

When Does Pharmacist-Led Medication Optimization Improve Patient Outcomes? A Systematic Review and Meta-Analysis of Intervention Components, Practice Settings, and Outcomes in Multimorbidity and Polypharmacy, 2017–2026

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ABSTRACT

Pharmacist-led medication optimization is increasingly used to address polypharmacy, potentially inappropriate prescribing, and medication-related risk in older people with multimorbidity. However, improvement in medication-related indicators does not necessarily translate into fewer hospitalizations, lower mortality, fewer falls, better function, or improved quality of life. To determine when pharmacist-led medication optimization is associated with improved outcomes by distinguishing intervention components, practice settings, patient contexts, and outcome domains. A structured search-and-screening process yielded 58 unique records after DOI/title deduplication. All 58 records were assessed against predefined eligibility criteria; 20 were excluded and 38 sources were included. The included evidence comprised clinical systematic reviews and meta-analyses, primary pharmacist-led medication-optimization studies, and methodological sources required for review conduct. Medication review, deprescribing, targeted medication-burden reduction, pharmacist prescribing authority, and multicomponent optimization were analyzed separately. Outcomes were grouped into medication-related, clinical, functional, treatment-burden, and patient-reported domains. Evidence was more consistent for proximal medication outcomes, including prescribing appropriateness, potentially inappropriate medication, medication burden, and drug-related problems, than for mortality, hospitalization, falls, quality of life, and other distal outcomes. Intervention effects varied across settings and populations, although these cross-study patterns did not establish causal moderation. Pharmacist-led medication optimization should not be treated as a uniform intervention or judged by medication count alone. Interpretation requires alignment among the medication problem, pharmacist role, patient vulnerability, practice setting, follow-up, and outcome selected.

Keywords: Pharmacist, Polypharmacy, Medication optimization, Deprescribing, Multimorbidity, Medication review

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Introduction

Polypharmacy in multimorbidity creates a medication-management problem that cannot be represented adequately by medication count alone. Pharmacist-led interventions differ in therapeutic target, decision authority, intensity, care-team integration, follow-up, and outcome selection, while the outcomes attributed to them range from prescribing quality and medication burden to hospitalization, mortality, function, and patient experience. An updated systematic overview demonstrates substantial heterogeneity across interventions addressing polypharmacy and supports evaluating medication optimization as a collection of clinically different strategies rather than a single intervention [1].

Recent syntheses also show why setting must remain visible. Multidisciplinary interventions among community-dwelling older adults and medication-review or deprescribing interventions among hospitalized older patients are delivered through different care structures and operate over different follow-up conditions; both bodies of evidence support separating medication-related change from downstream clinical outcome [2, 3]. A medication decision is temporally and mechanistically closer to pharmacist activity than mortality, hospitalization, functional decline, or quality of life.

Deprescribing is therefore one medication-optimization strategy rather than a synonym for optimization itself. Contemporary community evidence reinforces the need to examine medication reduction alongside clinical and patient-reported consequences rather than treating discontinuation alone as sufficient evidence of benefit [4]. This review examines when pharmacist-led medication optimization appears beneficial by distinguishing intervention composition, setting, patient context, outcome proximity, and evidential uncertainty.

Review questions and eligibility framework

Three linked questions guided the review: which pharmacist-led or pharmacist-integrated medication-optimization approaches are associated with improved outcomes; whether reported patterns differ across settings and patient contexts; and whether improvement extends beyond proximal medication measures to clinical and patient-reported outcomes. Pharmacist-led primary-care evidence supports preserving the pharmacist's identifiable role while distinguishing medicines optimization, overprescribing reduction, medication review, and deprescribing [5].

Eligibility required an identifiable medication-optimization contribution and sufficient information to classify population, practice setting, intervention mechanism, comparator where applicable, outcome domain, and follow-up. Healthcare environment was treated as an interpretive variable because regional pharmacist-intervention evidence and primary-care prescribing research emphasize different outcome profiles and organizational contexts [6, 7]. Multimorbidity, clinically important polypharmacy, or an older population at substantial medication-related risk was required for the clinical evidence subset.

