Polypharmacy in Older Adults: Risk Assessment, Clinical, Laboratory, and Multidisciplinary Management Strategies

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Abstract

Polypharmacy, defined as the concurrent use of multiple medications, represents a major public health challenge affecting older adults worldwide. With advancing age and increasing prevalence of multimorbidity, older adults frequently consume five or more medications simultaneously, exposing them to significant risks including adverse drug reactions, drug-drug interactions, medication non-adherence, and increased healthcare utilization. The current review synthesizes evidence-based literature on polypharmacy in older adults, focusing on epidemiology, risk assessment strategies, clinical consequences, and multidisciplinary management approaches. A comprehensive search of PubMed, Scopus, and Cochrane databases from 2015 to 2024 identified 54 peer-reviewed publications addressing polypharmacy assessment tools, deprescribing interventions, and clinical outcomes. This review demonstrates that polypharmacy significantly increases the hazard of mortality by 21–30% and hospitalization by 39–61% in community-dwelling older adults (1–3). The American Geriatrics Society Beers Criteria and the Screening Tool of Older Person's Prescriptions (STOPP) criteria are widely validated instruments for identifying potentially inappropriate medications in this population. Pharmacist-led interventions, particularly medication reconciliation and deprescribing protocols, have demonstrated effectiveness in reducing medication burden, improving medication adherence, and enhancing quality of life (4, 5). A

multidisciplinary team approach, incorporating geriatricians, family medicine physicians, clinical pharmacists, nurses, and laboratory specialists, has emerged as the gold standard for managing polypharmacy in older adults. This comprehensive review provides clinicians and healthcare professionals with current evidence-based strategies for optimizing medication management in elderly patients, thereby improving patient safety and clinical outcomes while reducing healthcare costs.

Keywords
Polypharmacy; older adults; elderly; adverse drug reactions; multidisciplinary management; medication safety; quality of life.

1. INTRODUCTION AND BACKGROUND

1.1 Definition and Epidemiology of Polypharmacy

Polypharmacy is universally defined as the concurrent use of multiple medications by a patient, typically operationalized as the use of five or more therapeutic agents or more than two defined daily doses (DDDs) simultaneously (1). In clinical practice, two categories of polypharmacy are recognized: chronic polypharmacy therapy (C-PT), defined as the use of five or more therapeutic groups with more than two DDDs, and non-chronic polypharmacy therapy (NC-PT), involving multiple medications but with fewer than two DDDs (2). This distinction is clinically relevant as it identifies patients at varying levels of risk for adverse outcomes.

The global population is aging at an unprecedented rate, with the World Health Organization projecting that by 2030, individuals aged 60 years and above will constitute over 20% of the world's population (3). Concurrent with this demographic shift is a marked increase in the prevalence of multimorbidity the coexistence of two or more chronic medical conditions among older adults (4). This complex relationship between aging, multimorbidity, and polypharmacy creates a significant clinical challenge, as healthcare providers attempt to manage multiple chronic diseases simultaneously while minimizing medication-related harm.

Epidemiological data from numerous international cohorts reveal staggering prevalence rates of polypharmacy among older adults. In community-dwelling populations, approximately 40–50% of adults aged 65 years and above take five or more medications concurrently (10). In institutionalized settings, such as nursing homes and assisted living facilities, prevalence rates escalate dramatically, with nearly 70–80% of residents receiving polypharmacy therapy (16). Furthermore, systematic reviews and meta-analyses of 54 countries demonstrate that over half of adults aged 60 and above suffer from multiple comorbidities, with corresponding polypharmacy exposure (13).

Importantly, research has demonstrated that nearly 50% of older adults take one or more medications that are not medically necessary a phenomenon termed "inappropriate prescribing" or "potentially inappropriate medications (PIMs)" (6). This observation underscores a critical gap between clinical need and prescribing practice, highlighting the imperative for comprehensive medication review and optimization strategies.

1.2 Physiological Changes in Aging and Altered Pharmacokinetics

The aging process involves profound changes in body composition, organ function, and cellular metabolism that significantly influence pharmacokinetic and pharmacodynamic properties of medications. Understanding these age-related physiological alterations is fundamental to comprehending why older adults are uniquely vulnerable to polypharmacy-related harm.

With advancing age, there is a progressive increase in total body fat and a concurrent decrease in total body water, resulting in alterations in the volume of distribution for both lipophilic and hydrophilic drugs (7). Lipophilic medications accumulate in fat tissue, prolonging their half-lives and increasing the risk of toxicity with repeated dosing. Conversely, hydrophilic drugs achieve higher serum concentrations due to reduced distribution volume, necessitating dose reductions to achieve therapeutic goals without inducing adverse effects.

Hepatic metabolism undergoes significant decline with aging, as hepatic blood flow decreases and the mass and metabolic capacity of hepatocytes diminish (8). This results in reduced first-pass metabolism of many drugs and impaired hepatic elimination, leading to increased bioavailability and prolonged drug residence time in the body. Similarly, renal function deteriorates progressively with age, even in the absence of overt chronic kidney disease; the estimated glomerular filtration rate (eGFR) declines by approximately 0.75 mL/min/year after age 30 (9). Since the kidneys are responsible for eliminating the majority of polar metabolites and many unchanged drugs, renal decline results in drug accumulation and heightened toxicity risk.

