Integrating exercise and medication management in geriatric care: a holistic strategy to enhance health outcomes and reduce polypharmacy

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Integrating exercise prescriptions with medication management represents a novel approach for enhancing health and function, optimising medication effectiveness, and reducing adverse drug reactions and polypharmacy in older adults (ie, those aged ≥60 years). This Personal View highlights the need for a comprehensive assessment of lifestyle, diagnoses, geriatric syndromes, and medications with an emphasis on fully incorporating exercise treatment into geriatric care. Exercise is an alternative to less effective or unsafe medications for many conditions, including depression, anxiety, insomnia, osteoarthritis, and dementia. Exercise is an important adjunct to pharmacotherapy for many common chronic conditions such as coronary artery disease, heart failure, diabetes, osteoporosis, cancer, and chronic obstructive pulmonary disease. Adding exercise to drug management can mitigate adverse drug reactions, enhance medication compliance, and reduce the adverse effects of sedentary behaviour and ageing processes on chronic disease expression. Targeted exercise programmes have also been shown to ameliorate drug-induced side-effects, including anorexia, falls, sarcopenia, osteoporosis, and orthostatic hypotension, and to overcome constraints such as reduced aerobic fitness, balance impairment, and muscle atrophy due to some medications. Health-care professionals require additional training and support to ensure that exercise assumes a key, central role in older adults with multimorbidity and polypharmacy, as supported by the current literature. This Personal View describes practical approaches to incorporating exercise into clinical practice as a step towards an integrated geriatric care model, with the ultimate aim of increasing health span and minimising disability.

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Integrative pharmacotherapy and exercise in geriatric care

Polypharmacy—commonly defined as the use of five or more medications—is highly prevalent among older adults (ie, those aged ≥60 years), with more than 60% of them regularly taking multiple prescriptions.[1–4] Polypharmacy is associated with increased risks of adverse drug reactions, frailty, falls, hospital admissions, and loss of physical function.[5–10] These effects are amplified when medications accelerate age-related physiological decline, contributing to sarcopenia, osteoporosis, cognitive impairment, neuropathy, and functional dependence.[6,7,11,12]

Throughout this paper, we use physical activity to refer to general bodily movement above resting levels and exercise to denote planned, structured activity aimed at improving or maintaining physical fitness. Our focus is on therapeutic exercise prescriptions for older adults, which should be medically indicated, professionally implemented, and clinically monitored. Robust evidence indicates that structured physical activity enhances cardiovascular health and fitness, metabolic control, bone health, muscle strength, balance, pain tolerance, mood, and cognitive function in older adults, ultimately supporting increased functional capacity and reduced disability.[13–16] However, the interplay between pharmacological treatment and exercise remains underappreciated.[17,18] Some drugs—such as psychotropic and anticholinergic agents—can hinder engagement in and adaptation to exercise,[19–21] whereas others contribute to complications such as vitamin B12 deficiency,[22–24] prescribing cascades,[25,26] or increased risk of falls. In many cases, individualised exercise prescriptions offer a safer and more effective alternative to pharmacological treatment—particularly for managing chronic pain, depression, insomnia, and anxiety and mitigating adverse effects such as muscle wasting and impaired balance.[13,27,28] Progressive resistance training (PRT) not only enhances muscle strength but also improves gait speed, mobility, and the capacity to perform activities of daily living—outcomes that are central to care goals in older adults with multimorbidity and polypharmacy. As such, PRT should be considered a first-line component of tailored exercise prescriptions for individuals with frailty.[13,17,18,29]

Moreover, exercise should be considered a first-line intervention when no effective pharmacological alternatives exist, such as in frailty, sarcopenia, and functional decline, or as a crucial adjunct when medications blunt physiological adaptations, as seen with metformin, corticosteroids, androgen deprivation therapy, or neurotoxic chemotherapy agents.[13,17,18,30–34] Tailored exercise plans, behavioural strategies, and nutritional support could mitigate these effects and promote safer, more effective ageing trajectories. Considering how to approach medications that can accelerate age-related physiological decline or blunt adaptations to exercise is also important to better understand the interaction between pharmacotherapy, nutritional status, and exercise in the care of older adults (table 1 and appendix p 1).[13,17]

See Online for appendix

In summary, this Personal View aims to provide health-care and exercise professionals with practical, evidence-based guidance for integrating exercise and pharmacological management in older adults with multimorbidity and polypharmacy. The Personal View also

	Expanded guidance beyond general recommendations
Adverse drug reactions	Link specific drug side-effects to tailored exercise (eg, aerobic exercise for opioid-induced constipation or resistance training for appetite stimulation). Moves beyond general guidelines by treating pharmacologically induced impairments such as fatigue, anorexia, depression, and cognitive dysfunction through multimodal strategies.
Drug–drug interactions	Emphasise exercise as a non-pharmacological alternative to manage additive drug effects, such as hypotension from multiple antihypertensives or bleeding risk from non-steroidal anti-inflammatory drugs and anticoagulants. Offer strategies to maintain function and avoid escalation of medication burden.
Drug–nutrient interactions	Restore functional integrity by compensating for medication-induced nutrient malabsorption (eg, vitamin B12 from metformin and vitamin D or calcium from corticosteroids). Provide exercise-based interventions for neuropathy (eg, balance and proprioception) and osteopenia (eg, resistance and power).
Drug–disease interactions	Align exercise with disease-specific pharmacological side-effects (eg, resistance training for osteoporosis from androgen deprivation therapy and tailored aerobic plans around meals in insulin-treated diabetes to avoid hypoglycaemia).
Drug–ageing interactions	Target polypharmacy-amplified ageing vulnerabilities such as falls and gastrointestinal dysmotility. Highlight exercise substitution for medications causing sedation or systemic side-effects, especially relevant in older adults with frailty.
Impaired exercise engagement	Compensate for sedation, fatigue, and mobility restrictions due to pharmacological treatments. Enhance engagement via cognitive-stimulating exercise and strength-building methods to regain independence.
Altered exercise prescription or monitoring	Provide adaptive monitoring techniques (eg, perceived exertion *vs* heart rate) when medications such as β blockers blunt physiological responses. Promote safe thermoregulation and vigilance for masked symptoms of distress.
Impaired exercise adaptation	Counteract reduced physiological responsiveness from drugs such as corticosteroids and metformin through specific training methods (interval training for VO_2 max gains and resistance or power training for musculoskeletal integrity).