Long-term care was retained as a distinct setting because medication review and deprescribing may improve prescribing appropriateness without corresponding improvement across falls, hospitalization, or mortality [8]. Medication number, potentially inappropriate medication, appropriateness, drug-related problems, hospitalization, mortality, falls, function, treatment burden, and patient-reported outcomes were therefore kept analytically separate.

Materials and Methods

The review followed PRISMA 2020 principles for transparent identification, screening, eligibility assessment, inclusion, and synthesis [9]. PRISMA explanation and elaboration guidance informed the documentation of eligibility decisions, evidence boundaries, synthesis choices, and interpretation [10]. Definitions of multimorbidity, polypharmacy, and structured medication review were additionally informed by contemporary review methodology addressing medication review in adults with multimorbidity and polypharmacy [11].

The evidence-selection process began after DOI/title deduplication, with 58 unique records entering screening. Each record was assessed for the publication period, peer-reviewed status, DOI verification, and direct relevance to the medication-optimization questions or review methods. Twenty records did not meet the eligibility criteria and 38 sources were included. Complete pre-screening retrieval and deduplication logs were unavailable; totals preceding the 58-record screening set are therefore not reported.

Search reporting was aligned with PRISMA-S principles [12]. Clinical evidence and methodological evidence were subsequently treated as different evidence layers so that reporting or statistical-method papers could not be interpreted as evidence of pharmacist effectiveness.

Information sources and search strategy

Search construction followed a multi-step, concept-based strategy rather than a single phrase. Contemporary methodological guidance supports translating review questions into database-adapted combinations and documenting how concepts are operationalized [13]. Search concepts covered pharmacist or clinical-pharmacy involvement; medication review, medication optimization, deprescribing, and inappropriate prescribing;

polypharmacy, multimorbidity, frailty, and older age; primary care, community pharmacy, hospital, long-term care, and nursing-home settings; and medication-related, clinical, functional, and patient-reported outcomes.

Complementary bibliographic sources were considered important because database coverage differs across indexing systems [14]. Metaresearch further indicates that reliance on multiple databases decreases the risk of missing relevant studies compared with single-database searching [15]. Citation checking and related-source verification were also incorporated because supplementary retrieval can identify evidence not recovered through one indexed search route [16].

After DOI/title deduplication, 58 unique records underwent eligibility screening. Twenty did not meet the review criteria, and 38 were included in the synthesis.

Study selection and screening

Screening required human adjudication against the predefined clinical and methodological criteria. Machine-learning systems can improve efficiency in systematic-review screening when their role and human oversight remain transparent [17]. Comparative evaluations nevertheless show that screening performance varies across tools and workflows [18]. Automated prioritization was therefore not treated as equivalent to an eligibility decision.

More recent evidence similarly demonstrates that automated identification performance is domain dependent [19]. Reviews of large-language-model applications in systematic-review tasks support cautious implementation and continued human verification rather than autonomous evidence exclusion [20].

Figure 1 presents this accounting explicitly. The clinical and methodological branches remain visually separate because only the former can support claims about medication-optimization outcomes.