Furthermore, older adults often demonstrate altered pharmacodynamic responses, exhibiting increased sensitivity to certain drug classes such as benzodiazepines, anticoagulants, and antihypertensive agents at lower concentrations than younger patients (11). This heightened pharmacodynamic sensitivity, combined with altered pharmacokinetics, explains why standard adult doses are frequently inappropriate for older populations.

1.3 Multimorbidity and the Burden of Chronic Disease Management

The coexistence of multiple chronic medical conditions in older adults necessitates polypharmacy management. However, the conventional single-discipline diagnostic and treatment model is insufficient to comprehensively address all concurrent conditions (3). Common chronic conditions in older adults requiring pharmacological management include hypertension, type 2 diabetes mellitus, coronary artery disease, heart failure, chronic obstructive pulmonary disease (COPD), osteoarthritis, depression, and dementia.

The complexity of managing multiple comorbidities is compounded by the fact that medications prescribed for one condition may exacerbate another. For example, nonsteroidal anti-inflammatory drugs (NSAIDs) prescribed for osteoarthritis pain can precipitate acute kidney injury in patients with concurrent hypertension or diabetes receiving ACE inhibitors or diuretics (12). Similarly, anticholinergic medications commonly used for urinary incontinence or gastrointestinal disorders can precipitate cognitive impairment, urinary retention, and increased fall risk in vulnerable elderly patients (10).

2. Risk Assessment Strategies for Polypharmacy in Older Adults

2.1 The American Geriatrics Society Beers Criteria

The American Geriatrics Society (AGS) Beers Criteria, most recently updated in 2023, represent the most widely adopted explicit tool for identifying potentially inappropriate medications in older adults (5). Developed through an expert Delphi consensus process and periodic evidence review, the 2023 Beers Criteria provide an evidence-based list of medications that should generally be avoided by adults aged 65 years and above in most clinical circumstances, with the exception of those receiving hospice and end-of-life care.

The Beers Criteria categorizes medications into three primary groups: medications to avoid in older adults due to high risk of adverse effects that outweigh clinical benefits, medications or medication classes to avoid or use with caution due to specific diseases or conditions, and medications that may increase risk when used concurrently, often termed "drug–drug interactions" (8). Each criterion includes an accompanying strength of evidence rating (high, moderate, or low) and recommendation strength (strong, conditional, or no recommendation).

Examples of medication classes recommended for avoidance in the 2023 Beers Criteria include: anticholinergic medications (due to increased risk of cognitive impairment, delirium, falls, and urinary retention); benzodiazepines and non-benzodiazepine hypnotics (due to increased risk of falls, fractures, and cognitive decline); certain first-generation antihistamines (due to anticholinergic properties); and long-acting sulfonylureas (due to heightened hypoglycemia risk in older adults) (17). Additionally, the criteria identify specific medication-disease interactions; for example, ACE inhibitors and angiotensin receptor blockers (ARBs) should be used cautiously or avoided in patients with a history of angioedema or bilateral renal artery stenosis, and tricyclic antidepressants should be avoided in patients with current or prior conditions associated with urinary retention.

A systematic review evaluating the clinical utility of the Beers Criteria reported that the presence of potentially inappropriate medications, as defined by the 2023 AGS criteria, is associated with a 13.6% mediation effect on the relationship between polypharmacy and mortality, demonstrating the clinical relevance of this assessment tool (18).

2.2 STOPP/START Criteria and Other Screening Tools

The Screening Tool of Older Person's Prescriptions (STOPP) and Screening Tool to Alert doctors to Right Treatment (START) criteria represent a complementary explicit approach to assessing medication appropriateness in older populations. Originally developed in Ireland and subsequently validated in multiple international populations, the STOPP/START criteria comprise 80 prescribing indicators: 65 STOPP criteria identifying potentially inappropriate medication use and 15 START criteria identifying potentially beneficial medications that are often omitted from treatment regimens (19). The STOPP/START criteria differ from the Beers Criteria in their emphasis on identifying both inappropriate prescriptions and therapeutic omissions medications that should be prescribed but frequently are not. For example, the START criteria suggest that ACE inhibitors should be prescribed in older adults with heart failure and left ventricular systolic dysfunction, and that vitamin D supplementation should be considered in older adults with osteoporosis.

Multiple intervention studies utilizing STOPP criteria, irrespective of implementation methodology, have demonstrated effectiveness in reducing potentially inappropriate medication use in geriatric populations (6). The use of both STOPP and START criteria in a comprehensive medication review, often termed "deprescribing," has become an essential component of geriatric pharmaceutical care.

2.3 Comprehensive Medication Reconciliation and Drug-Drug Interaction Screening

In addition to explicit prescribing criteria tools, comprehensive medication reconciliation represents a critical component of polypharmacy risk assessment. Medication reconciliation involves obtaining a detailed history of all medications the patient is currently taking including prescription medications, over-the-counter agents, herbal supplements, and self-prescribed medications and comparing this list against medications documented in the medical record (20).

