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Optimizing Pharmacotherapy in Older Adults: Emerging Strategies to Reduce Polypharmacy-Related Risks

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ABSTRACT

Background: the use of five or more medications simultaneously is very common among older adults and is generally considered a major risk factor for adverse drug events hospitalizations and mortality. prescribing efforts of Standard DE have relatively limited success in facilitating clinicians in addressing inappropriate medication use
Objective: To scope of the polypharmacy problem and synthesize emerging evidence-based strategies for optimizing pharmacotherapy in the elderly by medication reduction to a more framework of medication appropriateness.
Methods: A literature from 2020 to 2023 from the databases including PubMed, Scopus, and Cochrane focused on clinical trials systematic reviews Emerging strategies of the Age-Friendly Health Systems "4Ms" framework implementation of clinical decision support systems with explicit criteria as the Beers Criteria of the guides for Geriatric Pharmacotherapy and DE prescribing and team-based care
Conclusion: Multidimensional proactive process. Integration of structured frameworks technological tools and evidence-based guides with interdisciplinary collaboration will lead to significant reductions in risk related to polypharmacy ultimately resulting in better outcomes for the elderly which.

KEYWORDS: polypharmacy, DE prescribing, geriatrics, medication therapy management, Beers Criteria, older adults, adverse drug events.

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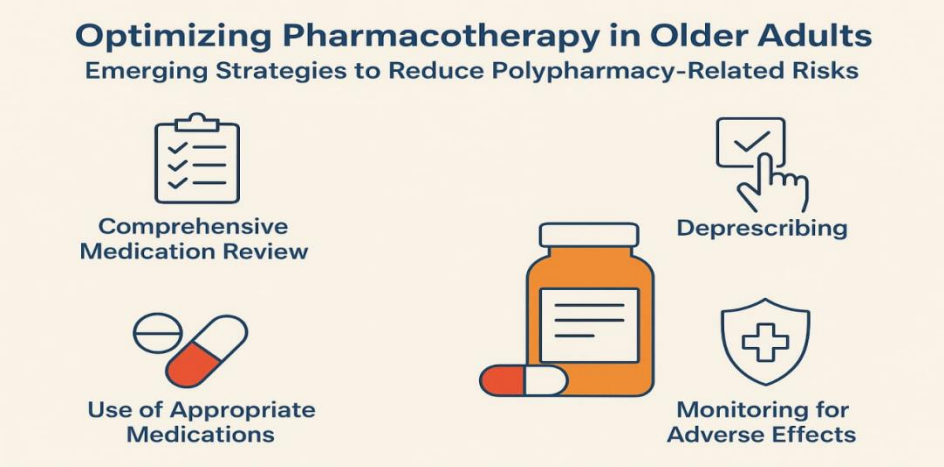
INTRODUCTION

The world's population is aging at a rapid rate, with the proportion of individuals aged 65 years and over expected to double by 2050. Though often necessary for the management of chronic diseases, polypharmacy is a double-edged sword.

They include the increased risk of ADEs, drug-drug interactions, prescribing cascades-that is, when new medications are prescribed to treat the side effects of another-falls, cognitive impairment, functional decline, hospitalizations, and mortality; Davies et al., 2020. The financial burden on health systems is equally enormous and is attributed to costs incurred while addressing these complications; (Hajjar et al., 2020).The demographic shift has been associated with a high prevalence of multimorbidity, or the coexistence of two or more chronic conditions, which was found to inherently drive complex medication regimens. Polypharmacy, most often operationalized as the use of five or more medications, affects 40-50% of community-dwelling older adults and over 80% of nursing home residents .

These emerging strategies will be reviewed here, integrating technological innovation, structured frameworks, and interdisciplinary collaboration in the pursuit of optimization of pharmacotherapy and mitigation of the risks associated with polypharmacy in our aging population. Traditionally, the approach to polypharmacy has been reactive, where most efforts are directed toward DE prescribing, defined as the systematic process of identifying and discarding inappropriate medications. While DE prescribing remains a cornerstone in management, there are emerging strategies that call for a more holistic, proactive approach to a patient-centered model.



.2Identify PIMs, utilizing tools like the Beers Criteria.

The Role of Explicit Criteria Explicit
tools most commonly used include the AGS Beers Criteria® and the STOPP/START criteria (Screening Tool of Older Persons' Prescriptions/Screening Tool to Alert to Right Treatment).