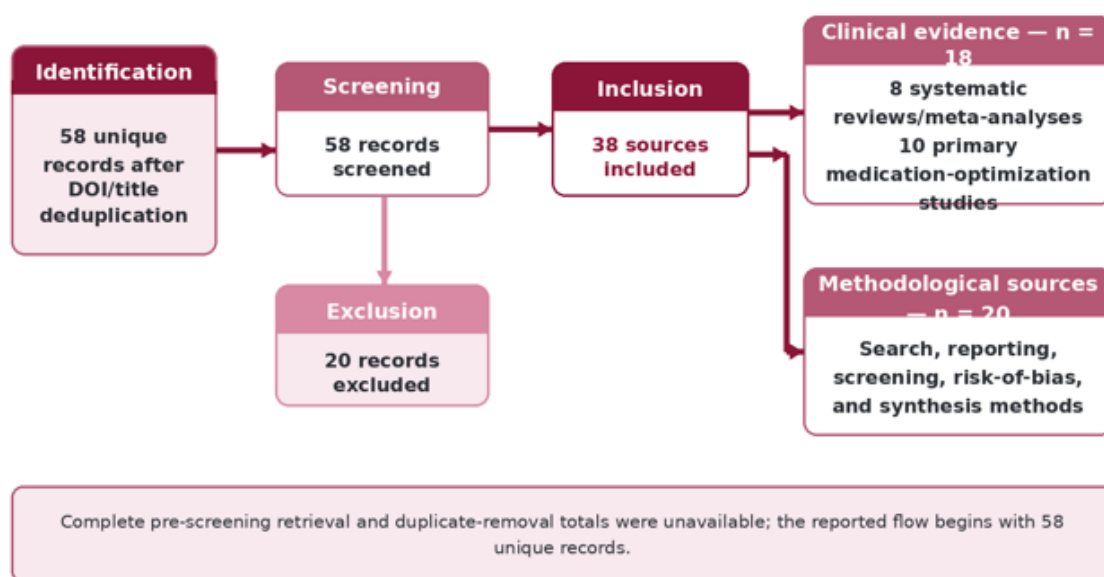


Figure 1. Selection of evidence for the pharmacist-led medication-optimization review

Data extraction and intervention-component coding

Extraction was designed to prevent clinically different pharmacist interventions from becoming an undifferentiated “medication review” category. Targeted medication review can address a specific pharmacological liability; pharmacist-led review has, for example, been evaluated specifically for reducing anticholinergic and sedative load in older people receiving polypharmacy [21]. Pharmacological target was therefore coded separately from intervention format.

Deprescribing-focused interventions were also distinguished from broader multicomponent optimization because their decision structures differ. A pragmatic deprescribing intervention and the multicomponent OPERAM strategy illustrate why intervention purpose, care-team involvement, implementation, and follow-up must remain separate extraction domains [22, 23]. Effects from a multicomponent intervention were not automatically attributed to an isolated component.

Professional authority was extracted independently of review content. The care-home evaluation of pharmacist independent prescribers demonstrates that capacity to initiate or modify therapy is itself an important service characteristic [24]. Extraction therefore covered population, setting, pharmacist role, intervention target, review or deprescribing components, decision authority, comparator, follow-up, outcome domain, and implementation context.

Risk-of-bias assessment

Risk of bias was conceptualized as a domain-based judgment rather than a numerical quality score. Applied experience with RoB 2 shows that structured assessment is useful but demanding in reviewer time and judgment [25]. Randomized evidence therefore requires transparent signaling-question assessment and adjudication where reviewers disagree.

Methodological research also shows that risk-of-bias tools differ in construction and scope [26]. This is important for an evidence base spanning randomized, cluster-randomized, pragmatic, observational, program-evaluation, review-level, and methodological sources. One undifferentiated instrument would not represent design-specific threats appropriately.

Aggregate numerical scoring was avoided because risk-of-bias tools can incorporate items that are not themselves bias domains, thereby obscuring why an estimate is judged credible or uncertain [27]. Empirical evaluation of RoB 2 has also demonstrated interrater-reliability challenges [28]. Interpretation therefore remained domain specific. Clinical findings were further qualified according to design: randomized studies permitted stronger comparative inference than retrospective or uncontrolled service evaluations, while review-level findings were interpreted with attention to heterogeneity and overlap among underlying studies.

Outcome harmonization and meta-analytic strategy

Outcome harmonization began with clinical compatibility rather than mathematical transformability. Medication count, deprescribing, potentially inappropriate medication, prescribing-appropriateness scores, drug-related problems, hospitalization, mortality, falls, quality of life, function, and treatment burden were treated as distinct families. Prediction intervals can add information about dispersion in random-effects meta-analysis when pooling is defensible [29], but statistical machinery cannot make clinically different outcomes equivalent.

Q , I^2 , τ^2 , and prediction intervals were assigned distinct interpretive roles because they represent different aspects of between-study variation [30]. Clinical and methodological compatibility therefore preceded statistical heterogeneity in deciding whether evidence could be pooled. Model selection likewise requires attention to the evidence-generating structure because fixed- and random-effects assumptions influence accuracy and precision [31]. Prediction-interval behavior also depends on characteristics of the underlying meta-analysis [32].