For examples of and management strategies for these interactions, see table 8 in the 2025 study by Izquierdo and colleagues.[13] This table provides a comprehensive overview of common interactions between exercise, medications, and nutrients affecting older adults, with emphasis on actionable strategies beyond general physical activity guidelines. Each category is linked to specific examples—such as gait disturbances, orthostatic hypotension, hypoglycaemia, or cognitive decline—and provides tailored guidance, such as exercise substitutions, scheduling relative to drug dosing, and adaptations in method or monitoring (eg, perceived exertion for β-blocker users). This expanded guidance enables clinicians to personalise exercise interventions on the basis of pharmacological profiles and improve function, reduce adverse events, and support deprescribing strategies wherever appropriate. Examples are provided to increase the clinical utility of the table. For instance, exercise might substitute antidepressants for mild-to-severe depression, benzodiazepines for insomnia or anxiety, and opioids for the management of chronic musculoskeletal pain. Anabolic exercise refers to high-intensity progressive resistance training to reverse muscle loss and improve function, particularly in individuals with sarcopenia or those undergoing corticosteroid use. Gastrointestinal motility refers to aerobic exercises that promote bowel regularity, particularly in individuals with constipation from opioids, calcium channel blockers, or anticholinergic drug use. Non-cardiac symptoms of cardiac distress include fatigue, shortness of breath, jaw claudication, light-headedness, or nausea that could indicate compromised cardiovascular tolerance to exercise, particularly in polypharmacy contexts (eg β-blocker and diuretic use) and warrant careful monitoring.

***Table 1:* Integrated management of exercise and pharmacotherapy interventions in the care of older adults**

outlines the effects of standard drug classes on exercise responses and offers strategies to enhance safety, adherence, and functional outcomes through tailored holistic interventions.[13]

Overview of exercise–drug interactions

Evaluating and subsequently identifying possible drug interactions are essential for drug safety and patient education. Nonetheless, drug manufacturers rarely evaluate drug–exercise interactions; thus, knowledge of the clinical significance of such interactions is scarce.[35] When developing exercise prescriptions for older adults, assessing and considering existing medications and any potential interactions with exercise that could compromise safety, enhance engagement, or promote desired physiological adaptations are crucial.[13,36] No medications specifically contraindicate exercise, but many drugs can interfere with physiological capacity and motivation or increase the risk for adverse events.[7,37–39] The consequences of such drug–exercise interactions include impaired cognition, weakened muscular function, impaired balance, altered metabolism, bleeding tendency, and potential cardiovascular adaptations.[37–39] In this population of older adults with comorbidities, a comprehensive evaluation of the total medication burden and potential physical activity barriers is essential to individualise exercise interventions.

Exercise–drug interactions are an increasingly relevant topic that deserve the attention of clinicians in several domains of geriatric care. Aspects of pharmacokinetics (absorption, distribution, metabolism, and excretion) and pharmacodynamics (drug effects on physiology) are crucial for understanding the effect of exercise on the effectiveness or toxicity of drug therapy. Knowledge of these processes is fundamental for optimising the timing and dosing of medications when used in combination with physical activity, to ensure that therapeutic levels are maintained without a corresponding increase in the risk of side-effects. The absorption site might vary based on the route of drug administration. During extreme physical activity, the blood is redirected to the active muscles to facilitate performance, which could theoretically affect the pharmacokinetics of specific drugs. Nonetheless, this effect will be small in less mobile populations or people who do not engage in vigorous exercise. Possibly of greater clinical importance in high-capacity athletes, this phenomenon is less relevant in sedentary individuals or those undertaking only light physical activity, for whom substantial blood redistribution is not expected.

Adjusting exercise programmes in older adults often requires consideration of standard medication classes that could interfere with physiological adaptations. A pragmatic framework is available to guide such modifications (table 2, appendix p 2). These strategies can help to optimise the adoption of physical activity and enhance the therapeutic effect of exercise, even in the presence of potential drug–exercise interactions.

	Medication classes	Modification
Sedation, confusion, and reduced cognitive engagement	Opioid analgesics, benzodiazepines, anticonvulsants, neuroleptics, antihistamines, and anticholinergic medications	Time exercise when sedating effects are minimum (not immediately following dose). Avoid overhead or unsupervised exercise involving dumbbells and perform seated strength training wherever needed. Physician should evaluate whether PRT and increased physical activity can be substituted for pain medications, psychotropic medications, or both.
Increased risk of falls and dizziness	Opioid analgesics, benzodiazepines, anticonvulsants, statins, antihypertensive medications, dopaminergic medications, and proton-pump inhibitors (can cause peripheral neuropathy and increase risk of falls)	Same considerations as for opioid analgesics, benzodiazepines, and anticonvulsants. Alternate exercises for arms and legs while maintaining typical breathing pattern. Perform seated calf raises before moving slowly from semi-recumbent to seated position and then to standing position. Physicians should consider PRT exercise to substitute in part or full for antihypertensive medication. Watch for signs of scuffing feet or reduced sensation, avoid prolonged walking in shoes, and monitor shoe fit. Perform targeted balance training in supervised settings to address balance deficit.
Myalgia and reduced muscle function during and following exercise	Statins and other lipid-lowering medications	Side-effects could be confused with delayed onset muscle soreness when a new drug and PRT are initiated at the same time. If delayed onset muscle soreness persists beyond 2 weeks, another cause should be investigated. If statin myopathy is severely interfering with mobility, function, or quality of life, the physician should consider an alternative lipid-lowering medication, reducing the dose, or discussing the evidence for alternative medication with the patient.
Altered cardiovascular response during exercise and dehydration	β blockers, antihypertensives, and diuretics	Use perceived exertion to monitor intensity (for aerobic training) rather than heart rate. Stay well hydrated before and after exercise. Clinicians should look for other signs of myocardial ischaemia such as pallor, fear, shortness of breath, and palpitations. β blockers could cause or exacerbate hypotension during exercise and decrease tolerance to heat and humidity; if hypotension is suspected, then measure blood pressure both in the seated and standing positions before starting standing exercise and wear loose, breathable clothing.
Blunted adaptations to exercise	Metformin and corticosteroids	Use high-intensity aerobic training or high-intensity interval training to optimise aerobic capacity gains. Use the highest intensity feasible for resistance training and add power training for muscle and bone adaptations.

PRT=progressive resistance training.

Table 2: **Strategies for modifying exercise regimens in response to medication-related effects on patient engagement and physiological adaptation**

The effect of adverse drug reactions on physical function and exercise adoption

Adverse drug reactions are a substantial concern among older adults, mainly because of their potential to exacerbate frailty, impair physical function, and increase the risk of falling. Many medications, including sedatives (eg, benzodiazepines), opioids, and anticholinergics, act on the CNS and can trigger side-effects such as sedation and cognitive impairment, which aggravate frailty and impair coordination and dual-task performance in high-risk individuals with prefrailty or mild cognitive impairment. Cognitive deficits can also precipitate decreased physical proficiency, resulting in a loss of balance and increased risk of falls, which discourages the affected patients from completing progressive balance exercise bouts.[40,41] These effects not only diminish an individual's ability to perform daily activities but might also discourage participation in beneficial physical activities, such as balance and resistance training.

