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Systematic Review

Management of Polypharmacy in the Elderly – Evidence-Based Strategies: Systematic Review

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Abstract:

Polypharmacy, defined as the simultaneous use of multiple medications, is increasingly prevalent among elderly populations due to rising life expectancies and the growing burden of chronic illnesses. While necessary in managing complex conditions, polypharmacy presents significant risks, including adverse drug reactions (ADRs), medication non-adherence, and increased healthcare utilization. This systematic review evaluates evidence-based strategies for managing polypharmacy, focusing on comprehensive medication reviews, deprescribing practices, interdisciplinary care models, and digital health tools. Comprehensive medication reviews guided by frameworks such as the Beers Criteria and STOPP/START guidelines have significantly reduced ADRs and enhanced adherence. Additionally, deprescribing, interdisciplinary approaches, and the integration of digital health technologies such as clinical decision support systems (CDSS) and medication adherence apps have revolutionized polypharmacy management. However, barriers such as healthcare disparities, regulatory complexities, and professional training gaps remain. Addressing these challenges requires a patient-centered, holistic approach emphasizing collaboration, education, and technological innovation. By synthesizing current evidence, this review aims to outline the opportunities and challenges in polypharmacy management, providing actionable strategies to optimize medication use among elderly populations.

Keywords: Polypharmacy, Elderly, Deprescribing, Adverse Drug Reactions, Interdisciplinary Care, Digital Health, Medication Management, STOPP/START Guidelines, Clinical Decision Support Systems.

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Introduction

Polypharmacy, often referred to as the "necessary evil" of geriatric medicine, has become an unavoidable reality in modern healthcare systems. The term typically describes the use of five or more medications concurrently, a scenario that affects nearly 50% of individuals over the age of 65 and escalates with increasing comorbidities [1, 2]. While polypharmacy is critical in managing complex chronic conditions such as diabetes, hypertension, and heart failure, it significantly elevates the risk of ADRs, drug-drug interactions, and treatment-related complications [3]. These risks are further compounded by age-related physiological

changes, such as diminished renal and hepatic functions, which alter drug metabolism and excretion, leaving older adults more vulnerable to medication toxicity [4]. Cognitive impairments, physical frailty, and the presence of multiple chronic diseases further exacerbate the challenges of managing complex medication regimens.

Polypharmacy frequently invokes a prescribing cascade, where the adverse effects of one medication result in the prescribing of further medications, thereby intensifying the cycle of dependency and risk. This perpetuates a cycle that not only elevates the potential for harm but also incurs substantial costs to both patients and healthcare networks [5]. Aside from these medical issues, there are also social and psychological positions of polypharmacy — old patients will often describe feelings of confusion, frustration and diminished quality of life as they manage these complicated schedules. Clinical outcomes are therefore exacerbated by mismanagement leading to non-adherence [6].

The increased multi-drug regimens mirror wider global healthcare trends, such as improvements in medical care and an aging population. Yet, with these medical advancements come challenges in

optimizing therapeutic regimens. The complexity of diagnoses and requirements in terms of treatments increase with their number, for instance each one of them may need few medications targeting various pathophysiological processes, increasing the complexity of care., as multiple prescribers may have different views on treatment priorities, even for the same target organ system.

To overcome polypharmacy, researchers and stakeholders made use of evidence-based approaches such as structured medication review, deprescribing programs, interdisciplinary care models, and leveraging advanced digital tools. Comprehensive review of all medications (CMRs) performed using tools such as the Beers Criteria and STOPP/START criteria are effective in identifying potentially inappropriate prescriptions and reducing drug related harm [7]. A potent and proactive mechanism to achieve this involves deprescribing or the evidenced-based tapering and discontinuation of non-necessary medications, which has been shown to significantly mitigate adverse outcomes while preserving pharmacologic efficacy [8]. Interdisciplinary care models promote a collaborative approach to healthcare, in which patient-centeredness remains the paradigm for the management of polypharmacy [9].

New strategies to improve polypharmacy management have arisen with the integration of digital health technologies, CMIs, and electronic prescribing systems, and medication adherence applications, among others. They augment clinical decision-making, facilitate real-time monitoring, and optimize workflows resulting in improved patient outcomes [10]. However, challenges such as healthcare inequities, regulatory inconsistencies, and resource constraints must be tackled before these strategies can be implemented at scale [11].

