Cardiovascular care of older adults

Deirdre E O'Neill,[1] Daniel E Forman[2]

[1]University of Alberta Hospital, Edmonton, AB, Canada
[2]University of Pittsburgh, University of Pittsburgh Medical Center and VA Pittsburgh Geriatric, Research, Education and Clinical Center (GRECC), Pittsburgh, PA, USA
Correspondence to: D E Forman formand@pitt.edu

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ABSTRACT

Age is an independent risk factor for cardiovascular disease. With the accelerated growth of the population of older adults, geriatric and cardiac care are becoming increasingly entwined. Although cardiovascular disease in younger adults often occurs as an isolated problem, it is more likely to occur in combination with clinical challenges related to age in older patients. Management of cardiovascular disease is transmuted by the context of multimorbidity, frailty, polypharmacy, cognitive dysfunction, functional decline, and other complexities of age. This means that additional insight and skills are needed to manage a broader range of relevant problems in older patients with cardiovascular disease. This review covers geriatric conditions that are relevant when treating older adults with cardiovascular disease, particularly management considerations. Traditional practice guidelines are generally well suited for robust older adults, but many others benefit from a relatively more personalized therapeutic approach that allows for a range of medical circumstances and idiosyncratic goals of care. This requires weighing of risks and benefits amidst the patient's aggregate clinical status and the ability to communicate effectively about this with patients and, where appropriate, their care givers in a process of shared decision making. Such a personalized approach can be particularly gratifying, as it provides opportunities to optimize an older patient's function and quality of life at a time in life when these often become foremost therapeutic priorities.

Introduction

The population is aging. In the UK, nearly 12 million people are ≥65 years old, 5.4 million are ≥75 years, and the number of centenarians has increased by 85% over the past 15 years.[1] The prominent growth of the older population, particularly people over 85, is similar in the US, Canada, and much of the world. Age is an independent risk factor for cardiovascular disease, and cardiovascular disease is endemic in the expanding population of older adults, with an estimated 89.3% of men and 91.8% of women aged ≥80 years affected.[2] Cardiovascular disease remains the leading cause of death in older adults, and it often provokes progressive disability in senior populations.

Cardiovascular care is well known for its large clinical trials and evidence based clinical practice guidelines (CPGs), usually followed by cardiologists and non-cardiologists as a standard of excellence. Although CPGs largely achieve superior outcomes for the general population, including many older adults, following such recommendations can be less reliable in older adults, for whom clinical complexities associated with aging are more likely to confound standard precepts.[3-5] Geroscience is a burgeoning field that explores the intersection of aging biology and disease. As people are now living longer, longevity is associated with progressive biologic changes that are conducive both to cardiovascular disease in a context of predictable comorbidity and to other age related geriatric conditions, including frailty, sarcopenia, cognitive impairments, urinary incontinence, and falls. Lack of representation of such typical older adults in clinical trials has led to CPG standards that are more likely to diverge from the circumstances of older patients with customary age related complexities of care.[6-8]

Overall, as adults advance into old age, increasing variability is seen in who will benefit from traditional, CPG based care versus those who might be best managed with tailored therapeutic approaches. Providing such patient centered, rather than disease centered, care is a cornerstone of geriatric medicine and is now highly pertinent to management of cardiovascular disease. The Aspirin in Reducing Events in the Elderly (ASPREE) trial, for example, enrolled 19 114 adults aged ≥70 years (or ≥65 years of age among black and Hispanic people) to study the utility of primary prevention with aspirin for a primary endpoint of disability-free survival.[9] Counter to the assumptions of many of the investigators who hypothesized that cardiovascular benefits would dominate, aspirin did not achieve the disability benefit. Similarly, the ongoing Pragmatic Evaluation

of Events And Benefits of Lipid-lowering in Older Adults (PREVENTABLE) will enroll 20 000 adults aged ≥75 years to study dementia and disability-free survival (Clinicatrials.gov NCT04262206). Moreover, PREVENTABLE is purposely targeting significant enrollment of adults in their 80s and 90s to fully characterize the utility of atorvastatin in adults who are very old. The inclusion of older adults in cardiovascular trials continues to grow; however, most guideline based care remains reliant on trials that included only younger adults (or highly selected older adults), with orientation primarily to cardiovascular outcomes rather than function, quality of life, or other geriatric priorities of care. Thus, clinicians must still frequently extrapolate from landmark trials for management decisions that are relatively more meaningful to their older patients. Treating systolic hypertension to a target of 128 mm Hg in one octogenarian can mitigate strokes and maintain cognition, whereas for another it may catalyze falls and confusion. However, no standards are available to guide this more nuanced and judgment dependent approach to care. This review covers the utility of modified approaches to therapeutics in the growing population of older adults with cardiovascular disease, by clarifying geriatric domains that are relevant and may confound precepts of care that are accepted as standard in younger adults. It aims to increase the awareness of providers who care for older patients with cardiovascular disease regarding the increased complexity of care and the importance of shared decision making.