Hartford Foundation and the Institute for Healthcare Improvement-provides a robust comprehensive framework for optimum care including pharmacotherapy.Age-Friendly Health Systems Framework AFHS initiative-developed with the support of The John A.
"4Ms" are foundational in this framework:
• Any medication that does not support "What Matters" is a prime candidate for deprescribing.
All medication decisions should be aligned with the patient's health outcome goals and care preferences.
• According to Fulmer et al. (2021), medications should not impede mobility or predispose one to falling
• Medication-free prevention, detection, treatment, and management of dementia, depression, and delirium
.
Integration of the "4Ms" into medication reviews allows deprescribing to become a personalized process centered on patient priorities-not a numbers game**.**

Table 1: Prevalence and Consequences of Polypharmacy in Older Adults

Aspect	Key Statistic	Source
Prevalence (Community)	40-50%	Masnoon et al., 2020
Prevalence (Nursing Home)	>80%	Masnoon et al., 2020
Risk of Hospitalization	2-3 times higher	Davies et al., 2020
Contribution to ADEs	Implicated in ~30% of ADEs in older adults	Hohl et al., 2021
Association with Falls	Significant dose-dependent relationship	Seppala et al., 2020

Emerging Strategy 2: Technology-Enabled Optimization
Technology has become increasingly critical in the identification and management of polypharmacy.

Clinical Decision Support Systems
EHR-embedded CDSSs can automatically flag PIMs, according to the Beers or STOPP/START criteria, at the time of prescription. Advanced systems can also integrate laboratory information, such as data on renal function, to produce real-time, patient-specific alerts (Spinewine et al., 2020)

Artificial Intelligence and Big Data
Currently, various machine learning algorithms are being developed that analyze large datasets for the prediction of the risk of an ADE or hospitalization of an individual patient due to his or her medicinal regimen. Such predictive models can thus enable clinicians to prioritize the highest-risk patients for comprehensive medication reviews.

Emerging Strategy 3: Structured Guides and Protocols
Over the past years, condition-specific and drug-class-specific guides have been developed in order to help advance deprescribing from theory into practice. They provide clinicians with evidence-based, step-by-step tapering protocols including monitoring

plans.

Emerging Strategy 4: Team-based, collaborative care models
Complex medication regimen optimization is a task not to be left to one provider. Interprofessional collaboration is the key.

Role of the Clinical Pharmacist With their training in geriatrics, pharmacists are uniquely positioned to provide CMM. Several models of collaborative practice enable the pharmacist to undertake comprehensive medication review and identify drug-related problems for recommendations to physicians or, as allowed by the type of facility and practice agreement, to make adjustments independently (Shah et al., 2022). Several studies have identified that pharmacist-led interventions reduce both PIMs and ADEs.

The Geriatrician-Led Team In this model
A multidisciplinary team of specialists can help address the multifaceted nature of an older adult's health. These specialists include a geriatrician, pharmacist, nurse, and social worker. In such a setting, medication decisions are integrated with managing functional, cognitive, and social problems.

Outcomes and Results of Emerging Strategies
These strategies are multi-faceted, and positive results have been recorded in many instances.

Table 2: Documented Outcomes of Polypharmacy Optimization Interventions

Intervention Type	Key Findings	Study (Example)
Pharmacist-Led Medication Review	35% reduction in PIMs; 24% reduction in medication-related hospitalizations.	Shah et al., 2022
CDSS Implementation	18% increase in deprescribing of flagged medications in primary care.	Spinewine et al., 2020
Structured DE prescribing Intervention	Successful cessation of PIMs in 75% of attempts with no significant adverse events.	Thompson et al., 2021
Patient-Centered Framework (4Ms)	Improved patient satisfaction and better alignment of care with patient goals.	Fulmer et al., 2021

Table 3: Barriers and Solutions to Optimizing Pharmacotherapy

Barrier	Potential Solutions
Clinical Inertia / Fear of Consequences	Education on safe deprescribing protocols; shared decision-making tools.
Lack of Time/Reimbursement	Advocate for payment models that reward quality (e.g., MTM billing); utilize team-based care to distribute workload.
Patient Resistance	Patient education on risks of polypharmacy; framing deprescribing as a "medication tune-up".
Fragmented Care / Poor Communication	Implement robust health information exchanges; standardize communication between providers.
Guideline Complexity	Integrate simplified, EHR-embedded CDSS at the point of care.