Published meta-analytic findings in the retained clinical reviews were therefore synthesized at the outcome-family level. A new pooled estimate was not calculated where a complete source-linked set of study-level effects, variances, time points, and unit-of-analysis information was not present. This preserves the distinction between synthesizing published meta-analytic evidence and reconstructing a *de novo* meta-analysis from incomplete primary data.

Results and Discussion

Of 58 unique candidate records screened, 20 were excluded and 38 were retained. The retained evidence architecture comprised 18 sources directly addressing clinical medication optimization and 20 methodological sources governing review conduct. The clinical subset included eight systematic reviews/meta-analyses and ten primary empirical medication-optimization studies.

The clinical literature demonstrated substantial variation in who was targeted and how pharmacists participated. In nursing-home care, pharmacist-led deprescribing using STOPP/Frail represents an explicitly frailty-oriented strategy in which medication decisions are conditioned by prognosis, therapeutic burden, and goals of care [33]. Such patients cannot be assumed to represent fitter community-dwelling adults with polypharmacy.

A dedicated ambulatory polypharmacy clinic provides a contrasting delivery structure in which medication optimization occurs through an outpatient pharmacist-led model [34]. This evidence informs service architecture but cannot establish transferability to systems with different prescribing authority, referral pathways, or continuity arrangements.

Cognitive impairment adds another boundary. The DemStepCare cluster-randomized study evaluated pharmacist-led medication review with prescribing appropriateness as a central outcome in people with dementia [35]. Across these examples, population vulnerability, intervention mechanism, setting, pharmacist authority, and outcome proximity remained necessary dimensions for interpretation.

Characteristics of included studies

The primary empirical evidence spans community pharmacy, ambulatory care, hospital and institutional environments, and high-risk clinical subgroups. A community-pharmacy randomized trial evaluated structured medication review against drug-related problems in people with polypharmacy [36]. In older people with hip fracture, pharmacist-led deprescribing was evaluated as a medication-safety strategy in an acute high-risk context [37]. Japanese community-pharmacy evidence additionally provides a real-world observational perspective on deprescribing in older adults with polypharmacy [38].

These studies complement earlier evidence on targeted anticholinergic and sedative-load reduction, pragmatic deprescribing, multicomponent inpatient optimization, pharmacist independent prescribing, frailty-oriented deprescribing, ambulatory polypharmacy services, and dementia-focused review. Their designs are not interchangeable. Randomized and cluster-randomized trials permit comparative interpretation under their design assumptions, whereas observational and program-evaluation evidence is more vulnerable to selection, confounding, and health-system effects.

Table 1 preserves intervention composition and practice context rather than collapsing all pharmacist activity into one exposure.

Table 1. Intervention composition and practice context of directly characterized pharmacist-led medication-optimization studies

Study/comparison	Population	Practice setting	Pharmacist role	Intervention components	Comparator	Follow-up representation	Principal outcome domain
van der Meer	Older adults with polypharmacy	Clinical medication review	Pharmacist reviewer	Targeted anticholinergic/sedative-load reduction	Control	Source-defined	Medication burden
Kuan	Older institutionalized adults	Institutional care	Deprescribing team role	Pragmatic deprescribing	Comparator	Source-defined	Mortality; hospitalization
OPERAM	Multimorbid older inpatients	Hospital	Integrated optimization role	Multicomponent pharmacotherapy optimization	Control clusters	Source-defined	Hospital admission; medication outcomes
CHIPPS	Care-home residents	Care homes	Independent prescriber	Review plus prescribing authority	Usual-care clusters	Source-defined	Clinical and medication-safety outcomes
Hurley	Frail older adults	Nursing homes	Pharmacist-led	STOPP/Frail deprescribing	Source-defined	Source-defined	Deprescribing outcomes
Tantipinichwong	Older patients	Ambulatory clinic	Clinic lead	Polypharmacy optimization service	Program evaluation	Source-defined	Medication/service outcomes
Kocklaener	People with dementia	Clustered care setting	Medication reviewer	Pharmacist-led review	Control clusters	Source-defined	Prescribing appropriateness
Bischof	Adults with polypharmacy	Community pharmacy	Structured-review provider	Medication review	Control group	Source-defined	Drug-related problems

