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Clinical Pharmacy

for Pharmacy Students

Lesson 6:

Clinical Pharmacy in Geriatric Patients

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6.1 Clinical Pharmacy in Geriatric Patients

6.1.1 Characteristics of Geriatric Pharmacotherapy

Fundamentals of geriatric pharmacotherapy rest on the recognition that ageing is accompanied by predictable biological changes, high burdens of multimorbidity and geriatric syndromes, and a narrowing gap between potential benefits and harms of medicines. These features require an explicitly individualized, goal-oriented and time-sensitive approach, in which preservation of function and quality of life takes precedence over strict disease-centric targets.[1],[2]

Ageing leads to characteristic alterations in pharmacokinetics and pharmacodynamics that modify both exposure to, and response to, drugs commonly used in older adults. Age-related **changes in body composition**, including reduced total body water and lean mass and relatively increased fat mass, reduce the apparent volume of distribution of hydrophilic drugs and increase that of lipophilic drugs, often prolonging the half-life of the latter. Hepatic blood flow and liver mass decline with age, decreasing first-pass metabolism and clearance of many high-extraction medicines, while phase I oxidative pathways are more affected than conjugation reactions, with consequences for drugs such as benzodiazepines, beta-blockers and certain calcium channel blockers. Renal function commonly falls due to structural and functional changes in the ageing kidney, and glomerular filtration rate is often overestimated if serum creatinine is interpreted without accounting for reduced muscle mass, which increases the risk of accumulation and toxicity of renally cleared medicines such as many antibiotics, metformin, digoxin and direct oral anticoagulants. (See Lesson 4: Clinical Pharmacy in Renal and Hepatic Impairment).

Beyond pharmacokinetics, ageing also **alters pharmacodynamic responses** and reduces physiological reserve, amplifying the clinical impact of a given exposure. Older adults frequently display increased sensitivity to central nervous system depressants, including benzodiazepines, opioids and many antipsychotics, with greater risks of sedation, confusion and falls at doses that would be well tolerated in younger adults. At the same time, responsiveness to some cardiovascular drugs, notably beta-adrenergic agonists and antagonists, may be blunted

[1] Mangoni AA, Jackson SH. Age-related changes in pharmacokinetics and pharmacodynamics: basic principles and practical applications. Br J Clin Pharmacol. 2004;57(1):6-14.
[2] Ngcobo NN. Influence of Ageing on the Pharmacodynamics and Pharmacokinetics of Chronically Administered Medicines in Geriatric Patients: A Review. Clin Pharmacokinet. 2025;64(3):335-367.

because of changes in receptor function and downstream signaling, while baroreflex impairment and autonomic dysfunction magnify the hemodynamic consequences of vasodilators and antihypertensives. These pharmacodynamic shifts occur against a background of reduced homeostatic capacity in multiple organ systems, meaning that relatively small perturbations induced by medicines can precipitate clinically important decompensation, such as orthostatic hypotension, acute kidney injury, or delirium.[3]

The concept of **frailty** is central to contemporary geriatric pharmacotherapy because it captures the vulnerability arising from cumulative deficits across organ systems and the consequent **loss of physiological reserve**. Frailty is associated with increased risks of mortality, functional decline, adverse drug effects and treatment burden, and it modifies both the probability of benefit and the likelihood of harm for many interventions. Multimorbidity and frailty frequently coexist and interact with high levels of drug use, such that polypharmacy becomes both a marker and a driver of complexity, with observational data showing that excessive polypharmacy is associated with higher mortality, hospitalization and prescribing of drugs linked to geriatric syndromes such as falls, urinary incontinence and depression (a prescribing cascade). In this context, the same pharmacological agent may play very different roles: a preventive drug that is clearly indicated in a robust older adult with long remaining life expectancy may offer marginal benefit and substantial harm in a frail person with limited prognosis, recurrent falls or advanced cognitive impairment.[4]

Multimorbidity, geriatric syndromes and drug use are tightly interwoven and must be approached as an integrated whole rather than as separate problems. **Multimorbidity**, defined as the coexistence of two or more chronic conditions, affects more than half of adults aged 60 years or older and rises steeply with advancing age, resulting in the concurrent application of multiple single-disease clinical practice guidelines. This guideline-driven accumulation of therapies, often devised without adequate representation of frail older adults in trials, interacts with age-related changes and social factors (such as cognitive impairment, sensory deficits or limited support) to promote **geriatric syndromes**, including falls, delirium, malnutrition, incontinence and functional decline, which may in turn trigger additional prescribing. Recent work on medicines associated with geriatric syndromes highlights how specific pharmacological classes (e.g., sedatives, anticholinergics, certain antihypertensives and hypoglycemic agents) cluster in older adults with extensive polypharmacy, reinforcing the need for medication review and prioritization of regimens.[5]

