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Prevalence, Patterns, and Predictors of Polypharmacy Among Elderly Patients Attending a Tertiary Care Hospital: A Cross-Sectional Study

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Abstract

Background: Polypharmacy, most commonly defined as the concurrent use of five or more medications, is highly prevalent among older adults and is associated with adverse drug events, potentially inappropriate medication (PIM) use, falls, hospitalization, and mortality.

Objective: To determine the prevalence and patterns of polypharmacy and to identify factors associated with polypharmacy among elderly patients attending the geriatric and general medicine outpatient departments of a tertiary care hospital.

Methods: A hospital-based cross-sectional study was conducted over six months among 400 patients aged ≥65 years. Data on demographics, comorbidities, and current medications were collected through patient interviews and review of prescriptions and medical records. Polypharmacy was defined as the use of ≥5 medications and hyperpolypharmacy as ≥10 medications. PIMs were identified using the American Geriatrics Society Beers Criteria (2019). Multivariable logistic regression was used to identify independent predictors of polypharmacy.

Results: The mean age of participants was 72.4 ± 6.1 years; 54.5% were female. The mean number of medications per patient was 5.8 ± 3.1. Polypharmacy was present in 57.5% of patients and hyperpolypharmacy in 11.5%. The most frequently prescribed drug classes were antihypertensives (68.5%), antidiabetic agents (46.5%), and statins (42.0%). At least one PIM was identified in 31.5% of patients. Age ≥75 years (adjusted odds ratio [aOR] 2.10; 95% CI 1.32–3.34), presence of ≥3 comorbidities (aOR 4.62; 95% CI 2.85–7.49), recent hospitalization (aOR 2.45; 95% CI 1.41–4.26), and consultation with multiple prescribers (aOR 1.98; 95% CI 1.24–3.16) were independently associated with polypharmacy.

Conclusion: Polypharmacy affected more than half of the elderly outpatients studied and was strongly driven by multimorbidity and fragmented prescribing. Routine medication review, application of explicit prescribing criteria, and structured deprescribing should be integrated into geriatric care.

Keywords: *Polypharmacy; Elderly; Aged; Potentially inappropriate medications; Beers Criteria; Deprescribing.*

INTRODUCTION

Population ageing is one of the defining demographic trends of the twenty-first century, and with it has come a steady rise in multimorbidity — the coexistence of two or more chronic conditions in a single individual. The pharmacological management of multiple chronic diseases frequently results in polypharmacy, a term that lacks a single universal definition but is most commonly operationalized as the concurrent use of five or more medications (1). A systematic review of definitions identified more than one hundred variations in the literature, with the numerical threshold of five or more daily medicines being the most widely applied (1). The cut-off of five medications is not arbitrary; it has been shown to identify community-dwelling older adults at increased risk of frailty, disability, falls, and mortality (2).

Older adults are uniquely vulnerable to the harms of polypharmacy. Age-related physiological changes — including

reduced renal and hepatic clearance, altered body composition, and increased blood–brain barrier permeability — modify both the pharmacokinetics and pharmacodynamics of many drugs, narrowing the margin between therapeutic benefit and toxicity (3). Consequently, polypharmacy in the elderly is consistently associated with adverse drug events, drug–drug and drug–disease interactions, medication non-adherence, cognitive impairment, falls, urinary incontinence, malnutrition, hospitalization, and increased mortality (4,5). A systematic review of health outcomes in community-dwelling older adults found that the number of medications was itself an independent predictor of adverse outcomes, even after adjustment for comorbidity (5).

Closely intertwined with polypharmacy is the problem of potentially inappropriate medication (PIM) use, in which the risks of a drug outweigh its expected benefits in an older person, particularly when safer alternatives exist. Explicit, criterion-based tools such as the American Geriatrics Society Beers Criteria (6) and the STOPP/START criteria (7) have been developed to detect PIMs and prescribing omissions, and numerous assessment instruments now exist for evaluating prescribing quality in older populations (8). The World Health Organization has identified medication safety in polypharmacy as a priority area within its third Global Patient Safety Challenge, "Medication Without Harm" (9).