The aforementioned sedative medications, in addition to statins, antihypertensive medications, dopaminergic medications, and proton-pump inhibitors, also increase the risk of falls through mechanisms such as peripheral neuropathy and muscle weakness. The low clarity regarding the actual prevalence of these adverse drug reactions stems from the overlap between typical ageing conditions, such as falls, muscle pain, and poor balance, and the tendency to dismiss such complaints rather than investigate them as possible drug reactions. More studies are needed to better define the effects of these medications on the risk of falls and exercise capacity in older adults.

Statins could cause side-effects such as muscle pain or weakness that can be mistaken for ageing or ordinary delayed onset muscle soreness, especially in novice resistance trainers.[42–44] Particular care needs to be taken to identify whether the symptom onset in these individuals over the subsequent 24 h is attributable to pharmacological myopathy or discomfort associated with exercise. Assessing creatine kinase concentrations in all older adults taking statins who present with musculoskeletal complaints or falls is warranted and underutilised. Statin and other hypolipidaemic agent-induced myopathies are related to age, dose, duration, and the use of lipophilic drugs. Therefore, a high index of caution should be maintained for older adults at high dosages, long durations of treatment, or taking simvastatin, which has the highest likelihood of causing myopathy in this population. This adverse drug reaction could be a barrier to exercise adoption; therefore, timely recognition and management via alteration of drug type or dosage or reconsideration of the use of such drugs in older adults as primary prevention, in line with to current guidelines, is important.[45,46]

Several pharmacological therapies also require adjustments to exercise prescriptions, behavioural interventions, and careful monitoring to ensure treatment effectiveness.[19–21] Medications such as benzodiazepines, which are widely prescribed for anxiety, insomnia, or muscle spasms, can attenuate muscular neural activation due to their sedative properties, exacerbating age-related decreases in strength and power.[47,48] These drugs impair multitasking, decrease motivation to adhere to rehabilitative exercises, and contribute to increased gait instability and risk of falls.[49,50] Both typical and atypical antipsychotic treatments, frequently used for behavioural and psychological symptoms of dementia, should be applied with caution, as their sedative effects can aggravate gait problems and increase the likelihood of falls in older adults.[6,7,51]

Anticholinergic medications, prescribed for conditions such as overactive bladder and allergies, can negatively affect executive function and mobility by acting on the peripheral nervous system to reduce muscle activity. These drugs also cause sedation, orthostasis, dry mouth, constipation, and confusion.[52,53] Such adverse drug reactions can severely restrict the ability of older adults to participate in exercise programmes, which are crucial for counteracting age-related functional decline and chronic illnesses.[54] Current medication optimisation literature emphasises minimising anticholinergic burden as a key recommendation for reducing potentially inappropriate medications and adverse drug reactions.[55]

When medications cannot be discontinued despite their adverse effects on mobility, sedation, impairment, or weight loss, specific exercise types, including balance, resistance, and aerobic training, are recommended to counteract these effects.[56,57] Recognising and promptly addressing adverse drug reactions is essential to support exercise participation and mitigate functional decline. Tailored exercise interventions, coupled with careful medication management, provide a key strategy for optimising the physical and cognitive health of older adults.

Prescription of tailored exercise to mitigate adverse drug reactions

Customised exercise prescription is an effective therapy for several drug-related side-effects[13] and enhances the overall resilience and wellbeing of affected individuals. For example, exercise relieves pain, fatigue, and body composition changes caused by therapies for autoimmune diseases and cancer, leading to improved drug tolerance and better patient outcomes.[58] Aerobic exercise, especially when paired with core muscle strengthening, can help to relieve the symptoms of constipation, enhance the quality of life, and reduce the dosage of opioid analgesics in individuals with opioid-induced constipation. In contrast, PRT can mitigate the muscle-wasting effects of corticosteroids while simultaneously addressing the primary and secondary health concerns associated with chronic diseases.[59,60] Moreover, vitamin D and calcium-supplemented resistance-based training can counteract the loss of bone mineral density that typically occurs over approximately 2 years of chronic steroid use, thereby supporting the maintenance of musculoskeletal health in an older population that is particularly prone to falls and fractures.[61,62] Furthermore, PRT, with or without aerobic exercise, can also improve metabolic syndrome indices related to corticosteroid or androgen deprivation therapy.[13,58]

Benzodiazepines and neuroleptics have sedative effects, and other exercises are needed to increase balance and proprioception and minimise the risk of falling due to sensory or motor impairments.[6,7,63,64] Specific interventions focusing on strength, balance, and innovative dual-task training have shown effectiveness in reducing falls among older adults,[14,65] thereby functioning as treatments for the adverse effects of benzodiazepines in those with anxiety or insomnia.

Scheduling exercise sessions during periods when medication effects are reduced could increase cognitive responsiveness.[63,64] If balance is impaired, intensive supervision is recommended. When intolerable fatigue, dizziness, or muscle weakness impairs participation in exercise, it might be necessary to increase the intensity and complexity of exercise gradually, introducing new elements in a sequenced manner.[13] The use of assistive devices and verbal cues could help individuals with executive functioning deficits.

Drugs can also affect the specifics and considerations that should be taken for exercise protocols. For example, individuals taking β blockers should use perceived exertion rather than heart rate to guide their aerobic exercise intensity.[38,66,67] Individuals on diuretic therapy should be kept hydrated and warm enough to sustain moderate-intensity exercise training,[68] as these medications can reduce tolerance to heat and humidity.[38] Individuals taking anticoagulants, platelet inhibitors, or both, can undergo PRT. However, these individuals should be cautioned about the importance of resistance exercise forms and techniques to prevent injuries. Well trained or supervised individuals can be instructed to exercise using free weights. However, machines are generally recommended for individuals with severe hand osteoarthritis or neurological disorders, because of the risk of dropping free weights.[13] Machine padding (eg, knee extension pads) might also be necessary to prevent excessive pressure on sensitive areas such as the shins. High-impact aerobic workouts should be minimised; however, aerobic intensity can be effectively increased by incorporating inclined or step-based movements. The risk of falls needs to be thoroughly evaluated, and robust balance training should be prescribed to reduce the risk of falls, particularly given the heightened risk of bleeding. In individuals with osteoporosis, plyometric or jumping exercises should be avoided. Therefore, PRT should be promoted to improve bone health and functional capacity in older adults. This personalised approach ensures safety while preserving the benefits of exercise interventions.[13]