Within this complex therapeutic landscape, **core principles of geriatric pharmacotherapy emphasize individualization of treatment goals rather than uniform application of disease-specific targets**. Position papers from geriatric pharmacology groups advocate tailoring therapy according to frailty status, comorbidity patterns, life expectancy, functional capacity, cognitive status and patient values, with explicit recognition that the intensity of pharmacological treatment should often be reduced as frailty increases. Individualization

[3] Bowie MW, Slattum PW. Pharmacodynamics in older adults: a review. Am J Geriatr Pharmacother. 2007;5(3):263-303.
[4] Kim DH, Park CM, Ko D, et al. Assessing the Benefits and Harms of Pharmacotherapy in Older Adults with Frailty: Insights from Pharmacoepidemiologic Studies of Routine Health Care Data. Drugs Aging. 2024;41(7):583-600.
[5] Al-Azayzih A, Al-Qerem W, Al-Azzam S, et al. Medications Associated with Geriatric Syndromes and Prescribing Patterns: The Impact of Excessive Polypharmacy in Older Adult Patients. Ther Clin Risk Manag. 2024;20:741-748.

encompasses not only drug selection and dosing, but also the negotiation of **what outcomes matter most to the person**, such as maintaining independence, avoiding institutionalization or preserving cognition, thereby shifting attention from surrogate markers (e.g., glycated hemoglobin or low-density lipoprotein cholesterol) to clinically meaningful endpoints. In everyday clinical pharmacy practice, this translates into structured medication reviews that systematically assess indication, effectiveness, safety, convenience and alignment with the patient's priorities, across all care settings.[6]

Time-to-benefit has emerged as a key conceptual tool for aligning pharmacotherapy with prognosis and therapeutic goals in older adults with multimorbidity. The notion refers to the typical interval between starting a medicine and achieving a clinically relevant benefit at the population level, and is particularly important for preventive therapies such as statins, antihypertensives for primary prevention, or bisphosphonates, which may require years to confer gains in hard outcomes. For frail older adults with limited remaining life expectancy or high competing risks of death from other causes, **the time-to-benefit may exceed their likely survival**, suggesting that initiation of such therapies is unwarranted and that continued use should be reconsidered considering adverse effects, pill burden and monitoring requirements. Incorporating time-to-benefit into shared decision-making encourages physicians and pharmacists to move beyond guideline-driven reflex prescribing, explicitly balancing short-term symptom relief and risk reduction against long-term preventive aims that may no longer be realistic or relevant.

Finally, geriatric pharmacotherapy places a premium on function and quality of life as the primary benchmarks for starting, adjusting or discontinuing medicines. **Frailty-oriented guidelines recommend more compassionate targets for certain conditions**, such as blood pressure or glycemic control, and supports dose reduction or cessation of therapies whose marginal benefits do not clearly translate into preserved mobility, cognition or social participation. Medicines that exacerbate geriatric syndromes, particularly falls, cognitive impairment and incontinence, warrant special scrutiny during medication review because of their disproportionate impact on functional trajectories and caregiver burden. Clinical pharmacy in this setting therefore extends beyond identifying pharmacological risks to leading interdisciplinary discussions, involving patients and carers, about **deprescribing and regimen simplification**, always anchored in the overarching aims of maintaining autonomy, comfort and dignity in later life.[7]

6.1.2 Polypharmacy in older adults

Polypharmacy in older adults is usually defined as the concurrent use of multiple medicines, most operationalized as five or more regular medicines, including prescription, over-the-counter and complementary products, while "excessive" or "hyper-polypharmacy" is often used for regimens of ten or more medicines. Beyond simple counts, recent work distinguishes between **"appropriate" polypharmacy**, when multiple medicines are clearly indicated and aligned with

[6] Liau SJ, Lalic S, Sluggett JK, et al. Medication Management in Frail Older People: Consensus Principles for Clinical Practice, Research, and Education. J Am Med Dir Assoc. 2021;22(1):43-49.
[7] Umegaki H. Frailty, multimorbidity, and polypharmacy: Proposal of the new concept of the geriatric triangle. Geriatr Gerontol Int. 2025;25(5):657-662.

goals of care, and **"problematic" or "inappropriate" polypharmacy**, when the overall regimen is not evidence-based, not tolerated, or misaligned with patient priorities.[8]

