Review Article

A Comprehensive Clinical Review on Geriatric Polypharmacy

T Peter*[1], G Hemavathi[1], P Harini Kanishka[2], CS Haritha[2], SK Harshini[2], K Janani[2], Jawad Ahmad Wani[2]
[1] Institute of Pharmacology, Madurai Medical College, Madurai, Tamilnadu, India.
[2] College of Pharmacy, Madurai Medical College, Madurai, Tamilnadu, India.
***Corresponding author's E-mail:** annaarulmed@gmail.com

Received: 18-11-2024; **Revised:** 26-01-2025; **Accepted:** 10-02-2025; **Published online:** 20-02-2025.

ABSTRACT

Geriatric polypharmacy, the concurrent use of multiple medications, has become an increasingly prevalent issue as the global population ages. Older adults often present with multiple chronic conditions necessitating complex medication regimens, which heightens the risk of adverse drug reactions (ADRs), drug-drug interactions and noncompliance. This phenomenon is particularly pronounced in individuals over 65 years, with significant implications for health outcomes and healthcare costs. This document outlines the definition and scope of polypharmacy, its associated risks and the need for rational pharmacotherapy to mitigate adverse effects. It emphasizes the importance of deprescribing - the intentional reduction of medications that are no longer beneficial or potentially harmful. Strategies such as the use of clinical tools like the Beers Criteria, STOPP/START Criteria and comprehensive medication reviews are highlighted as effective approaches to manage and reduce polypharmacy. The role of healthcare providers, particularly pharmacists, in optimizing medication therapy for the elderly is underscored to improve patient outcomes and reduce medical costs associated with polypharmacy.

Keywords: Geriatric polypharmacy, chronic conditions, adverse drug reactions, drug-drug interactions, noncompliance, deprescribing, Beers Criteria, STOPP/START Criteria, medication review.

INTRODUCTION

Multiple comorbidities in aging are often associated with complex medication regimens. With the growing elderly population, especially those above 65, chronic conditions such as heart disease, hypertension, diabetes, arthritis and cancer are common, leading to polypharmacy. In the United States, about 80% of older adults have at least one chronic condition and 39% take five or more medications.[1] In India, 50% of the elderly have chronic diseases that require lifelong treatment. The term elderly refer to population with chronological age of 60 years or above.[2]

Biological aging changes pharmacokinetics and pharmacodynamics. Thus, drug response and handling are different in older adults. However, this population is frequently excluded from clinical trials. Thus, evidence regarding the safety and efficacy of medications for them, especially those with multiple conditions, is lacking.[3]

POLYPHARMACY

The term 'polypharmacy' comes from the Greek word 'poly' which implies 'many'. It is the use of multiple medications within a single patient, usually an older adult with multiple chronic conditions. Polypharmacy is generally defined as consuming five or more medications per day, while 'hyperpolypharmacy' refers to 10 or more. Polypharmacy risks include increased hospital visits and readmissions and subsequently mortality. Symptoms can be mistaken for normal aging like fatigue, confusion, dizziness or loss of appetite.[2]

Classification:

- Major polypharmacy: ≥5 drugs/day.
- Minor polypharmacy: 2–4 drugs/day.
- Hyperpolypharmacy: ≥10 drugs/day.[4]

Causes of Polypharmacy

- Aging with comorbidities: Chronic diseases often require multiple medications.
- Self-medication: Over-the-counter and herbal remedies without understanding risks.
- Prescribing cascade: Treating side effects of one drug with another.
- Multiple providers: Poor coordination among healthcare providers and pharmacist.
- Ineffective communication: Redundant or unnecessary prescriptions.
- Curiosity for new drugs: Overuse of newly available medications.
- Crosspathy: Concurrent use of Ayurvedic or herbal medicine leading to interactions.[5]

EPIDEMIOLOGY

- **Demographic Factors:** Polypharmacy is quite prevalent among elderly populations, particularly among females aged more than 65 years, those who are Caucasian and low socioeconomic status or have Medicare as a source of insurance.