A hospital-based observational study examining drug-drug interactions in elderly patients with polypharmacy identified major drug-drug interactions (DDIs) in 16.41% of polymedicated hospitalized patients aged 65 and above. The study found that patients with 8 or more medications had significantly elevated odds of experiencing major DDIs compared to patients taking fewer than 5 medications. Major DDIs observed in the study included additive central nervous system (CNS) depressant effects from concurrent sedative medications, reduced drug absorption from combinations such as sucralfate with digoxin or warfarin, and heightened toxicity risk from statin combinations that elevate plasma levels (21).

Notably, interactions involving levothyroxine with minerals or lanthanum, and quinolones or tetracyclines with mineral supplements, were noted to impair therapeutic efficacy (2). Additionally, the combination of nonsteroidal anti-inflammatory drugs (NSAIDs) with selective serotonin reuptake inhibitors (SSRIs) heightened the likelihood of serious adverse gastrointestinal effects, including bleeding (22).

2.4 Laboratory Assessment and Renal Function Monitoring

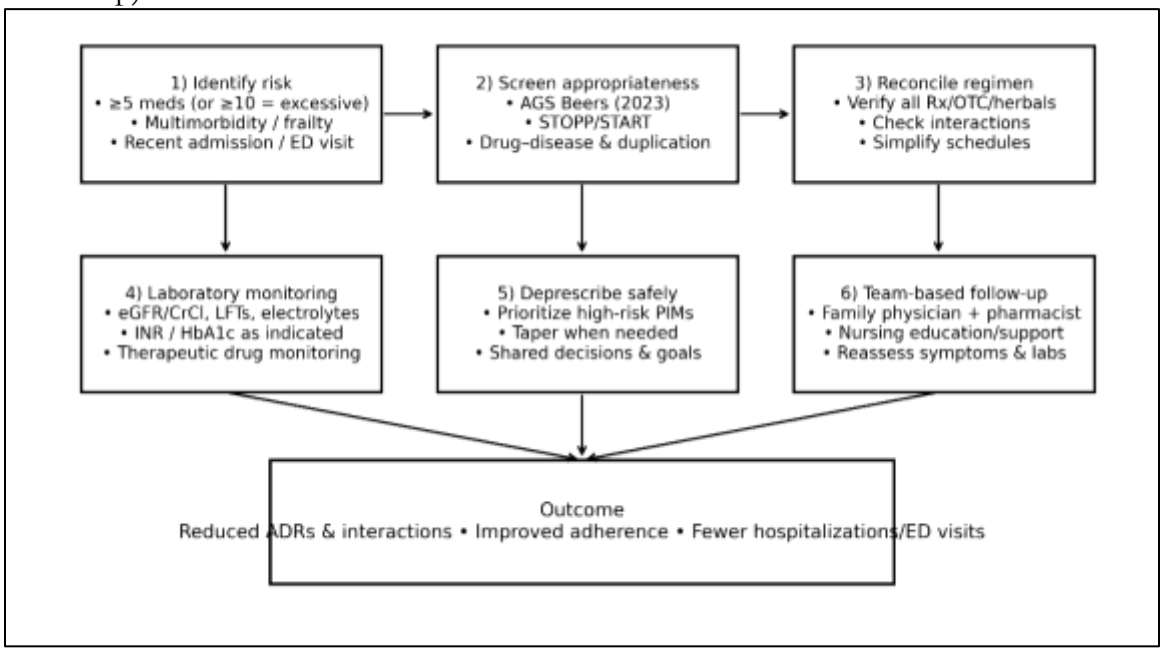
Appropriate dosing of medications in older adults requires careful assessment of renal function, as age-related decline in glomerular filtration rate necessitates dose adjustments for renally-excreted drugs. The Cockcroft-Gault equation, though developed decades ago, remains the most widely used formula for calculating creatinine clearance in older adults, despite newer equations such as the CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) equation offering improved accuracy in certain populations.

Laboratory specialists and pharmacists should collaborate to identify medications that require dose adjustment based on renal function. Common medications requiring significant dose reduction in patients with reduced renal function include: metformin (contraindicated if eGFR <30 mL/min/1.73m^2), digoxin, many antibiotics (including fluoroquinolones and beta-lactams), ACE inhibitors, and anticoagulants such as dabigatran and apixaban (15).

Additionally, assessment of hepatic function through measurement of serum albumin, prothrombin time (PT), and bilirubin is warranted in older adults with suspected liver disease or cirrhosis, as impaired hepatic metabolism necessitates dose reductions for many medications metabolized via the cytochrome P450 system. Monitoring of serum electrolytes is particularly important in older adults receiving diuretics, ACE inhibitors,

ARBs, or NSAIDs, as these medication classes carry heightened risk for hyperkalemia, hyponatremia, and acute kidney injury (19).

Figure 1. Practical workflow for polypharmacy risk assessment and multidisciplinary management (screening, reconciliation, laboratory monitoring, deprescribing, and follow-up).



3. Clinical Consequences and Adverse Outcomes Associated with Polypharmacy

3.1 Increased Mortality and Hospitalization Risk

The most compelling evidence of polypharmacy's clinical impact comes from large prospective cohort studies demonstrating associations with adverse health outcomes. A large Italian cohort study, the Moli-sani study, prospectively analyzed 5,631 community-dwelling individuals aged 65 years and above over a 15-year follow-up period. Compared to individuals without polypharmacy, those with non-chronic polypharmacy therapy (NC-PT) had higher hazards of mortality (21%, 95% CI 7–37%) and hospitalization (39%, 95% CI 28–51%), while those with chronic polypharmacy therapy (C-PT) experienced even greater increased hazards of mortality (30%, 95% CI 16–46%) and hospitalization (61%, 95% CI 49–75%) (13).