Epidemiological studies consistently show that polypharmacy is highly prevalent among older adults, particularly those with multimorbidity and under institutional care. In a recent systematic review of adults aged 65 years or more, most studies using the conventional cut-off of five or more medicines reported prevalence estimates for polypharmacy ranging from around 14% to over 50%, with higher figures in the oldest age groups and in long-term care facilities. Population-based surveys and cohort studies similarly indicate that a substantial proportion of community-dwelling older adults meet criteria for polypharmacy, and that a non-trivial subgroup experiences excessive polypharmacy, often in association with complex morbidity patterns and frequent healthcare contact.[9]

Multimorbidity is a central determinant of polypharmacy, as the coexistence of two or more chronic conditions naturally leads to the accumulation of medicines targeting different diseases. Because most clinical practice guidelines are developed for single conditions, clinicians caring for older adults with multimorbidity frequently apply several guidelines in parallel, each recommending disease-specific therapies and targets, which drives an incremental increase in the number and intensity of prescribed medicines. This **guideline-driven prescribing** is particularly problematic when trials underpinning recommendations have under-represented frail older adults, so that the balance between benefit and harm in real-world geriatric populations is more uncertain than guideline statements suggest.

Fragmentation of care across multiple providers and settings further fuels polypharmacy in older adults. Patients with multimorbidity often attend several specialists in addition to primary care, and each clinician may focus on a limited set of problems, adding new medicines without always having full visibility of the overall regimen or clear responsibility for **deprescribing**. **Transitions of care** are particularly vulnerable points at which medicines may be added for acute indications but not systematically reviewed afterwards, thereby converting short-term treatments into long-term polypharmacy. Lack of integrated information systems, poor communication between services and absence of a clearly designated coordinating professional all contribute to this cumulative prescribing.[10]

Prescriber-related factors also play a significant role in sustaining polypharmacy. Physicians frequently face time pressure, cognitive load and fear of undertreatment or litigation, all of which may favor adding a new drug rather than carefully reconsidering existing ones. Therapeutic inertia (continuing previously prescribed medicines without reevaluating their current indication), reluctance to deprescribe medicines initiated by other colleagues, and overreliance on guideline thresholds, even in very old or frail patients, have been identified as behavioral drivers of problematic polypharmacy. Moreover, limited training in geriatric pharmacotherapy

[8] Davies LE, Spiers G, Kingston A, et al. Adverse Outcomes of Polypharmacy in Older People: Systematic Review of Reviews. J Am Med Dir Assoc. 2020;21(2):181-187.
[9] McIntosh J, Alonso A, MacLure K, et al. A case study of polypharmacy management in nine European countries: Implications for change management and implementation. PLoS One. 2018;13(4):e0195232.
[10] Ruiz-Baena JM, Moreno-Juste A, Poblador-Plou B, et al. Influence of social determinants of health on quality of life in patients with multimorbidity and polypharmacy. PLoS One. 2024;19(9):e0297702.

and insufficient support from decision-support systems (CDSSs) and clinical pharmacists can leave prescribers uncertain about how best to simplify or rationalize complex regimens.[11],[12]

Patient-level factors intersect with these system and prescriber influences. Older adults and their carers may hold strong beliefs in the value of medicines, equating more intensive pharmacological treatment with better care, or may fear that stopping medicines implies abandonment. At the same time, sensory and cognitive impairments, low health literacy, financial constraints and insufficient social support can make it difficult for patients to question prescriptions, communicate adverse effects, or manage complex dosing schedules, thereby both perpetuating polypharmacy and compromising safe use. In some cases, symptoms related to medicines are misinterpreted as new diseases, leading to prescribing cascades that further expand the regimen.

Polypharmacy, particularly when associated with **inappropriate medicines**, increases the risk of adverse effects, drug–drug and drug–disease interactions and acute complications, many of which manifest as geriatric syndromes such as falls, delirium and incontinence. Large cohort studies and scoping reviews report consistent associations between higher medication counts and hospitalization, emergency department visits and mortality, even after adjusting for multimorbidity, suggesting that polypharmacy itself may be an independent marker of vulnerability.[13]

Falls and related injuries represent one of the most feared outcomes of polypharmacy in older adults. Multiple studies link higher numbers of medicines, and particularly combinations including psychotropics, antihypertensives and hypoglycemic agents, with increased incidence of falls and recurrent falls, as well as fractures and subsequent functional decline. Medicines with sedative or anticholinergic properties, when accumulated within a polypharmacy regimen, impair balance, reaction time and cognition, thereby increasing the likelihood of falls and limiting the capacity to recover functional independence after an event. Given the downstream consequences of falls (e.g., pain, disability, fear of falling, institutionalization), minimizing unnecessary medicines that contribute to postural instability has become a central target of geriatric medication review.

