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Mapping the evidence on interventions to reduce potentially inappropriate prescriptions in older adults: a scoping overview of 127 systematic reviews

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Abstract

Background Potentially inappropriate prescriptions (PIPs) are highly prevalent among older adults and associated with adverse outcomes, including hospitalisations and mortality. Numerous interventions have been evaluated and synthesised in reviews, but the review-level evidence remains heterogeneous and difficult to use for decision-making.

Methods We conducted a scoping overview of systematic, scoping, and realist reviews evaluating interventions to reduce PIPs in adults aged ≥ 65 years across healthcare settings, excluding palliative care. MEDLINE, Embase, Cochrane Library, and Web of Science were searched from inception to March 2025. Reviews were mapped by intervention category, setting, drug focus, outcome domain, and methodological quality. Intervention categories were pragmatic: medication review, drug-specific focused deprescribing, educational interventions, clinical decision support systems (CDSS), comprehensive geriatric assessment (CGA), and multifaceted interventions. Methodological quality was assessed using AMSTAR-2.

Results We included 127 reviews comprising 1,259 unique primary studies. Medication review was the dominant category (76 reviews; 59.8%) and had the broadest outcome coverage, especially for prescribing appropriateness, hospitalisations or readmissions, mortality, and quality of life. Multifaceted interventions (28; 22.0%), drug-specific focused deprescribing (27; 21.3%), educational interventions (24; 18.9%), CGA (22; 17.3%), and CDSS (17; 13.4%) were less frequently or more selectively represented. Focused deprescribing mainly addressed reducing, discontinuing, or substituting specific medicines or drug classes and showed a narrower outcome profile, with attention to prescribing appropriateness, falls, and adverse withdrawal events. Most reviews combined

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several settings, whereas reviews focused specifically on primary care and emergency departments were scarce. Outcomes were concentrated on prescribing indicators and selected clinical or healthcare-use endpoints, whereas safety, physical and cognitive function, adherence, acceptability and qualitative feedback, implementation processes, and formal economic evaluations were less consistently addressed. Methodological quality was predominantly low: 92 reviews (72.4%) were rated as critically low confidence and only 7 (5.5%) as high confidence.

Conclusion Review-level evidence on interventions to reduce PIPs in older adults is extensive but uneven, concentrated on medication review and prescribing outcomes, with more selective review-level coverage for other strategies, including focused deprescribing, CDSS, CGA, educational, and multifaceted interventions. Future syntheses should use rigorous methods and prioritise settings with limited review-level coverage, scalable technology-enabled strategies, patient-centred and safety outcomes, implementation-relevant evidence, and formal economic evaluations.

Keywords Potentially inappropriate prescriptions · Older adults · Patient safety · Evidence mapping · Deprescription

Introduction

Potentially inappropriate prescriptions (PIPs), encompassing potentially inappropriate medications (PIMs) and potential prescribing omissions (PPOs), represent a critical challenge in the care of older adults [1]. Their prevalence ranges from 21% to 79%, depending on the setting and the criteria used to identify them [2, 3]. Unlike polypharmacy — commonly defined as the concurrent use of five or more long-term medications —which can sometimes be clinically justified, PIPs are consistently associated with adverse health outcomes, including hospitalisations and mortality [4–6], and may impose a substantial economic burden on health systems [7]. The World Health Organization's Medication Without Harm initiative—launched to reduce severe, avoidable medication-related harm globally—clearly illustrates the level of international concern surrounding inappropriate prescribing [8].

To mitigate the risks associated with PIPs, interventions of varying scope and complexity have been developed and evaluated across different healthcare settings. Previous reviews have described several elements commonly used to reduce inappropriate prescribing, including structured medication review, educational or training components, audit and feedback, clinical decision support (CDSS), medication reconciliation, comprehensive geriatric assessment (CGA), and multidisciplinary models of care [9]. The growing number of primary studies on interventions to reduce PIPs has led to numerous systematic reviews synthesising this evidence. Systematic reviews are the cornerstone for evidence-based decision-making when individual studies are abundant and heterogeneous [10]. However, it remains unclear whether the existing review-level evidence is sufficiently comprehensive, reliable, and relevant to guide clinical practice and policy. To our knowledge, no comprehensive mapping has assessed the scope, methodological quality, and outcome coverage of reviews on interventions to reduce inappropriate prescribing.

To address these gaps, we conducted a scoping overview of literature reviews, including systematic, scoping, and realist reviews, on interventions to reduce PIPs in older adults across healthcare settings. Our objectives were to: (i) identify and classify the interventions evaluated in existing reviews; (ii) describe their settings and outcome domains; and (iii) assess the methodological quality of these reviews using AMSTAR-2 [11]. This scoping overview aimed to map the evidence landscape, identify areas with limited review-level coverage, and inform priorities for future reviews on medication safety in older adults.

Methods

Study design

We conducted a scoping overview of literature reviews of interventions aimed at reducing PIPs in older adults following established methodological guidance for umbrella reviews [12]. Reporting adhered to the PRISMA-ScR statement [13], while relevant methodological recommendations from the PRIOR framework [14] were considered during the conduct of the review. This publication forms part of a broader research initiative registered in PROSPERO (CRD42022356296).

Information sources and search strategy

We conducted a comprehensive search of MEDLINE (via PubMed), Embase (via Elsevier), the Cochrane Library, and the Web of Science Core Collection from inception to March 2025. Search strategies combined Medical Subject Headings (MeSH) terms and keywords. The full search strategy is provided in Additional File 1.