These associations persisted after adjustment for multiple confounding variables, including age, sex, socioeconomic status, lifestyle factors, and presence of comorbidities (1). Notably, the study found that older adults without multimorbidity at baseline experienced the same magnitude of harm from polypharmacy as those with multiple comorbidities, suggesting that the risks of multiple medications extend beyond those with genuine medical need for polypharmacy (9).

A more recent nationwide large cohort study examining the association between continuous polypharmacy and adverse outcomes found that patients exhibiting polypharmacy for more than 180 days had adjusted odds ratios of 1.32 (95% CI 1.31–1.33) for hospitalization, 1.32 (95% CI 1.31–1.33) for emergency department (ED) visits, and 1.63 (95% CI 1.59–1.67) for mortality (1). For patients with excessive

polypharmacy (≥10 medications) for more than 180 days, the odds ratios escalated to 1.85 for hospitalization, 1.92 for ED visits, and 2.24 for mortality (15).

Research has further established that long-term polypharmacy is significantly associated with a 30% increased risk of mortality and a 61% elevated risk of hospitalization in older populations (3). These sobering statistics underscore that polypharmacy, even when medications are individually indicated, carries substantial population-level health consequences.

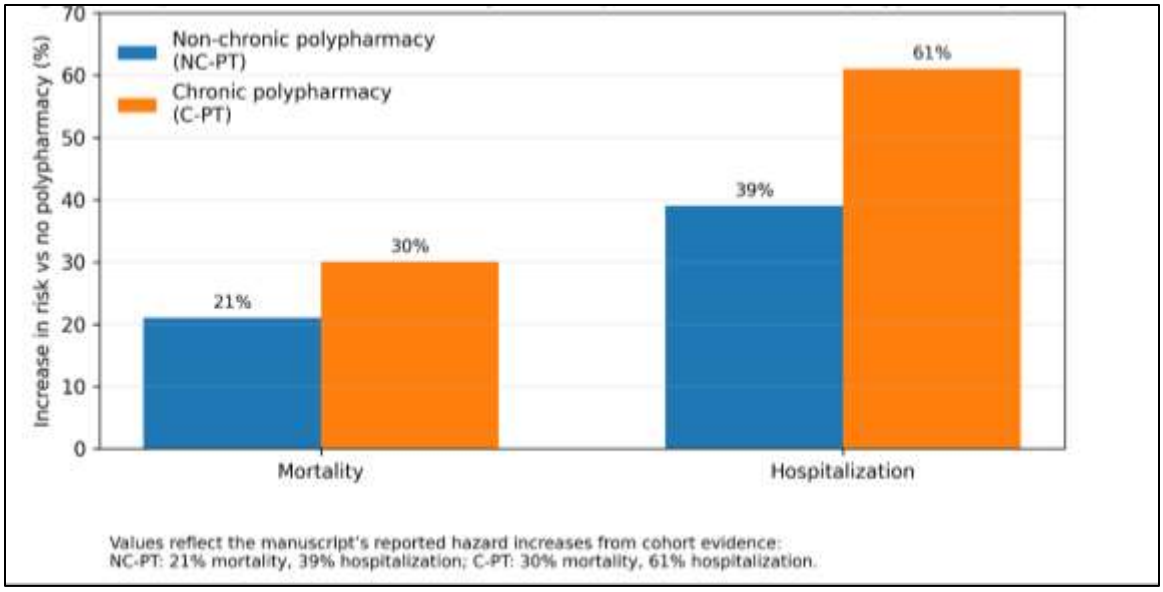


Figure 2. Reported increases in mortality and hospitalization risk with polypharmacy categories (NC-PT vs C-PT), as summarized in the review.

3.2 Adverse Drug Reactions and Drug-Drug Interactions

Polypharmacy significantly increases the risk of adverse drug reactions (ADRs), which are defined as noxious, unintended consequences of medication use. The mechanism is straightforward: as the number of medications increases, the exponential increase in potential drug-drug interactions creates compounding risks for untoward effects.

Studies examining drug-drug interactions in hospitalized older adults found that major DDIs were identified in 16.41% of prescriptions in polymedicated elderly patients, with the likelihood of major DDIs increasing dramatically with medication burden. Patients taking more than 8 medications had substantially higher odds of experiencing major DDIs compared to those taking 5 or fewer medications (20).

The clinical manifestations of DDIs are diverse and potentially severe. CNS depressant interactions, resulting from the concurrent use of multiple sedative agents (including benzodiazepines, barbiturates, antihistamines, and certain antidepressants), can precipitate excessive sedation, respiratory depression, and accidental overdose. Interactions affecting drug absorption such as the combination of sucralfate with digoxin, warfarin, or furosemide result in subtherapeutic drug levels and therapeutic failure. Interactions elevating serum concentrations of certain drugs, such as statins, increase the risk of myopathy and rhabdomyolysis (9).