Cognitive impairment and **functional decline** are also closely associated with polypharmacy. Studies show that both polypharmacy and long-standing exposure to many medicines correlate with poorer cognitive performance and accelerated decline, even after accounting for baseline health status, and that these associations are particularly marked in older adults with dementia. Polypharmacy is similarly linked to **loss of independence** in basic and instrumental activities of daily living, with higher medication counts predicting greater risk of future disability, nursing home placement and reduced quality of life.

Finally, problematic polypharmacy undermines adherence and the overall effectiveness of pharmacotherapy, while simultaneously increasing healthcare utilization and costs. Studies of

[11] Stewart D, Gibson-Smith K, MacLure K, et al. A modified Delphi study to determine the level of consensus across the European Union on the structures, processes and desired outcomes of the management of polypharmacy in older people. PLoS One. 2017;12(11):e0188348.
[12] Mair A, Fernandez-Llimos F; SIMPATHY Consortium. Polypharmacy management programmes: the SIMPATHY Project. Eur J Hosp Pharm. 2017;24(1):5-6.
[13] Davies LE, Spiers G, Kingston A, et al. Adverse Outcomes of Polypharmacy in Older People: Systematic Review of Reviews. J Am Med Dir Assoc. 2020;21(2):181-187.

older adults consistently show that as the number of medicines and **complexity of regimens increase**, **adherence decreases**, leading to suboptimal disease control, preventable exacerbations and avoidable hospitalizations. Non-adherence in this context is often unintentional, driven by confusion, forgetfulness or practical barriers, but it can also be intentional when patients feel overwhelmed by pill burden or experience unaddressed adverse effects.

6.1.3 Anticholinergic burden and geriatric syndromes

Anticholinergic exposure represents one of the most clinically important qualitative dimensions of polypharmacy in older adults, because many commonly prescribed medicines have antimuscarinic effects that accumulate across the regimen and contribute to multiple geriatric syndromes. High cumulative anticholinergic effect has been **associated with worse cognitive performance, incident cognitive impairment and dementia, delirium, constipation, urinary retention, blurred vision, dry mouth, impaired balance, falls and fractures, as well as greater hospitalization and mortality**, even after adjustment for multimorbidity and total medication count. Within a comprehensive medication review, quantifying **anticholinergic burden** therefore complements simple medicine counts by highlighting a specific, modifiable pharmacological dimension that is tightly linked to patient-centered outcomes such as function, continence and cognition.[14]

The concept of **anticholinergic burden** refers to the cumulative central and peripheral antimuscarinic effect arising from concurrent use of one or more drugs with anticholinergic activity, **including those not usually perceived as "anticholinergics"**, such as certain antidepressants, antipsychotics, antiemetics, antihistamines, bladder antimuscarinics and antispasmodics. Pharmacologically, these agents compete with acetylcholine at muscarinic receptors in the brain, eye, gut, bladder and cardiovascular system; when several such drugs are co-prescribed, **their effects add up** to produce a clinically relevant burden even if each individual agent is prescribed at a conventional dose. In older adults, age-related blood–brain barrier changes, increased pharmacodynamic sensitivity and reduced physiological reserve amplify the impact of this burden, so that relatively modest exposure can precipitate delirium, worsen pre-existing cognitive impairment or tip a frail patient into immobility and falls.

Beyond cognition, anticholinergic burden contributes to a cluster of geriatric syndromes mediated by **peripheral muscarinic antagonism**. By reducing detrusor contractility and increasing sphincter tone, these medicines can cause or worsen urinary retention and overflow incontinence, particularly in men with prostatic enlargement or in women with pelvic floor dysfunction. In the gastrointestinal tract, inhibition of smooth muscle activity and secretions contributes to constipation and ileus, which in frail older adults may lead to abdominal pain, anorexia and delirium. Ocular and cardiovascular effects, including blurred vision, mydriasis, tachycardia and orthostatic hypotension, further increase the risk of imbalance and falls, while central sedation and psychomotor slowing compound these risks when anticholinergic agents are combined with other CNS-active drugs. Observational studies have consistently linked higher anticholinergic scores with falls, fractures, hospitalization and mortality, suggesting that anticholinergic load is an independent marker of vulnerability within polypharmacy regimens.

[14] Wawruch M, Macugova A, Kostkova L, et al. The use of medications with anticholinergic properties and risk factors for their use in hospitalised elderly patients. Pharmacoepidemiol Drug Saf. 2012;21(2):170-176.