Eligibility criteria

We included systematic reviews, scoping reviews, and realist reviews evaluating interventions aimed at reducing PIPs in older adults (≥65 years). Reviews conducted in any healthcare setting were eligible. Reviews focused on palliative care populations were excluded.

Non–peer-reviewed publications, including conference abstracts, letters to the editor, and editorials, were excluded. Inclusion was restricted to publications in English, French, or Spanish and did not consider grey literature.

Selection process

Records were imported into Rayyan®, which was used for duplicate removal, title/abstract screening, and full-text assessment. Two reviewers independently screened titles/abstracts and assessed full texts. Disagreements were resolved by discussion or, when needed, consultation with a third reviewer.

Data extraction

Two reviewers independently extracted data using a predefined form regarding publication year, review type, geographic scope, primary study designs, population, setting, intervention characteristics, targeted drug classes, tools used to identify PIPs, intervention category, and outcomes. Disagreements between reviewers were solved by discussion or consultation with a third reviewer. Data were extracted from reviews and supplementary materials when available; primary studies were not systematically examined to retrieve missing information. Missing review-level details were recorded as not reported or unavailable.

Methodological quality assessment

Methodological quality was assessed independently by two reviewers using AMSTAR-2 [11], with disagreements resolved by discussion or consultation with a third reviewer. AMSTAR-2 was applied pragmatically across all included systematic, scoping, and realist reviews using the full 16-item framework. For reviews without meta-analysis, items 11, 12, and 15 were recorded as not applicable; methods that were not undertaken or reported were rated as "No". Overall confidence ratings for scoping and realist reviews should therefore be interpreted as alignment with AMSTAR-2 requirements rather than as a design-specific assessment.

Synthesis methods

We organised the synthesis as a descriptive evidence map. The synthesis was descriptive and intended to characterise the distribution of topics, intervention categories, settings, drug focus, and outcomes across the corpus of reviews, not to assess intervention effectiveness.

Review characteristics were summarised using counts and percentages. Temporal patterns in intervention categories were plotted by publication year, and intervention categories were cross-tabulated against outcome domains to show evidence coverage and concentration.

To identify unique primary studies and assess overlap across reviews, we constructed a citation matrix and consolidated citations referring to the same primary study based on bibliographic information, while retaining their occurrence in each review. Overall overlap was quantified using the corrected covered area (CCA). Primary-study overlap was assessed descriptively to quantify the extent of overlap across the review corpus and to estimate the number of unique primary studies. However, overlap was not used to adjust the evidence map, which was based on review-level coverage rather than counts of independent primary studies.

Interventions were grouped into six pragmatic analytical categories derived from review-level intervention descriptions: medication review, focused deprescribing, educational interventions, CDSS, CGA, and multifaceted interventions. These categories were used to standardise the mapping of a highly heterogeneous evidence base and were not necessarily mutually exclusive. Whole-regimen interventions were mainly mapped according to their intervention model, component, or delivery strategy, whereas focused deprescribing captured drug-specific interventions aimed at reducing, discontinuing, or substituting specific medicines or drug classes. Reviews could contribute to multiple categories when multiple components were reported.

Outcomes were classified into six predefined domains—process measures, clinical endpoints, safety endpoints, patient-related outcomes, resource use, and economic evaluations—using a framework informed by four published core outcome sets for medication optimisation and deprescribing in older adults. An additional implementation-related domain captured reviews reporting implementation frameworks or processes. This framework was used only for outcome classification, not to develop a new core outcome set [15–18].

To visualise the distribution and concentration of review-level evidence across intervention categories and outcome domains, we developed an intervention-outcome heat map. For the heat map, each unique review–intervention category × outcome pairing was counted once. Reviews reporting multiple intervention categories or outcomes could contribute to multiple cells. Consequently, cells represent review–intervention category–outcome pairings rather than mutually exclusive reviews.