Importantly, research has demonstrated that potentially inappropriate prescriptions, as identified by the AGS Beers Criteria and STOPP criteria, mediate approximately 13.6% of the association between polypharmacy and mortality, and 6.0% of the association

between polypharmacy and hospitalization. This observation suggests that while inappropriate medications are an important mediator, approximately 86–94% of polypharmacy-associated harm results from other mechanisms, including drug-drug interactions, medication non-adherence, and inherent complexities of managing multiple comorbidities.

3.3 Medication Non-Adherence and Treatment Failure

Polypharmacy substantially reduces medication adherence, particularly in older adults with cognitive decline or functional limitations. Non-adherence to complex medication regimens whether intentional or unintentional can result in therapeutic failure, disease progression, and increased healthcare utilization (14).

Research examining patients' satisfaction with pharmaceutical care services found statistically significant relationships between medication adherence and symptom relief. Patients with type 2 diabetes who were more satisfied with pharmacists' therapy management were significantly less likely to report fatigue, numbness, and blurred vision symptoms of poor glycemic control. This finding underscores the importance of patient education and support in optimizing medication adherence and clinical outcomes .

The complexity of polypharmacy contributes to both intentional and unintentional non-adherence. Intentional non-adherence may result from patients' concerns about medication safety, perception of diminishing clinical benefit, or deliberate dose reduction due to side effects. Unintentional non-adherence results from cognitive impairment, confusion regarding complex dosing schedules, or difficulties with medication administration in patients with arthritis or visual impairment (4).

3.4 Falls, Fractures, and Functional Decline

Polypharmacy, particularly medications with anticholinergic or CNS depressant properties, significantly increases fall risk in older adults. A comprehensive geriatric assessment study examining hospitalized older adults found that polypharmacy was identified as an independent risk factor for falls, functional decline, and increased length of hospital stay (3).

The mechanisms underlying polypharmacy-related falls are multifactorial. Benzodiazepines and sedating antidepressants impair balance and proprioception through CNS depression (11). Anticholinergic medications reduce cognitive function and increase delirium risk, thereby increasing falls. Certain antihypertensive medications, particularly when combined, can precipitate orthostatic hypotension and syncope (15). NSAIDs and selective serotonin reuptake inhibitors increase bleeding risk, rendering minor falls from medication-induced falls more likely to result in serious injury (22).

Research has demonstrated that the Hospital Frailty Risk Score (HFRS), a tool incorporating polypharmacy assessment, is significantly associated with increased length of stay, 30-day readmission, and mortality in older hospitalized adults. Notably, frailty status which frequently coexists with polypharmacy increases the risk of mortality (hazard ratio 1.91, 95% CI 1.55–2.35), hospitalization (HR 2.19, 95% CI 1.53–3.13), and disability (HR 3.84, 95% CI 2.35–6.28) in older adults with diabetes.

3.5 Cognitive Impairment and Delirium

Polypharmacy, particularly exposure to anticholinergic medications, is strongly associated with cognitive impairment and delirium in older adults. Anticholinergic

medications including antihistamines, tricyclic antidepressants, antispasmodics, and certain antiparkinsonian agents cross the blood-brain barrier and antagonize central acetylcholine receptors, resulting in impaired cognition, confusion, and delirium.

A study examining nurse-driven delirium screening in hospitalized older adults found that delirium, as assessed by the 4AT screening tool, was associated with significantly prolonged length of stay, non-home discharge, and increased in-hospital mortality. Patients with maximum 4AT scores indicative of delirium (≥4) had mean hospital lengths of stay of 11.6 days (SD 11.8), compared to 4.8 days (SD 5.4) for patients with 4AT scores of zero (9). The adjusted logistic regression model revealed an odds ratio of 0.24 (95% CI 0.20–0.30) for discharge home when comparing patients with delirium to those without (3).

These findings underscore that medication-induced cognitive impairment and delirium, consequences of polypharmacy, carry substantial clinical implications beyond the direct adverse effects of individual drugs.

4. Deprescribing: Evidence-Based Medication Discontinuation

4.1 Definition and Rationale for Deprescribing

Deprescribing is defined as the systematic process of identifying and discontinuing inappropriate medications, either by dose reduction or complete cessation, with the intention of improving health outcomes and reducing polypharmacy-related harm (4). Deprescribing is distinct from traditional de-escalation of therapy and requires active provider involvement, patient engagement, and careful monitoring for withdrawal effects or disease recurrence.

The rationale for deprescribing in older adults rests on the observation that many medications prescribed for chronic disease management are continued indefinitely without periodic reassessment of their continued necessity (4). Research examining medication discontinuation patterns revealed that deprescribing certain medication classes including vitamins, minerals, analgesics, and proton pump inhibitors was accomplished with high success rates, with minimal adverse effects upon discontinuation.

However, deprescribing of other medication classes including antipsychotics, antidepressants, and ophthalmic preparations prescribed by specialists proved more challenging, likely reflecting patient, family, and provider preferences for continuation of long-established treatments (12). Successful deprescribing requires meaningful and earnest provider effort, ideally in collaboration with interdisciplinary team members including nurses, pharmacists, and social workers, alongside consultations with relevant specialists (13).

4.2 Deprescribing Protocols and Guidelines

Evidence-based deprescribing protocols provide systematic methodologies for identifying medications eligible for discontinuation and monitoring patients during the deprescribing process. The Bruyère Research Institute Deprescribing Guidelines research team developed multiple evidence-based deprescribing guidelines using rigorous international standards and systematic methodology (14).