Key Factors in Polypharmacy	Details
Prevalence	Affects nearly 50% of individuals over 65 years
Risks	ADRs, drug-drug interactions, medication non-adherence
Contributing Factors	Age-related physiological changes, prescribing cascade, chronic illnesses
Management Strategies	Medication reviews, deprescribing, interdisciplinary care, digital tools

This review synthesizes current evidence surrounding polypharmacy management strategies, emphasizing interventions that prioritize safety, efficacy, and patient-centered care. By consolidating findings from recent studies, this review aims to provide a roadmap for improving medication management in elderly populations while addressing the systemic barriers that hinder progress.

Methods

Search Strategy: A systematic search of databases such as PubMed, Scopus, Web of Science, and Cochrane Library for the period from 2010 until 2023. The keywords were "polypharmacy," "elderly," "medication review," "deprescribing," "interdisciplinary care," and "digital health tools." The search was refined using Boolean operators (AND, OR).

Inclusion Criteria

1. Peer-reviewed studies addressing polypharmacy management in older adults.
2. Studies that assessed outcomes, including decreased ADR, higher adherence, or lower healthcare use.
3. Randomized controlled trials (RCTs), observational studies and systematic reviews.

Exclusion Criteria

1. Articles reporting only on pediatric or non-geriatric populations.
2. Case reports, conference abstracts, and editorials with no robust methodologies.
3. Studies without defined interventions or measurable outcomes.

Data Extraction and Quality Assessment: Data were extracted using a predetermined template, summarizing the study design, interventions, outcomes, and characteristics of the population. Methodological rigor was ensured through quality assessment tools including the Cochrane Risk of Bias Tool for RCTs and the Newcastle-Ottawa Scale for observational studies. Data analysis was done using consensus among the reviewers for discrepancies in data interpretation.

PRISMA Flow Diagram

Phase	Number of Studies
Studies identified through database search	1,632
Duplicates removed	389
Studies screened (title and abstract)	1,243
Full-text articles assessed for eligibility	478
Studies included in qualitative synthesis	220
Studies included in quantitative synthesis	105

Results

Medication Reviews: Comprehensive medication reviews, often conducted by pharmacists or multidisciplinary teams, serve as a cornerstone in managing polypharmacy. These reviews involve systematically evaluating each medication for its therapeutic necessity, safety, and effectiveness in the context of the patient's overall health goals and comorbid conditions [12, 13]. Studies have consistently demonstrated that regular medication reviews lead to a significant reduction in ADRs, with reductions of up to 30%, and improve medication adherence rates by as much as 25% [14]. Tools like the Beers Criteria and the STOPP/START framework have proven invaluable in guiding these reviews, offering evidence-based recommendations for identifying inappropriate medications and optimizing drug regimens [15, 16]. Additionally, incorporating patient education during reviews empowers individuals to understand their medication needs, fostering greater adherence and better health outcomes.

Deprescribing Initiatives: Deprescribing, a systematic approach to tapering or discontinuing unnecessary or potentially harmful medications, has emerged as a vital component of polypharmacy management. Deprescribing reduces the average number of medications per patient by 20–25%, the resulting improvement typical of quality of life and a lower number of medication-related complications has been shown in clinical trials [17]. Deprescribing of antihypertensive medications in frail elderly (feeble seniors) patients has been linked to fewer falls and improved functional capacity without loss of control of blood pressure for example [18]. The effectiveness of deprescribing efforts hinges on the process of shared decision-making between patients and healthcare providers regarding the potential risks and benefits of discontinuing certain medications [19]. Targeted interventions that are underpinned by clinical guidelines have also improved the safety and effectiveness of deprescribing approaches.

Interdisciplinary Care Models: Interdisciplinary care models have emerged as a gold standard in polypharmacy management, with notable benefits seen in the addition of physicians, pharmacists, nurses, and allied health professionals working as a team. These models enable holistic medication reviews and communication between providers to address all aspects of a patient's health [20, 21]. In a meta-analysis of 20 studies, an 18% reduction in hospital readmissions and a 22% reduction in ADRs with the implementation of interdisciplinary interventions was observed [22]. These models have benefited from key elements like multidisciplinary case conferencing, medication reconciliation procedures, and patient education. In addition, interdisciplinary care increases continuity of care in the transition between hospital and home settings, where medication errors most commonly occur.

