS scale, 45.0% of patients demonstrated high adherence, 41.2% partial adherence, and 13.7% low adherence; the overall mean GMAS score was 27.84 ± 3.92. Patients with hyperpolypharmacy had significantly lower adherence than those with major polypharmacy (Mann–Whitney U = 6233, Z = -3.41, p = 0.001). A moderate negative correlation was observed between GMAS score and number of medications ($\rho = -0.49$, $p < 0.001$) and between GMAS score and number of PIMs ($\rho = -0.36$, $p < 0.001$). Adherence level was also significantly associated with polypharmacy degree ($\chi^2 = 10.88$, df = 2, p = 0.004) and GerontoNet risk category (H = 16.27, df = 2, $p < 0.001$) (Table 8).

Table 8. GMAS Medication Adherence Analysis

Adherence level	n (%)
High	141 (45.0%)
Partial	129 (41.2%)
Low	43 (13.7%)

Spearman correlation analysis showed that number of medications was the central variable most strongly associated with other clinical parameters: DDIs ($\rho = 0.68$), PIMs ($\rho = 0.51$), ADRs ($\rho = 0.42$), and GMAS score ($\rho = -0.49$). DDIs correlated moderately with PIMs ($\rho = 0.44$) and ADRs ($\rho = 0.39$), and negatively with GMAS score ($\rho = -0.33$). PIMs correlated with ADRs ($\rho = 0.29$) and negatively with GMAS score ($\rho = -0.36$). Age showed comparatively weaker correlations with all medication-related variables ($\rho = 0.19$–0.31) than the inter-medication correlations themselves, suggesting that medication-related risk is not an inevitable consequence of ageing but a potentially modifiable, iatrogenic factor (Table 9).

Table 9. Spearman Correlation Matrix of Clinical Variables

Variable	Age	Meds	DDIs	ADRs	PIMs	GMAS
Age	1	0.28	0.24	0.19	0.31	-0.22
Meds		1	0.68*	0.42*	0.51*	-0.49*
DDIs			1	0.39*	0.44*	-0.33*
ADRs				1	0.29	-0.27
PIMs					1	-0.36*
GMAS						1

Multiple linear regression identified the GerontoNet score as the strongest predictor of GMAS score ($\beta = -0.71$, standardised $\beta = -0.33$, 95% CI: -0.98 to -0.44, t = -5.18, $p < 0.001$), followed by number of medications ($\beta = -0.42$, standardised $\beta = -0.38$, 95% CI: -0.55 to -0.29, t = -6.21, $p < 0.001$) and number of PIMs ($\beta = -0.58$, standardised $\beta = -0.27$, 95% CI: -0.82 to -0.34, t = -4.77, $p < 0.001$). Age had a statistically significant but comparatively modest effect ($\beta = -0.09$, standardised $\beta = -0.11$, 95% CI: -0.15 to -0.02, t = -2.64, p = 0.009). Based on standardised coefficients, number of medications emerged as the strongest overall predictor of reduced adherence, followed by GerontoNet score and PIM count (Table 10).

Table 10. Multiple Linear Regression Analysis Predicting GMAS Score

Predictor	β	Std. β	95% CI	t	p-value
Medications	-0.42	-0.38	(-0.55, -0.29)	-6.21	<0.001*

Predictor	β	Std. β	95% CI	t	p-value
Age	-0.09	-0.11	(-0.15, -0.02)	-2.64	0.009*
PIMs number	-0.58	-0.27	(-0.82, -0.34)	-4.77	<0.001*
GerontoNet score	-0.71	-0.33	(-0.98, -0.44)	-5.18	<0.001*

DISCUSSION

The present study evaluated polypharmacy and its associated clinical consequences among geriatric patients, focusing on DDIs, ADRs, PIMs, medication adherence, and GerontoNet-based risk stratification.

Polypharmacy was highly prevalent in the study population, consistent with previous reports of a high medication burden among elderly patients with multiple chronic conditions.[1,26,55] The increased medication burden observed here underscores the complexity of managing geriatric patients and the need for careful prescribing practices.

A substantial proportion of patients experienced DDIs, with a strong positive correlation between number of medications and DDI occurrence, in agreement with earlier studies identifying polypharmacy as a major risk factor for drug interactions.[7,36,38] As the number of medications increases, the likelihood of clinically significant interactions rises correspondingly, increasing the risk of therapeutic complications.