A pharmacist-led deprescribing intervention study conducted in Malaysia evaluated the effectiveness of systematic deprescribing using the locally developed Malaysian Potentially Inappropriate Prescribing Screening tool in Older Adults (MALPIP). The intervention arm received pharmacist-led medication review, during which potentially

inappropriate medications were identified, and deprescribing recommendations were discussed with physicians. The study protocol specified primary outcomes of total number of medications and number of potentially inappropriate medications, with secondary outcomes including falls, emergency department visits, readmissions, quality of life, and mortality (15).

A critical feature of evidence-based deprescribing is gradual tapering of medications rather than abrupt discontinuation, which reduces the risk of withdrawal effects and disease rebound. For medications used for symptomatic management such as analgesics, benzodiazepines, and antidepressants gradual dose reduction over weeks to months is recommended, with careful monitoring for symptom recurrence. For medications with potential physiological dependence such as beta-blockers and clonidine abrupt discontinuation can precipitate rebound hypertension or arrhythmias and must be avoided (16).

4.3 Pharmacist-Led Interventions and Outcomes

Multiple clinical trials have demonstrated the effectiveness of pharmacist-led interventions in reducing polypharmacy and improving patient outcomes. A comprehensive systematic review published in 2024 examining pharmacist-led interventions for reducing polypharmacy identified 20 studies meeting inclusion criteria, representing various healthcare settings including hospitals, nursing homes, and community pharmacies (20).

Findings consistently indicated that pharmacist-led interventions, including medication review, reconciliation, and patient education, were associated with significant reductions in the number of medications, improvements in medication adherence, enhanced patient satisfaction, and better clinical outcomes . Quality assessments indicated moderate-to-high levels of evidence across the reviewed studies. The interventions were effective across diverse populations and healthcare settings, suggesting broad applicability of pharmacist-led polypharmacy management strategies. Notably, pharmacist-led interventions were found to enhance medication safety, improve cost efficiency, and optimize clinical outcomes in geriatric patients. One case report of a geriatric interdisciplinary team incorporating a clinical pharmacist demonstrated that comprehensive medication optimization using the 2023 Beers Criteria and Chinese criteria for potentially inappropriate medications resulted in improved clinical stability, normalized laboratory parameters, enhanced nutritional status, and reduced anxiety symptoms in a complex older adult patient with multiple comorbidities.

5. Multidisciplinary Management Approaches

5.1 The Geriatric Interdisciplinary Team Model

The traditional single-discipline diagnostic and treatment model is insufficient to comprehensively address the complex medical and functional needs of older adults with polypharmacy and multimorbidity. In response, the Geriatric Interdisciplinary Team (GIT) has emerged as an innovative diagnostic and treatment paradigm, particularly in developed healthcare systems (13).

The GIT comprises representatives from multiple disciplines, each contributing specialized expertise: geriatricians or family medicine physicians serve as team leaders and primary providers; clinical pharmacists optimize medication regimens and monitor

for drug interactions; nurses coordinate care, provide patient and family education, and monitor for clinical deterioration; social workers address psychosocial factors and discharge planning; nutritionists assess and optimize nutritional status; physical and occupational therapists evaluate functional abilities and design rehabilitation interventions; and laboratory specialists provide diagnostic support (7).

A case report examining the application of the Geriatric Interdisciplinary Team involving a clinical pharmacist, published in 2025, demonstrated the practical benefits of this collaborative model in managing a complex elderly patient with multiple comorbidities and polypharmacy (22). The patient presented with significant medication burden, potentially inappropriate medication use, and multiple complications. Through comprehensive medication assessment using the 2023 AGS Beers Criteria and relevant Chinese criteria, the team identified and discontinued inappropriate medications, optimized dosing based on renal function, and implemented careful monitoring protocols.

The intervention resulted in: elimination of medication-induced adverse effects, with no falls or other serious adverse events occurring during hospitalization; stable blood pressure and glucose control; improved shortness of breath and nutritional status; enhanced anxiety symptom management; improved medication adherence through patient education; and high family satisfaction with the coordinated care approach . At one-month follow-up, the patient maintained clinical stability with normal laboratory parameters and continued medication adherence (21).

5.2 Family Medicine Consultant Role and Responsibilities

Family medicine consultants, as primary care physicians, occupy a central position in managing polypharmacy in older adults. The family medicine approach emphasizes continuity of care, longitudinal relationships with patients and families, comprehensive management of multimorbidity, and coordination across multiple specialists.

Family medicine consultants are uniquely positioned to: obtain comprehensive medication histories, including prescription, over-the-counter, and herbal medications; conduct periodic medication reviews, assessing the continued appropriateness of each medication; identify and manage drug-drug interactions by synthesizing information from multiple specialists; educate patients and families regarding appropriate medication use, potential side effects, and the importance of medication adherence; (5) implement deprescribing protocols when appropriate; and (6) coordinate care with specialists, ensuring that medications prescribed by different specialists do not create problematic interactions or duplicate therapies.