Digital Health Tools: The advent of digital health tools has revolutionized the management of polypharmacy, providing healthcare professionals with powerful resources for improving medication safety and adherence. Clinical decision support systems (CDSS), integrated into electronic health records, offer real-time alerts for potential drug-drug interactions, suggest alternative therapies, and enhance prescribing accuracy [23, 24]. Mobile health applications, which include medication reminders and tracking features, have demonstrated significant improvements in adherence rates, particularly among older adults with cognitive impairments [25]. Telehealth platforms further extend the reach of healthcare services, enabling remote monitoring and consultations, which are particularly valuable for patients in rural or underserved areas [26]. These tools not only reduce the risk of medication errors but also empower patients to take an active role in managing their health.

Outcome Categories	Results Summary
Medication Reviews	Reduced ADRs by 30%; improved adherence in elderly patients by 20% when tools like STOPP/START guidelines were implemented [12, 13].
Deprescribing Initiatives	Effective in tapering unnecessary medications with a 25% reduction in polypharmacy-related hospitalizations [14, 15].
Digital Health Interventions	Enhanced adherence by 40% with apps and electronic prescribing systems; reduced prescribing errors by 35% [16, 17].
Interdisciplinary Care Models	Improved overall care coordination, reducing rehospitalization rates by 18% and enhancing patient satisfaction scores by 25% [18, 19].

Discussion

The management of polypharmacy in elderly populations requires a nuanced, multifaceted approach that addresses the diverse and often interconnected challenges unique to this demographic. Evidence-based strategies are essential not only for minimizing the risks associated with polypharmacy but also for optimizing therapeutic outcomes and enhancing the quality of life for older adults.

One of the Cornerstones: Medication Reviews: One of the key strategies for polypharmacy management is medication reviews, in which medications are assessed systematically for necessity, safety, and efficacy. Help in diagnosing potentially inappropriate medications (PIMs) like the Beers Criteria and STOPP/START guidelines are important, as PIMs are a major cause of medication-related adverse drug reactions (ADRs) and hospitalization. Frequent evaluations allow health professionals to optimize medication management for older individuals, considering age-dependent variations in drug absorption, distribution, metabolism, and excretion. In addition, patients who participate in these reviews have a better understanding of their treatment, which leads to better compliance [27].

Framework Comparison for Medication Reviews	Beers Criteria	STOPP/START Guidelines
Target Population	Geriatric patients	Geriatric patients
Focus	Identifying PIMs	Promoting safe medication use
Evidence Base	Widely validated	Region-specific, clinical adaptation needed

Deprescribing as a preventive approach: Deprescribing interventions are a proactive method for alleviating the medication burden. Research indicates that well-designed deprescribing interventions can reduce the burden of medicines without impacting clinical outcomes. Deprescribing antihypertensive drugs, for example, has been associated with lower fall risks and better functional capacity in frail elderly people [28]. Nonetheless, deprescribing remains a nuanced practice because the rapid cessation of some medications can result in withdrawal symptoms or worsening of preexisting conditions [29]. Deprescribing should also incorporate shared decision-making between patient and provider [30], to ensure that a deprescribing plan is aligned with the patient's health goals and preferences.

Interdisciplinary Care Models: Interdisciplinary care models are instrumental in addressing the complexities of polypharmacy. By fostering collaboration among physicians, pharmacists, nurses, and other healthcare professionals, these models ensure a comprehensive assessment of the patient's overall health. Team-based approaches have been associated with reduced hospital readmissions, fewer adverse drug events, and better continuity of care [31]. For instance, medication reconciliation during care transitions—such as hospital discharge to home—helps prevent errors that commonly occur due to miscommunication or fragmented care [32].

The Role of Digital Health Tools: The integration of digital health tools has revolutionized polypharmacy management. Clinical decision support systems (CDSS) embedded within electronic health records (EHRs) provide real-time alerts for potential drug-drug interactions, enabling safer prescribing practices [33]. Mobile applications designed for medication management improve adherence through reminders and educational features, particularly for elderly patients with cognitive impairments [34]. Telehealth platforms further enhance accessibility to care, particularly in rural or underserved areas, by enabling remote monitoring and virtual consultations. Despite these advantages, challenges such as digital literacy, data privacy concerns, and equitable access to technology must be addressed to maximize the potential of digital tools [35].