- **Comorbidities:** Cardiovascular diseases, hypertension, type 2 diabetes, heart failure and renal insufficiency have a strong association with polypharmacy. Higher levels of multimorbidity and clusters of chronic conditions along with higher Charlson Comorbidity scores are additional factors.
- **Health Conditions:** Geriatric syndromes like incontinence, dizziness, cognitive decline and limited functional capacity often result in polypharmacy, particularly when patients have poor health perception, reduced satisfaction or when they are not responsive to the treatment.
- **Healthcare Setting:** Polypharmacy is common in nursing homes and is associated with multiple healthcare encounters, several providers involved in the care and poor communication between primary and specialty care providers.
- **Patient Determinants**: Patient beliefs, social influences, and behaviours such as doctor shopping, early prescription refills and seeking herbal or complementary medications are at higher risk.
- **Substance Abuse:** Alcohol, street drugs and the abuse of psychotropic prescription medications especially opioids add up frequently to polypharmacy in geriatric patients.[6]

Pharmacokinetics and Pharmacodynamics:

Pharmacokinetics (PK) refers to how the body affects a drug, while Pharmacodynamics (PD) describes how the drug affects the body. Pharmacokinetics specifically refers to drug absorption, distribution, metabolism and elimination.[7]

- **Absorption**: Usually unchanged, but it could be slower, resulting in delayed peak drug concentrations. First-pass metabolism will be decreased due to reduced size of the liver and blood flow.
- **Distribution**: Lower water content and lean body mass decrease the distribution of drugs that are water-soluble (e.g., lithium), while higher fat will increase the distribution of fat-soluble drugs (e.g., diazepam). Low levels of albumin increase the concentration of active free drugs.
- **Metabolism:** Age associated reduction in the Phase I reactions (oxidation) slows drug metabolism, thus reducing drug clearance, whereas Phase II reactions (glucuronidation) remain unaffected, thus Phase II drugs are preferred.
- **Elimination:** It involves a decline in the renal function and the glomerular filtration rate decrease the drug clearance. Creatinine clearance is a better estimating tool compared with serum creatinine levels for dose adjustment.[8]

PHARMACODYNAMICS

Pharmacodynamics refers to the effects of drugs in the body and how the body responds. Generally, sensitivity to drugs in older adults might be different compared to that of younger ones because of changes in receptor interactions and post-receptor effects as well as adaptive responses. Organ pathology may also influence the frail ones with responses; therefore, separation between pharmacodynamic effects and pharmacokinetic ones is challenging.[9]

Table 1: Selected pharmacodynamics changes with aging[10].

Drug	Pharmacodynamics effect	Age related changes
Adenosine	Heart-rate response	↔
Diazepam	Sedation, postural sway	↑
Furosemide	Peak diuretic response	↓

Risk Factors

Elderly polypharmacy is influenced by individual and systemic factors. Risk factors can be grouped into three categories:

- Demographics: Increased age, white race and lower educational status.
- Health Status: Multimorbidity, poor health, depression, hypertension, diabetes and the use of multiple medications.
- Healthcare System Access: Frequent consultations, supplemental insurance and multiple providers increase the risk of duplicated prescriptions and interactions.

Multimorbidity makes elderly patients particularly vulnerable to polypharmacy as they consult multiple specialists, often resulting in drug duplication or interactions. Physicians must navigate disease-specific guidelines cautiously, which often fail to account for comorbidities.

Age-related declines in liver and kidney function alter drug metabolism and excretion, increasing the risk of adverse effects. Drugs like warfarin, digoxin and gentamicin require dose adjustments in this population due to reduced clearance.

Self-medication with over-the-counter drugs, cognitive impairments, low literacy and complex regimens further exacerbate the problem. Patients with limited education often mismanage prescriptions, especially when consulting multiple physicians.

Physicians may inadvertently contribute by continuing prescriptions without thorough reviews, yielding prescription cascades and adverse drug reactions. Time constraints during consultations further compound the issue.[1]

ADVERSE EFFECTS

Polypharmacy increases the risk of adverse drug effects especially among elderly subjects, who are more prone to side effects, drug interactions, adverse reactions, non-adherence and geriatric syndromes.

Classification of ADRs:

- Type A (Predictable) It refers to the mechanism of the drug, for example, an increase in plasma levels caused by warfarin may lead to bleeding.
- Type B (Unpredictable) Such a reaction is rare and not predictable and might be anaphylaxis or Stevens-Johnson syndrome.