Hu	Older hip-fracture patients	Acute care	Deprescribing role	Medication-safety deprescribing	Source-defined	Source-defined	Medication safety
Fujita	Older adults with polypharmacy	Community pharmacy, Japan	Routine-practice deprescribing	Deprescribing	Observational comparison	Source-defined	Deprescribing outcomes

Note: Table entries describe reported intervention characteristics and outcome domains. Quantitative values are not inferred where they were not part of the extraction record.

Effects on clinical and medication-related outcomes

Medication-related outcomes were consistently closer to the pharmacist intervention than mortality, hospitalization, falls, or other distal endpoints. The primary-care synthesis of potentially inappropriate prescribing supports treating prescribing quality as a discrete medication-level outcome [7]. Targeted anticholinergic and sedative-load reduction further illustrates that optimization may address a defined pharmacological burden rather than medication number [21]. In dementia, pharmacist-led medication review has likewise been evaluated through prescribing appropriateness [35]. Community-pharmacy structured review adds drug-related problems as another distinct proximal outcome [36].

Hard clinical outcomes require a different evidential threshold. The long-term-care synthesis demonstrates why medication-related improvement should not automatically be translated into reductions in falls, hospitalization, or mortality [8]. A favorable appropriateness score may indicate improvement in prescribing even when follow-up is too short or the study is insufficiently powered to detect a downstream clinical event. Conversely, a null mortality result does not demonstrate that medication quality was unchanged.

Published meta-analytic evidence therefore supports an outcome-specific interpretation rather than one global effect. **Table 2** records what can and cannot be treated as quantitatively commensurable. **Figure 2** makes the associated quantitative boundary explicit.

Table 2. Outcome-level quantitative interpretation of pharmacist-led medication-optimization evidence

Outcome family	Evidence structure	Appropriate effect family	Quantitative interpretation	Main uncertainty	Heterogeneity consideration	Interpretation boundary
Medication count/deprescribing	Multiple intervention types	MD or compatible medication-count metric	Published evidence supports medication reduction in selected contexts	Clinical appropriateness of reductions	Intervention target; baseline burden	Fewer medicines is not automatically better
PIM/appropriateness	Reviews and trials	RR/OR for binary measures; MD/SMD for compatible scales	Favorable prescribing signals occur across selected evidence	Definitions and instruments vary	Binary and continuous measures differ	Appropriateness is not equivalent to patient benefit
Drug-related problems	Community-pharmacy and review evidence	MD/RR when definitions align	Review can reduce identified medication-related problems	DRP taxonomy and adjudication	Taxonomy and assessment or variation	Identified/resolved DRP is a proximal endpoint
Hospitalization/readmission	Reviews and trials	RR/HR/IRR according to estimate	Effects are less consistent than medication-level outcomes	Follow-up and event definition	All-cause vs drug-related events	No universal utilization benefit established
Mortality	Review and trial evidence	RR/HR	No consistent universal mortality benefit established	Sparse events; competing risk	Population frailty and follow-up	Medication optimization should not be justified by assumed survival benefit
Falls	Mainly frail/LTC evidence	RR/IRR	Evidence does not support assuming a consistent fall reduction	Falls vs fallers; recurrent events	Frailty and medication target	Medication change and fall prevention are not interchangeable outcomes