These examples indicate that optimised exercise interventions can provide a treatment option for adverse drug reactions associated with pharmacological treatment (table 3; appendix p 3).[69,70]

Drug–drug interactions: managing cardiovascular medication and exercise regimens

Integrating pharmacological interventions for cardiovascular conditions with exercise programmes in older individuals is necessary to enhance treatment effectiveness, mitigate side-effects, improve adherence, address multimorbidity, and support functional independence.[35,71] Cardiovascular agents (eg, those used for managing hypertension, heart

	Medication class leading to side-effect	Action
Adverse drug reactions		
Sarcopenia	Glucocorticosteroids	Prescribe high-intensity PRT 2–3 days per week.
Osteoporosis	Glucocorticosteroids, androgen deprivation therapy, and aromatase inhibitors	Prescribe high-intensity PRT 2–3 days per week, incorporating exercises involving multidirectional loading of the bone. Impact training (such as jumping and hopping) is not generally suitable for aged care.
Fluid retention or oedema	Glucocorticosteroids, non-steroidal anti-inflammatory drugs, and calcium channel blockers	Prescribe moderate-to-high-intensity PRT 2–3 days per week, with legs elevated intermittently to reduce swelling. Both seated and standing calf raises should be performed throughout the day and session.
Myopathy	Statins and glucocorticosteroids	Prescribe moderate-intensity PRT 2–3 days per week and increase as tolerated. Avoid excessive eccentric contraction and allow for extended breaks between both sets and sessions.
Arthralgia	Statins and aromatase inhibitors	Prescribe moderate-to-high-intensity PRT 2–3 days per week, with pain-free range of motion targeting muscles surrounding the knee and hip. Isometric contractions should be performed when feeling pain.
Weight gain; adipose tissue expansion	Glucocorticosteroids, antipsychotics, anticonvulsants, and lithium	Prescribe moderate-to-high-intensity PRT 2–3 days per week and reduce extended sedentary bouts throughout day by incorporating bouts of aerobic exercise.
Dyslipidaemia	Glucocorticosteroids, thiazide diuretics, oral oestrogens, testosterone, and tamoxifen	
Drug–disease interactions		
Urinary incontinence	Selective α blockers (prazosin and doxazosin), diuretics, anticholinesterases (donepezil), and sedative hypnotics. Opioids and anticholinergics might cause urinary retention and overflow incontinence. Drug-induced incontinence is common in older adults.	Prescribe pelvic floor muscle exercises or training and PRT with fast or sustained contractions, including behavioural interventions.
Delirium and cognitive impairment	Anticholinergics, such as antidepressants (eg, amitriptyline, doxepin, and paroxetine), antihistamines (eg, diphenhydramine and hydroxyzine), antimuscarinics (eg, oxybutynin and tolterodine), antipsychotics (eg, chlorpromazine and olanzapine), antispasmodics (eg, atropine, dicycloverine, and hyoscine), and skeletal muscle relaxants (eg, cyclobenzaprine); benzodiazepines; corticosteroids; H2-receptor antagonists; and sedative hypnotics	Prescribe moderate-to-high-intensity PRT combined with power training and moderate-intensity aerobic training. Adopt a multimodal approach incorporating balance challenges, cognitive training tailored to individual status, Mediterranean diet, and socioemotional enrichment.
Impaired exercise engagement		
Dizziness or orthostasis	Anticholinergics, antihypertensives (eg, peripheral α-1 blockers, and central α blockers), sulfonylureas (long-term use), antiparkinsonian drugs, and diuretics	Vestibular rehabilitation and moderate exercise training, especially in individuals with low tolerance.
Impaired exercise adaptation		
Weight loss	Bisphosphonates, doxycycline, iron, non-steroidal anti-inflammatory drugs*, and potassium; angiotensin-converting enzyme* inhibitors, allopurinol, antibiotics, anticholinergics, antihistamines, and calcium channel blockers; antibiotics, anticonvulsants, benzodiazepines, digoxin, metformin, opioids, and SSRIs*; and donepezil	Multicomponent exercise training that includes moderate-to-vigorous intensity PRT combined with diet management to ensure intake of nutrient and energy-dense, high-protein diet.
Falls	Anticonvulsants, antihypertensives, antipsychotics, benzodiazepines, opioids, SSRIs*, and tricyclic antidepressants*	Multicomponent exercise programmes, including combinations of resistance training, balance or gait retraining, or both.
Constipation	Anticholinergics, calcium channel blockers, opioids, and iron	Combination of moderate-intensity aerobic and PRT and regular physical activity.

PRT recommendations follow the Frequency, Intensity, Time, and Type framework: frequency of two to three sessions per week, moderate-to-high intensity (60–80% one-repetition maximum or rate of perceived exertion 13–17), and volume of one to three sets of six to 12 repetitions for each muscle group. Exercise selection should emphasise multi-joint functional movements and include specific muscle groups important for transfers, such as triceps, hip abductors, and dorsiflexors, for fall prevention. Supervision is strongly advised for older adults with frailty, cognitive decline, or polypharmacy. Exercise programme progression should be individualised and based on performance and tolerance. For more specific exercise guidelines, refer to the 2025 study by Izquierdo and colleagues.[13] PRT=progressive resistance training. SSRIs=selective serotonin reuptake inhibitors. *These medications, including antipsychotics, insomnia drugs, opioids, antidepressants, benzodiazepines, and sedating antihistamines, increase the risk of falls and cognitive confusion. The medications are commonly used for pain management, allergies, and disruptive behaviour in dementia, psychosis, insomnia, and anxiety and as a form of chemical restraint.

Table 3: **Tailoring exercise interventions to counteract medication-induced side-effects in older adults**

disease, or thrombosis, or a combination of these) raise important considerations regarding physical exercise.[72] Medications used to lower blood pressure, such as β blockers, angiotensin-converting enzyme inhibitors, or calcium channel blockers, could induce intermittent or orthostatic hypotension or electrolyte changes that diminish effort tolerance and manifest as postexercise hypotension myalgias and fatigue.[73] Diuretics are effective in controlling blood pressure at the expense of volume contraction, leading to increased symptoms of dehydration, which could limit exercise tolerance; however, these side-effects are recognised.[74] Studies such as the SPRINT trial have shown that although intensive blood pressure control reduces the rate of severity of cardiovascular events in older adults, it might also lead to an increased number of falls and other adverse outcomes.[75] Thus, providing a comprehensive global assessment that focuses on the effectiveness and safety of these therapies, especially regarding individualised treatment in older adults who engage in exercise, is essential.