Results

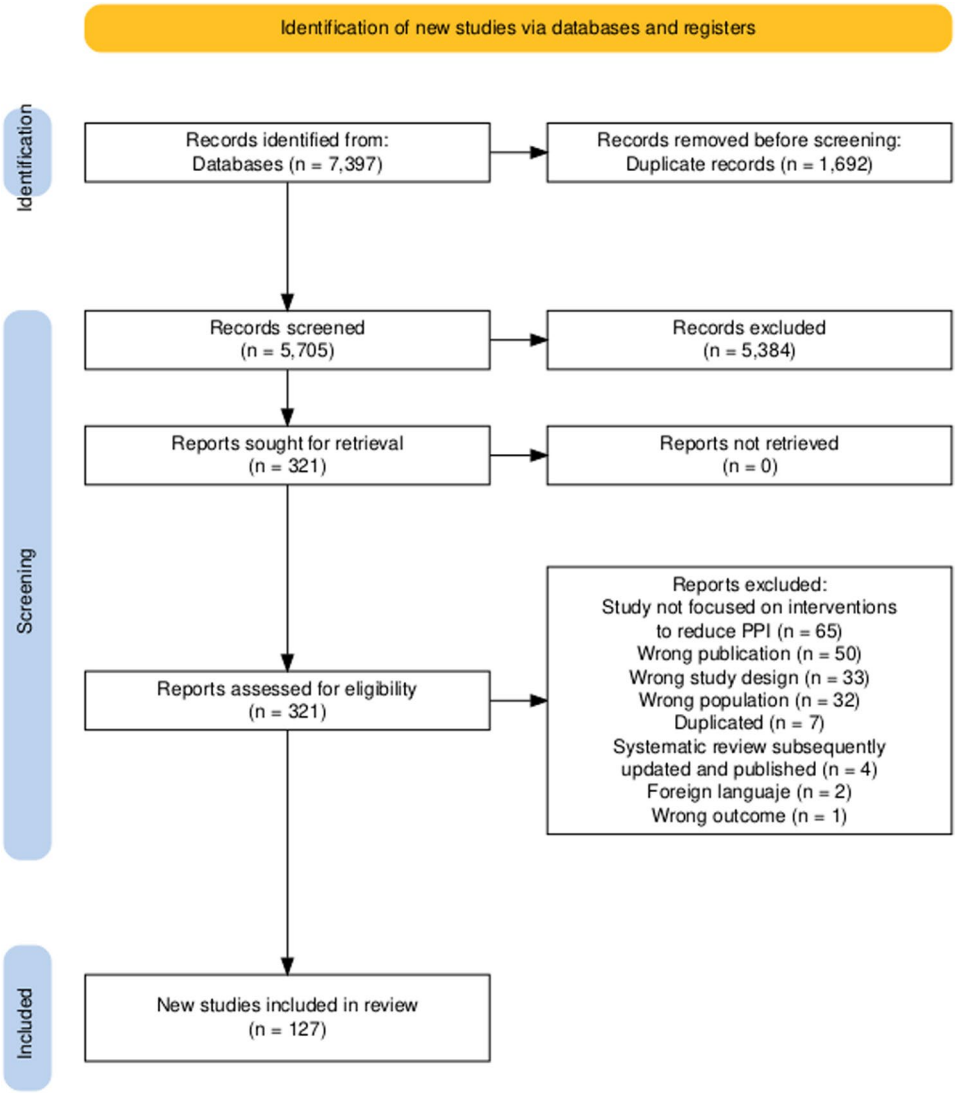
Results of literature search and study selection

A total of 7,397 records were identified through database searches. After removing 1,692 duplicates, 5,705 records were screened by title and abstract, and 5,384 were excluded. Of 321 full-text reports assessed for eligibility, 127 reviews met the inclusion criteria. Across these reviews, 2,541 primary-study occurrences corresponded to 1,259 unique primary studies. The overall CCA was 0.8%, indicating low overlap across the review corpus. The selection process is summarised in Fig. 1. Included reviews are listed in Additional File 2, their methodological characteristics in Additional File 3, and excluded full-text reports with reasons for exclusion in Additional File 4.

Characteristics of included reviews

Table 1 summarises the aggregated characteristics of the 127 included reviews. Detailed review-level information, including eligibility criteria, tools used to define PIPs, drug focus, intervention targets, and outcomes

Fig. 1 PRISMA flow diagram



assessed, is provided in Additional File 5. Additional File 6 summarises the principal findings and authors' conclusions across reviews.

The evidence base was dominated by systematic reviews without meta-analysis, with quantitative synthesis available in only a minority of reviews. Most reviews were published from 2020 onwards, suggesting a rapid expansion of evidence synthesis on interventions to reduce PIPs (Table 1).

Most reviews adopted a broad geographic and healthcare scope, often synthesising evidence across countries and care settings rather than focusing on setting-specific evidence (Table 1). Single-setting reviews were less common and mainly addressed nursing homes and hospitals, whereas primary care, community or home care, and emergency departments were rarely examined in isolation. Review size was heterogeneous: most included between 10 and 25 primary studies, although smaller and larger reviews were also represented, and one review reported no eligible studies.

Most reviews addressed prescribing or medication optimisation broadly, while a smaller subset focused on specific drug classes (Table 1). Tools used to define PIPs varied across reviews, with many combining several explicit criteria or not reporting the tool used. Intervention targets were most often multidisciplinary teams or pharmacists, whereas patient- or physician-directed interventions were less frequent. The outcomes reported by the reviews covered prescribing-related, clinical, safety, patient-related, resource-use, economic, and implementation-related

Table 1 Overall characteristics of the included reviews (aggregated data)