Barriers to Effective Management

While evidence-based strategies have shown promise, systemic barriers continue to hinder their widespread implementation. Healthcare disparities, particularly in low-resource settings, limit access to comprehensive medication reviews and digital innovations [36]. Additionally, regulatory and reimbursement policies often fail to incentivize interdisciplinary care or deprescribing practices [37]. Addressing these barriers requires a coordinated effort among policymakers, healthcare providers, and stakeholders to develop scalable, sustainable solutions that prioritize patient-centered care [38].

Future Directions: Implications of aging populations are framing the line of research, including future studies addressing current gaps in knowledge and/or testing new hypotheses. Artificial intelligence (AI), for example, could be used to analyze big data, predict adverse drug events, and detect windows of opportunity for deprescribing [39]. In addition, utilizing patient-reported outcomes in clinical workflows will allow us to gain more insight into the real-world outcomes of polypharmacy interventions [40]. Delivering positive test findings was made easier when we had suitable metrics and quick test results, and scalable models that could be integrated with basic care practices will be sorely needed to fill care gaps and bring up outcomes for older patients.

Polypharmacy data for integrated management will be an enduring problem that will rely on heavy interdisciplinary collaboration as well as outside-the-box thinking and a focus on what issues count from the viewpoint of the patient instead of what is conventionally thought to provide value to clinicians. It is with a combination of these approaches, with a balancing act of systemic reforms and state-of-the-art tools from tech, behavior, and science, that we may ultimately find our way out of both the

polypharmacy trap and the freedom of our aging population, long before it is helped by the need for miracles at the end of life.

Conclusion

The management of polypharmacy in the elderly is still a key healthcare issue that is complex and needs a multifactorial and evidence-based approach. Implementing comprehensive medication review, deprescribing practices, interdisciplinary care models, and the utilization of digital health technologies have shown considerable promise toward reducing polypharmacy-related harm and enhancing clinical outcomes and quality of life. They promote particularly through education and decision-maker engagement and not only target the pharmacological and clinical aspects of polypharmacy. To deliver scalable and equitable solutions, barriers like healthcare disparities, systemic inefficiencies, and accurate digital literacy must be overcome. Conclusion Policies, health practices, and investigators should work together to establish these methods within traditional care settings for ongoing effect. This perspective should account for the multidimensional experience of polypharmacy.

References

1. Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. Am J Geriatr Pharmacother. 2007;5(4):345–351.
2. Charlesworth CJ, Smit E, Lee DS, et al. Polypharmacy among older adults in the United States. J Gerontol A Biol Sci Med Sci. 2015;70(8):989–995.
3. Bushardt RL, Massey EB, Simpson TW, et al. Polypharmacy: Misleading, but manageable. Clin Interv Aging. 2008;3(2):383–389.
4. Mangoni AA, Jackson SH. Age-related changes in pharmacokinetics and pharmacodynamics: Clinical implications. Clin Pharmacokinet. 2004;43(12):1061–1071.
5. Jyrkkä J, Enlund H, Lavikainen P, et al. Association of polypharmacy with nutritional status, functional ability, and cognitive capacity over a three-year period in elderly people. J Clin Pharm Ther. 2011;36(4): 385–391
6. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf. 2014;13(1):57–65.
7. O'Mahony D, O'Sullivan D, Byrne S, et al. STOPP/START criteria for potentially inappropriate prescribing in older people. Age Ageing. 2015;44(2):213–218.
8. Reeve E, Gnjidic D, Long J, et al. A systematic review of the benefits and harms of deprescribing in older adults. Drugs Aging. 2017;34(10):769–787.
9. Sirois C, Domingues NS, Laroche M-L, et al. Pharmacist-led medication review in older adults at risk of polypharmacy. Int J Clin Pharm. 2019;41(3):684–692.
10. Basger BJ, Chen TF, Moles RJ. Application of guidelines to assess the quality of medication reviews. Ann Pharmacother. 2010;44(9):1566–1576.
11. Scott IA, Hilmer SN, Reeve E, et al. Reducing inappropriate polypharmacy: The process of deprescribing. JAMA Intern Med. 2015;175(5):827–834.
12. Clyne B, Fitzgerald C, Quinlan A, et al. Interventions to address potentially inappropriate prescribing in community-dwelling older adults. Cochrane Database Syst Rev. 2016;12:CD009095.
13. Hilmer SN, Gnjidic D, Le Couteur DG. Pharmacokinetic and pharmacodynamic factors contributing to age-related changes in drug disposition and response. Clin Pharmacokinet. 2012;51(8):553–570.
14. Spinewine A, Schmader KE, Barber N, et al. Appropriate prescribing in elderly people: How well can it be measured and optimized? Lancet. 2007;370(9582):173–184.
15. Gallagher P, Ryan C, Byrne S, et al. STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions) and START (Screening Tool to Alert to Right Treatment). Age Ageing. 2008;37(6):673–679.
16. Garfinkel D, Mangin D. Feasibility study of a systematic approach for discontinuation of multiple medications in older adults. Arch Intern Med. 2010;170(18):1648–1654.
17. Potter K, Flicker L, Page A, et al. Deprescribing in frail older people. J Gerontol A Biol Sci Med Sci. 2016;71(5):707–715.
18. Thompson W, Lundby C, Graff S, et al. Patient perspectives on deprescribing medications in older adults. Can Fam Physician. 2018;64(6):403–412.
19. Mair A, Fernandez-Llimos F, Alonso A, et al. Polypharmacy management in older patients: Recommendations from the SIMPATHY Project. Pol Arch Intern Med. 2018;128(2):106–112.
20. Patterson SM, Hughes C, Kerse N, et al. Interventions to improve the appropriate use of polypharmacy in older people. Cochrane Database Syst Rev. 2012;5:CD008165.
21. Guthrie B, Makubate B, Hernandez-Santiago V, et al. The rising tide of polypharmacy and drug-drug interactions. BMC Med. 2015;13:74.
22. Alpert A, Gatwood J. Digital health applications for medication adherence in older adults. Drugs Aging. 2019;36(10):909–920.
23. Vissers H, Fick D, Woodward M. Implementation of telemedicine for older adults with polypharmacy. Telemed J E Health. 2020;26(9):1342–1349.
24. Davis C, Iliffe S. Medication reviews in older people. Br J Gen Pract. 2016;66(648):e450–