Quality of life/PROs	Review-level evidence	MD/SMD only for compatible constructs	Effects remain variable and instrument dependent	Construct a standard scale heterogeneity	Timing and responsiveness	Patient benefit requires direct patient-centered measurement
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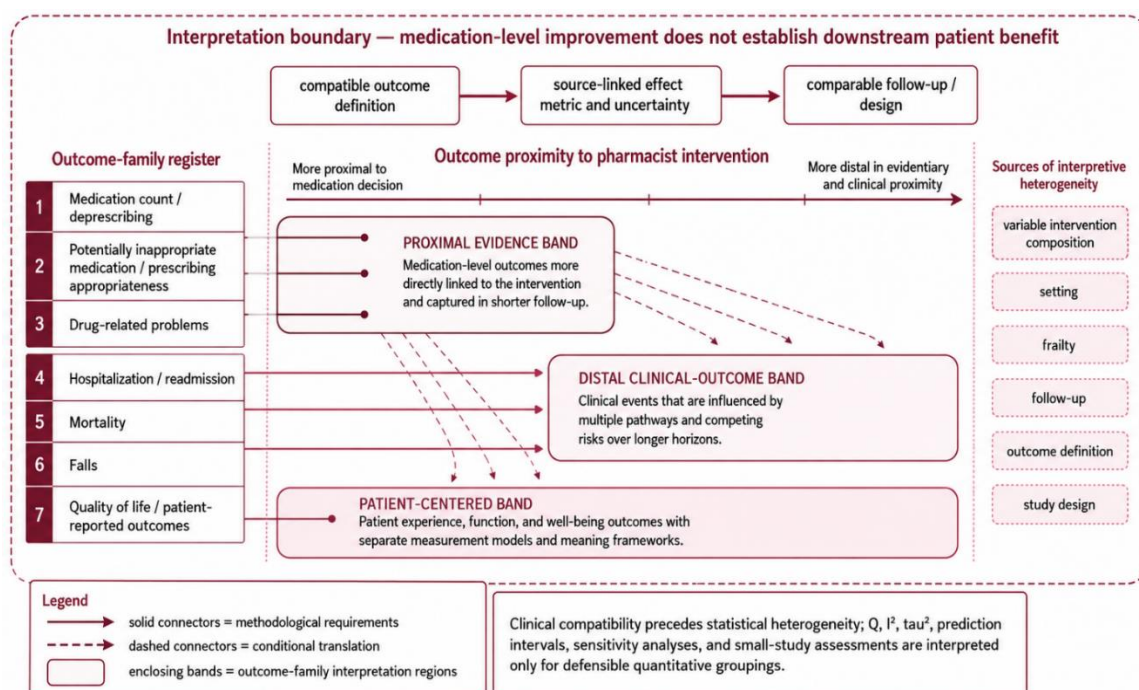


Figure 2. Outcome proximity constrains how medication-optimization effects can be interpreted across heterogeneous evidence

Effects on functional, treatment-burden, and patient-reported outcomes

Patient-centered outcomes require direct measurement rather than inference from medication reduction. Recent community deprescribing evidence supports evaluating quality of life and downstream outcomes separately from the act of deprescribing itself [4]. Regional pharmacist-intervention evidence similarly includes quality of life alongside hospitalization and mortality, reinforcing that these constructs require their own definitions and observation periods [6].

Treatment burden may persist even when the medication list becomes shorter. Monitoring, complex dosing, caregiver activity, replacement treatments, or disease-management requirements can remain unchanged. Functional benefit may likewise require a substantially longer time horizon than the pharmacist's medication decision. Patient-centered outcomes should therefore be interpreted at the patient level rather than inferred from regimen-level changes.

This distinction guards against surrogate substitution. Reduction in medication number or improvement in an appropriateness score does not demonstrate that symptoms, function, treatment workload, or perceived health improved. The broader polypharmacy evidence base is sufficiently heterogeneous to reinforce this outcome-specific interpretation [1]. Where patient-reported constructs, instruments, or follow-up periods differ materially, qualitative interpretation is preferable to forcing mathematical equivalence. Sparse or imprecise evidence should remain uncertain rather than being converted into an overall statement of improved patient experience.

Intervention components and practice-setting moderators

Several characteristics emerge as plausible explanatory dimensions, although the retained evidence does not establish them as causal moderators. Pharmacist-led primary-care interventions differ in purpose, integration, and professional responsibility [5]. Targeted review of anticholinergic and sedative burden demonstrates pharmacological specificity [21]. Pharmacist independent prescribing in care homes adds decision authority as another potentially important intervention characteristic [24].