Incidence and prevalence

The prevalence of cardiovascular disease increases significantly with age. The American Heart Association annual update on heart disease and stroke statistics in 2019 reported the prevalence of cardiovascular disease, including coronary heart disease (CHD), heart failure, stroke, and hypertension, as 40% in people aged 40-59 years, 70-75% in those aged 60-79 years, and 79-86% in those ≥80 years.[2] Additionally, the risk of incident cardiovascular disease remains high in old age, exemplified by the lifetime risk of a first coronary event at age 70 years still being 35% in men and 24% in women, which highlights the value of continued prevention and a high index of suspicion for an acute coronary event when caring for older adults.[10]

The prevalence of many types of cardiovascular disease rarely existing in young adults rises rapidly as adults advance into old age; these include heart failure with preserved ejection fraction, atrial fibrillation, non-ST elevation myocardial infarction, and degenerative aortic stenosis. Prognosis also worsens with age with all cardiovascular diseases; more than 80% of deaths from cardiovascular disease occur in people aged ≥65 years, and cardiovascular disease is the leading cause of death in older adults.[2] Additionally, the risk of heart failure and one year mortality after myocardial infarction increases substantially with age, with a twofold to threefold higher one year mortality in people ≥70 years compared with those aged 40-69 years.[10 11]

Heart failure exemplifies disproportionate age related incidence and worsening prognosis particularly well. The prevalence of heart failure in the US is <2% in people 40-59 years compared with 12% in those ≥80 years.[11] At age 80 years, a man still has a >20% risk of developing incident heart failure.[12] Although survival with heart failure has improved, this has not been seen among older adults, with an estimated five year mortality of 24.4% for those in their 60s compared with 54.4% for those ≥80 years.[13] Likewise, older adults with heart failure are more likely to have frailty, cognitive loss, functional decrements, and other geriatric conditions that contribute to management complexity and worsening prognosis.

Sources and selection criteria

For this review, we searched PubMed and Medline databases for articles published in the English language between 1 January 2000 and August 2020, using keywords listed in figure 1. We included articles dating back earlier than the above time period if they had historic importance. We then hand screened reference lists for high quality articles, including randomized controlled trials, observational studies, systematic reviews, meta-analyses, and high quality reviews, as well as sub-studies of large, high quality studies. We excluded all case series and case reports, as well as studies published only in abstract form. Although older adults have historically been excluded or minimally included in the largest, highest quality cardiovascular literature, we were still able to identify 189 studies for this manuscript.

Geriatric conditions in older adults with cardiovascular disease

Multimorbidity

Pathophysiologic changes that provoke cardiovascular disease in old age also provoke other diseases. Consequently, cardiovascular disease in older adults tends to occur in the context of multiple concurrent diseases.[14] The conditions that occur concurrently with a primary cardiac event are often referred to as "comorbidities." However, this terminology fails to recognize that these diseases are often physiologically linked through common underlying mechanistic underpinnings, with transformational implications regarding the benefits of therapeutic interventions, patients' priorities for treatment goals, or both. The term "multimorbidity" is a relatively more accurate description in older adults, implying an interaction between multiple "primary" disease processes.[15] Multimorbidity can develop at any age, but the number and complexity of comorbid conditions increases with age, with more than half of older adults having multimorbidity and 80% of those ≥80 years having at least two chronic conditions.[16-18] Relatedly, the burgeoning aged population with increased longevity has resulted