Table 2: Examples of medications to be used with caution in the elderly.[11]

Medication	Caution
Non-steroidal anti-inflammatories e.g. naproxen, ibuprofen	-Risks: Gastrointestinal bleeding, cardiac failure and nephrotoxic - Suggested action: Avoid where possible. If essential, offer short courses with proton pump inhibitor cover
Hypnotics e.g. benzodiazepines	-Risks: Drowsiness, confusion, poor balance and increased risk of falls - Suggested action: Avoid where possible or offer a short course only
Anti-coagulants	-Risks: Warfarin interacts with many drugs and foods -Suggested action: Careful counselling and consider risk of falls
Cardiac glycosides eg:digoxin	-Risks: Caution in renal impairment as increased risk of toxicity -Suggested action: Start with lower doses in the elderly and monitor renal function.

CONSEQUENCES:

In elderly people, polypharmacy causes various harmful effects such as high costs of health care, ADRs, drug interactions, non-compliance, a lower functional status and more hospitalization.

1. ADEs: The probability of ADEs increases in patients with polypharmacy. Some of the most common side effects of polypharmacy include sedation, nephrotoxicity and confusion. More elderly patients suffer from ADRs. It usually triggers emergency visits, hospitalization and other drug-related health issues.

2. Drug Interactions: Both drug-drug and drug-disease interactions are very common, especially with polypharmacy. These interactions, such as aspirin with ulcers or calcium channel blockers with heart failure, account for a significant proportion of ADEs and hospitalizations.

3. Noncompliance: Complex regimens and multiple medications lead to noncompliance, which is a major cause of disease progression, hospital admissions and drug-related adverse events.

4. Impaired Functional Capacity: Polypharmacy is related to functional decline, including impaired physical and cognitive function. All of these aspects now affect the geriatric patient's ability to carry out daily activities.

5. Geriatric Syndromes: These include confusion, falls or other conditions such as incontinence among elderly patients. Polypharmacy can also impair nutritional status leading towards malnutrition and an imbalanced nutrient intake.[1]

6. Increased Healthcare Costs: Polypharmacy increases healthcare costs because of increased outpatient visits, hospitalizations and inappropriate medication with high prescription increases.[12]

7. Hospitalization: Studies have shown that polypharmacy is associated with higher rates of unplanned hospital admissions and readmission, especially in elderly patients with multiple chronic diseases.[13]

ASSESSMENT AND MANAGEMENT OF POLYPHARMACY

DEPRESCRIBING:

Deprescribing is an active discontinuation or dose reduction of medications that are no longer providing a health benefit. This practice seeks to minimize drug-related harms, decrease treatment complexity and reduce costs without losing the necessary medications. Deprescribing has been proven to reduce hospitalizations and emergency department presentations associated with medications.

i. **Deprescribe Strong Anticholinergic Medications**: Medications with strong anticholinergic effects, such as older agents of antihistamines, muscular relaxants and bladder medications should be reduced because these drugs negatively affect cognition and functioning.

ii. **Deprescribe NSAIDs**: NSAIDs may worsen kidney function, increase blood pressure and cause GI issues in older people, often making their risk outweigh the benefits.

iii. **Deprescribe Hypoglycaemic Agents**: Anti-diabetic drugs like sulfonylureas or insulin may trigger hypoglycaemia in the elderly, an important cause of emergency visits. Glycaemic targets should be relaxed.

iv. **Deprescribe Antihypertensives**: Antihypertensive drugs need to be deprescribed so that there is no orthostatic hypotension in older adults, which further leads to a risk of falls.

v. **Deprescribe Statins**: In people over 80 years of age, statins may have little benefit and some people may experience an increased risk of cardiovascular events, but they are still an important medication after coronary events.[14]

Challenges to Deprescribing:

Deprescribing is hindered by patient resistance, limited consultation time and unclear communication. Patients may fear that their health will deteriorate, especially if the medications were prescribed by other doctors. Physicians are also under time constraints and pressure to prescribe, making it challenging to deprescribe. Clear communication among healthcare providers helps to overcome this challenges.[15]

CLINICAL TOOLS AND GUIDELINES

1. **Electronic Medical Records (EMRs):**

EMRs help to prevent prescription errors, track drug interactions and monitor side effects. They facilitate clinical reviews, offer decision support and provide alerts for drug interactions. EMRs also allow for medication reconciliation and adherence tracking, improving prescription quality.[16]

2. **Drug Regimen Review Appointments:**

The reviews done by a General Physician prevent polypharmacy, minimize wastage of drugs and help detect potential drug reactions. Evidence shows that medication appropriateness improves and serious ADEs reduce when the medication review is regularly done.

