

Pharmacotherapy Optimization and Adverse Drug Event Prevention in Older Adults Receiving Palliative and Supportive Care

Sophie Dubois^{1*}, Thomas Andersen², Lars Petersen³

¹*Department of Clinical Pharmacy and Palliative Care, Faculty of Pharmacy, Utrecht University, Utrecht, Netherlands.*

²*Department of Palliative Medicine and Geriatrics, Faculty of Health Sciences, University of Copenhagen, Copenhagen, Denmark.*

³*Department of Pharmaceutical Care and Older Adults, Faculty of Pharmacy, KU Leuven, Leuven, Belgium.*

Abstract

Medication use in older adults receiving palliative and supportive care presents a decision problem that cannot be resolved by medication count, potentially inappropriate medication criteria, or deprescribing targets alone. Therapeutic benefit may diminish as prognosis, goals of care, functional reserve, treatment burden, and monitoring capacity change, yet medication withdrawal can also create harm when effective symptom control, prevention of near-term complications, or correction of therapeutic underuse remains clinically important. This conceptual article develops a clinical pharmacotherapy decision framework that integrates goals of care, prognosis and time-to-benefit, medication benefit–burden balance, patient-level determinants, medication-level determinants, clinician judgment, organizational capacity, and surveillance for medication-related harm. The framework treats continuation, initiation, modification, simplification, intensified monitoring, and deprescribing as alternative optimization responses rather than assuming that medication reduction is the preferred endpoint. Particular attention is given to potentially inappropriate prescribing, drug–drug interactions, prescribing cascades, medication discrepancies, administration complexity, therapeutic failure, and the division of responsibility among pharmacists, physicians, and nurses. The central proposition is that pharmacotherapy optimization in palliative and supportive care is a dynamic, context-sensitive process in which the same medication may remain appropriate, require modification, or become inappropriate as patient goals, prognosis, risk, and implementation conditions change. The framework therefore positions adverse drug event prevention within repeated clinical reassessment rather than within medication reduction alone.

Keywords: Pharmacotherapy optimization, Palliative care, Older adults, Medication-related harm, deprescribing, Adverse drug event prevention

Introduction

Polypharmacy is common in later life, but the clinical problem is not adequately represented by medication count alone. A regimen containing many medicines may remain clinically coherent, whereas a shorter regimen may still expose a patient to avoidable harm or fail to provide therapy that is needed [1-3].

This distinction becomes particularly important in palliative and supportive care. Palliative care is directed toward the relief of serious health-related suffering and may coexist with disease-directed and preventive treatment rather than beginning only when all active treatment has ceased [4, 5].

Limited life expectancy can alter the appropriateness of therapies whose benefits are delayed, burdens are immediate, or monitoring requirements are substantial [6, 7]. This article addresses that problem through a clinical pharmacotherapy decision framework in which medication-related risk is interpreted together with expected benefit, goals of care, patient circumstances, professional judgment, and system capacity.

Corresponding author: Sophie Dubois

Address: Department of Clinical Pharmacy and Palliative Care, Faculty of Pharmacy, Utrecht University, Utrecht, Netherlands.

E-mail: ✉ sophie.dubois@uu.nl

Received: 29 August 2024; **Revised:** 07 November 2024;

Accepted: 10 December 2024

How to Cite This Article: Dubois S, Andersen T, Petersen L. Pharmacotherapy Optimization and Adverse Drug Event Prevention in Older Adults Receiving Palliative and Supportive Care. *J Integr Nurs Palliat Care*. 2024;5(2):365-75. <https://doi.org/10.51847/cVRhxFVAs7>

Scope and conceptual approach

The framework uses pharmacotherapy optimization to denote the repeated process of determining whether an existing or potential treatment should be continued, initiated, modified, simplified, substituted, more closely monitored, or discontinued. Medication-related harm can arise from excessive treatment, inappropriate exposure, interactions, administration problems, and monitoring failures, but it can also arise through therapeutic failure when an indicated intervention is omitted, insufficiently used, poorly implemented, or prematurely withdrawn [8-10].

This wider scope also places deprescribing within the continuum of good prescribing. The analytical task is therefore not to identify medicines that can be stopped in isolation. It is to determine which action produces the most defensible balance among expected benefit, medication-related risk, treatment workload, patient preferences, and the conditions under which care can actually be delivered [11, 12].

The clinical problem of medication burden in advanced age

Medication burden encompasses more than the number of products prescribed. Explicit geriatric prescribing criteria identify drug classes and drug-disease combinations that warrant avoidance, caution, dose adjustment, or closer review in many older adults [13-15]. Population-level evidence also associates potentially inappropriate medication exposure with adverse outcomes, including mortality risk, although these associations should not be interpreted as proof that every listed medication produces harm in every patient [13, 16, 17].

Other pathways are less visible. Drug-drug interactions can alter exposure and contribute to adverse drug reactions, but risk varies markedly by the interacting medicines and patient context. In one older inpatient population, the overall association between severe interactions and adverse-drug-reaction admission was not statistically definitive, while selected interaction classes showed substantially stronger relationships [18, 19]. This heterogeneity argues against treating the presence of any interaction as equivalent to confirmed harm.

Prescribing cascades add a different mechanism. An adverse effect may be interpreted as a new clinical condition, leading to another prescription rather than reconsideration of the precipitating medicine [20, 21]. Medication burden can therefore accumulate through several mechanisms that require different responses: inappropriate continuation, interaction risk, treatment complexity, prescribing cascades, and failure to provide necessary therapy.

The distinctions that guide this article are summarized in **Table 1**. The table separates the object being judged from the response that may follow, preventing medication burden, medication-related harm, and pharmacotherapy optimization from being treated as interchangeable concepts.