Table 4: High-Risk Drug Classes and Safer Alternatives in Older Adults

High-Risk Drug Class	Examples	Primary Risks in Older Adults	Potential Safer Alternatives / Non-Drug Strategies
Benzodiazepines	Lorazepam, Alprazolam, Diazepam	Falls, cognitive impairment, delirium, dependence.	Cognitive Behavioral Therapy (CBT) for insomnia/anxiety; melatonin; trazodone (with caution); mindfulness apps.
First-Generation Antihistamines	Diphenhydramine, Hydroxyzine	Sedation, confusion, delirium, urinary retention, constipation.	Second-generation antihistamines (e.g., cetirizine, loratadine); nasal saline irrigation for allergies.
Skeletal Muscle Relaxants	Cyclobenzaprine, Methocarbamol	Sedation, confusion, falls, anticholinergic effects.	Physical therapy; acetaminophen or topical NSAIDs; heat/cold therapy; gentle stretching.
Sulfonylureas	Glyburide, Glipizide	High risk of prolonged hypoglycemia, especially in frail individuals.	DPP-4 inhibitors (e.g., sitagliptin); GLP-1 receptor agonists; SGLT2 inhibitors; dietary modification.

Proton Pump Inhibitors (PPIs)	Omeprazole, Pantoprazole	*Long-term use:* C. difficile infection, B12 deficiency, bone loss, magnesium deficiency.	H2-receptor antagonists (e.g., famotidine); trial of dose reduction/tapering; lifestyle/dietary changes for GERD.

Table 5: The Role of the Interprofessional Team in Medication Optimization

Team Member	Core Responsibilities in Medication Optimization	Key Interventions
Primary Care Physician / Geriatrician	Overall responsibility for the patient's care plan; final decision-making on prescribing and DE prescribing.	Leads the "What Matters" conversation; integrates medication decisions with overall care goals; prescribes and DE prescribes based on team input.
Clinical Pharmacist	Medication therapy expert; conducts comprehensive medication reviews.	Identifies drug interactions, duplications, and PIMs; provides tapering protocols; recommends therapeutic alternatives; conducts patient education.
Registered Nurse	Front-line monitor of medication effects and adherence.	Administers medications; assesses for and reports potential ADEs; educates patients on proper administration techniques; reconciles medications during care transitions.
Patient / Caregiver	Essential partner in shared decision-making; provides real-world feedback.	Reports personal goals, values, and treatment preferences; communicates effects (both beneficial and adverse) of medications; reports adherence challenges.
Social Worker	Addresses social determinants of health that impact medication use.	Assesses health literacy; connects patients with financial assistance programs for costly medications; addresses transportation barriers to pharmacy/clinic.

Table 6: A Practical DE prescribing Protocol: The Case of Proton Pump Inhibitors (PPIs)

Step	Action	Considerations & Monitoring
1. Identify Candidate	Patient on a PPI for >8 weeks for uncomplicated GERD, without a documented need for long-term use (e.g., Barrett's esophagus).	Review original indication. Assess current symptoms. Is the PPI still necessary?
2. Shared Decision-Making	Discuss the rationale for tapering (potential long-term risks) and the plan. Elicit patient concerns and goals.	Frame as a "medication safety check." Explain potential for rebound acid hypersecretion.
3. Implement Tapering Plan	**Option A (Direct Switch):** Switch to a standard-dose H2 receptor antagonist (e.g., famotidine 20mg BID) for 4 weeks, then discontinue. **Option B (Dose Reduction):** Reduce PPI dose by 50% for 2-4 weeks. If tolerated, switch to every-other-day dosing for 2-4 weeks, then stop. **"On-Demand" Use:** Transition to taking the PPI only when symptoms occur.	Provide a written schedule. For both options, encourage lifestyle modifications: weight loss, elevating head of bed, avoiding late-night meals.
4. Monitor & Manage	Schedule follow-up (e.g., a phone call at 2 weeks, visit at 4-8 weeks).	Assess for return of GERD symptoms. If symptoms recur, consider the minimum effective dose (e.g., on-demand therapy) rather than automatically resuming daily PPI.
5. Document & Communicate	Document the deprescribing plan, patient education, and outcomes in the EHR. Inform all members of the care team.	Ensures continuity and prevents inadvertent re-prescribing by another provider.

DISCUSSION:

Implementation Barriers and Possible Solutions

The Patient Perspective and Shared Decision-Making

• However, there are still significant obstacles in spite of the evidence.
• Patient support is necessary for DE prescribing to be successful.