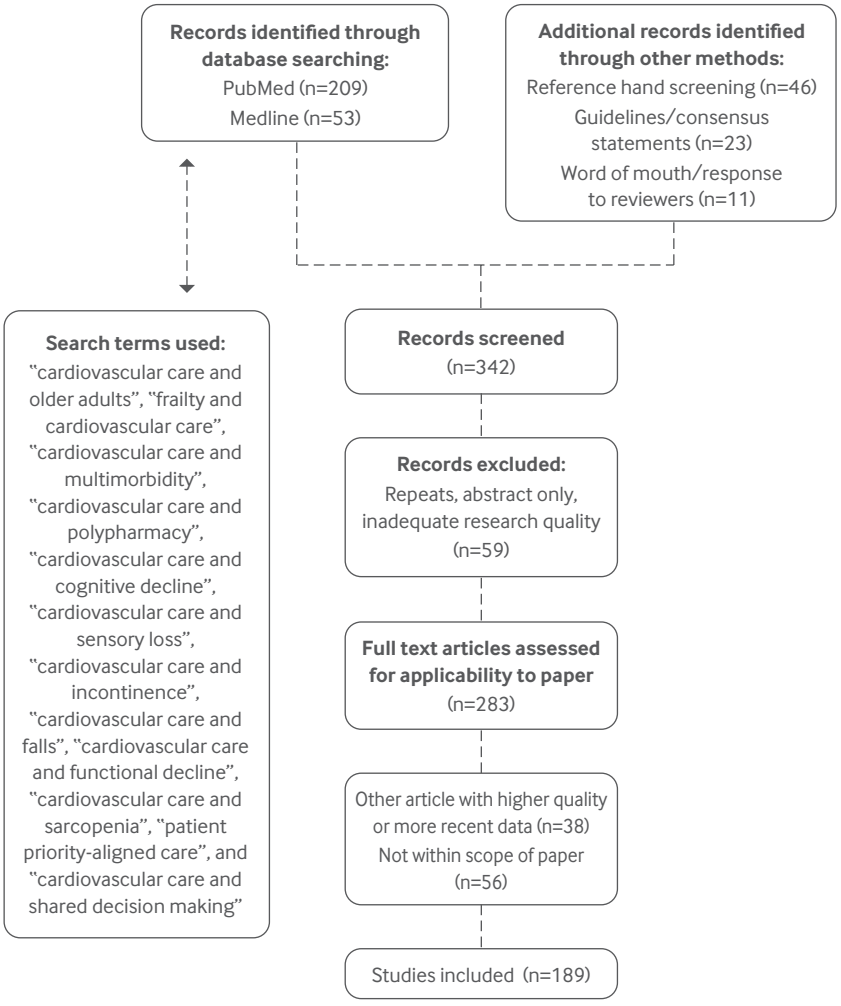

Fig 1 | Sources and selection criteria

in an expanding population with multimorbidity. A population based cohort study of more than 4 million people in the UK found that the prevalence of at least five conditions increased fourfold, from 6.3% to 24.3%, between 2000 and 2014.[19]

Cardiovascular disease and multimorbidity are predictably linked, as both commonly arise from the same underlying biologic pathways.[20 21] Whereas seminal cardiovascular disease research and related CPGs have traditionally focused on single disease specific paradigms, this overlooks the fact that cardiovascular disease rarely presents as an isolated problem in old age. Providers adhering strictly to CPGs in patients with multimorbidity can potentially exacerbate risks associated with concurrent diseases (for example, aspirin increasing bleeding risk), contradict an older adult's therapeutic goals (for example, prescribing additional drugs in a patient wanting to be on as few pills as possible), or both.[3 4] However, as data are limited, little assistance is available to guide clinicians caring for older adults with multimorbidity.

In some instances, multimorbidity may result in under-prescribing of appropriate drugs in older adults who may benefit. Several observational studies show that medication under-use occurs in 40-60% of older adults, and significantly more often in those with multimorbidity.[8 22 23] Such omissions can be detrimental, especially given the high prognostic risks of cardiovascular disease in older adults. In a retrospective cohort study of 5332 older adults, of whom only 21% of those eligible were treated with a β blocker after acute myocardial infarction, β blocker recipients had a 43% lower mortality rate (relative risk 0.57, 95% confidence interval 0.47 to 0.69) and 22% lower repeat hospital admission rate (0.78, 0.67 to 0.90) compared with those without β blockers.[24] Using the START (screening tool to alert doctors to the right treatment[25]) criteria can assist in identifying potential prescribing omissions, allowing the practitioner to assess the risks/benefits and appropriateness of this exclusion on an individual basis. Over-medication is also common among older adults with multimorbidity. Risks of adverse drug events (ADE), including disease-disease, disease-drug, and drug-drug interactions (DDI) in these patients must also be considered (detailed in table 1).