Table 1. Differentiating the principal medication-decision constructs used in pharmacotherapy optimization

Decision construct	Primary object of evaluation	Clinical signal that triggers reconsideration	Appropriate response family	Misclassification risk
Medication burden	Total demands created by medicines, schedules, monitoring, administration, and treatment workload	Regimen becomes difficult to administer, understand, monitor, or sustain	Simplify, consolidate, modify, monitor, or discontinue selected elements	Treating every large regimen as inappropriate
Potential medication-related harm	Exposure or process that may increase risk of an adverse outcome	Potentially inappropriate therapy, interaction, cascade, discrepancy, administration problem, or adverse effect	Investigate, modify exposure, improve surveillance, substitute, or discontinue	Treating a risk signal as proof that harm has already occurred
Therapeutic failure	Failure to achieve an important treatment objective despite a clinically relevant need	Omitted therapy, undertreatment, nonadherence, ineffective implementation, or premature withdrawal	Initiate, intensify, restore, modify, or support treatment	Assuming that medication reduction always lowers risk
Medication appropriateness	Fit between treatment, indication, expected benefit, risk, goals, prognosis, and feasibility	Change in clinical condition, priorities, prognosis, evidence, or treatment burden	Continue, initiate, modify, simplify, monitor, or stop	Applying explicit criteria without patient-level interpretation
Palliative pharmacotherapy alignment	Concordance between medication use and relief of suffering, near-term benefit, patient priorities, and acceptable burden	Shift in goals, functional status, symptom burden, prognosis, or care setting	Rebalance the regimen around current goals and feasible care	Equating palliative care with withdrawal of disease-directed treatment
Pharmacotherapy optimization	Selection of the most defensible medication action from several alternatives	Evidence that current therapy no longer represents the best achievable benefit-burden configuration	Continue, initiate, substitute, simplify, monitor more intensively, or deprescribe	Reducing optimization to deprescribing alone

Conceptual foundations of appropriate pharmacotherapy

Appropriate pharmacotherapy in this framework is defined by alignment rather than maximal treatment intensity. This definition also recognizes therapeutic failure as a safety concern: avoiding inappropriate exposure is insufficient if clinically important treatment is omitted.

Patient-priorities research demonstrates why this distinction matters. The value of this approach lies less in producing a uniform reduction in medicines than in making medication decisions answerable to outcomes that patients themselves consider important [22].

Implementation studies of Patient Priorities Care further show that “what matters” can be incorporated into real clinical workflows across different settings [23, 24]. These findings do not establish that priority-based care improves every outcome, but they support a central premise of the present framework: medication appropriateness depends partly on whether treatment serves a patient-defined purpose.

Goals of care, prognosis, and time-to-benefit

Goals of care determine what pharmacotherapy is expected to accomplish. Symptom relief, maintenance of function, avoidance of hospitalization, prevention of a near-term complication, or preservation of life may each be prioritized differently. Prognosis modifies these goals by changing the time available for benefit to emerge and the importance of immediate treatment burden.

Time-to-benefit research provides a useful conceptual example. Preventive interventions can require a substantial interval before measurable benefit appears, as demonstrated in analyses of statin therapy for primary prevention [25, 26]. The numerical estimate from one drug class cannot be transferred to all therapies, but the underlying reasoning is broadly relevant: a treatment whose likely benefit occurs after the patient’s clinically meaningful time horizon warrants different consideration from one that produces immediate symptom relief.

STOPPFrail was developed to make this reasoning more explicit in frail adults with limited life expectancy [27, 28]. Its later revision strengthened the patient-centered orientation of medication review near the end of life [29, 30]. Such tools can identify medicines that deserve reconsideration, but neither prognosis nor a deprescribing criterion should function as an automatic stopping rule. Prognostic estimates are uncertain, goals may differ among patients with similar disease trajectories, and some medicines retain substantial short-term value despite limited life expectancy.

Medication benefit–burden balance

Benefit–burden assessment should consider both the probability and timing of benefit and the immediacy of treatment costs. Burden may include adverse effects, interaction risk, administration difficulty, monitoring, financial or caregiver workload, and interference with patient priorities. Benefit may include symptom relief, prevention of a near-term event, preservation of function, or reduction of distress. A medicine can therefore remain worthwhile despite some burden when the expected benefit is immediate and important.

Evidence on deprescribing outcomes reinforces the need for this balanced interpretation. Reviews of inpatient medication review similarly report potentially favorable effects for selected outcomes while retaining important heterogeneity and risk-of-bias concerns [30–32]. These findings do not weaken the rationale for deprescribing when treatment is low value. They instead indicate that medication reduction should be justified by the patient-specific relationship between benefit and burden rather than by an assumption that fewer medicines necessarily produce better outcomes.

Patient-level determinants

Patient-level determinants influence both what should be done and what can realistically be done. Capacity to adhere can also be altered by cognitive impairment, dexterity, swallowing difficulty, fatigue, health literacy, caregiver availability, cost, and the number of daily medication tasks [33].

Qualitative evidence from deprescribing in older adults with diabetes illustrates how patients and clinicians may interpret medication reduction differently, with concerns about disease control, future harm, and the meaning of stopping long-standing treatment influencing decisions [34, 35]. These reactions are clinically relevant even when the pharmacological rationale for change appears strong.

Shared decision-making interventions seek to make such preferences explicit rather than treating acceptance as the final administrative step after a clinician has already chosen the treatment plan [36, 37]. Within this framework, patient preference does not function as a fixed veto or automatic mandate. It is a determinant that must be integrated with expected benefit, risk, feasibility, and decision-making capacity, and it should be revisited when health status or goals change.