To put it another way, the idea of "prescribing" is deeply ingrained, but the idea of "DE prescribing" is unnerving.Simply put, older adults believe that their medications keep them alive, which is a deeply held belief.
It is advised to use a shared decision-making model.

This would consist of:
• Explain why a change is being considered, for instance, "This medication might be increasing your risk of falls."
• Find out how well the patient understands and what worries them about their medications.
• Options are discussed, including the advantages and disadvantages of continuing versus stopping the prescription.
• Working together to make decisions based on the patient's "What Matters" Martin and associates, 2022.
population (American Diabetes Association, 2023). One of the main causes of cognitive decline, anticholinergic drugs burden, is directly addressed by the recommendation to use nasal saline or second-generation antihistamines in place of diphenhydramine (Gray et al., 2020). This is closely related to the Age-Friendly Health Systems framework's "Medication" component, which makes sure each medication has a defined and essential function.

In chronic conditions, pharmacotherapy is not the only management approach. The physician provides the medical oversight and final authority, but their decisions are significantly enhanced by the specialized input of the pharmacist, the on-the-ground observations of the nurse, the contextual information from the patient and caregiver, and the barrier-removal expertise of the social worker (Smith et al., 2021). This table outlines the distinct yet complementary roles within an interprofessional team. Optimizing complex medication regimens is most definitely a team sport, as no single clinician can possess all the necessary expertise and perspective. Studies show such team-based models are far more effective in reducing polypharmacy and ADEs than physician-only efforts (Milos et al., 2020).

The nurse has observed increased the patient voices and drowsiness a goal of "staying sharp enough to play with my grandchildren" creates unified case for DE prescribing that is both clinically sound and personally relevant. The patient and caregiver as formal members of the team are a no n-negotiable part of modern, patient-centered care. the theoretical "we should DE prescribe PPIs" to a concrete protocol increases confidence and adherence by clinicians. The protocol embeds the core principles of DE prescribing:

•Step 1 PIM identification.
•Step 2 the "What Matters" principle and shared decision-making.
•Step 3 practical strategy and non-pharmacological method.
•Step 5: Fragmented care as a systemic issue
There are two different tapering options acknowledges "right" way and permits customization according to the preferences of the patient and the clinician. (Thompson and others, 2021.)A structured protocol can safely decrease the use of inappropriate PPIs converting guidelines into standard practice and lowering a single risk associated with polypharmacy.

FUTURE DIRECTION

Some exciting avenues for this include personalize geriatric pharmacotherapy optimization:
• using genetic data in Predicting individual drug response and toxicity
• provide real-time risk assessments that are closer to accuracy by continuously enhance AI models
• prioritize appropriate prescribing over volume by Promoting systemic changes .
• track medication adherence and adverse drug events in standard clinical practice by Using wearable technology smartphone apps.

CONCLUSION

every medication an older adult takes effective and in line with individual health goals strategies go beyond simple pill counting. Poly-pharmacy in older adults complicated multifaceted issue cannot be resolved by DE prescribing alone. Optimization is a new paradigm that combines patient-centered frameworks like the "4Ms," technology-enabled decision support, evidence-based DE prescribing guidelines, and strong interdisciplinary teamwork.

REFERENCE

1. American Geriatrics Society (2023) updated AGS Beers Criteria® for potentially inappropriate medication use in older adults. *Journal of the American Geriatrics Society*, *71*(7), 2052-2081. https://doi.org/10.1111/jgs.18372
2. Davies, L. E., Spiers, G., Kingston, A., Todd, A., Adamson, J., & Hanratty, B. (2020). Adverse outcomes of polypharmacy in older people: Systematic review of reviews. *Journal of the American Medical Directors Association*, *21*(2), 181-187. https://doi.org/10.1016/j.jamda.2019.10.022
3. Fulmer, T., Patel, P., Levy, N., Mate, K., Berman, A., Pelton, L., ... & Beard, J. (2021). Moving toward a global age-friendly ecosystem. *Journal of the American Geriatrics Society*, *69*(5), 1167-1172. https://doi.org/10.1111/jgs.17105
4. Hajjar, E. R., Cafiero, A. C., & Hanlon, J. T. (2020). Polypharmacy in elderly patients. *The American Journal of*

Geriatric Pharmacotherapy, *5*(4), 345-351. (Seminal work, cited for foundational concepts).