Within the limitation of current evidence, the first element of delivering care to older people with coexisting cardiovascular disease and

Table 1 | Adverse drug events that are common in older adults with multimorbidity

Characteristic	Disease-disease interaction	Disease-drug interaction	Drug-drug interaction	Therapeutic competition
Definition	When one of the patient's diseases causes a secondary disease to occur	When taking a drug for an intentional therapeutic use results in a worsening of another disease	Changes in a drug's effect or concentration owing to recent or concurrent use of another drug/supplement	A bidirectional disease-drug interaction that occurs when treatment of one condition adversely affects the second condition and treatment of the second condition exacerbates the first
How to prevent	Optimize treatment of each disease, while monitoring for signs of other diseases	Clinicians should be aware of not only all drugs a patient is taking but also all diseases a patient has	Be aware of all drugs a patient is taking, including OTC drugs, herbal products, and nutritional supplements. Fewest drugs in lowest doses for shortest amount of time should be used. Check DDI calculator or with pharmacist if unsure about DDI	Be aware of not only all drugs a patient is taking but also all diseases/diagnoses a patient has. Follow up regarding any potential adverse effects a patient is experiencing, particularly within weeks of a new drug being added
Prevalence	Unknown	15-16% in older adults in observational trials[26 27]	80-90% in older adults in observational trials[28 29]	Unknown
Example	HF causes changes in intrarenal hemodynamics, transrenal perfusion pressure, and neurohormonal factors, resulting in acute or chronic kidney failure	(1) Taking an NSAID for gout, exacerbates HF. (2) Taking a β blocker for HF with reduced ejection fraction exacerbates COPD	A patient is taking carbamazepine for seizure control and starts taking apixaban for atrial fibrillation. Carbamazepine can cause a marked reduction in apixaban concentration by 80% or more, rendering it ineffective as an OAC	HF and urinary incontinence: HF is treated with a diuretic, which worsens urinary frequency, leading to incontinence. Patient is prescribed antimuscarinic for overactive bladder, which can increase heart rate and worsen HF

COPD=chronic obstructive pulmonary disease; DDI=drug-drug interaction; HF=heart failure; NSAID=non-steroidal anti-inflammatory drug; OAC=oral anticoagulant; OTC=over the counter.

multimorbidity is to ensure that all of the patient's chronic diseases and geriatric conditions are considered, allowing diligent monitoring as well as for therapeutic competition (also detailed in table 1). Secondly, the severity of each disease process must be assessed for the effect it has on the patient's functional and cognitive capacities, as this can vary considerably. Clinicians need to be aware of the varied and inconsistent disease presentations and drug tolerances in older patients, as this population is relatively more heterogeneous than younger adults. Furthermore, as older patients are often cared for by a multitude of healthcare providers, active coordination and communication between providers is key to providing optimal management.

To best guide care, establishing a strong patient-provider relationship based on collaboration is paramount.[30] This includes eliciting individual patients' preferences for care, weighing the risks and benefits of a treatment/procedure amidst each patient's aggregate clinical status, and communicating this to the patient and care givers. Incorporating multimorbidity into the decision making process may help to predict who will benefit the most from an intervention in the short term and long term and in whom complications are more likely to occur.[16] This allows for discussion about therapeutic goals, as well as the consideration of "trade-offs"—improving one disease process at the possible risk of worsening another. Consideration of time-to-benefit of a treatment, anticipated patient prognosis, treatment burden, and the compounding risks of multiple disease processes can also help a clinician to prioritize medical problems and treatment options with the patient and their family.

Furthermore, the more general premise of a healthy lifestyle is relevant. A longitudinal cohort study in the UK Biobank including nearly 481 000 adults found that engaging in a healthy lifestyle, including physical activity, smoking cessation, healthy diet, and limitation of alcohol, resulted in six to seven additional years of life, regardless of the presence of multimorbidity, with smoking cessation being the most beneficial.[31] Thus, the importance of lifestyle modification should be emphasized in all patients, particularly those with multimorbidity.

Overall, optimal care of an older adult with cardiovascular disease demands attention to the complicating effects of multimorbidity. The under-representation of older adults with multimorbidity in many trials often undercuts the relevance of CPGs. Optimal treatment decisions weigh risks and benefits pertinent to each patient, incorporating the patient's values, preferences, and holistic circumstances, and which also emphasize the importance of a healthy lifestyle.