Medication-level determinants

Medication-level determinants describe properties of the treatment itself rather than characteristics of the patient. Relevant dimensions include indication, expected onset of benefit, withdrawal risk, adverse-effect profile, interaction potential, formulation, dosing frequency, monitoring requirements, cumulative anticholinergic or sedative burden, and vulnerability to administration error.

Regimen complexity is particularly important because burden may sometimes be reduced without discontinuing clinically valuable therapy. The SIMPLER trial demonstrated that medication-administration schedules in residential aged care can be simplified using a structured process [38].

Transitions of care create another medication-level vulnerability. Additions, omissions, and dose discrepancies can emerge when older patients move between hospital, post-acute care, and home [39]. Such discrepancies may reflect deliberate change, communication failure, or incomplete reconciliation. Their significance therefore depends on clinical interpretation rather than counting discrepancies alone.

Clinician decision factors

Medication decisions are also shaped by professional judgment and the way recommendations are communicated and acted upon. Clinicians vary in their estimation of treatment risk, confidence in prognosis, tolerance of uncertainty, familiarity with deprescribing, and willingness to alter therapy initiated by another professional. These factors can affect whether an identified medication problem results in action.

Evidence on pharmacist recommendations illustrates this dependency. Acceptance by prescribers varies according to setting, recommendation characteristics, and the circumstances in which the recommendation is made [40]. Pharmacist review therefore creates an important source of medication expertise without eliminating the need for clinical integration and shared responsibility.

Decision environments can also modify clinician behavior. Electronic health-record interventions that alter defaults, prompts, or choice architecture have been tested as methods for increasing deprescribing activity in older adults [41]. Such tools may improve the visibility of medication problems, but they cannot determine whether a particular treatment remains appropriate for an individual patient. Their role is to support, not replace, judgment.

Organizational and system factors

Pharmacotherapy decisions occur within organizations that determine how information, responsibility, and follow-up are distributed. Time pressure and limited access to pharmacists, nurses, geriatric expertise, or palliative-care consultation can further restrict the range of actions that are practically available.

Medication-review evidence shows why organizational configuration matters. Reviews of interventions intended to reduce readmission suggest that medication review alone does not reliably achieve the same effects as multicomponent approaches incorporating additional transitional or follow-up support [42]. The implication is not that medication review lacks value, but that identification of a medication problem and successful correction are separate processes. An optimization framework must therefore include implementation capacity: who can change the regimen, who monitors the consequences, how information is transferred, and whether reassessment occurs after the decision.

Identification of potential medication-related harm

Potential medication-related harm should be identified through multiple channels rather than through a single list of inappropriate medicines [43]. Contemporary geriatric medication-safety literature recognizes both excessive or inappropriate exposure and underuse as clinically relevant quality problems [44]. Harm identification must consequently ask two complementary questions: which current treatments may be causing or increasing risk, and which clinically important treatment goals are not being adequately met?

Signals of possible harm include new symptoms temporally related to medication use, known high-risk exposures, drug–drug or drug–disease interactions, abrupt changes after dose modification, prescribing cascades, treatment duplication, medication discrepancies, administration difficulty, and failure to obtain required monitoring. None of these signals establishes causality by itself. Each initiates further clinical interpretation.

Medication administration deserves particular attention because the act of delivering therapy is itself a safety process. Mixed-methods evidence from aged-care facilities demonstrates the complexity of administration workflows and the opportunities for error created by staffing, communication, interruptions, formulation requirements, and resident-specific needs [45]. These observations make nursing and caregiver knowledge important sources of medication-safety information.

Table 2 organizes these risks around the medication-level determinant, the contextual factor that modifies its meaning, and the professional response needed before a safe optimization decision can be made.

Table 2. Interaction matrix for medication-level determinants, harm mechanisms, contextual modifiers, and professional response

Medication-level determinant	How risk can manifest	Patient or contextual modifier	Professional responsibility interface	Optimization consequence	Primary surveillance target
Potentially inappropriate exposure	Adverse effect, disease aggravation, excessive sedation, bleeding, falls,	Frailty, comorbidity, organ function,	Pharmacist review; physician interpretation and prescribing	Continue with justification, modify, substitute,	New symptoms, functional change,

	cognitive burden, or other drug-specific risk	current goals, previous tolerance	decision; nursing observation	monitor, or discontinue	laboratory or clinical toxicity
Drug–drug interaction	Altered drug exposure or additive pharmacodynamic effect	Renal/hepatic function, dose, duration, coexisting risk factors	Pharmacist identification; prescriber risk assessment; nursing monitoring	Avoid combination, adjust dose, change agent, or intensify surveillance	Interaction-specific adverse effects
Prescribing cascade	Adverse effect interpreted as a new disease requiring another medicine	Diagnostic uncertainty, fragmented care, multiple prescribers	Cross-professional medication history and diagnostic reassessment	Remove precipitating exposure, treat only if separate indication remains	Temporal relationship between symptom and medication change
Regimen complexity	Missed doses, administration error, treatment fatigue, caregiver burden	Cognition, dexterity, swallowing, daily routine, caregiver support	Pharmacist regimen redesign; prescriber authorization; nursing/caregiver implementation	Consolidate dosing, change formulation, simplify schedule, or discontinue low-value therapy	Adherence and administration feasibility
Medication discrepancy	Omission, duplication, unintended continuation, unintended dose change	Care transition, incomplete documentation, multiple medication lists	Medication reconciliation shared across professions and settings	Correct unintended discrepancy and clarify intended regimen	Concordance between prescribed and actually used medicines
Administration constraint	Incorrect timing, preparation, route, or inability to deliver therapy reliably	Dysphagia, fatigue, staffing, equipment, care setting	Nursing detection; pharmacist formulation advice; prescriber modification	Change formulation, route, schedule, monitoring, or therapy	Actual administration rather than prescribed regimen alone
Therapeutic failure	Persistent untreated symptom, preventable complication, or failure to achieve an important goal	Nonadherence, underdosing, omitted indication, inaccessible treatment	Multidisciplinary reassessment of indication, adherence, dose, and feasibility	Initiate, restore, intensify, substitute, or support therapy	Evidence that intended clinical benefit is not being achieved