These drug effects pose substantial challenges in developing efficient exercise programmes for older adults with cardiovascular issues. For example, anticoagulants, which are essential for preventing strokes, increase the risk of bleeding during intense exercise when combined with non-steroidal anti-inflammatory drugs for pain management.[76,77]

This effect is particularly relevant in contact sports and PRT involving heavy equipment,[78,79] and also during ambulatory exercise in individuals with balance impairment. Additionally, cardiovascular drugs, such as nitrates and β blockers, are commonly used in the management of angina because of their ability to reduce the heart rate and myocardial oxygen demand, effectively preventing symptoms of angina.[80,81] However, this therapeutic effect also means that, during exercise, β blockers can mask the symptoms of angina or contribute to orthostatic hypotension due to reduced blood pressure and a blunted heart rate response to changes from the supine to standing position. Assessment of orthostatic signs and balance training might be required to mitigate the risk of falls. The altered heart rate response can obscure accurate assessment of exercise tolerance and detection of underlying ischaemic events. In these situations, alternative strategies, such as monitoring exercise intensity using perceived exertion scales instead of relying solely on heart rate, might be necessary to ensure safe and effective exercise prescription.

The effect of drugs on exercise adaptations

The relationship between pharmacological interventions and physical exercise is complex, particularly in older populations. Medications can influence the effectiveness of physical training through pharmacokinetic and pharmacodynamic pathways, thereby altering the body's response to exercise. Widely prescribed drugs, such as metformin and statins, can affect exercise adaptation. Statins, commonly used to manage cholesterol levels and prevent vascular events, can reduce the expected muscular benefits of resistance training, potentially limiting gains in strength or power.[42–44,82] However, evidence from a 2023 study suggests that regular exercise remains safe and beneficial in people using statins, with no substantial increase in muscle injury markers.[83] Similarly, metformin, a commonly prescribed diabetes medication, can blunt improvements in aerobic capacity, insulin sensitivity, and muscle hypertrophy during training,[84–86] although effects vary across studies. These findings highlight the importance of tailoring exercise methods, such as incorporating high-intensity aerobic or resistance training, to counter the potential dampening effects of medications.[84,87–90] Individuals undergoing long-term glucocorticoid or androgen deprivation therapy should engage in PRT at the highest possible intensity, incorporating power training to mitigate muscle and bone loss, central adiposity, and insulin resistance associated with the use of these drugs.[89,90]

Exercise prescription adjustments for standard drug classes and implementation considerations

Most medications require minimal adjustments to standard exercise prescriptions; however, a few key considerations are important for some medications. For individuals with diabetes, considering insulin and other glycaemic agents in conjunction with physical activity is crucial.[13,91–93] Adhering to proper timings for exercise after meals is key for maintaining glycaemic balance, enhancing glucose utilisation, and preventing both hyperglycaemia and postexercise hypoglycaemia. This delicate balance highlights the importance of synchronising insulin intake, dietary habits, and daily energy expenditure to achieve optimal metabolic health. Exercising 60–90 min after a meal is an ideal time to blunt postprandial hyperglycaemia with no risk of hypoglycaemia, even during long-lasting activity or intense exercise in individuals with stable diabetes. For individuals with type 1 diabetes, with brittle diabetes control, or who are prone to hypoglycaemia, the likelihood of extreme postexercise reductions in glycaemia is less likely with PRT than with aerobic exercise, whereas the beneficial effects of exercise in reducing hyperglycaemia are more sustained.[94]

For those with osteoarthritis or other severe chronic pain conditions, scheduling anti-inflammatory analgesic medications shortly before exercise sessions is beneficial to maximally engage the subjects cognitively, increase motivation, attenuate any pain from movement, and ensure adherence to therapeutic doses of physical activity. Combining exercise with drug treatment could improve symptom control, reduce polypharmacy, and alleviate the consequences of physical deconditioning.[95] However, use of opioids could result in sedation, falls, and motor impairment; therefore, exercise sessions should be scheduled away from the peak of these effects. A carefully modulated exercise programme can be implemented as a treatment for opioid-induced hyperalgesia, but such a programme should reduce pain and not increase it.[96]

For individuals with neuropathic, auditory, or visual impairments, in addition to polypharmacy, exercise modifications such as seated activities and assistive technologies are important for ensuring safety and accessibility. Minimising distractions, such as background music and conversation, might be necessary when a hearing impairment compromises safety or attention to instructions. Moreover, considerations related to incontinence and methods to minimise the mechanical fatigue or strain associated with exercise in those with frailty or dementia are important not only because they are functionally helpful in an otherwise highly challenging disease, but also because they are crucial for helping the older adults retain dignity, both physically and psychologically, which is a primary determinant of exercise adherence.[97] Specialised instructional methods and supervision are required to enable exercise in all older adults, regardless of cognitive status.[13,98,99] Ensuring toileting before exercise, using continence products when needed, keeping spare gym pants available, and avoiding the Valsalva manoeuvre can help minimise incontinence-related incidents.

Blood pressure regulation during aerobic exercise in older adults receiving antihypertensive therapy requires close clinical attention. Although resting blood pressure can be well controlled, emerging evidence suggests that this does not necessarily translate into haemodynamic stability during exertion. Notably, Chant and colleagues[100] showed that individuals on antihypertensive medications can have exaggerated increases in systolic blood pressure during moderate-to-high-intensity exercise. This effect—known as exercise-induced hypertension—has been independently associated with elevated cardiovascular risk and mortality,[101] underscoring the need for careful monitoring of blood pressure responses during physical activity.

Conversely, some antihypertensive agents could have beneficial modulatory effects on exercise. For instance, angiotensin-converting enzyme inhibitors have been shown to blunt sympathetic nerve activity during exertion, potentially mitigating hypertensive surges.[102] In parallel, angiotensin receptor blockers might preserve baroreflex sensitivity and neuromuscular control, thereby reducing the risk of postexercise hypotension, which is an important consideration in older adults with frailty and functional impairment.[103] These findings highlight the dual importance of pharmacological context and managing exercise intensity when designing safe and effective exercise interventions for older adults undergoing antihypertensive therapy.

Substituting exercise for medication in older adults

A substantial body of research supports a paradigm shift in geriatric care that favours exercise over medication for some conditions, highlighting the notion of exercise as medicine in older adults.[13] This model is especially relevant for individuals with polypharmacy who frequently experience cognitive side-effects of medications. For example, PRT can reduce pain and opioid reliance,[104,105] whereas aerobic and isometric exercises have shown blood pressure-lowering effects that are similar to those of antihypertensive drugs.[106,107] These findings support cautious deprescribing when appropriate, with close monitoring to avoid undertreatment or adverse events. For type 2 diabetes, structured exercise improves glycaemic control and can reduce the need for multiple agents,[13] reinforcing its role as a primary therapeutic strategy in geriatric care.