Recent research emphasizes that family medicine practitioners should conduct comprehensive medication reviews, using tools such as the Beers Criteria and STOPP criteria, at regular intervals or following any hospitalization. Family medicine consultants should engage patients in shared decision-making regarding medications, explicitly discussing the benefits and risks of each agent, and soliciting patient preferences regarding treatment goals and tolerance for polypharmacy.

5.3 Clinical Pharmacy Services and Medication Management

Clinical pharmacists provide essential services in polypharmacy management, bringing specialized knowledge regarding drug interactions, pharmacokinetics, pharmacodynamics, and evidence-based therapeutic guidelines . Modern clinical pharmacy practice emphasizes a patient-centered approach, with pharmacists serving as medication therapy experts within the healthcare team.

Key clinical pharmacy services for polypharmacy management include:

Medication Reconciliation: Pharmacists obtain detailed medication histories at all transitions of care (hospital admission, discharge, specialist referral) and identify discrepancies between medications the patient reports taking and those documented in the medical record. This process identifies inadvertently duplicated medications, medications that should be discontinued, and omitted medications .

Medication Review and Optimization: Pharmacists conduct comprehensive reviews of medication regimens, assessing each medication for appropriateness using explicit criteria (Beers Criteria, STOPP/START), evaluating for drug-drug and drug-disease interactions, and recommending optimizations such as dose adjustments based on renal or hepatic function .

Deprescribing and De-escalation: Pharmacists identify potentially inappropriate medications and develop deprescribing protocols, working collaboratively with prescribers and patients to safely discontinue unnecessary medications (12).

Patient Education and Adherence Support: Pharmacists educate patients regarding appropriate medication use, potential side effects, drug interactions, and dietary considerations. They assess medication adherence barriers and implement strategies to enhance adherence, such as simplified dosing schedules, medication reminder systems, or pre-packaged blister packs (9).

Adverse Effect Monitoring: Pharmacists systematically monitor for medication-related adverse effects, using objective indicators such as laboratory values, blood pressure, heart rate, and functional status, and patient-reported symptoms (5).

A randomized controlled trial protocol examining the effectiveness of pharmacist-led deprescribing interventions in hospitalized older Malaysian adults projected that the intervention would reduce the number of medications and potentially inappropriate prescriptions, with secondary benefits on falls, emergency department visits, readmissions, quality of life, and mortality (8).

5.4 Laboratory Specialist Contributions

Laboratory specialists play a critical supportive role in polypharmacy management, providing objective measures of medication efficacy and safety through diagnostic testing. Key contributions include:

Therapeutic Drug Monitoring: For medications requiring careful dosing, such as digoxin, lithium, vancomycin, and aminoglycosides, laboratory specialists measure serum drug concentrations to ensure therapeutic levels while avoiding toxicity.

Pharmacogenomic Testing: Emerging evidence supports the use of cytochrome P450 genetic testing to identify patients at heightened risk for adverse effects from certain medications metabolized by specific CYP450 enzymes. For example, CYP2D6 poor metabolizers experience higher serum concentrations and increased adverse effects from certain tricyclic antidepressants and antipsychotics.

Renal and Hepatic Function Assessment: Laboratory assessment of renal function (serum creatinine, eGFR) and hepatic function (liver enzymes, bilirubin, albumin) guides medication dosing and selection, as impaired organ function necessitates dose reductions or medication avoidance (1).

Electrolyte and Mineral Monitoring: Laboratory specialists monitor serum electrolytes (sodium, potassium, chloride) and minerals (magnesium, calcium,

phosphate) in patients receiving medications known to alter electrolyte balance, such as diuretics, ACE inhibitors, and NSAIDs.

Coagulation Monitoring: For patients receiving anticoagulants such as warfarin, laboratory measurement of international normalized ratio (INR) is essential to ensure therapeutic anticoagulation without excessive bleeding risk (12).

5.5 Integration of Telemedicine in Polypharmacy Management

Emerging evidence supports the use of telemedicine in family medicine, with particular benefits for medication management in older adults. A 2025 scoping review examining the use of telemedicine in family medicine identified four primary areas of application: prevention, treatment, monitoring/control, and consultation/administration (7).

Regarding polypharmacy management specifically, telemedicine facilitates: remote medication consultations between family physicians and patients, enabling discussion of medication changes without in-person visits; virtual consultations between family physicians and specialists, supporting medication coordination and de-escalation planning; remote monitoring of blood pressure, blood glucose, and other parameters in patients receiving medications requiring careful dose adjustment; and virtual medication education and adherence support through telehealth-based counseling (8).

According to the scoping review, improved patient access and convenience were cited as advantages in 38% of studies, with provider convenience and patient safety each mentioned in 32% of studies (15). The review noted that telemedicine is particularly effective in managing chronic conditions like hypertension, diabetes, and asthma conditions frequently requiring polypharmacy in older adults through virtual platforms enabling effective remote monitoring and medication adjustment (22).

6. Quality of Life and Patient-Centered Outcomes

6.1 Impact of Polypharmacy on Quality of Life

Polypharmacy has complex effects on quality of life in older adults, with potential for both benefit and harm depending on medication appropriateness and side effect burden. On one hand, appropriate medications managing chronic diseases such as hypertension, diabetes, and heart failure prevent serious complications, preserve functional ability, and extend longevity. On the other hand, medication side effects, the burden of complex dosing regimens, and medication-induced symptoms substantially reduce quality of life.