Pharmacotherapy optimization logic

Identification of a medication problem is only the beginning of optimization. The next step is to determine which response best addresses the problem without creating a new one. The available action set should therefore remain wider than “continue versus stop.” A medicine may require continuation with closer surveillance, dose reduction, substitution, simplification of administration, restoration after inappropriate omission, initiation of an indicated treatment, or withdrawal.

Structured pharmacist-led review in frail nursing-home populations demonstrates how explicit medication criteria can be converted into recommendations that are then interpreted and implemented with the prescribing clinician [46]. A screening criterion may identify risk, but the final action depends on indication, current benefit, expected future benefit, treatment burden, patient preference, withdrawal risk, and the capacity to monitor what happens next.

The clinical logic can therefore be expressed as a conditional sequence. First, establish the medication’s current purpose and whether that purpose remains relevant to the patient’s goals. Second, assess whether benefit is occurring now or is reasonably expected within the patient’s clinical horizon. Third, identify medication-specific harm, treatment workload, interaction risk, therapeutic failure, or implementation difficulty. Fourth, determine whether the problem can be corrected while preserving useful treatment. Only then should continuation, initiation, modification, simplification, intensified monitoring, substitution, or deprescribing be selected.

This logic is deliberately nonhierarchical: deprescribing does not occupy the final or preferred position. A drug should be discontinued when withdrawal produces the strongest expected benefit–burden configuration, just as a clinically necessary medicine should be maintained or initiated when doing so better serves current goals. Pharmacotherapy optimization is therefore the repeated selection of the most defensible medication action under changing clinical and care conditions.

Deprescribing as a component of optimization

Deprescribing represents one possible response when the balance between medication-related burden and expected benefit has shifted. In this sense, deprescribing is a clinical intervention rather than a passive removal of treatment.

Evidence from community and frail older-adult populations demonstrates that deprescribing interventions can modify medication exposure and potentially inappropriate medication use, although effects vary according to intervention design, population, medication class, and outcome assessed [47]. A reduction in pill burden may be

valuable, but symptom recurrence, loss of disease control, withdrawal effects, or increased caregiver burden may occur if the medication was providing meaningful benefit.

End-of-life prescribing provides a particularly important example of why deprescribing must remain connected to optimization rather than treated as its endpoint. Research among patients receiving home-based hospice care has identified both potentially inappropriate medications and prescribing omissions, demonstrating that medication problems near the end of life can involve excessive treatment as well as insufficient treatment [48]. A patient may require withdrawal of a preventive therapy with limited near-term value while simultaneously requiring initiation or continuation of medication that improves comfort, function, or symptom control.

Therefore, deprescribing decisions should be evaluated through several questions: What purpose does the medicine currently serve? Are there safer or less burdensome alternatives? These questions maintain deprescribing as an important component of optimization while preventing it from becoming a substitute for individualized pharmacotherapy assessment.

Adverse drug event prevention pathways

Adverse drug event prevention requires attention to the pathways through which medication-related harm develops. Some pathways begin with the properties of a medicine itself, such as interaction potential or adverse-effect burden. Others emerge through clinical processes, including incomplete reconciliation, prescribing cascades, administration problems, or insufficient monitoring after medication changes.

Drug–drug interactions illustrate why prevention cannot rely solely on identifying whether a patient takes multiple medicines. The clinical importance of an interaction depends on the specific agents involved, patient characteristics, dose, duration, and physiological vulnerability [19]. Similarly, prescribing cascades require recognition of temporal relationships between medication exposure and new symptoms rather than simply adding treatments in response to each new clinical problem [20].

Transitions between care environments represent another prevention pathway. When medication information is transferred inaccurately, unintended continuation, omission, duplication, or dose alteration may occur [39]. These discrepancies require interpretation: some represent deliberate therapeutic changes, whereas others indicate failures of communication or reconciliation.

Medication administration systems also influence safety. In aged-care environments, medication delivery depends on workflow, staffing, communication, interruptions, formulation requirements, and resident-specific needs [45]. Prevention therefore extends beyond selecting the correct medicine. It includes ensuring that the medicine can be delivered, monitored, and adjusted within the realities of the care environment.

The resulting prevention logic is multidimensional: reduce avoidable exposure when appropriate, preserve necessary treatment, detect emerging harm early, clarify responsibility across professionals, and maintain mechanisms for reassessment. **Figure 1** presents this relationship architecture by linking medication-level determinants, contextual modifiers, and prevention pathways.