Publication year	*N* (%)
Prior 2014	17 (13.4)
2015 to 2019	27 (21.2)
2020 to 2025	83 (65.4)
Publication type	
Systematic review	100 (78.7)
Systematic review and meta-analysis	15 (11.8)
Scoping review	11 (8.7)
Realist review	1 (0.8)
Number of included studies per SR	
0	1 (0.8)
1–9	33 (26.0)
10–25	68 (53.5)
>25	25 (19.7)
Geographic location	
Worldwide	106 (83.4)
Not reported	10 (7.9)
Europe	4 (3.1)
America	3 (2.4)
Oceania	2 (1.6)
Asia	1 (0.8)
North America	1 (0.8)
Setting	
Combination of settings[a]	81 (63.8)
Institutionalized/nursing home	18 (14.2)
Hospitalized	15 (11.8)
Community dwelling/home care	7 (5.5)
Primary care	5 (3.9)
Emergency department	1 (0.8)
Drugs	
Generic	105 (82.7)
Specific	22 (17.3)
Anticholinergics	6 (4.7)
Benzodiazepines	4 (3.1)
Antihyperglycemics	3 (2.4)
Psychotropic	2 (1.6)
Analgesics	2 (1.6)
Fall risk–increasing drugs	2 (1.6)
Heart failure drugs	1 (0.8)
Proton pump inhibitors	1 (0.8)
Antipsychotics	1 (0.8)
Tool to define PIP	
Combination of different tools	83 (65.3)
Not reported or N/A	33 (26.0)
MAI	4 (3.1)
Beers criteria	3 (2.4)
STOPP/START	3 (2.4)
Drug Burden Index	1 (0.8)
Intervention target	
Multidisciplinary team	86 (67.7)
Pharmacist	23 (18.1)
Patient	9 (7.1)
Not reported or N/A	8 (6.3)
Physician	1 (0.8)
Type of Intervention[c]	
Medication review	76 (59.8)
Multifaceted interventions	28 (22.0)
Drug-specific focused deprescribing[b]	27 (21.3)
Educational intervention	24 (18.9)
Clinical decision support systems	17 (13.4)
Comprehensive geriatric assessment	22 (17.3)
Empty review	1 (0.8)
Outcomes[c]	
Reduction of PIPs or inappropriate medication	86 (67.7)
Hospitalizations/readmissions/LOS	69 (54.3)
Falls	51 (40.1)
Mortality	61 (48.0)
Quality of life	57 (44.9)
Adverse reactions to medication	21 (16.5)
Cost or cost/effectiveness	46 (36.2)
Reduction of polypharmacy	43 (33.8)
Urgent care visits	28 (22.0)
Medication adherence	18 (14.2)
Adverse Drug Events	31 (24.4)
Medication Related Problems	25 (19.7)
Physical Function/Functional status	22 (17.3)
Cognitive Function	16 (12.6)
Adverse Drugs Withdrawal effects	11 (8.6)
Potentially Prescribing Omissions	11 (8.6)
General Practice Visits	9 (7.1)
Implementation	7 (5.5)
Qualitative feedback (perceptions/acceptability/perceived utility)	26 (20.5)
AMSTAR-2	
Critically low	92 (72.4)
Low	27 (21.3)
High	7 (5.5)
Not assessed	1 (0.8)

LOS Length of stay, *MAI* Medication Appropriateness Index, *PIP* Potentially Inappropriate Prescribing, *START* Screening Tool to Alert to Right Treatment, *STOPP* Screening Tool of Older Persons' Prescriptions, *SR* Systematic Review

[a] Combination refers to interventions delivered across multiple settings, such as hospitals, primary care, nursing homes, community pharmacies, outpatient clinics, and home or community-based care

[b] One review met the eligibility criteria but included no primary studies and therefore did not contribute to the intervention–outcome evidence map

[c] Percentages calculated as n/127. Categories are not mutually exclusive; individual reviews may have been classified in multiple categories

domains; detailed intervention–outcome patterns are presented below. Although most reviews reported intervention–outcome data that could be mapped, some primarily addressed qualitative or conceptual aspects.

Methodological quality of the included reviews

Of the 127 included reviews, 92 (72.4%) were rated as critically low confidence, 27 (21.3%) as low confidence, and only 7 (5.5%) as high confidence; one review (0.8%) could not be assessed because it included no eligible studies. Deficiencies were concentrated in critical AMSTAR-2 domains, especially protocol registration, reporting of excluded studies, integration of risk of bias into the interpretation of findings, and assessment of publication bias (Fig. 2 and Additional File 7). Additional weaknesses concerned the reporting of funding sources for primary studies. Conversely, most reviews adequately specified their research questions, eligibility criteria, and characteristics of included studies.

Types of interventions evaluated in the included reviews

The included reviews were broadly grouped according to intervention scope. Most adopted a whole-medication-regimen approach, aiming to optimise prescribing across the patient's complete treatment regimen, whereas a smaller subset focused on specific medicines, drug classes, or groups of medicines defined by a shared risk profile.

Within the whole-regimen approach, medication review was the most frequently reported intervention category, appearing in 76 reviews (59.8%), followed by multifaceted interventions (28; 22.0%), educational interventions (24; 18.9%), CGA (22; 17.3%), and CDSS (17; 13.4%). Many reviews addressed multiple intervention categories rather than focusing on a single approach. Only a small subset focused exclusively on one intervention category, 18 on medication review [19–36], 6 on multifaceted interventions [1, 37–41], and 6 on CDSS [42–47] (Additional File 3).

Drug-specific focused deprescribing was identified in 27 reviews. One review met the eligibility criteria but included no primary studies and therefore did not contribute outcome data to the intervention–outcome analysis.