To operationalize this concept, several **anticholinergic burden scales** have been developed for use in research and clinical practice. The **Anticholinergic Cognitive Burden (ACB)** scale, one of the most widely used, classifies drugs into three levels (0 to 3) according to their established anticholinergic activity and evidence of cognitive effects, and yields a cumulative score by summing the levels of all medicines in a regimen. The **Anticholinergic Drug Scale (ADS)** similarly assigns scores from 0 to 3 based on serum anticholinergic activity and expert consensus, whereas the **Anticholinergic Risk Scale (ARS)** focuses on the risk of peripheral anticholinergic adverse effects and was initially derived in hospitalized older adults. More recently, newer instruments such as the **Drug Burden Index (DBI)**, incorporate both anticholinergic and sedative load in a dose-dependent manner.[10][11][2][4]

Despite their shared goal, these scales differ in the number and type of drugs included, the weighting of individual agents and the strength of evidence linking each drug to anticholinergic effects.[15] Comparative studies show only moderate agreement between scales, and the magnitude of association with clinical outcomes such as falls, hospitalization or mortality can vary depending on which instrument is used. While most scales show consistent associations between higher scores and adverse outcomes, the quality of evidence regarding predictive performance and responsiveness to change is heterogeneous, and few scales have been prospectively validated as decision-support systems (CDSSs) in routine care.[16]

For clinical pharmacists, this heterogeneity underscores that anticholinergic burden measures are best interpreted as screening instruments that identify patients at higher risk and highlight potentially problematic medicines, rather than as precise predictors of individual outcomes.[17] In practice, anticholinergic burden scales can be integrated into structured medication review as a pragmatic way to prioritize interventions in older patients with complex regimens. Medication review will be further explored in Pharmaceutical Care course (5th year). During the initial review, the pharmacist can calculate a cumulative score (for example using the ACB or ARS), identify which medicines contribute most to the burden, and consider whether each of these agents remains indicated, effective and aligned with the patient's current goals, prognosis and symptom profile. Particular attention should be paid to combinations of psychotropics (e.g. tricyclic antidepressants, certain antipsychotics, sedating antihistamines) and bladder antimuscarinics in patients with dementia, recurrent falls, constipation, urinary retention or visual disturbances, since deprescribing or substitution in these classes may offer substantial symptom relief and functional gains. When discussing potential changes with prescribers, summarizing the patient's anticholinergic score and linking it to specific geriatric syndromes (for example, "current ACB score 5 in a patient with recurrent falls and cognitive decline") can facilitate shared recognition of risk and support a shift from disease-centered to function-centered decision making.

Anticholinergic burden metrics also provide a concrete basis for engaging patients and caregivers in deprescribing conversations. Explaining that several of their medicines act on the same "acetylcholine system" and that, together, they may be contributing to symptoms such as confusion, constipation, blurred vision or dry mouth can help patients understand why

[15] Lisibach A, Benelli V, Ceppi MG, at al. Quality of anticholinergic burden scales and their impact on clinical outcomes: a systematic review. Eur J Clin Pharmacol. 2021;77(2):147-162.
[16] Lavrador M, Castel-Branco MM, Cabral AC, Veríssimo MT, Figueiredo IV, Fernandez-Llimos F. Association between anticholinergic burden and anticholinergic adverse outcomes in the elderly: Pharmacological basis of their predictive value for adverse outcomes. Pharmacol Res. 2021;163:105306.
[17] Lavrador M, Cabral AC, Veríssimo MT, Fernandez-Llimos F, et al. A Universal Pharmacological-Based List of Drugs with Anticholinergic Activity. Pharmaceutics. 2023;15(1):230.

simplification is being proposed, especially when some medicines were initiated years earlier for indications that are no longer relevant. Pharmacists can use burden scores to illustrate progress over time (for instance, showing that the score has decreased as certain agents have been tapered or replaced) and to monitor for both improvements in geriatric syndromes and potential withdrawal effects. In this way, anticholinergic burden assessment becomes not only a technical exercise in risk quantification but also a communication tool that anchors deprescribing in observable benefits for cognition, continence, mobility and overall quality of life, which are central objectives of geriatric pharmacotherapy.

6.1.4 Potentially Inappropriate Medication (PIM) in older adults

Potentially inappropriate medication (PIM) in older adults is usually defined as **drugs whose expected harms clearly outweigh their likely benefits in this age group, either in all circumstances or in specific clinical situations, when safer or more effective alternatives are available**. Instruments to identify such drugs translate this concept into operational lists or criteria that can be systematically applied to prescriptions, with the aim of improving the safety and appropriateness of pharmacotherapy in older people.[18]

Explicit tools for identifying PIMs consist of predefined sets of medicines, doses, treatment durations or clinical scenarios that are considered problematic in older adults, based on evidence from observational studies, clinical trials, or expert consensus. These criteria are usually structured as lists of medicines to avoid in all older persons, medicines to avoid in specific diseases or syndromes, dose or duration limits, and sometimes medicines that should be considered for prescription when there is a clear indication but frequent underuse. In contrast to **implicit approaches**, which rely on clinician judgment in the context of an individual patient (for example, the Medication Appropriateness Index - MAI)[19], explicit tools are designed to be relatively quick to apply, require less geriatric pharmacotherapy expertise, and are well suited for use in pharmacoepidemiologic research and computerized decision-support systems.