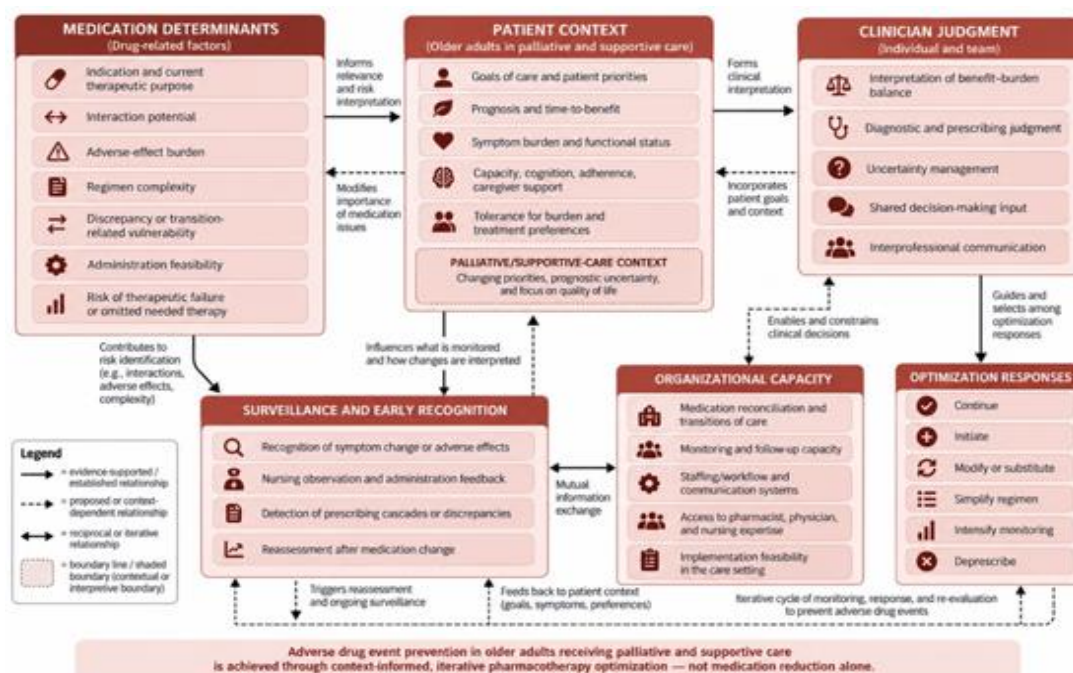


Figure 1. Multilevel pharmacotherapy optimization pathways linking medication determinants, clinical context, and adverse drug event prevention

Nursing surveillance and early recognition

Medication safety in palliative and supportive care depends partly on the ability to recognize meaningful changes after treatment decisions are made. Nurses frequently observe patients over time and may identify symptom changes, functional decline, adverse effects, administration difficulties, or deviations between prescribed and actual medication use.

Palliative nursing competencies include assessment, communication, coordination, symptom recognition, and collaboration across professional roles [49]. These functions are particularly relevant when medication effects cannot be evaluated solely through laboratory values or scheduled clinical encounters. Changes in alertness, mobility, appetite, comfort, cognition, swallowing ability, or daily function may provide important information about whether a medication plan remains appropriate.

However, surveillance should not be interpreted as the responsibility of a single profession. A nurse may identify a concerning change, but interpretation of indication, pharmacology, alternatives, and prescribing authority requires collaboration.

Thus, nursing surveillance functions as a clinical feedback mechanism within optimization. It helps determine whether the anticipated benefit of a medication is occurring, whether burden has increased, and whether the selected action should be revisited.

Pharmacist–physician–nurse responsibilities

Medication optimization requires shared responsibility, but shared responsibility does not mean interchangeable roles. Physicians contribute diagnostic assessment, therapeutic decision-making, prognostic integration, and prescribing authority within their clinical context. Nurses contribute continuous observation, administration assessment, symptom recognition, and communication of patient changes.

Studies of pharmacist recommendation acceptance demonstrate that medication expertise only produces change when recommendations are integrated into clinical decision processes [40]. Pharmacist review therefore represents an important contribution, but implementation depends on communication, professional collaboration, and agreement about the patient's goals.

Similarly, pharmacist-led interventions in frail older adults and palliative settings demonstrate that medication optimization often requires longitudinal follow-up rather than a single medication review encounter [46, 50]. Medication changes may require monitoring for symptom recurrence, withdrawal effects, improved function, or new concerns after implementation.

The framework therefore treats responsibility as distributed across the medication-use pathway. Optimization emerges from combining medication expertise, clinical judgment, patient priorities, and observations from those involved in daily care.

Proposed pharmacotherapy optimization framework

The proposed pharmacotherapy optimization framework integrates seven decision domains: goals of care, prognosis and time-to-benefit, medication benefit–burden balance, patient-level determinants, medication-level determinants, clinician decision factors, and organizational capacity.

The framework begins with the question of purpose: what outcome is this medication intended to achieve, and does that outcome remain relevant? The next consideration is temporal alignment: can meaningful benefit occur within the patient's clinical horizon, and is the current burden acceptable while waiting for that benefit?

The third domain concerns medication-specific characteristics. A medicine may require reassessment because of adverse-effect risk, interaction potential, administration complexity, discrepancy, or lack of ongoing indication. However, medication-level concern does not automatically determine the response. The patient's priorities, functional status, preferences, and ability to manage treatment remain essential modifiers.

The fourth domain concerns professional and organizational feasibility. Even a clinically appropriate plan may fail if monitoring, communication, follow-up, or implementation capacity is insufficient. Conversely, organizational support can allow continuation of complex therapy when its benefits remain meaningful.

Clinical application of the framework

Application begins with medication purpose identification: why is each treatment present, and what outcome does it serve? The second step is assessment of current alignment between that purpose and the patient's goals, prognosis, functional state, and treatment burden.

The third step examines medication-specific concerns, including adverse effects, interaction risk, administration feasibility, and evidence of therapeutic failure. The fourth step considers who can safely implement change and monitor consequences. The final step selects an action and establishes reassessment.