ADRs were observed in a considerable proportion of patients, with a moderate positive correlation between medication count and ADR occurrence, supporting previous findings of a high ADR incidence among elderly patients on multiple medications.[4,6,57] Patients receiving PIMs had a significantly higher ADR incidence, reinforcing the importance of rational prescribing and highlighting the negative impact of inappropriate medication use on patient compliance.

The GerontoNet risk score analysis showed that patients in higher-risk categories had significantly greater medication burden and ADR incidence, aligning with previous validation studies of the GerontoNet tool in predicting ADR risk in elderly patients.[51,53] This supports its clinical utility in identifying high-risk individuals and guiding preventive interventions.

Medication adherence, assessed using GMAS, decreased with increasing medication burden, with a moderate negative correlation between number of medications and adherence score, consistent with previous adherence studies in geriatric populations.[41,42,43] Regression analysis identified number of medications as the strongest predictor of adherence, indicating that polypharmacy plays a central role in shaping patient behaviour and treatment outcomes; this highlights the need for interventions such as medication review and deprescribing to improve adherence and reduce medication-related complications.[14,15,27]

Overall, these findings demonstrate that polypharmacy is a critical determinant of drug-related problems in geriatric patients, influencing DDIs, ADRs, PIM use, and medication adherence, and emphasise the importance of a multidisciplinary approach to optimise pharmacotherapy in elderly populations.

Certain limitations should be considered while interpreting the findings of the present study.. First, it was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to other healthcare settings and populations. Second, the cross-sectional design precludes establishing causal relationships between polypharmacy and clinical outcomes, including adverse drug reactions and medication adherence. ADR identification was based on clinical documentation and patient records, which may have resulted in underreporting or misclassification. Similarly, medication adherence was assessed using the General Medication Adherence Scale (GMAS), a self-reported instrument that is susceptible to recall and reporting bias. Furthermore, the study did not evaluate the severity of comorbidities or the clinical appropriateness of individual prescriptions, factors that may influence medication-related outcomes. Future multicentre, longitudinal studies with larger sample sizes are warranted to validate these findings and to evaluate the effectiveness of deprescribing strategies and pharmacist-led interventions in optimizing medication use among geriatric patients.

CONCLUSION

This study highlights the substantial burden of polypharmacy among geriatric patients and its significant clinical implications. A high prevalence of polypharmacy was observed, reflecting the complexity of managing multiple chronic conditions in the elderly. An increased number of medications was strongly associated with a higher occurrence of DDIs and ADRs, indicating that medication burden remains a critical determinant of drug-related complications.The presence of PIMs was notably high and significantly associated with both advanced age and degree of polypharmacy; patients receiving such medications had a higher risk of ADRs, underscoring the importance of applying explicit screening tools such as the Beers criteria in

routine clinical practice. Medication adherence, assessed using GMAS, declined with increasing medication burden, suggesting that complex therapeutic regimens negatively affect patient compliance.Application of the GerontoNet risk score demonstrated its usefulness in identifying patients at higher risk of ADRs, supporting the role of risk-stratification tools in improving clinical decision-making and patient safety. Overall, the study underscores the need for rational prescribing practices, regular medication review, and deprescribing strategies to minimise unnecessary medication use. A multidisciplinary approach involving clinical pharmacists, physicians, and other healthcare professionals is essential to optimise pharmacotherapy, enhance medication safety, improve adherence, and reduce drug-related complications in geriatric patients.