Setting modifies the environment in which optimization is delivered. Community-dwelling adults, hospital inpatients, long-term-care residents, nursing-home populations, ambulatory-clinic patients, people with dementia, and people recovering from hip fracture differ in baseline risk, treatment goals, access to prescribers, follow-up opportunity, and competing causes of clinical outcomes. The frailty-oriented nursing-home intervention illustrates the relevance of prognosis and goals of care [33]. The ambulatory clinic model represents a contrasting continuity and referral structure [34].

Implementation opportunity also differs. Hospital-based interventions can alter therapy during acute care but may depend on postdischarge continuity. Community pharmacists may have repeated contact but more limited authority to modify prescriptions. These contrasts are plausible explanations for heterogeneity, not demonstrated causal mechanisms.

Table 3 separates observed component/context patterns from stronger claims that the evidence cannot support.

Table 3. Component–context patterns and interpretation boundaries in pharmacist-led medication optimization

Component or context	Principal outcome domain	Observed pattern	Evidence basis	Major confounding concern	Interpretation boundary
Target-specific medication review	Medication burden/appropriateness	Favorable medication-level signals	Targeted intervention evidence	Baseline burden; co-interventions	Does not prove downstream benefit
Deprescribing-focused care	Medication and clinical outcomes	Variable across outcome domains	Pragmatic and setting-specific evidence	Frailty; prognosis; selection	Deprescribing is not universally beneficial
Independent prescribing authority	Medication management/safety	Context dependent	Care-home cluster evidence	Team structure; local prescribing system	Authority effect cannot be isolated
Frailty or cognitive impairment	Appropriateness/deprescribing	Population specific	Nursing-home and dementia evidence	Severity; goals of care	Candidate boundary, not proven moderator
Practice setting	Multiple outcome domains	Heterogeneous	Community, inpatient, LTC and ambulatory evidence	Case mix; access; follow-up	Cross-setting difference is not causal evidence

Heterogeneity, sensitivity, and small-study considerations

Clinical compatibility determines whether statistical heterogeneity is meaningful. Prediction intervals can be informative in random-effects meta-analysis, but only once a defensible quantitative grouping exists [29]. Q , I^2 , τ^2 , and prediction intervals should not be interpreted interchangeably because they answer different heterogeneity questions [30]. Model choice also affects precision and depends on assumptions about the underlying distribution of effects [31].

For pharmacist-led medication optimization, plausible heterogeneity sources include intervention target, pharmacist authority, practice setting, baseline frailty or cognitive impairment, comparator, outcome definition, clustering, implementation intensity, and follow-up duration. Sensitivity analyses should therefore interrogate influential eligibility, design, risk-of-bias, time-point, and model assumptions where sufficient compatible evidence exists. Risk-of-bias judgments themselves warrant caution because interrater agreement can be imperfect [28].

Small-study and publication-bias procedures are not informative simply because they are conventional. When evidence within an outcome family is sparse or clinically diverse, an underpowered funnel-plot or regression test can create false reassurance. Statistical homogeneity likewise cannot establish clinical exchangeability. The review therefore gives priority to clinical compatibility and design interpretation before numerical heterogeneity measures.

The principal pattern is not that pharmacist-led medication optimization uniformly improves patient outcomes. Instead, apparent benefit depends strongly on which outcome is used to judge the intervention. Medication appropriateness, potentially inappropriate prescribing, drug-related problems, and targeted pharmacological burden are close to the medication decision and therefore may respond more directly than mortality, hospitalization, falls, function, or quality of life. Long-term-care evidence demonstrates why medication-level improvement cannot automatically be translated into hard-outcome benefit [8].

This interpretation avoids two opposite errors. The first is therapeutic minimalism: assuming that fewer medicines are intrinsically better. The second is outcome maximalism: assuming an intervention has no value unless it reduces mortality or hospitalization. Medication optimization requires correspondence between the problem targeted and the outcome used to assess it. An intervention directed at inappropriate anticholinergic exposure should first be evaluated on whether the relevant exposure and associated medication risk change; wider patient outcomes remain separate empirical questions [21].