The use of explicit criteria is associated with high prevalence estimates of PIMs in hospital, primary care and long-term care settings, reflecting both the sensitivity of these instruments and the widespread exposure of older adults to medicines with an unfavorable benefit–risk balance. However, different explicit tools do not identify the same patients or the same medicines. Concordance between instruments such as Beers, STOPP and EU(7)-PIM is often only moderate, which underscores that they should be regarded as screening aids rather than definitive arbiters of prescribing quality.[20]

Beers criteria

The Beers criteria, developed by Beers and colleagues in the early 1990s and regularly updated by the American Geriatrics Society, are among the most widely used explicit tools for identifying PIMs in older adults. The most **recent versions** organize criteria into several domains: medicines that are potentially inappropriate in most older adults; medicines that are potentially

[18] Kaufmann CP, Tremp R, Hersberger KE, Lampert ML. Inappropriate prescribing: a systematic overview of published assessment tools. Eur J Clin Pharmacol. 2014;70(1):1-11.
[19] Schmader K, Hanlon JT, Weinberger M, et al. Appropriateness of medication prescribing in ambulatory elderly patients. J Am Geriatr Soc. 1994;42(12):1241-1247.
[20] Alshammari H, Al-Saeed E, Ahmed Z, Aslanpour Z. Reviewing Potentially Inappropriate Medication in Hospitalized Patients Over 65 Using Explicit Criteria: A Systematic Literature Review. Drug Healthc Patient Saf. 2021;13:183-210.

inappropriate in older adults with specific diseases or syndromes; medicines that should be used with caution; clinically important drug–drug interactions; and medicines requiring dose adjustment based on kidney function.[21] The development process combines systematic literature review with expert panel consensus, and the criteria are intended for use in adults aged 65 years or older in most care settings, excluding hospice and palliative care where goals of therapy differ.

The Beers criteria have been extensively used in pharmacoepidemiologic studies to estimate the prevalence of exposure to PIMs, to examine associations with outcomes such as falls, hospitalization and mortality, and as quality indicators in healthcare systems. Comparative analyses suggest that Beers criteria identify a relatively large number of PIMs, particularly psychotropics, anticholinergics and certain cardiovascular drugs, but may be less sensitive to context-specific issues such as drug–disease interactions that require detailed clinical information. In practice, Beers criteria are often implemented within electronic prescribing and medication review workflows to flag high-risk medicines for further clinical evaluation rather than automatic discontinuation. An important limitation of Beers criteria is the actual limited information that clinical pharmacists may have about patients' diagnoses.[22]

STOPP/START criteria

The **Screening Tool of Older Persons' Prescriptions (STOPP) and the Screening Tool to Alert to Right Treatment (START)** were developed in Ireland to provide a comprehensive, system-organized set of explicit criteria for inappropriate prescribing and potential prescribing omissions in older adults. **STOPP** criteria list medicines and prescribing situations that should generally be avoided in people aged 65 years or more because of excessive risk relative to benefit, including drug–drug and drug–disease interactions, therapeutic duplications, and inappropriate durations, while **START** criteria enumerate evidence-based medicines that are frequently underused in common chronic conditions such as heart failure, ischemic heart disease or osteoporosis. Subsequent revisions have expanded and updated the criteria, with version 2 and version 3 incorporating new evidence, additional drug classes and more detailed specification of clinical scenarios, and national adaptations have been undertaken to align the lists with local formularies and practice patterns.[23]

Compared with Beers, **STOPP/START criteria require more granular clinical information, including diagnoses, laboratory values and functional status, but in return they provide a closer integration between pharmacotherapy and geriatric syndromes**, and they explicitly capture both overuse and underuse of medicines. Inter-rater agreement studies show that STOPP criteria can be applied with acceptable reliability by trained physicians or pharmacists, and intervention studies suggest that structured medication review using STOPP/START may reduce PIMs, improve prescribing omissions, and decrease adverse outcomes such as falls or acute hospitalizations, although the evidence remains heterogeneous. However, the limited

[21] By the 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):2052-2081.
[22] Lavrador M, Silva AA, Cabral AC, Caramona MM, Fernandez-Llimos F, et al. Consequences of ignoring patient diagnoses when using the 2015 Updated Beers Criteria. Int J Clin Pharm. 2019;41(3):751-756.
[23] O'Mahony D, Cherubini A, Guiteras AR, et al. STOPP/START criteria for potentially inappropriate prescribing in older people: version 3. Eur Geriatr Med. 2023;14(4):625-632.