Examples of application logic include simplifying a complex regimen when administration burden threatens adherence, maintaining a preventive therapy when expected benefit remains relevant and consistent with patient goals, discontinuing a low-value medicine with immediate burden and limited expected benefit, or initiating treatment when an important symptom or therapeutic need remains insufficiently addressed.

Evidence from pharmacist-led programs supports the feasibility of structured medication optimization processes, although available studies do not validate a universal algorithm [46, 50]. Community and older-adult deprescribing evidence similarly demonstrates that interventions can influence medication use while maintaining substantial heterogeneity in outcomes [47]. The framework therefore functions as a guide for structured reasoning and research testing rather than as a replacement for clinical judgment.

Research propositions and future research agenda

The framework generates several propositions for future evaluation. First, studies should test whether multidimensional medication decision approaches improve outcomes beyond medication-count reduction alone. Second, research should determine which combinations of patient priorities, medication characteristics, professional collaboration, and organizational support most strongly influence successful optimization.

Third, future studies should distinguish different optimization outcomes. Medication reduction, symptom control, functional status, treatment burden, adverse events, caregiver workload, and patient satisfaction represent related but nonidentical outcomes. Fourth, research should examine how decision processes perform across settings with different resources, including home hospice, community care, residential aged care, and specialist palliative services.

Finally, empirical validation should examine whether the framework improves decision consistency without reducing individualized judgment. The goal is not to replace clinical reasoning with a score or automated pathway, but to identify which components most reliably support appropriate medication decisions.

Results and Discussion

This article proposes that pharmacotherapy optimization in older adults receiving palliative and supportive care should be understood as a dynamic decision process rather than a medication-reduction strategy. However, the same evidence also demonstrates that deprescribing outcomes are heterogeneous and that medication-related harm can arise from underuse, therapeutic failure, or inadequate implementation.

The contribution of the framework is therefore its integration of multiple decision domains into one conceptual structure. Goals of care determine what matters; prognosis and time-to-benefit determine whether expected value remains relevant; medication-level characteristics determine potential burden or risk; patient-level factors determine feasibility; clinician judgment determines interpretation; and organizational factors determine whether the selected action can be safely implemented.

The framework also preserves uncertainty. A clinically useful approach must therefore support reassessment rather than assume that one decision remains correct indefinitely.

Conclusion

Pharmacotherapy optimization in older adults receiving palliative and supportive care requires a broader approach than medication reduction alone. The most appropriate medication plan may involve continuing, initiating, modifying, simplifying, monitoring, substituting, or deprescribing treatments depending on goals of care, prognosis, expected benefit, treatment burden, patient circumstances, medication characteristics, and care capacity. A clinically meaningful approach therefore treats adverse drug event prevention as part of an ongoing process of reassessment in which medication decisions remain responsive to changing patient needs.

Acknowledgments: None

Conflict of interest: None

Financial support: None

Ethics statement: None

References

1. Thompson W, McDonald EG. Polypharmacy and deprescribing in older adults. *Annu Rev Med.* 2024;75:113-27. doi:10.1146/annurev-med-070822-101947
2. Hung A, Kim YH, Pavon JM. Deprescribing in older adults with polypharmacy. *BMJ.* 2024;385. doi:10.1136/bmj-2023-074892
3. Sergun VP, Evgenia B, Burkova VN, Poznyakovsky VM, Danko NN, Tokhiriyon B. Treatment of menstruation disorders at puberty: a plant-based dietary supplement efficacy and safety. *J Biochem Technol.* 2023;14(3):13-7. doi:10.51847/r9vJrE0mHw