The second major pattern is contextual. Multicomponent inpatient optimization, care-home independent prescribing, community-pharmacy review, frailty-oriented deprescribing, dementia-focused review, ambulatory polypharmacy services, and routine community deprescribing are not interchangeable interventions. OPERAM illustrates the difficulty of attributing a complex intervention's outcome to a single component [23]. Real-world Japanese community-pharmacy evidence likewise shows why observational associations should remain distinct from randomized comparative effects [38].

The synthesis proposed here is therefore conditional: meaningful patient benefit is most plausible when the medication problem is clinically important, pharmacist activity directly addresses that problem, recommendations can be implemented, care-team coordination supports continuity, and follow-up is adequate to detect the intended outcome. This is an organizing interpretation rather than a validated mechanism. Baseline prescribing quality, patient selection, secular changes, co-interventions, health-system access, frailty, cognition, and follow-up intensity remain alternative explanations for cross-study differences.

The included source set comprised 18 clinical sources and 20 methodological sources. Keeping these groups separate prevents reporting and statistical-method literature from inflating the apparent amount of clinical effectiveness evidence.

Implications for medication-optimization design

Medication-optimization programs should begin with a defined medication problem rather than an undifferentiated objective to reduce medicine numbers. Potentially inappropriate prescribing, pharmacological burden, drug-related problems, treatment complexity, unsafe continuation, and ineffective therapy represent different targets and may require different pharmacist capabilities. Primary-care evidence supports preserving the identifiable role of the pharmacist within that intervention structure [5].

The proposed design logic asks five questions: What medication problem is targeted? What decision authority does the pharmacist possess? How is the pharmacist integrated with prescribers, patients, and caregivers? What follow-up can detect emerging problems? Which outcome is sufficiently proximal and clinically meaningful to evaluate the intervention? Independent prescribing may be feasible in some care-home systems [24], whereas ambulatory and community-pharmacy models operate under different access and continuity conditions [34].

Future trials and pragmatic evaluations should describe the intervention component explicitly, document whether recommendations were accepted and implemented, identify who could authorize changes, and match follow-up duration to the outcome being claimed. Patient-centered outcomes should be measured directly rather than inferred from medication reduction. These are proposed design principles requiring prospective evaluation, not a validated implementation recipe.

Review Limitations

The documented screening set began with 58 unique records after DOI/title deduplication. Complete earlier retrieval and deduplication logs were unavailable, so pre-screening counts are not reported. Of the 58 records screened, 20 were excluded and 38 were included.

The included set contains both clinical and methodological sources. Eighteen sources directly inform clinical medication-optimization interpretation, whereas 20 support reporting, searching, screening, risk-of-bias assessment, and statistical reasoning. The clinical evidence also combines review-level and primary evidence, creating potential overlap among underlying studies.

Intervention composition, outcome definitions, setting, patient vulnerability, follow-up, and study design remain heterogeneous. Risk-of-bias assessment is judgment dependent, and numerical scoring can obscure domain-specific limitations [27]. Finally, evidence from frailty, dementia, hip fracture, institutional care, and individual health systems restricts transferability. These limitations prevent a universal estimate of patient benefit or a validated hierarchy of intervention components.

Conclusion

Pharmacist-led medication optimization is best understood as a family of context-dependent interventions rather than a single treatment. The evidence supports keeping prescribing appropriateness, medication burden, drug-related problems, clinical events, function, treatment burden, and patient-reported outcomes analytically separate. Proximal medication outcomes may improve without corresponding improvement in mortality, hospitalization, falls, or quality of life.

Meaningful benefit is most plausibly evaluated by matching the medication problem, pharmacist role and authority, care setting, follow-up structure, patient vulnerability, and outcome selected for assessment. Cross-setting variation does not establish causal moderation, and medication reduction alone is not sufficient evidence of patient benefit. More consistent patient-centered outcome measurement, prospective component-focused evaluation, and transparent source-linked quantitative synthesis are needed before stronger claims about comparative effectiveness and transferability are justified.

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