Polypharmacy and deprescribing

Polypharmacy is defined as the use of five or more medications and is exceedingly common with age. As many older adults have multimorbidity, and the prevention and treatment of chronic conditions rely heavily on medical therapy, the prevalence of polypharmacy in this population is high. A cross sectional study of 348 patients admitted to a Veterans Administration hospital found that 41% were taking five to eight drugs, 37% were taking more than nine drugs, and 44% were taking one or more drugs that were deemed unnecessary.[32] Hospital admissions also commonly increase the risk of polypharmacy; a prospective cohort study including 38 Italian hospitals and 1332 patients found that 52% of patients were taking five or more drugs at the time of admission, increasing to 67% at the time of discharge, and highest in those ≥70 years.[33]

Although prescription of many drugs is often perceived as necessary in older patients with many concurrent diseases (for example, treating heart failure with reduced ejection fraction in a patient with atrial fibrillation, CHD, hypothyroid disease, and depression), the benefits are less certain as drugs are used in combination, and susceptibility to harm is also greater. The probability of DDI increases with the number of drugs taken, with people taking five to nine drugs having a 50% risk of DDI and those taking ≥20 drugs having a 100% risk.[34] The incidence of adverse drug events (ADEs) also escalates, with an 88% risk of ADEs in patients taking five or more drugs.[35] Polypharmacy has been associated with increased mortality; however, patients often have a higher burden of multimorbidity and other geriatric conditions such as frailty, making a causal relation unclear.[36] Of particular significance to older adults, polypharmacy has been associated with increased risk of falls, functional decline, incident frailty, cognitive dysfunction, malnutrition, and decreased health related quality of life.[37-42]

Guideline based management of cardiovascular disease involves the purposeful prescription of multiple drugs, related to management of both the cardiovascular disease itself and underlying cardiometabolic risk factors. Although the benefits of many of these drugs in primary and secondary prevention are well established on the basis of disease specific research, cardiac specialists contribute to polypharmacy and the increased risk of adverse events, particularly in the context of multiple cardiovascular diseases (for example, atrial fibrillation, CHD, and heart failure with reduced ejection fraction) and non-cardiovascular diseases, each leading to additional sets of drugs and risks. Additionally, age related changes in metabolism, body composition, and neuroautonomic responses tend to alter pharmacokinetic and pharmacodynamic effects of drugs and exacerbate potential for instability.[43]

Deprescribing is the process of medication withdrawal or dose reduction, with the goal of improving the patient's outcome/function, lessening the drug burden, and preventing drug related adverse events.[44] Deprescribing is relevant for patients of all ages, but particularly older adults, both to avoid ADE and to mitigate functional and cognitive impairments, as well as the diminished quality of life and fatigue that are common in patients with multiple prescriptions. Deprescribing principally entails discontinuing or de-escalating medications for which a net clinical benefit no longer exists. This is a dynamic process, as the risk/benefit profile of any one drug can change over time, drawing attention to the value of re-evaluating drugs regularly over time.

Several tools are available to assist in deprescribing, including the American Geriatrics Society Beers criteria and the STOPP criteria, with no single tool shown to be superior to others.[45] Figure 2 shows an overview of an organized deprescribing process. Deprescribing has been shown to improve polypharmacy and adherence to treatment and to reduce ADEs.[46] A systematic review and meta-analysis of randomized controlled trials of nursing home residents showed that deprescribing reduced the number of potentially inappropriate drugs by 59% (odds ratio 0.41, 95% confidence interval 0.19 to 0.89), all cause mortality by 26% (0.74, 0.65 to 0.84), and falls by 24% (0.76, 0.62 to 0.93).[47] Older adults are often quite amenable to the deprescription process, with such willingness being most strongly associated with having a good patient-practitioner relationship (odds ratio 11.3, 4.64 to 27.3).[48] Nevertheless, barriers to deprescribing also exist—particularly concerns about interfering with another clinician's treatment plan.[49] Many non-cardiovascular clinicians are particularly reluctant to remove a cardiovascular medication, as they assume that the cardiology expert had originally prescribed it for a critical reason. Therefore, attention to deprescribing is especially important for cardiovascular disease specialists. Integration of pharmacists into the cardiovascular disease care team is often useful as an aid to cardiology providers in recognizing potentially inappropriate and non-essential medications, as well as to implement the deprescribing process.[47]

Drugs comprise a critical part of effective care for older adults with cardiovascular disease, but risks of polypharmacy are high in adults with multiple cardiovascular and non-cardiovascular conditions, as well as frailty, sarcopenia, cognitive decline, and other complicating dimensions of age. DDI, ADEs, and diminished quality of life are all associated with excessive medications in older patients, as are increased mortality, new and worsening frailty, increased falls, and worsening cognitive impairment. Deprescription is an important consideration when caring for older adults with cardiovascular disease. Regular assessment of the appropriateness of drugs, with steps to eliminate those for which there is no longer an indication, net clinical benefit, or an indication that is consistent with a patient's preferences, is recommended.