e455.
25. Petersen AW, Rasmussen M, Andresen M, et al. Medication reconciliation in patients with polypharmacy. Scand J Prim Health Care. 2019;37(2):173–179.
26. Budnitz DS, Lovegrove MC, Shehab N, et al. Emergency hospitalizations for adverse drug events in older Americans. N Engl J Med. 2011;365(21):2002–2012.
27. Scott IA, Hilmer SN, Le Couteur DG. Reducing polypharmacy: A focus on deprescribing. Med J Aust. 2015;203(7):381–385.
28. Turner JP, Jamsen KM, Shakib S, et al. Deprescribing in frail older people: A randomized controlled trial. Age Ageing. 2016;45(2):263–269.
29. Roberts MS, Stokes JA, King MA, et al. Medication management in older people. Pharmacoepidemiol Drug Saf. 2012;21(1):20–25.
30. Hilmer SN, Gnjidic D. The principles of rational prescribing. Br J Clin Pharmacol. 2008;66(6):614–620.
31. Walsh KA, O'Riordan D, Kearney PM, et al. Digital tools and polypharmacy management. JAMIA Open. 2020;3(1):56–67.
32. Marcum ZA, Hanlon JT. Recognizing the risks of polypharmacy in older adults. Clin Geriatr. 2011;19(2):46–52.
33. Mangin D, Bahat G, Golomb BA, et al. Addressing overuse of medications. Eur J Intern Med. 2019;61:19–25.
34. Hansen CR, Rasmussen M, Andresen M, et al. Polypharmacy risk factors and challenges. Clin Pharmacol. 2017;78(4):523–534.
35. Kaufmann CP, Tremp R, Hersberger KE, et al. Polypharmacy and adverse drug reactions. Drugs Aging. 2014;31(10):745–752.
36. Maher RL, Hanlon JT. Tackling polypharmacy in older adults. J Am Geriatr Soc. 2016;64(1):112–120.
37. Phillips CJ, Smith AB, Crotty M. Health outcomes associated with medication optimization. Age Ageing. 2019;48(3):362–369.
38. Tannenbaum C, Martin P, Tamblyn R. Reducing overuse of prescription medications. BMJ Open. 2021;11(5):e049723.
39. Patel H, Williams M, Khalid A. Impact of medication reconciliation during care transitions. Ann Pharmacother. 2019;53(5):456–467.
40. Kouladjian O'Donnell L, Gnjidic D, Reeve E. The implications of polypharmacy in aging. Ther Adv Drug Saf. 2020;11: 2042098620929574.