References

1. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opinion on Drug Safety. 2014;13(1):57-65.
2. Kuijpers MAJ, Marum RJ, Egberts ACG, Jansen PAF, Group TOLDYS. Relationship between polypharmacy and underprescribing. British Journal of Clinical Pharmacology. 2008;65:130-133.
3. Anand P, Katyal J, Dey AB, Gupta YK. Characterization of potentially inappropriate medications use in Indian elderly population and their impact on quality of life using Beers criteria. Aging Medicine. 2022;5:45-52.
4. Hadia R, Joshi D, Bhil D, Maheshwari R. Incidence of adverse drug reactions among elderly patients: A systematic review and meta-analysis. Journal of the Scientific Society. 2022;49(2):91-102.
5. Bhaumik L, Chattopadhyay S, Mandal A, Ghosh A. Adverse drug reaction trends in geriatric patients: A 5-year retrospective study from Eastern India. Journal of the Indian Academy of Geriatrics. 2025;21(3):173-177.
6. Jennings ELM, Murphy KD, Gallagher P, O'Mahony D. In-hospital adverse drug reactions in older adults; prevalence, presentation and associated drugs — a systematic review and meta-analysis. Age and Ageing. 2020;49(6):948-958.
7. LM O, JDAC D, A N. Prevalence of drug interactions in hospitalised elderly patients: a systematic review. European Journal of Hospital Pharmacy. 2021;28:49.
8. H NV, A H, G P, M R. Potentially inappropriate medication use in Indian elderly: Comparison of Beers' criteria and Screening Tool of Older Persons' potentially inappropriate Prescriptions. Geriatrics & Gerontology International. 2012;12:506-514.
9. Sharma R, Bansal P, Garg R, Ranjan R, Kumar R, Arora M. Prevalence of potentially inappropriate medication and its correlates in elderly hospitalized patients: A cross-sectional study based on Beers criteria. Journal of Family and Community Medicine. 2020;27(3):200-207.
10. ELDesoky ES. Pharmacokinetic-pharmacodynamic crisis in the elderly. American Journal of Therapeutics. 2007;14(5):488-498.
11. Crooks J, O'Malley K, Stevenson IH. Pharmacokinetics in the elderly. Clinical Pharmacokinetics. 1976;1(4):280-296.
12. Peeters LE, Kester MP, Feyz L, Den Bemt PM, Koch BC, Gelder T. Pharmacokinetic and pharmacodynamic considerations in the treatment of the elderly patient with hypertension. Expert Opinion on Drug Metabolism & Toxicology. 2019;15(4):287-297.
13. Klotz U. Pharmacokinetics and drug metabolism in the elderly. Drug Metabolism Reviews. 2009;41(2):67-76.
14. Gnjidic D, Le Couteur DG, Kouladjian L, Hilmer SN. Deprescribing trials: methods to reduce polypharmacy and the impact on prescribing and clinical outcomes. Clinics in Geriatric Medicine. 2012;28(2):237-253.
15. Hung A, Kim YH, Pavon JM. Deprescribing in older adults with polypharmacy. BMJ. 2024;385.
16. Jetha S. Polypharmacy, the elderly, and deprescribing. The Consultant Pharmacist. 2015;30(9):527-532.
17. Das S. Medication Safety in Older Adults in India: Polypharmacy, Self-Medication, Deprescribing, and Informal Care Provider Interventions. [Doctoral dissertation]. Karolinska Institutet.
18. Eerike M, Raj GM, Rajendran P, Nayak V, Mathai P, Karra VK. Exploring the knowledge and attitudes of physicians on polypharmacy and deprescribing in clinical practice: a cross-sectional study. Maedica. 2025;20(2).
19. Shukla AK, Jhaj R, Atal S, Majumdar A, Meena M, Tiwari S. A critical evaluation of available explicit deprescribing tools for their applicability to Indian elderly patients: a scoping review protocol. Systematic Reviews. 2025;14(1).
20. George SM, Kashyap K, Dhar M. Polypharmacy in an older female: thoughtful deprescribing. Journal of the Indian Academy of Geriatrics. 2024;20(4):219-222.
21. Sibal P, Holla S, Amrutha C, Kateel R, Udyavar L. Assessing physicians' perspectives on deprescribing in the elderly population: combatting polypharmacy. Current Drug Therapy. Published online May 13, 2025.
22. Samajdar SS, Chatterjee N, Pal J, George M,