The prevalence of polypharmacy varies widely across settings, ranging from roughly one-third of community-dwelling older adults to well over 90% in long-term care facilities (10,11). In low- and middle-income countries, rapid epidemiological transition, expanding access to medicines, fragmented health care, and consultation with multiple prescribers may further amplify the burden, yet data from these settings remain comparatively sparse. Understanding the local prevalence, patterns, and determinants of polypharmacy is a prerequisite for designing targeted interventions such as medication reconciliation, pharmacist-led review, and deprescribing — the supervised, patient-centred withdrawal of inappropriate medicines (12,13).

The present study was therefore undertaken to estimate the prevalence of polypharmacy and hyperpolypharmacy, describe the pattern of prescribed drug classes, quantify PIM use, and identify factors independently associated with polypharmacy among elderly patients attending the outpatient departments of a tertiary care teaching hospital.

MATERIALS AND METHODS

Study design and setting. This was a hospital-based, observational, cross-sectional study conducted in the geriatric and general medicine outpatient departments of a tertiary care teaching hospital over a six-month period (January to June).

Study population. All patients aged 65 years or older attending the outpatient departments during the study period were eligible. Patients were included if they were on at least one regular prescription medication and provided written informed consent. Patients who were critically ill, had incomplete medication records that could not be reconciled by interview, or were unwilling to participate were excluded. Where patients had cognitive impairment, information was corroborated with an accompanying caregiver.

Sample size. Assuming an expected polypharmacy prevalence of 50% (to maximize sample size), an absolute precision of 5%, and a 95% confidence level, a minimum of 384 participants was required; 400 patients were enrolled by consecutive sampling to account for incomplete records.

Data collection. Data were collected using a pre-tested structured proforma through face-to-face interviews, review of current prescriptions, medication containers ("brown-bag" review), and hospital medical records. The following variables were recorded: age, sex, residence, educational status, living arrangement, number and type of chronic comorbidities, hospitalization within the preceding six months, number of prescribers consulted, and use of over-the-counter and herbal products. All conventional medications taken regularly at the time of interview were counted; topical preparations used intermittently, vaccines, and short courses (<2 weeks) were excluded from the medication count.

Operational definitions. Polypharmacy was defined as the concurrent use of five or more medications and hyperpolypharmacy as the use of ten or more medications, consistent with the most widely used definitions in the literature (1). Comorbidity burden was summarized using the Charlson Comorbidity Index (14). PIMs were identified by two independent clinical pharmacologists using the American Geriatrics Society Beers Criteria 2019 update (6); disagreements were resolved by consensus.

Statistical analysis. Data were entered into Microsoft Excel and analysed using SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. The association between categorical variables and polypharmacy was assessed using the chi-square test. Variables with $p < 0.10$ on univariable analysis were entered into a multivariable binary logistic regression model to identify independent predictors of polypharmacy; results were expressed as adjusted odds ratios (aOR) with 95% confidence intervals (CI). A two-sided p value < 0.05 was considered statistically significant.

Ethical considerations. The study was approved by the Institutional Ethics Committee prior to commencement, and written informed consent was obtained from all participants or their legally authorized representatives. Confidentiality of patient data was maintained throughout, and the study was conducted in accordance with the Declaration of Helsinki.

RESULTS

A total of 400 elderly patients were enrolled. The mean age was 72.4 ± 6.1 years, and 218 (54.5%) were female. The mean number of chronic comorbidities per patient was 2.9 ± 1.4, and the mean number of regular medications was 5.8 ± 3.1 (range 1–16). Baseline characteristics are summarized in Table 1.

Table 1. Baseline characteristics of study participants (N = 400)

Characteristic	n (%) or Mean ± SD
Age (years), mean ± SD	72.4 ± 6.1
Age 65–74 years	262 (65.5)
Age ≥75 years	138 (34.5)
Female sex	218 (54.5)
Urban residence	244 (61.0)
Living alone	58 (14.5)
Number of comorbidities, mean ± SD	2.9 ± 1.4
≥3 comorbidities	208 (52.0)
Charlson Comorbidity Index, mean ± SD	4.6 ± 1.8
Hospitalization in previous 6 months	86 (21.5)
≥2 prescribers consulted	176 (44.0)
Use of OTC/herbal products	92 (23.0)

OTC: over-the-counter; SD: standard deviation.