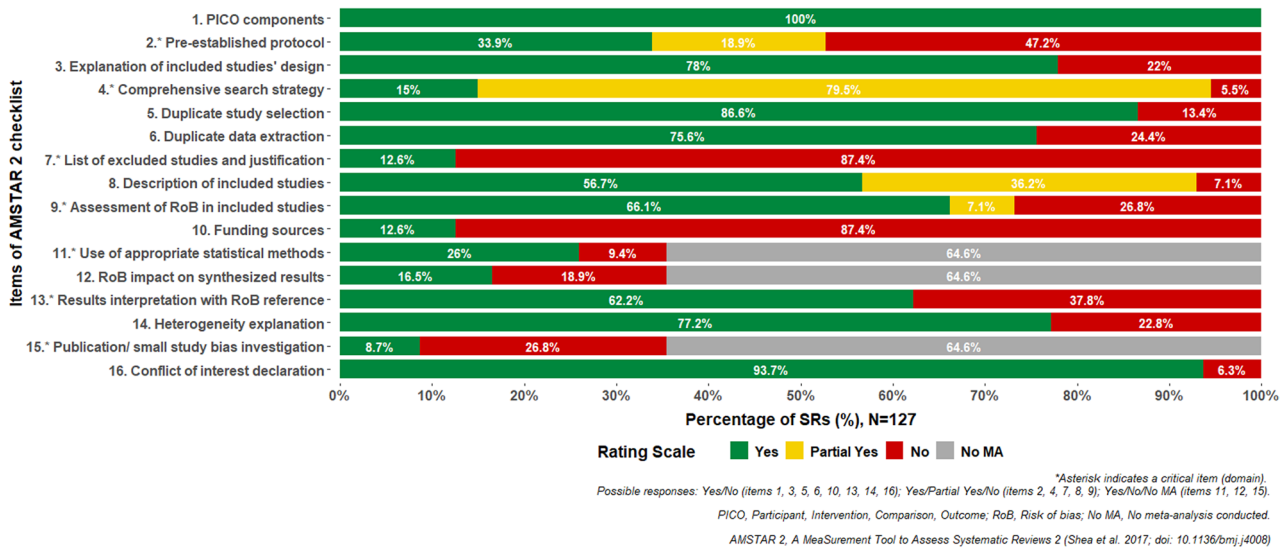


Fig. 2 Summary of AMSTAR-2 methodological quality assessment of included reviews. Stacked horizontal bars show the percentage of included reviews meeting each AMSTAR-2 item criterion across the 127 reviews. Response categories are shown as *Yes*, *Partial Yes*, *No*, or *No MA* when the item was not applicable because no meta-analysis was conducted. Asterisks indicate AMSTAR-2 critical domains. Percentages were calculated using the total number of included reviews as the denominator ($N=127$). AMSTAR-2: A MeaSurement Tool to Assess Systematic Reviews 2; MA: meta-analysis; PICO: population, intervention, comparison, outcome; RoB: risk of bias

Intervention components within this group were heterogeneous and included dose reduction or discontinuation strategies, educational or behavioural components, multifaceted approaches, pharmacological substitution, and, less frequently, medication review or CDSS.

Fourteen reviews had a primarily qualitative or conceptual focus, although five also contributed mappable intervention–outcome data. These reviews addressed barriers and facilitators to deprescribing or PIP reduction [48–54], including two drug-specific reviews focused on glucose-lowering treatments [52] and benzodiazepine receptor agonists [50], respectively; patient or caregiver attitudes and behavioural determinants [55–57], intervention components and theoretical underpinnings, service-delivery strategies [9, 58, 59], and professional roles in deprescribing [60]. Of the 127 included reviews, 11 were excluded from the intervention–outcome heat map: nine were exclusively qualitative or conceptual in nature [9, 49, 50, 52, 54–57, 60], one included no eligible studies [61] and one did not report results by intervention category [62]. The remaining 116 reviews provided extractable data and were included in the heat map.

Temporal patterns in review-level intervention-category reporting by publication year (Fig. 3) showed that medication review was the dominant category across most periods, particularly from 2016 onwards. The volume of reported intervention categories increased markedly between 2019 and 2025. Focused deprescribing and multifaceted interventions became more prominent over time, although they remained less frequent than medication review. Educational interventions appeared intermittently and were mainly concentrated in recent years, whereas CDSS and CGA were less frequently represented. Overall, review-level evidence expanded over time but remained concentrated on medication review and, to a lesser extent, multifaceted interventions and drug-specific focused deprescribing, while CDSS and CGA were less frequently represented in reviews.

The intervention–outcome evidence map (Fig. 4) showed marked differences in outcome coverage across analytical intervention categories. Among whole-medication-regimen interventions, medication review showed