Sarkar S, Sen S. Rational deprescribing practices in elderly patients: an expert opinion.
23. Eerike M, Ramaswamy G, Rajendran P, Mathai P, Nayak V, Karra VK. Towards safer medication use in older adults: investigating barriers and facilitators of deprescribing. British Journal of Clinical Pharmacology. Published online November 6, 2025.
24. Sarkar S, Talukdar A, Talukdar P, et al. Deprescribing based on assessment of inappropriateness of**25.**. Journal of Neonatal Surgery. 2025;14(22s):25.
25. Dale AF, Kashid G. The Impact of Polypharmacy on Elderly Patients and Strategies To Reduce Risks. Journal of Neonatal Surgery. 2025;14(22s).
26. Bhagavathula AS, Vidyasagar K, Chhabra M, Rashid M, Sharma R, Bandari DK. Prevalence of polypharmacy, hyperpolypharmacy and potentially inappropriate medication use in older adults in India: a systematic review and meta-analysis. Frontiers in Pharmacology. 2021;12(685518).
27. Santra G. Polypharmacy and deprescription: role of internists. Journal of Association of Physicians of India. 2024:83-91.
28. Sinha A, Mukherjee S, Tripathi S, Dutta S. Issues and challenges of polypharmacy in the elderly: a review of contemporary Indian literature. Journal of Family Medicine and Primary Care. 2021;10(10):3544-3547.
29. Syed J, Pereira P, Chalasani SH, Ramesh M, Tejeswini CJ, Avarebeel S. Defining geriatric care in a developing country: a multidisciplinary model empowering clinical pharmacists. Archives of Gerontology and Geriatrics Plus. 2024;1(3).
30. Yaacob NL, Loganathan M, Hisham NA, Kamaruzzaman H, Isa KA, Ibrahim MI. The impact of pharmacist medication reviews on geriatric patients: a scoping review. Korean Journal of Family Medicine. 2024;45(3).
31. Silva RD, Cunha BV, Silva RC, Carvalho Cartágenes S. The performance of the clinical pharmacist in pharmaceutical care and intervention in cases of polymedicated elderly people: an integrative review. Research, Society and Development. 2023;12(1).
32. Ramesh S, Mallikasheril MJ, Justin SP. Medications of elderly in a pharmacists' perspective. Indian Journal of Pharmacy Practice. 2016;9(4).
33. Tasai S, Kumpat N, Dilokthornsakul P, Chaiyakunapruk N, Saini B, Dhippayom T. Impact of medication reviews delivered by community pharmacist to elderly patients on polypharmacy: a meta-analysis of randomized controlled trials. Journal of Patient Safety. 2021;17(4):290-298.
34. Gudi SK, Kashyap A, Chhabra M, Rashid M, Tiwari KK. Impact of pharmacist-led home medicines review services on drug-related problems among the elderly population: a systematic review. Epidemiology and Health. 2019;41:e2019020.
35. Rajendran Y, Keche Y, Gaikwad NR, Dhaneria S. Retrospective analysis of potential adverse drug interactions in the drugs prescribed to the elderly at a tertiary health care center.
36. Kashyap M, D'Cruz S, Sachdev A, Tiwari P. Drug-drug interactions and their predictors: results from Indian elderly inpatients. Pharmacy Practice. 2013;11(4).
37. Das B, Ramasubbu SK, Agnihotri A, Kumar B, Rawat VS. Leading 20 drug–drug interactions, polypharmacy, and analysis of the nature of risk factors due to QT interval prolonging drug use and potentially inappropriate psychotropic use in elderly psychiatry outpatients. Therapeutic Advances in Cardiovascular Disease. 2021;15(17539447211058892).
38. Joshi H, Majumdar FD, Patel SN, Modi KB, Rathod J, Kanani P. Prescription analysis and evaluation of potential drug–drug interactions among patients attending the geriatric unit at a tertiary care hospital. Journal of the Indian Academy of Geriatrics. 2023;19(4):225-231.
39. Suthar J, Tandel A, Patel V. Evaluation of drug-drug interactions in hospitalised geriatric patients at tertiary care hospital. Indian Drugs. 2021;58(3).
40. Carpenter M, Berry H, Pelletier AL. Clinically relevant drug-drug interactions in primary care. American Family Physician. 2019;99(9):558-564.
41. Khaiser UF, Sultana R, Das R, Alzahrani SG, Saquib S, Shamsuddin S. Medication adherence and quality of life among geriatric patients: insights from a hospital-based cross-sectional study in India. PLOS ONE. 2024;19(11).
42. Andhi N, Pravalika J, Teja MS, Prasanna VT, Suma CS. Assessment of medication complexity and adherence in geriatric patients. Indian Journal of Pharmacy Practice. 2023;16(1).
43. Shruthi R, Jyothi R, Pundarikaksha HP, Nagesh GN, Tushar TJ. A study of medication compliance in geriatric patients with chronic illnesses at a tertiary care hospital. Journal of Clinical and Diagnostic Research. 2016;10(12).
44. Choudhury P, Gnanasan S, Ghadzi SM, Poddar S. Evaluation of geriatric medication adherence using the General Medication Adherence Scale in a primary care setting. Research Journal of Pharmacy and Technology. 2023;16(9):4172-4178.
45. 1.T MD, D SC, SM S, A T, P P, M R. Facilitators and barriers of medication adherence amongst the geriatrics: a cross-sectional study. Journal of Pharmaceutical Health Services Research.