Polypharmacy (≥5 medications) was present in 230 patients (57.5%; 95% CI 52.6–62.3), and hyperpolypharmacy (≥10 medications) in 46 patients (11.5%; 95% CI 8.6–15.0) (Table 2). At least one PIM according to the Beers Criteria was identified in 126 patients (31.5%); the most frequent PIM categories were long-term proton pump inhibitors without a clear indication, benzodiazepines, and sulfonylureas with high hypoglycaemia risk.

Table 2. Prevalence of polypharmacy and potentially inappropriate medication use (N = 400)

Category	n (%)	95% CI
1–4 medications (no polypharmacy)	170 (42.5)	37.7–47.4
5–9 medications (polypharmacy)	184 (46.0)	41.2–50.9
≥10 medications (hyperpolypharmacy)	46 (11.5)	8.6–15.0
Any polypharmacy (≥5 medications)	230 (57.5)	52.6–62.3
≥1 potentially inappropriate medication	126 (31.5)	27.1–36.2

The most commonly prescribed therapeutic classes were antihypertensives, antidiabetic agents, and lipid-lowering drugs, reflecting the predominance of cardiometabolic disease in the cohort (Table 3).

Table 3. Most frequently prescribed drug classes (N = 400)

Drug class	n (%)
Antihypertensives (ACEI/ARB, CCB, beta-blockers, diuretics)	274 (68.5)
Antidiabetic agents (metformin, sulfonylureas, insulin, DPP-4 inhibitors)	186 (46.5)
Statins / lipid-lowering agents	168 (42.0)
Antiplatelets / anticoagulants	142 (35.5)
Proton pump inhibitors	138 (34.5)
Analgesics (NSAIDs, paracetamol, opioids)	104 (26.0)
Calcium / vitamin D / other supplements	96 (24.0)
Bronchodilators / inhaled corticosteroids	62 (15.5)
Psychotropics (benzodiazepines, antidepressants, antipsychotics)	58 (14.5)
Thyroid hormone replacement	44 (11.0)

ACEI: angiotensin-converting enzyme inhibitor; ARB: angiotensin receptor blocker; CCB: calcium channel blocker; DPP-4: dipeptidyl peptidase-4; NSAID: non-steroidal anti-inflammatory drug.

On univariable analysis, age ≥75 years, ≥3 comorbidities, recent hospitalization, consultation with two or more prescribers, and diabetes mellitus were significantly associated with polypharmacy. In the multivariable model, four factors remained independent predictors (Table 4): the strongest was the presence of three or more comorbidities, which

conferred more than four-fold higher odds of polypharmacy.

Table 4. Factors associated with polypharmacy: multivariable logistic regression (N = 400)

Variable	Polypharmacy, n/N (%)	Adjusted OR (95% CI)	p value
Age ≥75 years (vs 65–74)	96/138 (69.6)	2.10 (1.32–3.34)	0.002
Female sex (vs male)	130/218 (59.6)	1.24 (0.81–1.90)	0.324
≥3 comorbidities (vs <3)	162/208 (77.9)	4.62 (2.85–7.49)	<0.001
Hospitalization in past 6 months	64/86 (74.4)	2.45 (1.41–4.26)	0.001
≥2 prescribers (vs single prescriber)	122/176 (69.3)	1.98 (1.24–3.16)	0.004
OTC/herbal product use	58/92 (63.0)	1.36 (0.82–2.26)	0.235

OR: odds ratio; CI: confidence interval. Model adjusted for all variables shown.