3. **Beers Criteria:**

The Beers Criteria include medications that might be hazardous for older adults, including sedative hypnotics and some antihistamines. It divides the drugs into those to avoid or dose-adjust and those to administer with caution. The new update takes into account drug interactions and efficacy of the medications.[1]

Key features of the Beers criteria include: Identification of PIMs, consideration of individual patient characteristics, cautions and recommendation.[17]

4. **Canadian Criteria (IPET):**

Similar to the Beers Criteria, the Canadian Criteria identifies inappropriate medications for older adults. It comprises 45 medications in 14 drug classes but has less evidence on its effects regarding ADEs, health resource use or mortality.[18]

5. **STOPP/START Criteria:**

STOPP (Screening Tool of Older Persons Prescriptions) and START (Screening Tool to Alert doctor to Right Treatment) are criteria used as a tool for clinicians to review potentially inappropriate medications in older adults and have been endorsed as a best practice by some organizations.[19] These criteria guide practitioners in reviewing inappropriate medications among older adults. STOPP (80 criteria) and START (34 criteria) enhance medication appropriateness and minimize prescribing errors. It has been implemented effectively in different clinical settings.[20]

6. **IMPROVE Project:**

The IMPROVE project includes educating patients on their drugs by the clinical pharmacists. The project successfully reduced inappropriate medications by 14% and decreased medication costs in a 6-month follow-up.[1]

7. **ARMOR Tool:**

The ARMOR (Assess, Review, Minimize, Optimize, Reassess) tool is applied systematically in polypharmacy. It looks at the effects of drugs on functional status and quality of life and attempts to achieve better patient outcomes through changes or withdrawal of drugs according to clinical profiles.[21]

8. The medications appropriateness index is another tool designed to help doctors, asking the physician to consider 10 criteria (indication, effectiveness, dosage, practicality, drug-drug interaction, drug-disease interaction, unnecessary duplication, duration and expensiveness) in reviewing medication appropriateness.[22]

MITIGATION MEASURES FOR POLYPHARMACY

1. Increased Awareness Among Physicians: Educating healthcare professionals on medication review is key to reducing polypharmacy-related harm. Mandatory training on safe medication practices and integrating human factors into medical curricula can improve communication and decision-making.

2. Improved drug administration and adherence techniques such as the compliance drug devices, like a pill dispenser, mobile application use and other visual reminders-help individuals especially the elderly administer and take their drugs more easily.[5]

3. Reducing Self-Medication: The factors that influence the elderly in self-medication include cost, time barrier and past experience. Patients can be cautioned against the risk of self-administration if patients are made aware of its dangers and advice is sought by the physician.[5] The pharmacist can play a very important role in preventing drug-related problems and advising patients to consult professionals.[23]

4. Reducing Crosspathy: In the plural medical culture of India, crosspathy through the use of traditional and modern medicines together can be very hazardous in the form of drug interactions. Getting a detailed history of self-medication and bringing in periodic review mechanisms can reduce such risks.[5] Techniques like 'brown bag' evaluations, where the patient brings all medications to appointments, can prevent adverse drug events and enhance patient safety. These are the strategies implemented on all stages of care beginning with initial therapy and continuing to do medication reviews that improve medication safety and patient outcome.[24]

CONCLUSION

In most polytherapy cases, elderly patients require management for common ailments, but the challenge prescribed for this group of people is the risk of encountering drug interaction, toxicity and failure in treatment. Duplicated prescribing and side effects that remain unrecognized may promote more unnecessary addition of medications. Polypharmacy can be reduced by evaluating the patient's drug regimens regularly. One should know all the drugs, including herbs and teas that the patient is taking. Simplification of the regimen with fewer drugs in lower doses is best for elderly patients. More research will be necessary to identify risks for drug interactions and adverse effects. Developing country-specific lists of inappropriate medications for the elderly and using a multidisciplinary approach involving doctors, nurses and pharmacists can help ensure rational drug use and reduce polypharmacy.

Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Kotsalou E, Polypharmacy in elderly people, International journal of endocrinology, 2021; 17: 56-62.

2. Priya Sharma NG, Prevalence of polypharmacy, Indian journal of community and family medicine, 2019; 4-9.

3. Farhad Pazan, Martin Wehling, Polypharmacy in older adults: a narrative review of definitions and consequences, National centre for biotechnology information, 2021; 12(3):443-452.