4. Radbruch L, De Lima L, Knaul F, Wenk R, Ali Z, Bhatnagar S, et al. Redefining palliative care—a new consensus-based definition. *J Pain Symptom Manage.* 2020;60(4):754-64. doi:10.1016/j.jpainsymman.2020.04.027
5. Ati UB, Atangwho IJ, Itam EH. Effect of monosodium glutamate on selected tissue lipids and haematology of neonatal and adult Wistar rats. *J Biochem Technol.* 2025;16(1):1-8. doi:10.51847/88vnUSGDHJ
6. Dijk MT, Pouw CAM, Hertogh CMPM, van Marum RJ, Hugtenburg JG, Smalbrugge M. Medication appropriateness for older nursing home patients with a limited life expectancy: from STOPP/START version 2 to the ReNeWAL criteria. *J Am Med Dir Assoc.* 2024;25(9):105143. doi:10.1016/j.jamda.2024.105143
7. Boulaares I, Derouiche S, Niemann J. *Ocimum basilicum* L.: a systematic review on pharmacological actions and molecular docking studies for anticancer properties. *J Biochem Technol.* 2024;15(1):12-8. doi:10.51847/TlkGjN14PM
8. Naples JG, Aspinall SL, Schmader K, Hanlon JT. Have we forgotten about therapeutic failure in older adults? *J Am Geriatr Soc.* 2025;73(8):2579-88. doi:10.1111/jgs.19497
9. Bona C, Camacho-Alonso F, Vaca A, Llorente-Alonso M. Oral biofilm control in patients using orthodontic aligners: evidence from a systematic review. *Asian J Periodontics Orthod.* 2025;5(1):33-42. doi:10.51847/silhUaqfip
10. Cahyaningsih I, Hikmah N, Maziyyah N. Drug-related problems in elderly patients with diabetes: a study in primary health care setting. *J Adv Pharm Educ Res.* 2023;13(2):29-34.
11. Krishnaswami A, Steinman MA, Goyal P, Zullo AR, Anderson TS, Birtcher KK, et al. Deprescribing in older adults with cardiovascular disease. *J Am Coll Cardiol.* 2019;73(20):2584-95. doi:10.1016/j.jacc.2019.03.467
12. Romano F, Conti GB, Bianchi ML. Classification systems for periodontal risk in adult orthodontics. *Asian J Periodontics Orthod.* 2024;4(1):165-74. doi:10.51847/ZyFXwgAlFT
13. 2023 American Geriatrics Society Beers Criteria Update Expert Panel. American Geriatrics Society 2023 updated AGS Beers Criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc.* 2023;71(7):2052-81. doi:10.1111/jgs.18372
14. Patel P, Prajapati B, Patel D. Innovative approaches in designing a pregabalin orodispersible film for epilepsy treatment. *Pharmacophore.* 2024;15(4):6-14. doi:10.51847/NlljG760uB
15. Febrianti Y, Muhajir M, Khoiroh U, Claridho F, Djodibroto JA, Srihadi N. Prevalence of potentially inappropriate medications in psychogeriatric patients in Indonesia based on the Beers 2019 criteria. *J Adv Pharm Educ Res.* 2023;13(2):144-9. doi:10.51847/FQO4oRKkfk
16. Zhou Y, Pan YF, Xiao Y, Sun YJ, Dai Y, Yu YF. Association between potentially inappropriate medication and mortality risk in older adults: a systematic review and meta-analysis. *J Am Med Dir Assoc.* 2025;26(2):105394. doi:10.1016/j.jamda.2024.105394
17. Su Z, Sun Q, Cheng X, Hu Y. Resistance mechanisms of cigarette beetles (*Lasioderma serricornis*) to beta-cyfluthrin and the efficacy of imidacloprid space sprays. *Entomol Lett.* 2025;5(1):1-11. doi:10.51847/FbyVITpsJZ
18. Idrissi FE, Bennani S, Benali Y, Ali AB. Organizational fragility under persistent over-optimization and reduced operational slack. *J Appl Organ Syst Behav.* 2025;5(1):81-9. doi:10.51847/Z4zHLWsZcW
19. Hughes JE, Moriarty F, Bennett KE, Cahir C. Drug-drug interactions and the risk of adverse drug reaction-related hospital admissions in the older population. *Br J Clin Pharmacol.* 2024;90(4):959-75. doi:10.1111/bcp.15970
20. Growdon ME, Jing B, Morris EJ, Deardorff WJ, Boscardin WJ, Byers AL, et al. Which older adults are at highest risk of prescribing cascades? A national study of the gabapentinoid-loop diuretic cascade. *J Am Geriatr Soc.* 2024;72(6):1728-40. doi:10.1111/jgs.18892
21. Bennett O, Collins H, Foster J, Wright E. Algorithmic psychological contracts and fairness expectations in artificial intelligence-mediated work. *J Appl Organ Syst Behav.* 2024;4(2):103-11. doi:10.51847/o95HH2b6Sl
22. Tinetti ME, Naik AD, Dindo L, Costello DM, Esterson J, Geda M, et al. Association of patient priorities-aligned decision-making with patient outcomes and ambulatory health care burden among older adults with multiple chronic conditions: a nonrandomized clinical trial. *JAMA Intern Med.* 2019;179(12):1688-97. doi:10.1001/jamainternmed.2019.4235
23. Fonseca Valencia C, Schell BR, Guerrier C, VanSpeybroeck GA, Gurevitch J, Harrington M, et al. Addressing what matters: a pilot study and mixed methods evaluation of Patient Priorities Care in four clinical settings. *J Am Geriatr Soc.* 2025;73(7):2229-37. doi:10.1111/jgs.19419
24. Zhao Y, Chen L, Fauzi A, Hayati N. Human judgment and responsibility after artificial intelligence recommendations. *J Appl Organ Syst Behav.* 2024;4(2):121-9. doi:10.51847/5UBPUjO0HH
25. Yourman LC, Cenzer IS, Boscardin WJ, Nguyen BT, Smith AK, Schonberg MA, et al. Evaluation of time to benefit of statins for the primary prevention of cardiovascular events in adults aged 50 to 75 years: a meta-analysis. *JAMA Intern Med.* 2021;181(2):179-85. doi:10.1001/jamainternmed.2020.6084