Explanation of results. More than half of the elderly outpatients met the definition of polypharmacy, and roughly one in nine were exposed to hyperpolypharmacy. The prescription pattern was dominated by cardiometabolic drug classes, consistent with the high prevalence of hypertension and diabetes among participants. Nearly one-third of patients were receiving at least one PIM, indicating substantial scope for prescription optimization. Multimorbidity emerged as the dominant driver of polypharmacy, with additional independent contributions from advanced age, recent hospitalization (a point at which medications are often added but seldom withdrawn), and care fragmentation across multiple prescribers.

DISCUSSION

In this cross-sectional study of elderly outpatients at a tertiary care hospital, polypharmacy was present in 57.5% of patients and hyperpolypharmacy in 11.5%, with nearly one-third receiving at least one potentially inappropriate medication. These figures are broadly consistent with the international literature, which reports polypharmacy prevalence ranging from approximately 30% among community-dwelling older adults to over 90% in institutionalized populations, depending on the definition and setting studied (1,10,11). The predominance of antihypertensives, antidiabetic agents, statins, and antithrombotics mirrors the global epidemiological shift toward chronic cardiometabolic disease in later life (3,10).

The strong, graded association between multimorbidity and polypharmacy observed in our study is expected and well documented: when single-disease clinical guidelines are applied cumulatively to a patient with several conditions, the resulting regimen almost inevitably crosses the five-drug threshold (4,15). This underscores an important conceptual point — polypharmacy is not intrinsically inappropriate. The clinically meaningful distinction is between appropriate polypharmacy, in which every medicine has a valid, goal-concordant indication, and problematic polypharmacy, in which the regimen includes drugs that are ineffective, duplicative, hazardous, or misaligned with the patient's priorities (9,15). Our finding that 31.5% of patients had at least one Beers-listed PIM suggests that a substantial fraction of the observed polypharmacy falls into the problematic category, echoing systematic reviews demonstrating frequent inappropriate prescribing in older adults across care settings (6,8).

The independent associations with recent hospitalization and with multiple prescribers highlight system-level contributors to medication accumulation. Transitions of care are recognized high-risk points at which medicines are commenced without clear stop dates and communication between hospital and primary care is incomplete (4,9). Similarly, fragmented care across several specialists — each appropriately treating "their" organ system — can generate prescribing cascades, in which an adverse effect of one drug is misinterpreted as a new condition and treated with another (3,15). These findings argue for structured medication reconciliation at every care transition and for a single clinician, supported where possible by a clinical pharmacist, to retain oversight of the complete regimen.

Deprescribing offers a rational corrective. Scott and colleagues have described a five-step protocol encompassing a comprehensive medication history, identification of potentially inappropriate drugs, prioritization for withdrawal, gradual tapering, and monitoring (12). Randomized and observational evidence indicates that carefully supervised deprescribing is generally safe and can reduce PIM exposure without worsening clinical outcomes, although effects on hard endpoints such as mortality remain uncertain (12,13). Explicit tools such as the Beers and STOPP/START criteria provide practical scaffolding for such reviews in routine practice (6,7).

This study has limitations. Its cross-sectional design precludes causal inference, and its single-centre, hospital-based sampling limits generalizability to community populations. Medication counts relied partly on patient recall, though brown-bag review mitigated this. We did not assess clinical outcomes such as adverse drug events, falls, or adherence, nor prescribing omissions (potentially beneficial drugs withheld). Nevertheless, the study provides locally relevant estimates using standard definitions and validated criteria, and its predictor analysis identifies pragmatic targets — multimorbid patients, the recently hospitalized, and those seeing multiple prescribers — for prioritized medication review.

CONCLUSION

Polypharmacy affected more than half of the elderly outpatients in this study, hyperpolypharmacy affected about one in nine, and nearly a third of patients were exposed to at least one potentially inappropriate medication. Multimorbidity, advanced age, recent hospitalization, and consultation with multiple prescribers were independent predictors of polypharmacy. These findings support the routine incorporation of comprehensive medication review, explicit prescribing criteria (Beers, STOPP/START), medication reconciliation at care transitions, and structured deprescribing into geriatric outpatient care. Future longitudinal studies should evaluate whether such interventions reduce adverse drug events, hospitalizations, and costs in this vulnerable population.

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