information pharmacists may have about patients diagnoses precluded an accurate use of START/STOPP criteria.[24]

EU(7)-PIM list and other national lists

The **EU(7)-PIM list** is a European explicit tool that synthesizes and harmonizes several national PIM lists, including the German **PRISCUS** list and criteria from the United States, France and Canada, to provide a common reference for older adults across multiple European countries.[25] The list includes more than 280 drugs from a wide range of therapeutic classes, often with explicit restrictions regarding dose, treatment duration, or concomitant conditions, and it offers suggestions for therapeutic alternatives or monitoring in many instances. Its development relied on a Delphi consensus process involving experts from seven European countries, who evaluated candidate medicines in successive rounds based on the balance of benefits and harms in older adults, availability of safer alternatives, and quality of underlying evidence.

Subsequent work has **adapted and operationalized the EU(7)-PIM list for national contexts**, including Portugal, by cross-referencing the original list with medicines that are authorized and marketed locally, and by adding pharmacologically similar agents when appropriate.[26] Comparative studies show that EU(7)-PIM criteria tend to identify a high prevalence of PIMs in both community and institutionalized older adults, and that concordance with Beers and STOPP criteria is incomplete but substantial, with overlapping identification of some high-risk medicines and divergence for others.

The FORTA list

The **Fit fOR The Aged (FORTA) list** represents a distinct type of explicit tool that classifies drugs commonly used in older adults into four categories, from A (clearly beneficial, indispensable) to D (to be avoided), for specific indications.[27] This dual focus on appropriateness and inappropriateness allows clinicians not only to identify medicines that should be minimized or discontinued, but also to recognize drugs with strong evidence of benefit in geriatric populations, thereby supporting more nuanced medication optimization. FORTA ratings are derived from systematic assessment of the literature and expert consensus and have been periodically updated. randomized controlled trials using FORTA-guided medication optimization have shown improvements in prescribing quality and some clinical outcomes, although the magnitude and generalizability of these benefits are still under investigation.

[24] Carvalho R, Lavrador M, Cabral AC, Veríssimo MT, Figueiredo IV, Fernandez-Llimos F, Castel-Branco MM. Patients' clinical information requirements to apply the STOPP/START criteria. Int J Clin Pharm. 2019;41(6):1562-1569.
[25] Renom-Guiteras A, Meyer G, Thürmann PA. The EU(7)-PIM list: a list of potentially inappropriate medications for older people consented by experts from seven European countries. Eur J Clin Pharmacol. 2015;71(7):861-875.
[26] Rodrigues DA, Herdeiro MT, Thürmann PA, et al. Operacionalização para Portugal da Lista EU(7)-PIM para Identificação de Medicamentos Potencialmente Inapropriados nos Idosos. Acta Med Port. 2021;34(3):194-200.
[27] Kuhn-Thiel AM, Weiß C, Wehling M; FORTA authors/expert panel members. Consensus validation of the FORTA (Fit fOR The Aged) List: a clinical tool for increasing the appropriateness of pharmacotherapy in the elderly. Drugs Aging. 2014;31(2):131-140.

6.1.5 Deprescribing frameworks in geriatrics

Deprescribing in geriatrics is best understood as **a structured, patient-centered process of withdrawing, reducing or simplifying medicines that are no longer appropriate, beneficial or aligned with the person's goals and preferences, with the intention of improving clinical outcomes and reducing treatment burden** rather than simply "stopping drugs". In older adults with multimorbidity and polypharmacy, deprescribing is therefore not an isolated technical act but an integral component of longitudinal medication management, tightly linked to concepts such as **time-to-benefit**, **frailty**, **geriatric syndromes** and the overarching aim of **preserving function and quality of life**. From the perspective of geriatric clinical pharmacy, most contemporary definitions emphasize that deprescribing is a planned, supervised and evidence-informed intervention that should be embedded in routine care, rather than an ad hoc response to acute adverse events.[28],[29]

Within such a process, the first step is the **identification of candidates for deprescribing**. Pharmacists and physicians usually start by compiling an accurate, reconciled medication[30] list across all care settings and products, including prescription, non-prescription and complementary medicines, and then screening this list for agents that are potentially harmful or low value in the context of the individual older adult. Common triggers include medicines listed in explicit tools for PIMs, high anticholinergic or sedative burden, preventive medications whose time-to-benefit clearly exceeds expected life expectancy, duplication within therapeutic classes, and agents that aggravate geriatric syndromes such as falls, cognitive impairment, orthostatic hypotension or urinary incontinence. Clinical events such as recurrent falls, delirium, unexplained functional decline, unintentional weight loss or repeated hospitalizations should also prompt a focused search for medicines that could be causally implicated and thus represent high-yield deprescribing targets.