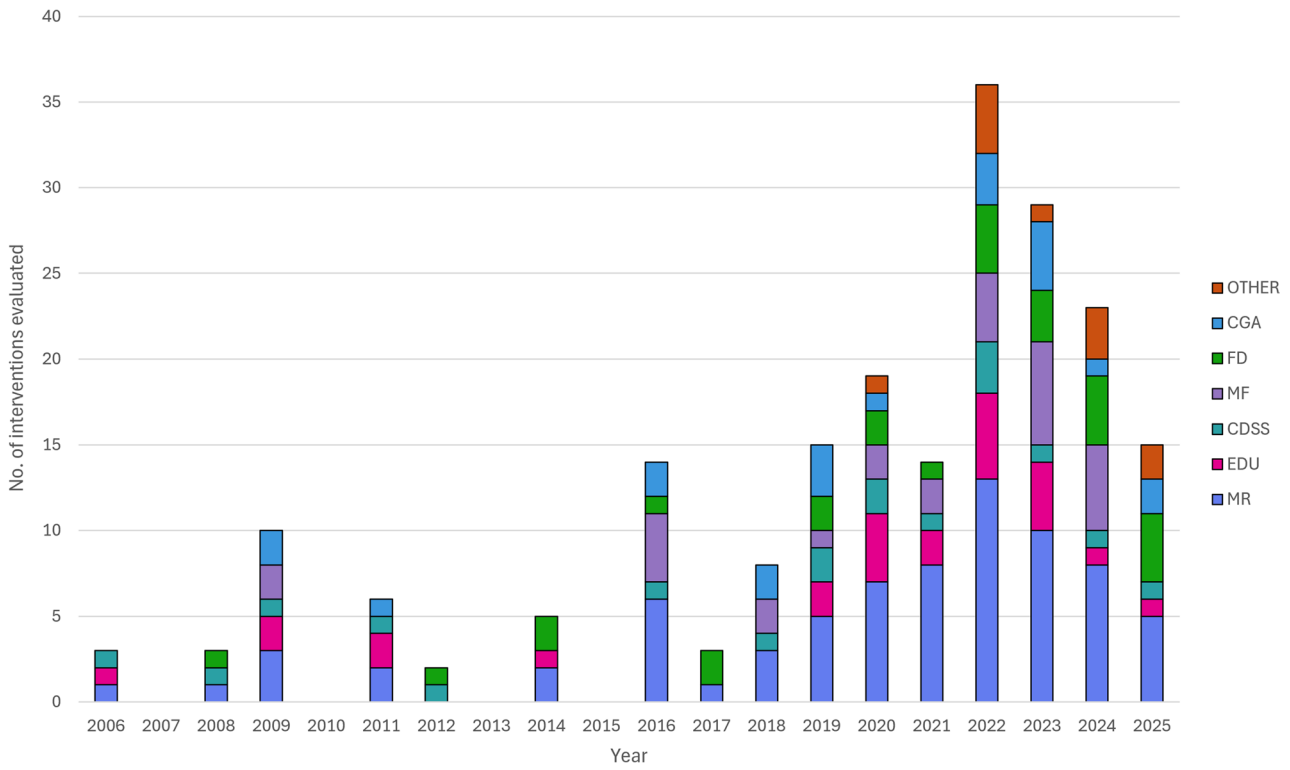


Fig. 3 Types of Interventions Addressed in Reviews, by Year of Publication. CDSS: Clinical Decision Support Systems, CGA: Comprehensive Geriatric Assessment, EDU: Educational Intervention, FD: Focused Deprescribing, MF: Multifaceted Interventions, MR: Medication Review, OTHER: other type of intervention or not focused on a specific type of intervention

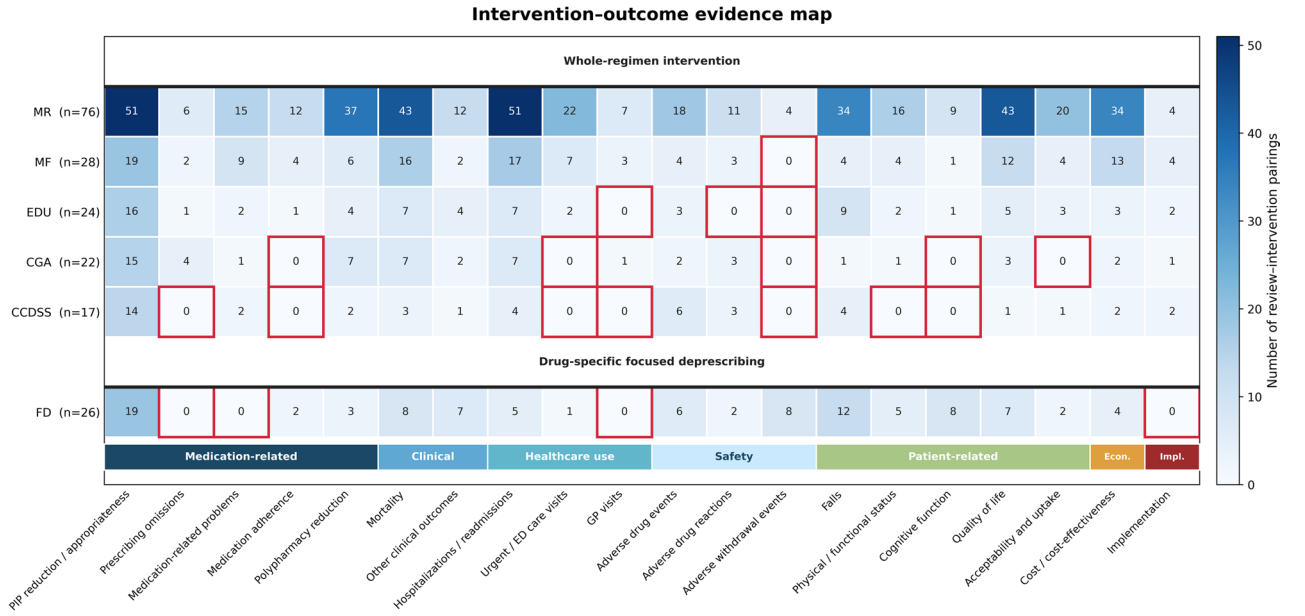


Fig. 4 Intervention–outcome evidence map. Cells indicate the number of unique review–intervention category–outcome pairings. Intervention categories are pragmatic analytical groupings derived from review-level descriptions and are not mutually exclusive. Whole-medication-regimen interventions were mainly mapped according to intervention model, component, or delivery strategy, whereas drug-specific focused deprescribing captured interventions centred on reducing, discontinuing, or substituting specific medicines or drug classes. CDSS: clinical decision support systems; CGA: comprehensive geriatric assessment; EDU: educational intervention; FD: focused deprescribing; GP: general practice; MF: multifaceted interventions; MR: medication review; PIP: potentially inappropriate prescription. Note: Drug-specific focused deprescribing was identified in 27 reviews; however, one review included no primary studies and was therefore not represented in the intervention–outcome evidence map

the broadest coverage. The highest counts were observed for PIP reduction or prescribing appropriateness and hospitalisations, readmissions or length of stay (LOS) (51 review–intervention pairings each), followed by mortality and quality of life (43 each). Cost or cost-effectiveness outcomes were also frequently reported, although rarely as formal economic evaluations. In contrast, physical or functional status, cognitive function, medication adherence, adverse withdrawal events, and implementation-related outcomes were much less frequently reported.