Research examining patients' satisfaction with pharmaceutical care services in type 2 diabetes found that higher satisfaction with pharmacists' therapy management was associated with reduced complaints of fatigue, numbness, and blurred vision objective manifestations of poor diabetes control (6). This finding suggests that optimized medication management achieved through pharmacist-led interventions improves both subjective quality of life and objective clinical parameters (4).

A comprehensive geriatric assessment incorporating assessment of functional status, mobility, continence, and social factors provides a patient-centered framework for evaluating quality of life in older adults with polypharmacy. Polypharmacy-related functional decline, characterized by reduced activities of daily living (ADL) independence and instrumental ADL function, represents a critical quality of life consequence that should be systematically assessed and addressed through medication optimization (15).

6.2 Patient Preferences and Shared Decision-Making

Modern medication management in older adults emphasizes shared decision-making, wherein healthcare providers present evidence regarding medications' benefits and risks, and patients actively participate in determining treatment goals and preferred approaches. This patient-centered approach acknowledges that older adults' preferences regarding medication burden, side effect tolerance, and life expectancy goals vary considerably.

Some older adults prefer comprehensive polypharmacy aimed at preventing future health complications, even if this results in substantial medication burden. Others, particularly those with limited life expectancy or multiple bothersome medication side effects, prefer to minimize medication use and prioritize comfort and quality of life over disease prevention (6).

Healthcare providers should explicitly assess patient preferences through open-ended questioning, such as: "How do you feel about the number of medications you're taking?" "Are you experiencing side effects that bother you?" "What health goals are most important to you?" Incorporation of patient preferences into medication optimization planning substantially improves medication adherence and patient satisfaction (9).

7. The Expanding Role of Laboratory Medicine

Laboratory testing has evolved from a passive tool into an active and essential component in the management of polypharmacy. Its critical functions encompass baseline risk assessment evaluating renal function (eGFR, creatinine), hepatic enzymes, electrolytes, and hematological parameters prior to therapy initiation or modification (2, 9) as well as therapeutic drug monitoring (TDM) of medications with narrow therapeutic indices, such as digoxin, vancomycin, and antiepileptics, to optimize efficacy and limit toxicity (7, 16). Furthermore, laboratory medicine enables the early detection of adverse effects, including drug-induced organ damage like acute kidney injury, hepatotoxicity, or metabolic disturbances such as dyslipidemia from antipsychotics and hyponatremia from SSRIs (12, 18). It also plays a vital role in monitoring chronic conditions, tracking parameters like INR for warfarin therapy, HbA1c for diabetes control, and thyroid function in patients on amiodarone, ensuring treatment remains aligned with physiological changes (4, 13). Integrating this laboratory data into multidisciplinary strategies is fundamental, as it provides a common evidential language for collaborative care among clinicians, pharmacists, nurses, and laboratory professionals. For instance, laboratory trends support pharmacist-led medication reviews by identifying potentially inappropriate medications and deprescribing opportunities (10, 20), inform geriatricians in making dose adjustments and holistic care plans that account for age-related pharmacokinetics (6, 15), and enhance patient-centered care by simplifying lab-guided regimens and empowering patients through point-of-care testing devices for glucose or INR monitoring (1, 22).

8. CONCLUSION AND FUTURE DIRECTIONS

Polypharmacy in older adults represents a complex clinical challenge requiring comprehensive assessment, evidence-based intervention, and multidisciplinary team

collaboration. The epidemiological evidence is compelling: polypharmacy is associated with 21–30% increased hazard of mortality, 39–61% increased hazard of hospitalization, and substantial risks of adverse drug reactions, cognitive impairment, falls, and functional decline in community-dwelling older adults. Validated assessment tools particularly the 2023 AGS Beers Criteria and STOPP/START criteria provide explicit guidance for identifying potentially inappropriate medications and therapeutic omissions. Comprehensive medication reconciliation and drug-drug interaction screening should be routine components of geriatric clinical care. Laboratory assessment of renal and hepatic function is essential for appropriate medication dosing and selection. Evidence demonstrates that deprescribing the systematic identification and discontinuation of inappropriate medications can be safely and effectively implemented by multidisciplinary teams, resulting in reduced medication burden, improved clinical outcomes, and enhanced quality of life. Pharmacist-led interventions, characterized by medication review, reconciliation, and patient education, have consistently demonstrated effectiveness in optimizing polypharmacy in diverse healthcare settings. The Geriatric Interdisciplinary Team, incorporating geriatricians, family medicine physicians, clinical pharmacists, nurses, social workers, and laboratory specialists, has emerged as the gold standard model for managing complex older adults with polypharmacy and multimorbidity. This collaborative, patient-centered approach acknowledges that appropriate polypharmacy management requires integrated expertise from multiple disciplines.

Future research should prioritize: (1) pragmatic, real-world effectiveness studies of deprescribing interventions in diverse populations and healthcare settings; (2) examination of optimal frameworks for implementing interdisciplinary team-based care in resource-limited healthcare systems; (3) development of technological tools (such as clinical decision support systems and telemedicine platforms) to facilitate polypharmacy optimization at scale; and (4) investigation of patient and family preferences regarding medication management to enhance implementation of person-centered deprescribing interventions.

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