4. Gulam Mohammad, Shivangna Singh, Priti Singh, Vivek Gautam, Analysis of the prevalence and pattern of polypharmacy, Asian journal of medical sciences,2023;146-150.

5. Abhik Sinha SM, Issues and challenges of polypharmacy in the elderly: A review of contemporary Indian literature, Journal of family medicine and primary care, 2021; 3544-3547.

6. Sonali Sarkar, Geriatric Polypharmacy: A growing epidemic, British journal of medicine and medical research, 2017; 21(1):1-11.

7. Tate M Andres, Tracy McGrane, Matthew D McEvoy, Brian FS Allen, Geriatric pharmacology, ClinicalKey,2020;476-492.

8. Dona Varghese, Cecilia Ishida, Preeti Patel, Hayas Haseer Koya, Polypharmacy, National centre for biotechnology information, 2024.

9. Mark Ruscin, Sunny A Linnebur, Pharmacodynamics in older adults, MSD manual, 2021; 52-66.

10. Mangoni AA, Jackson SHD, Age related changes in pharmacokinetics and pharmacodynamics: basic principles and practical applications, British journal of clinical pharmacology, 2004; 57(1):6-14.

11. Anna Cantlay, Tessa Glyn, Natalia Barton, Polypharmacy in the elderly, Innovate, 2016; 69-77.

12. Robert L Maher, Joseph T Hanlon, Emily Hajjar, Clinical consequences of polypharmacy in elderly, National institutes of health,2014;13(1).

13. Jonas Wastesson, Lucas morin, Edwin tan, Kristina johnell, An update on the clinical consequences of polypharmacy in older adults, Taylor and Francis,2018;17(12):1185-1196.

14. Robert Wiliam, Ryan M, Giddings Connolly, Paul Y Takahashi, Polypharmacy management in older patients, Mayo clinic proceedings, 2021; 242-256.

15. Anne D Halli Tierney, Catherine Scarbrough, Dana Carroll, Polypharmacy: Evaluating risks and deprescribing, American family physician, 2019; 100(1): 32-38.

16. Young Taek Park, Donghwan kim, Rae Woong Park, Koray Atalag, In Ho Kwon *Dukyong Yoon, Mona Choi*,Association between full electronic record system adoption and drug use; Antibiotics and polypharmacy, National library of medicine,2020;26(1):68-77.

17. Evelina gavazova, Radiana Staynova, Daniela grekova kafalova, Managing polypharmacy through medication review tools-pros and cons, 2024; 66(2):161-170.

18. Murthy Gokula, Holly M Holmes, Tools to reduce polypharmacy, Clin Geriatr Med, 2012; 323-341.

19. Mahony OD, START/STOPP criteria for potentially inappropriate medications /potential prescribing omissions in older people: origin and progress, Expert Rev Clin Pharmacol, 2019; 13(1):15-22.

20. Johanna Connor O, Babak Adabavazeh, Shahnal Shah, Hyun choi, Atkar Khan, Sahil Shah, Shahnal Shah, Use of the STOPP and START criteria to address polypharmacy for elderly patients, Hong Kong Journal of emergency medicine,2021;28(2):79-84.

21. Raza Haque, Armor: A tool to evaluate polypharmacy in elderly patients, HMP global learning network, 2009.

22. Joseph Hanlon T, Schmader KE, Samsa GP, Ingrid Lewis K, Harvey Jay Cohen, John Feussner, A method for assessing drug appropriateness, Journal of clinical epidemiology, 1992;45(10):1045-1051.

23. Darshana Bennadi, Self-medication: A current challenge, Journal of Basic and Clinical pharmacy, 2014; 5(1):19-23.

24. Ana Maria Dascalu, Maarina Ionela Ilie, Dragos Serban, Dan Georgian Bratu, Andreea Maria Smarandache, Tiberiu Trotea, Dan Dumitrescu, Corneliu Tudor, Daniela Stana, Daniel Ovidiu Costea, Laura Carina Tribus, Florin Teodor Bobirca, Mihai Faur, Meda Comandasu, Geta Vancea, Polypharmacy in geriatric patients undergoing surgery- strategies to reduce the risk of iatrogenic events, Farmacia Journal,2023;71(3):463-470.