Multifaceted interventions also showed broad outcome coverage, concentrated on PIP reduction or prescribing appropriateness (19 pairings), hospitalisations, readmissions or LOS (17 pairings), and mortality (16 pairings), with quality of life and cost or cost-effectiveness reported in 12 and 13 pairings, respectively. Educational interventions, comprehensive geriatric assessment, and CDSS showed narrower profiles, mainly focused on prescribing indicators. PIP reduction or prescribing appropriateness was reported in 16 educational, 15 CGA, and 14 CDSS pairings. Clinical, safety, patient-related, economic, acceptability and uptake, and implementation-related outcomes were generally reported less consistently across these categories.

Drug-specific focused deprescribing showed a more selective outcome profile. Reporting was concentrated on PIP reduction or prescribing appropriateness (19 pairings), with falls as the most frequently captured patient-related problem (12 pairings). Mortality, cognitive function, and adverse withdrawal events were each reported in 8 pairings. Adverse withdrawal events were captured more often for focused deprescribing than for any other intervention category, whereas healthcare-use outcomes, quality of life, medication adherence, acceptability and uptake, cost or cost-effectiveness, and implementation-related outcomes were less frequently reported or absent.

Discussion

Summary of main findings

This overview mapped 127 reviews evaluating interventions to reduce PIPs in older adults. The evidence base was extensive but highly heterogeneous in intervention scope, healthcare setting and outcome coverage. Two broad intervention scopes were identified: whole-medication-regimen approaches, aimed at optimising the patient's overall pharmacological treatment, and drug-specific focused deprescribing approaches, targeting specific medicines, drug classes, or medicines sharing a common risk profile.

Medication review was the most frequently evaluated category and showed the broadest outcome coverage, particularly for prescribing appropriateness, healthcare use, mortality, and quality of life. Multifaceted interventions and drug-specific focused deprescribing were also well represented, although their outcome profiles were more selective. Educational interventions, CDSS, and CGA were less frequently represented in reviews. This distinction between therapeutic scope and intervention model is important because whole-regimen and drug-specific approaches may differ in intervention logic, expected effects, and relevant outcome priorities.

Evidence coverage across healthcare settings was uneven. Most reviews synthesised studies across multiple settings, whereas reviews focused exclusively on primary care or emergency departments were scarce. This limits the availability of context-specific review-level evidence for settings in which prescribing processes, medication changes, and transitions of care may differ substantially.

Outcome coverage was also imbalanced. Reviews most often reported prescribing indicators, particularly PIP reduction or prescribing appropriateness, and selected clinical or healthcare-use outcomes such as hospitalisations, readmissions, LOS, and mortality. Patient-related outcomes, safety, economic outcomes, acceptability and uptake, and implementation-related outcomes were less consistently reported. Review-level coverage of implementation-related outcomes was particularly limited. This pattern limits understanding of these interventions beyond prescribing and selected clinical or healthcare-use outcomes. In addition, several reviews noted that many primary studies were likely underpowered to detect differences in clinical, economic, or patient-centred outcomes, which were often secondary endpoints. Therefore, when outcomes such as hospitalisation, mortality, quality of life, or costs were reported, absence of observed effects should not necessarily be interpreted as evidence of no effect.

Methodological quality was a major concern: nearly three quarters of reviews were rated as critically low confidence using AMSTAR-2. Taken together, these findings suggest that the large volume of reviews should not be interpreted as a mature or decision-ready evidence base. Rather, the mapped review-level literature is marked by important gaps in intervention and outcome coverage, setting-specific synthesis, and methodological rigour.

Strengths and limitations of this overview

This overview has several strengths. First, it provides the most comprehensive mapping to date of reviews addressing interventions to reduce PIPs in older adults across healthcare settings, intervention categories, and outcome areas. Second, the review followed established methodological guidance for overviews of reviews and adhered to the PRISMA-ScR reporting standards for scoping reviews, ensuring methodological transparency and reproducibility. Third, the evidence-map approach allowed us to describe the breadth and distribution of the review-level evidence without conflating mapping with effectiveness synthesis, which was important given the heterogeneity of interventions, settings, and outcomes.

Several limitations should also be acknowledged. Inclusion was restricted to reviews published in English, French, or Spanish, and grey literature was not considered, which may have introduced language or publication bias. The synthesis was descriptive and did not assess intervention effectiveness or perform quantitative pooling, as this was beyond the scope of the overview. In addition, although we applied rigorous screening and duplicate data extraction, the classification of interventions and outcomes relied on the reporting within the original

reviews, which was often inconsistent. With regard to methodological appraisal, AMSTAR-2 provided a structured assessment but does not generate an overall numeric score, and its confidence judgements are categorical, which may limit granularity in comparing reviews. Moreover, because AMSTAR-2 was not specifically developed for scoping or realist reviews, ratings assigned to these designs should be interpreted cautiously, as they may partly reflect differences in review purpose and design-specific methodological expectations. The aggregation of studies across heterogeneous healthcare settings may limit the applicability of review findings to specific contexts, particularly primary care and emergency departments, where few setting-specific reviews were available.

A further limitation concerns the classification of interventions in the evidence map. Intervention categories were pragmatic analytical groupings rather than mutually exclusive mechanisms of action. In particular, focused deprescribing was defined mainly by its drug-specific therapeutic aim, whereas other categories primarily reflected broader intervention models, components, or delivery strategies. Therefore, the intervention–outcome map should be interpreted as a descriptive overview of how review-level evidence was distributed across these analytical categories, rather than as a classification of mutually exclusive intervention mechanisms.