Converting individuals from medication-based treatments to exercise programmes should be approached cautiously, prioritising patient safety and setting realistic expectations for the programme. This process involves carefully tapering the medication dose or reducing the number of prescribed agents while monitoring for adequate symptom control. Additionally, a well-structured reversal plan should be implemented to address any adverse events that could occur during this transition. Health professionals can provide supervision to facilitate these changes and prevent complications such as withdrawal symptoms or disease exacerbation. However, the intensity of oversight required differs among patients based on their medications and comorbid diagnoses. Specifically, discontinuation of key medicines, such as insulin or antihypertensives, generally requires careful management to minimise risks.

This patient-centred approach encourages active living and independence while promoting agency and self-management, which aligns with broader public health goals for consumers. Improving referral systems and access to community-based exercise programmes can promote sustained health behaviours, but only if health-care practitioners truly understand and implement the published evidence on the efficacy of exercise. This approach provides a scientific basis and collaborative strategy for why exercise as medicine could be the paradigm shift needed to harness the transformative power of exercise in older adults.

Strategic exercise and medication management to optimise therapeutic outcomes

Combining exercise routines with pharmacological interventions through interdisciplinary health care is an important aspect of the multidimensional domain of geriatric health care. This combination is particularly relevant to the many chronic illnesses affecting older adults. Therefore, an approach that merges medication adherence with the facilitation of improved physical function is paramount for formulating effective treatment plans. These plans focus on the wellbeing and functionality of older adults and on reducing the risk of side-effects from medications.

Aligning pharmacotherapy with exercise is particularly important for managing diabetes, cardiovascular disease, and hypertension in older adults. Practical considerations, such as timing, intensity, and risk of drug-related complications (eg, hypoglycaemia or orthostatic hypotension), should inform personalised exercise prescriptions (panel). Incremental adjustments and close clinical monitoring can support a precision-medicine approach that optimises both safety and effectiveness in this population.

Practical implementation

Official guidelines, such as those from the American College of Sports Medicine and the WHO Integrated Care for Older People model, provide a framework for implementing physical activity in geriatric care.[13,108,109] These guidelines emphasise the importance of comprehensive health assessments that account for the intricate relationships between medical conditions, pharmacological interventions, and physical activity.

Notably, the effective implementation of exercise as medicine for older adults with polypharmacy requires a coordinated multidisciplinary care model grounded in clinical safety and professional expertise. Physicians—and particularly geriatricians—are well positioned to initiate the exercise prescription process, ideally as part of a comprehensive geriatric assessment that incorporates input from pharmacists and other allied health professionals. However, geriatricians are not widely available, and most general or primary care physicians do not have the specific training, time, and infrastructure to deliver or monitor individualised exercise interventions—particularly in people with multimorbidity.[13]

Panel: Strategic exercise prescription in conjunction with medication management optimises therapeutic outcomes in older adults

Precautions regarding medication use in exercise prescriptions for diabetes

Dosage and timing of diabetes medications:

- Consider reducing the regular insulin dose on days with exercise
- Optimal timing for exercise is 60–90 min after a meal to mitigate postprandial hyperglycaemia and prevent hypoglycaemia
- If blood glucose concentrations are less than 5·0 mmol/L before a planned long-lasting or vigorous exercise session, a carbohydrate snack might be necessary
- Ensure individuals with fluctuating or unpredictable glucose levels or irregular eating habits have access to a glucometer and juice or candy
- Generally, oral hypoglycaemics do not pose issues concerning the dose or timing of exercise sessions. However, fast-acting agents such as repaglinide require careful consideration, as these agents can increase the risk of hypoglycaemia when exercise is done close to the time of dosing. Individualising exercise timing and monitoring blood glucose concentrations closely is advisable in people using these medications
- Cease exercise immediately when any symptoms indicate possible hyperglycaemia or hypoglycaemia
- Avoid exercising during acute infections, fever, or illness, as these conditions can impair physiological responses and exacerbate symptoms in all individuals. For those with diabetes, these situations can also lead to fluctuations in glucose control

Medication precautions in diabetes, cardiovascular disease, or hypertension (ie, treatment with β blockers)

- Monitor exercise intensity using perceived exertion for aerobic training instead of relying solely on heart rate
- β blockers can obscure hypoglycaemic or ischaemic symptoms, especially in individuals with diabetes. Maintain heart rate at ten beats less than the known ischaemic threshold and be vigilant for other signs of myocardial ischaemia, such as pallor, apprehension, shortness of breath, and palpitations
- Be aware that non-selective β blockers can contribute to symptoms such as fatigue, depression, claudication, impotence, and peripheral vascular disease in some individuals, although the evidence for these effects is not consistently strong. The effect might vary depending on the specific β blocker used and the characteristics of the affected individual
- Exercise caution, as β blockers can induce or worsen hypotension during exercise. If hypotension is suspected, then check blood pressure both in seated and standing positions before initiating standing exercise
- Ensure adequate hydration before and after exercise
- Recognise that β blockers can reduce tolerance to heat and humidity; choose loose and breathable clothing and avoid exercising in extreme temperatures or high-humidity conditions

Medication precautions in individuals with hyperlipidaemia, type 2 diabetes, or cardiovascular disease (ie, treatment with statins)

- Statins can induce myopathy, causing pain, fatigue, and mobility restrictions, potentially affecting exercise tolerance or motivation to exercise
- In older adults, statins have been linked to an increased risk of falls. Conducting an objective falls risk assessment and prescribing balance and strength training, in addition to assessing other risk factors for falls, is advisable for all adults on statins
- New statin usage and initiation of resistance training could result in similar side-effects, potentially leading to confusion with delayed onset muscle soreness. If delayed onset muscle soreness persists beyond 2 weeks, then investigate other potential causes
- If myopathy hampers mobility, function, or quality of life substantially, then consider referring the patient to a general practitioner for evaluation and use of alternative lipid-lowering medications

Medications for angina, chronic obstructive pulmonary disease, or asthma

- Clinicians should familiarise themselves with typical symptoms before initiating exercise training
- Ensure that medications are brought to all testing and training sessions
- If bronchodilators are part of the regular medication routine, then take them 15–30 min before engaging in exercise or any known trigger activity
- Keep nitroglycerin easily accessible during training sessions
- Immediately halt exercise when there is chest pain, wheezing, or any new symptoms
- Refrain from exercising during flares or episodes of unstable angina

Precautions in individuals on anticoagulants or antiplatelet agents

The risk of bleeding during exercise could be elevated in individuals with:

- Fall risk factors
- Gait instability
- Poor judgement
- Risk-taking behaviour
- A tendency to engage in ambulatory exercise before strength and balance training
- Delirium
- Recent surgery or biopsy
- Recent retinal tear or retinal surgery
- Poor form leading to muscle or ligament tears
- Poor choice of equipment
- A tendency to engage in free weights

(Continues on next page)

Panel (continued from previous page)

- Peripheral neuropathy
- Visual impairment
- Cognitive impairment
- Sedation from drugs or disease
- Unknown cerebral or other aneurysm
- Clinicians should take a history in individuals with polycystic kidney disease

Drugs causing orthostatic hypotension

- Common causes of orthostatic hypotension include drugs used to treat high blood pressure, such as diuretics, angiotensin-converting enzyme inhibitors, and α blockers
- Medications with hypotension as a side-effect, such as nitrates, erectile dysfunction medications, drugs for Parkinson's disease, antipsychotics, neuroleptics, anti-anxiety agents, sedative hypnotics, and tricyclic antidepressants, are also frequently implicated
- Orthostatic hypotension could worsen pre-existing autonomic neuropathy secondary to factors such as age, diabetes, Parkinson's disease, Lewy body disease, or other causes
- The condition can be exacerbated by malnutrition, dehydration, diarrhoea, vomiting, bleeding, and peripheral oedema
- The combination of postprandial hypotension, morning medication, and autonomic neuropathy could lead to significant orthostatic symptoms during an exercise session or when transitioning from a seated position to a standing one, especially when using a large muscle mass, such as in a leg press
- Checking blood pressure in both seated and standing positions before initiating exercise sessions is advisable in individuals at high risk
- Balance training is important, and performing calf and ankle exercises before standing can be beneficial for reducing orthostatic hypotension and improving postural stability

Therefore, exercise should be prescribed by physicians or geriatricians and implemented and progressed by certified health professionals—such as physiotherapists, clinical exercise physiologists, sports scientists, physical activity professionals, or trained nurses in rehabilitation settings—who are equipped to deliver, monitor, and adapt individualised programmes over time. Given the global shortage of geriatricians, relying on their oversight alone is neither scalable nor sustainable.[13] This team-based approach reflects the structure of nutritional care, in which physicians delegate implementation to dietitians and ensure clinical safety, adherence, and scalability.

Exercise professionals are uniquely qualified to translate clinical assessments into targeted, evidence-informed programmes and adjust interventions in response to functional status, comorbidities, and treatment-related effects. Embedding these professionals in multidisciplinary care teams enables a tailored and adaptive strategy that enhances functional capacity, autonomy, and health span in the ageing population. As with pharmacological interventions, prescribing exercise requires not only clinical judgement but also appropriate delivery and monitoring of infrastructure to maximise benefits and mitigate risks.[13] However, this framework implies that the physician is sufficiently educated in the evidence supporting the utility of exercise in the prevention and treatment of chronic diseases and is aware of drug–exercise interactions that need to be addressed. The goal of this Personal View is to highlight the most important considerations in targeted exercise prescription. This integrated approach aligns with the core tenets of healthy ageing and reinforces the complementary roles of pharmacological and non-pharmacological interventions in geriatric care.

As endorsed by the International Consensus on Physical Activity for Healthy Longevity,[13] a system-level approach is essential for addressing polypharmacy and its interaction with exercise. Such an approach must include investments in workforce development, integrated service delivery models, and infrastructure that supports team-based health care. Multidisciplinary collaboration not only enhances the precision of exercise prescription but also ensures continuity of care, particularly for older adults with frailty, multimorbidity, and polypharmacy.

To implement this approach, we propose a structured multidisciplinary model grounded in a comprehensive geriatric assessment. This initial step enables the identification of frailty, medication burden, and exercise-related contraindications. Based on this evaluation, qualified professionals can prescribe tailored multimodal exercise interventions, with particular attention to drug–exercise interactions. Monitoring includes functional metrics, adverse events, and patient-reported outcomes, coupled with medication reviews and deprescribing, when appropriate. To enhance adherence and mitigate motivational barriers, behaviour change strategies—such as motivational interviewing and physical activity counselling—must be integrated into the care pathway, particularly during the transition from prescription to participation (figure, appendix p 1).

Conclusions and future directions

This Personal View summarises the effect of commonly prescribed medications on physical function and exercise capacity in older adults. Although no medication precludes exercise, some medications, including sedatives, fatigue-inducing drugs, and those causing muscle atrophy or