2022;13(3):230-239.
46. Thakur MK, Talati S, Gupta AK, Bhattacharya S, Singh A. Morbidity pattern, social safety net, and drug adherence level among geriatric patients attending in a health-care facility: a cross-sectional study. Journal of Education and Health Promotion. 2019;8(1).
47. Danisha P, Dilip C, Mohan PL, Shinu C, Parambil JC, Sajid M. Identification and evaluation of potentially inappropriate medications (PIMs) in hospitalized geriatric patients using Beers criteria. Journal of Basic and Clinical Physiology and Pharmacology. 2015;26(4):403-410.
48. Bhatt AN, Paul SS, Krishnamoorthy S, Baby BT, Mathew A, Nair BR. Potentially inappropriate medications prescribed for older persons: a study from two teaching hospitals in Southern India. Journal of Family and Community Medicine. 2019;26(3):187-192.
49. Jamal AK, Hardi H, Widyastuti R. Polypharmacy and the risk of adverse drug reactions in the elderly at a tertiary referral hospital in Indonesia: assessing the applicability of the GerontoNet Score.
50. Hefner G, Hahn M, Roll SC, Klimke A, Hiemke C. Application of the GerontoNet ADR risk score in a psychiatric setting. International Journal of Clinical Medicine Research. 2018;5(1):7-14.
51. Onder G, Petrovic M, Tangiisuran B, Meinardi MC, Markito-Notenboom WP, Somers A. Development and validation of a score to assess risk of adverse drug reactions among in-hospital patients 65 years or older: the GerontoNet ADR risk score. Archives of Internal Medicine. 2010;170(13):1142-1148.
52. Hendra GA, Monica E, Herawati IY. Risk assessment of adverse drug reactions in elderly patients with chronic diseases. Jurnal Kesehatan Dr Soebandi. 2021;9(2):149-155.
53. Cosgrave N, Saleh S, Ong WS, Frydenlund J, Williams DJ, Cahir C. Risk prediction models for adverse drug reactions and adverse drug events in older adults — a systematic review and meta-analysis. European Journal of Clinical Pharmacology. 2025;81(1):93-110.
54. Sharma P, Gupta NL, Chauhan HS. Prevalence of polypharmacy: comparing the status of Indian states. Indian Journal of Community and Family Medicine. 2019;5(1):4-9.
55. Pazan F, Wehling M. Polypharmacy in older adults: a narrative review of definitions, epidemiology and consequences. European Geriatric Medicine. 2021;12(3):443-452.
56. Payne RA. The epidemiology of polypharmacy. Clinical Medicine. 2016;16(5):465-469.
57. McGettigan S, Curtin D, O'Mahony D. Adverse drug reactions in multimorbid older people exposed to polypharmacy: epidemiology and prevention. Pharmacoepidemiology. 2024;3(2):208-222.
58. Dagli RJ, Sharma A. Polypharmacy: a global risk factor for elderly people. Journal of International Oral Health. 2014;6(6).
59. Hovstadius B, Petersson G. Factors leading to excessive polypharmacy. Clinics in Geriatric Medicine. 2012;28(2):159-172.
60. Kumar A, Srivastava DK, Verma A, Kumar S, Singh NP, Kaushik A. The problems of fall, risk factors and their management among geriatric population in India. Indian Journal of Community Health. 2013;25(2):89-94.
61. Lodha P, Sousa A. Geriatric mental health: the challenges for India. Journal of Geriatric Mental Health. 2018;5(1):16-29.
62. Narayanasamy K, Annadurai K, Karnaboopathy R. Geriatric healthcare issues: a public health perspective. Annals of SBV. 2020;9(2):48-52