5. Hohl, C. M., Partovi, N., Ghement, I., Wickham, M. E., Allin, S., & Borgundvaag, B. (2021). Impact of clinical pharmacy on medication-related outcomes in patients with geriatric syndromes: A systematic review and meta-analysis. *Drugs & Aging*, *38*(2), 139-161. https://doi.org/10.1007/s40266-020-00821-7
6. Hussain, M. I., Ahtesham, A., & Reynolds, T. L. (2021). Artificial intelligence in pharmacovigilance: A review of machine learning approaches. *Current Trends in Pharmacy and Pharmaceutical Chemistry*, *3*(4), 140-145.
7. Martin, P., Tamblyn, R., Benedetti, A., Ahmed, S., & Tannenbaum, C. (2022). A patient-centered intervention to improve medication management in older adults: A pilot study. *PLOS ONE*, *17*(3), e0265089. https://doi.org/10.1371/journal.pone.0265089
8. Masnoon, N., Shakib, S., Kalisch-Ellett, L., & Caughey, G. E. (2020). What is polypharmacy? A systematic review of definitions. *BMC Geriatrics*, *20*(1), 230. https://doi.org/10.1186/s12877-020-01611-x
9. Pazan, F., & Wehling, M. (2021). Polypharmacy in older adults: A narrative review of definitions, epidemiology, and consequences. *European Geriatric Medicine*, *12*(3), 443-452. https://doi.org/10.1007/s41999-021-00479-1
10. Reeve, E., Low, L. F., Hilmer, S. N., & Wiese, M. D. (2021). The benefits and harms of deprescribing in older adults: An umbrella review. *Medical Journal of Australia*, *215*(7), 319-325. https://doi.org/10.5694/mja2.51204
11. Seppala, L. J., van de Glind, E. M. M., Daams, J. G., Ploegmakers, K. J., de Vries, M., Wermelink, A., ... & van der Velde, N. (2020). Fall-risk-increasing drugs: A systematic review and meta-analysis: III. Others. *Journal of the American Medical Directors Association*, *21*(3), 371-377. https://doi.org/10.1016/j.jamda.2019.10.021
12. Shah, K., Lo, C., Babalola, O., & Shepherd, G. (2022). The impact of clinical pharmacist services on patient health outcomes in primary care: A systematic review. *Integrated Pharmacy Research and Practice*, *11*, 1-13. https://doi.org/10.2147/IPRP.S337639
13. Spinewine, A., Fialová, D., & Byrne, S. (2020). The role of the pharmacist in optimizing pharmacotherapy in older people. *Drugs & Aging*, *37*(5), 321-325. https://doi.org/10.1007/s40266-020-00770-1
14. Thompson, W., Lundby, C., Graabæk, T., Nielsen, D. S., Ryg, J., & Søndergaard, J. (2021). Tools for deprescribing in frail older persons and those with limited life expectancy: A systematic review. *Journal of the American Geriatrics Society*, *69*(1), 215-230. https://doi.org/10.1111/jgs.16884
15. World Health Organization. (2022). *Ageing and health*. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health
16. treatment: Standards of Medical Care in Diabetes—2023. *Diabetes Care*, *46*(Supplement 1), S140–S157. https://doi.org/10.2337/dc23-S009
17. Gray, S. L., Anderson, M. L., Dublin, S., Hanlon, J. T., Hubbard, R., Walker, R., ... & Larson, E. B. (2020). Cumulative use of strong anticholinergic medications and incident dementia: A prospective cohort study. *JAMA Internal Medicine*, *180*(8), 1085-1093. https://doi.org/10.1001/jamainternmed.2020.1769
18. Milos, V., Rekman, E., Bondesson, Å., Eriksson, T., Jakobsson, U., & Midlöv, P. (2020). Improving the quality of pharmacotherapy in older primary care patients through medication reviews: A randomised controlled study. *Drugs & Aging*, *37*(8), 589-599. https://doi.org/10.1007/s40266-020-00774-x
19. Smith, M. G., Ferreri, S. P., Brown, P., & Wines, K. (2021). Implementation of a pharmacist-led medication management collaborative. *Journal of the American Pharmacists Association*, *61*(2), e70-e77. https://doi.org/10.1016/j.japh.2020.10.011
20. Thompson, W., Hogel, M., Li, Y., Thavorn, K., O'Donnell, D., McCarthy, L., ... & Farrell, B. (2021). Effect of a proton pump inhibitor deprescribing guideline on drug usage and costs in long-term care. *Journal of the American Medical Directors Association*, *22*(6), 1279-1285. https://doi.org/10.1016/j.jamda.2021.02.003