26. Fischer D, Meier L, Braun T, Koch S, Roth F. Beyond bioavailability: evaluating pharmaceutical technologies through usability, robustness, and therapeutic continuity. *J Appl Pharm Technol Syst.* 2024;3:169. doi:10.68159/s063882182
27. Lavan AH, Gallagher P, Parsons C, O'Mahony D. STOPPFrail (Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy): consensus validation. *Age Ageing.* 2017;46(4):600-7. doi:10.1093/ageing/afx005
28. Ferraro G, De Luca M, Ricci P, Romano A. Clinical and experimental evidence for the use of macrolide antibiotics in gastrointestinal and respiratory diseases. *J Appl Pharm Technol Syst.* 2025;4:112. doi:10.68159/s160882507
29. Curtin D, Gallagher P, O'Mahony D. Deprescribing in older people approaching end-of-life: development and validation of STOPPFrail version 2. *Age Ageing.* 2021;50(2):465-71. doi:10.1093/ageing/afaa159
30. Alves R, Costa B, Martins H, Faria N. Strategic leadership in algorithmically mediated organizations: managing firms where data-driven systems inform decision authority. *J Digit Bus Manag Stud.* 2025;5:47. doi:10.68159/y092135641
31. Quek HW, Page A, Lee K, Lee G, Hawthorne D, Clifford R, et al. The effect of deprescribing interventions on mortality and health outcomes in older people: an updated systematic review and meta-analysis. *Br J Clin Pharmacol.* 2024;90(10):2409-82. doi:10.1111/bcp.16200
32. Carollo M, Crisafulli S, Vitturi G, Besco M, Hinek D, Sartorio A, et al. Clinical impact of medication review and deprescribing in older inpatients: a systematic review and meta-analysis. *J Am Geriatr Soc.* 2024;72(10):3219-38. doi:10.1111/jgs.19035
33. Anazi WMA, Habeeb KA, Alahmadi AF, Alajaj IY, Alahmari SM, AlHammad AA, et al. Sarcopenic obesity evaluation and management in primary care: a narrative review. *World J Environ Biosci.* 2025;14(1):59-66. doi:10.51847/9YZnkZJp81
34. Pickering AN, Richardson S, Rogal S, Thorpe CT, Brach J, Radomski TR. Facilitators of and barriers to deprescribing diabetes medications in older adults: a qualitative study. *J Am Geriatr Soc.* 2025;73(8):2447-56. doi:10.1111/jgs.19550
35. Fischer D, Meier L, Braun T, Koch S. Uncertainty and reliability in materials AI—concepts, language, and decision consequences. *J Artif Intell Mater Sci.* 2025;4:65. doi:10.68159/c294355934
36. Fariman S, Arabshomali A, Goordeen D, Niznik JD, Hemati H, Lafata JE. Shared decision making interventions for deprescribing in older adults with polypharmacy: a scoping review. *J Am Geriatr Soc.* 2025;73(12):3884-94. doi:10.1111/jgs.70059
37. Nakamura H, Kato Y. Scientific risk in autonomous materials discovery: a conceptual framework for anticipating unsafe recommendations. *J Artif Intell Mater Sci.* 2025;4:80. doi:10.68159/n815660688
38. Sluggett JK, Chen EYH, Ilomäki J, Corlis M, van Emden J, Hogan M, et al. Reducing the burden of complex medication regimens: Simplification of Medications Prescribed to Long-term care Residents (SIMPLER) cluster randomized controlled trial. *J Am Med Dir Assoc.* 2020;21(8):1114-20.e4. doi:10.1016/j.jamda.2020.02.003
39. Vasilevskis EE, Trumbo SP, Shah AS, Hollingsworth EK, Shotwell MS, Mixon AS, et al. Medication discrepancies among older hospitalized adults discharged from post-acute care facilities to home. *J Am Med Dir Assoc.* 2024;25(7):105017. doi:10.1016/j.jamda.2024.105017
40. Ramsey NC, Peterson GM, Mirkazemi C, Salahudeen MS. Factors influencing medical prescribers' acceptance of pharmacists' recommendations in non-hospitalized older adults: a systematic review and meta-analysis. *J Am Med Dir Assoc.* 2025;26(3):105462. doi:10.1016/j.jamda.2024.105462
41. Lauffenburger JC, Isaac T, Trippa L, Glynn RJ, Russo M, Keller P, et al. Comparing fourteen behavioral science electronic health record deprescribing tools in older adults: NUDGE-EHR adaptive trial. *J Am Geriatr Soc.* 2025;73(10):3031-43. doi:10.1111/jgs.19609
42. Dautzenberg L, Bretagne L, Koek HL, Tsokani S, Zevgiti S, Rodondi N, et al. Medication review interventions to reduce hospital readmissions in older people. *J Am Geriatr Soc.* 2021;69(6):1646-58. doi:10.1111/jgs.17041
43. Alanazi WM, Alshamrani AH, Algadmi MS, Alkandari AA, Husain FSH, Banoon HJ, et al. The efficacy of pre-habilitation in primary care for geriatric fall prevention: a narrative review. *World J Environ Biosci.* 2025;14(2):98-106. doi:10.51847/096UIF7Q8R
44. Ailabouni NJ, Marcum ZA, Schmader KE, Gray SL. Medication use quality and safety in older adults: 2019 update. *J Am Geriatr Soc.* 2021;69(2):336-41. doi:10.1111/jgs.17018
45. Garratt S, Dowling A, Manias E. Medication administration in aged care facilities: a mixed-methods systematic review. *J Adv Nurs.* 2025;81(2):621-40. doi:10.1111/jan.16318
46. Hurley E, Dalton K, Byrne S, Foley T, Walsh E. Pharmacist-led deprescribing using STOPPFrail for frail older adults in nursing homes. *J Am Med Dir Assoc.* 2024;25(9):105122. doi:10.1016/j.jamda.2024.105122

47. Linsky AM, Motala A, Booth M, Lawson E, Shekelle PG. Deprescribing in community-dwelling older adults: a systematic review and meta-analysis. *JAMA Netw Open.* 2025;8(5). doi:10.1001/jamanetworkopen.2025.9375
48. Lee J, Lee CW, Kim HS, Kim HR, Lim SY, Kim JR. Potentially inappropriate prescriptions in end-of-life cancer patients in home-based hospice care. *J Pain Symptom Manage.* 2025;70(1):22-9. doi:10.1016/j.jpainsymman.2025.03.021
49. Guo J, Dai Y, Chen Y, Liang Z, Hu Y, Xu X, et al. Core competencies among nurses engaged in palliative care: a scoping review. *J Clin Nurs.* 2024;33(10):3905-22. doi:10.1111/jocn.17294
50. Lowry MF, Lee S, Hoke MF, Leung ER, Roup H, Linge HE, et al. Pharmacist-led opioid deprescribing pilot clinic within outpatient palliative care. *J Pain Symptom Manage.* 2025;70(5). doi:10.1016/j.jpainsymman.2025.07.020