Once a pool of candidate medicines has been identified, prioritization becomes necessary because it is rarely feasible or acceptable to modify all suspect agents simultaneously. Frameworks proposed in the geriatric deprescribing literature recommend **ranking drugs according to several dimensions**: the likelihood and severity of current or future harms; the presence or absence of a clear indication; the expected magnitude and time-frame of benefit; and the patient's own valuation of the medicine, including perceived benefit, burden and fears regarding discontinuation. In frail older adults with limited life expectancy, medicines used for long-term primary prevention, such as statins for primary prevention of cardiovascular disease or tight glycemic control regimens in type 2 diabetes, are often high-priority deprescribing candidates when compared with medicines that provide symptomatic relief and immediate functional benefit. Prioritization also needs to account for pharmacological considerations such as dependence, withdrawal risk and the feasibility of tapering; for instance, long-term benzodiazepines or high-dose opioids generally require careful, staged deprescribing plans and intensive follow-up.

Shared decision-making with patients and caregivers is a central element of safe and acceptable deprescribing in geriatrics. Older adults may have ambivalent feelings about their

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[28] Wu H, Kouladjian O'Donnell L, et al. Deprescribing in the Older Patient: A Narrative Review of Challenges and Solutions. Int J Gen Med. 2021;14:3793-3807. Published 2021 Jul 24.
[29] Linsky AM, Motala A, Booth M, et al. Deprescribing in Community-Dwelling Older Adults: A Systematic Review and Meta-Analysis. JAMA Netw Open. 2025;8(5):e259375.
[30] Medication reconciliation will be further explored in Pharmaceutical Care course (5th year).

medicines, simultaneously valuing them as symbols of good care and fearing the consequences of discontinuation, while carers often express concerns about both adverse effects and the complexity of regimens. Effective deprescribing conversations therefore involve explaining in plain language why certain medicines may now be causing more harm than benefit, discussing alternative non-pharmacological strategies or substitute therapies, and negotiating realistic expectations about symptom trajectories and the possibility of re-starting medicines if needed. Clinical pharmacists can play a role as mediators in these discussions, translating pharmacological risks into clinically meaningful terms (for example, linking sedative–anticholinergic combinations to falls, confusion and loss of independence) and ensuring that the patient's priorities, such as maintaining mobility or cognition, explicitly inform deprescribing decisions.

Planning and implementing dose reductions or withdrawals require careful attention to pharmacology, comorbidity and care setting. Some medicines, including benzodiazepines, Z-drugs, many antidepressants, antipsychotics, opioids, beta-blockers, proton pump inhibitors and corticosteroids, are associated with clinically important withdrawal or rebound phenomena and should usually be **tapered** rather than stopped abruptly, with specific tapering schedules adapted to treatment duration, dose, formulation and patient vulnerability. Other agents with low dependence potential and limited risk of rebound, such as certain vitamins, minerals or topical treatments, can often be discontinued directly, if monitoring plans are in place.

Monitoring after deprescribing is indispensable for distinguishing between withdrawal phenomena, recurrence of the underlying condition and unrelated intercurrent events. The monitoring plan should specify which symptoms or clinical parameters will be followed, over what time frame, by whom, and what thresholds will prompt re-assessment or re-initiation of therapy, with particular attention to medicines stopped for symptom control such as analgesics, antidepressants or bronchodilators.

Despite its conceptual appeal, deprescribing in routine geriatric practice faces multiple barriers at the levels of healthcare systems, professionals and patients. Prescribers frequently report uncertainty about the balance of risks and benefits when stopping long-standing medicines, particularly those initiated by specialists or perceived as "standard of care", and they may fear legal liability or criticism if adverse events occur after discontinuation. Conversely, several facilitators can make deprescribing more feasible and sustainable in geriatric clinical pharmacy practice. Evidence-based explicit tools, such as Beers, STOPP/START, EU(7)-PIM and FORTA, provide structured starting points for identifying high-risk medicines, while condition-specific deprescribing guidelines and algorithms (for example, for benzodiazepines, proton pump inhibitors or antipsychotics in dementia) offer practical tapering strategies.

Embedding deprescribing into routine medication review[31] workflows helps to normalize deprescribing as a standard element of care rather than an exceptional activity. Multidisciplinary collaboration between clinical pharmacists, geriatricians, general practitioners, nurses and, where relevant, specialists, together with deliberate investment in communication skills and shared decision-making training, further strengthens the capacity of healthcare teams to negotiate and implement complex deprescribing plans in a way that respects patients' values and priorities.

[31] Medication reviews will be further explored in Pharmaceutica Care course (5th year).