Comparison with previous overviews

Previous overviews have synthesised evidence on deprescribing, polypharmacy, or medication management interventions in older adults, but most have focused on intervention effectiveness or on narrower intervention groups, with less attention to detailed intervention characterisation and the distribution of outcomes by intervention category. Although recent overviews have summarised deprescribing-related outcomes and highlighted heterogeneity in the existing evidence [63–66], they have not provided a detailed mapping of intervention types, the breadth of outcomes associated with each intervention category, and the methodological quality of existing reviews.

In contrast, our overview included 127 reviews and provides a broad mapping of this evidence base. Beyond cataloguing intervention scope and type, we examined how interventions were distributed across healthcare settings and outcomes, assessed temporal trends, and systematically evaluated methodological quality using AMSTAR-2. This broader scope revealed gaps that were less visible in previous overviews, including the concentration of evidence on whole-medication-regimen approaches—especially medication review—the still modest synthesis of technology-enabled strategies, the scarcity of reviews focused specifically on primary care or emergency departments, and the limited attention to implementation-related aspects, which are essential for adoption, scale-up, and sustainability in routine care. By shifting the focus from "what works" to "what has been reviewed—and how well," this overview provides a complementary perspective on the adequacy of current review-level evidence mapped for informing practice and policy. It also helps identify where targeted, methodologically robust reviews are most needed.

Implications for practice and policy

Our findings have important implications. The large number of reviews may suggest a mature evidence base, but our mapping shows otherwise. Review-level evidence was concentrated on medication review, while high-quality syntheses were scarce and implementation-related aspects were infrequently synthesised. This makes it difficult to identify which strategies are appropriate, feasible, and transferable to routine care. The scarcity of reviews focused on primary care and emergency departments further limits applicability to settings where prescribing, deprescribing, and care-transition decisions may differ substantially.

multidisciplinary teams were the most frequently reported intervention delivery model, appearing in 86 reviews (67.7%). this finding suggests that medication optimisation in older adults is commonly delivered through collaborative approaches involving multiple healthcare professionals. from a practice perspective, this supports the integration of medication optimisation activities into routine multidisciplinary care pathways rather than relying exclusively on interventions delivered by a single professional group. although the specific contribution of

different professionals was often not described in detail, the predominance of multidisciplinary approaches suggests that collaboration across professional groups is a central component of medication optimisation strategies in older adults.

Uneven outcome coverage further complicates decision-making. Most reviews prioritised process indicators, especially PIP reduction, across intervention categories. Outside medication review, review-level coverage of outcomes beyond prescribing indicators was limited; even within this category, relevant gaps remained in safety outcomes, physical and cognitive function, economic evaluations, acceptability, and the experience of patients or professionals, beyond indirect indicators such as the proportion of recommendations accepted or implemented. As a result, decision-makers have limited review-level evidence on feasibility, cost-effectiveness, and real-world impact—dimensions that are critical for policy adoption and resource allocation.

Finally, AMSTAR-2 identified important methodological weaknesses, including lack of protocol registration, incomplete reporting of excluded studies, and limited integration of risk of bias into interpretation. Policymakers should prioritise transparent, methodologically robust syntheses when designing medication safety strategies.

Future research priorities

Our mapping identifies several priorities for future research. First, future syntheses should strengthen review-level coverage of intervention categories beyond medication review, particularly CDSS, given their comparatively limited representation in reviews and their potential to support scalable medication optimisation.

Second, future reviews should address care settings with limited review-level coverage. Primary care and emergency departments were infrequently addressed in reviews, despite their importance for prescribing, deprescribing, and care-transition decisions.

Primary care and emergency departments were infrequently addressed in reviews, despite their importance for prescribing, deprescribing, and care-transition decisions.

Third, outcome standardisation should be strengthened. Reviews mainly focused on prescribing indicators, especially PIP reduction, while safety outcomes, physical and cognitive function, medication adherence, acceptability, implementation outcomes, and economic evaluations were less consistently captured. Greater uptake of existing core outcome sets for deprescribing and medication optimisation, including setting-specific sets, would reduce selective outcome reporting, improve comparability, and increase the decision relevance of future studies and reviews [15–18].

Fourth, future reviews should strengthen methodological rigour through prospective protocol registration, transparent reporting of excluded studies, explicit integration of risk of bias into conclusions, and assessment of publication bias.

Finally, future primary studies and reviews should incorporate implementation science frameworks and qualitative evidence to capture barriers, facilitators, and contextual factors affecting feasibility, acceptability, and sustainability in routine care.

Conclusions

This overview shows that review-level evidence on interventions to reduce PIPs in older adults is extensive but uneven. It is concentrated on medication review and prescribing outcomes, with comparatively limited synthesis of other strategies, particularly technology-enabled approaches, and limited setting-specific review-level coverage in primary care and emergency departments. Even for medication review, which had broader outcome coverage, relevant gaps remained in safety, selected patient-centred outcomes, economic evaluations, acceptability, patient and professional experience, and implementation. methodological quality was also predominantly low. Future research should prioritise targeted, methodologically robust syntheses, especially for settings with limited review-level coverage, technology-enabled strategies, and outcomes relevant to implementation and

decision-making. Strengthening these areas is essential to support more transferable and scalable medication-safety strategies for older adults.

Abbreviations

CDSS	Clinical Decision support
CGA	Comprehensive geriatric assessment
LOS	Length of stay
PIMs	Potentially inappropriate medications
PPOs	Potential prescribing omissions
PIPs	Potentially inappropriate prescriptions

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Declarations

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