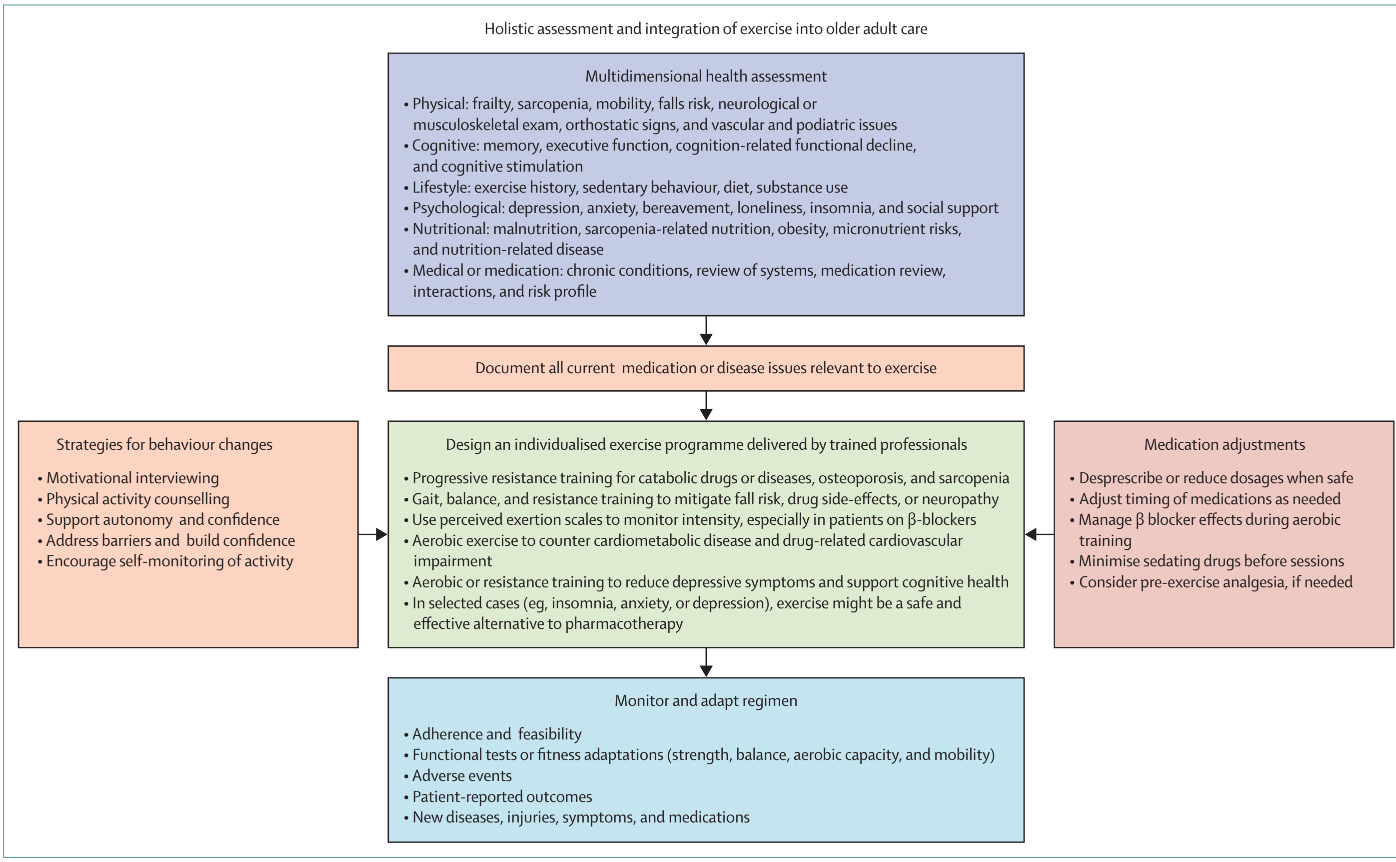

***Figure:* Integrated care model for aligning exercise prescription with pharmacological management in older adults**

This conceptual flowchart depicts a structured, multidisciplinary framework for integrating exercise as medicine in older adults with multimorbidity and polypharmacy. The process begins with a multidimensional assessment—including frailty, sarcopenia, cognition, fall risk, nutrition, and medication use—conducted by a geriatrician or other qualified clinician. This evaluation identifies contraindications, medication burden, and modifiable impairments. Based on this assessment, trained professionals develop an individualised, multimodal exercise prescription, typically incorporating progressive resistance, balance, and aerobic training, with pharmacological considerations embedded throughout (eg, perceived exertion scales for individuals on β blockers and fall prevention strategies for those taking sedatives or drugs impairing neuromotor control), and exercise might serve as an alternative or adjunct to pharmacological treatment where appropriate. Monitoring includes standardised functional performance tests, patient-reported outcomes, adverse event surveillance, and regular medication review. Drug dosages are adjusted alongside exercise progression, and deprescribing is pursued when clinically indicated. Behaviour-change strategies—including motivational interviewing, autonomy-supportive communication, and physical activity counselling—are incorporated to enhance adherence, self-efficacy, and long-term engagement. The model supports shared decision making and optimises both pharmacological and non-pharmacological care in line with international consensus recommendations.[13]

mobility impairment, can substantially limit the ability of older adults to be physically active or inhibit them from gaining the full benefits of a personalised exercise regimen. Prescribing exercise interventions comprising aerobic, resistance, flexibility, and balance exercises uniquely tailored to suit individual health conditions and drug interactions, and even substituting medications where indicated, offers substantial potential benefits.

To realise these benefits, standardised procedures and protocols for prescribing and implementing exercise prescriptions must be established, to ensure high effectiveness and safety. These procedures and protocols should specify the type, volume (ie, sets and repetitions), load (ie, intensity), number of training sessions, and variables such as tempo and rest intervals that contribute to training adaptation. In addition, a collaborative, patient-centred, multidisciplinary team approach to medication optimisation is recommended, including careful tapering of medications when the risks of polypharmacy outweigh the therapeutic benefits. This approach emphasises the ability of exercise prescriptions to supplement and, in some cases, replace specific drug therapies. An increasing number of well-conducted randomised controlled trials have shown that structured exercise can be as effective as, if not better than, first-line pharmacological treatments for conditions such as insomnia, depression, and chronic pain.

Despite strong experimental evidence of the effects of molecular and cellular age determinants on age-associated health outcomes, the expanding field of exercise in geriatric health is full of unanswered questions, especially regarding the long-term effects of new therapeutic agents on exercise adaptation and the practical implementation of affordable and integrative exercise strategies in the community. Realising the full potential of exercise as medicine will require a concerted effort to raise awareness among health-care providers and build better-coordinated care systems,

Search strategy and selection criteria

We conducted a narrative review of the literature to inform the development of this Personal View. Relevant articles were identified by searching PubMed, Scopus, and Web of Science for English-language publications from Jan 01, 2000, to May 31, 2025. Search terms included combinations of keywords such as: "polypharmacy", "multimorbidity", "older adults", "frailty", "pharmacotherapy", "exercise prescription", "physical activity", "drug–exercise interaction", "adverse drug reactions", and "sarcopenia". Boolean operators ("AND" and "OR") and truncations were applied to broaden or narrow the search as appropriate. The inclusion criteria comprised studies involving human participants aged 60 years and older; articles addressing the intersection of pharmacotherapy and exercise or physical activity; research on drug–exercise interactions, adverse drug reactions, or the role of exercise in mitigating medication-related risks; clinical guidelines, systematic reviews, meta-analyses, observational studies, and interventional trials; and publications in peer-reviewed journals in English. The exclusion criteria included studies involving participants aged <60 years unless findings were explicitly stratified for older adults; animal or in-vitro studies; case reports, conference abstracts without full text, or non-peer-reviewed sources; articles focused solely on drug pharmacokinetics or pharmacodynamics without relation to exercise; and non-English publications. Additional references were identified by hand searching bibliographies of key articles, consensus statements, and relevant clinical practice guidelines. Selection was based on relevance to the topic, methodological quality, and potential contribution to the conceptual framework of this Personal View.

along with policies that prioritise functional outcomes over a disease-centric approach. Exercise as medicine highlights patient-centred care to enhance the quality of life, autonomy, and resilience in older adults while reducing health-care costs and disease burden. Identifying molecular targets relevant to exercise-induced and medication-induced benefits commonly observed in older adults should help to define forward-looking approaches for developing new therapeutic targets and precision exercise-based medicine. As noted by Kaeberlein, the concept of improving the health span should continue to be an outwards-facing point of emphasis in geroscience.[110] Therefore, we must more fully integrate global public health with geriatric medicine, design a strategic plan that includes individualised exercise prescriptions along with medications, treat exercise as a drug that should be administered for both preventive and therapeutic purposes, and use relevant information to create general public health plan policies that will enhance and extend the health span.

Contributors

MI and MAFS conceptualised this Personal View and drafted the manuscript. All authors critically revised the draft and approved the final manuscript.

Declaration of interests

We declare no competing interests.

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