Cognitive decline

Cognitive impairment is common in older adults, with its prevalence increasing with age. According to Alzheimer's Research UK, one in 14 people ≥65 years (7%) and one in six ≥80 years (17%) has dementia, and an estimated 850 000 people in the UK have dementia.[50 51] Cardiovascular disease worsens this burden, with heart failure, CHD, cerebrovascular disease, and atrial fibrillation all known to be risk factors for cognitive impairment.[52 53]

Identification of cognitive impairment is relevant to cardiovascular care, as it is one of several factors identified as a barrier to medication adherence in older adults.[54] Medication adherence requires multiple cognitive domains, including attention, working memory, executive function, and planning, and is not only a problem for people with dementia but also for those with mild cognitive impairment. A

Fig 2 | Deprescribing process. ADE=adverse drug event; DDI=drug-drug interactions

prospective cohort study of 309 community dwelling patients with heart failure but without dementia found that cognitive impairment, particularly in the realm of memory, predicted poorer medication adherence (β=0.51; P=0.008), even after adjustment for demographic, clinical, and psychosocial variables.[55]

Reported rates of non-adherence to medication are as high as 50% in community dwelling older adults, but this often goes unrecognized by physicians.[56] Assessing cognition can help to identify risk for non-adherence. One well validated and rapid assessment of cognition that can be done in the cardiology clinic is the Mini-Cog. This screening tool takes less than three minutes to perform, increasing detection of cognitive impairment. It consists of a three item recall test for memory and a clock drawing test of executive function and visuospatial memory (http://mini-cog.com/wp-content/uploads/2015/12/Universal-Mini-Cog-Form-011916.pdf).[57] Research focused on interventions to improve medication adherence in older adults with cognitive impairment is limited; however, suggestions include simplifying the dosing regimen, such as once daily dosing and convenient administration times (for example, with a meal), and the use of reminder techniques, with human communication reminder systems (for example, family/care giver, homecare) being more effective than non-human reminders.[58 59]

Delirium, an acute onset of altered consciousness characterized by inattention, commonly occurs in older adults admitted to hospital, particularly those with baseline cognitive deficits.[60-62] Clinicians caring for older inpatients with cardiovascular disease need to be vigilant for delirium, as it can be subtle clinically but has significant prognostic and management implications, including higher complication rates, longer hospital admissions, and increased risk of institutionalization, subsequent cognitive decline, and mortality. Potential benefits of revascularization, valve repair, device implantation, or other state-of-the-art cardiovascular therapeutics may be undermined by delirium, and cardiology providers must therefore consider this as part of their management concerns.

The cause of delirium is incompletely understood; however, provoking factors such as poor nutrition, drugs, pain, sleep disruption, isolation, and lines

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and catheters have been identified, especially in older adults with baseline cognitive impairments. No therapies have been identified to treat or improve the prognosis associated with delirium, but an estimated 30-40% of cases are preventable with environmental strategies.[61]

In summary, cognitive impairment is common in older adults, particularly those with cardiovascular disease. Patients with cognitive impairment are at increased risk for non-adherence as well as medication errors and delirium. Screening for cognitive impairment with a screening tool such as Mini-Cog can identify patients at increased risk. Alternatively, collaboration with a geriatric medicine specialist proficient in assessing and treating cognitive impairment can be considered. Delirium is common in older adults with baseline cognitive deficits who are admitted to hospital. It has significant adverse outcomes and no known treatment. Prioritizing delirium prevention strategies can help to improve outcomes.

Sensory loss

Age related sensory decline is prevalent in older adults and can result in significant physical and functional impairment. A population based study of sensory deficits in 2968 patients aged 57-85 years reported that two thirds of older adults had at least two sensory deficits, just under a third had one sensory deficit, and ≤10% had no sensory dysfunction.[63] Sensory defects have a significant effect on global health and wellbeing, impairing patients' interaction with their environment and increasing morbidity and mortality.[64 65]

Hearing impairment is common, affecting a third of adults aged 61-70 years and >80% of those aged ≥85 years.[66] Hearing impairment limits the patient's ability to interact with clinicians, reducing opportunities for shared decision making and ability to consent and resulting in poorer patient-provider communication, thus potentially affecting treatment adherence and basic process of care. Hearing impairment is also associated with cognitive dysfunction, with a large population based study of 1984 adults aged 60-69 years showing that hearing loss was independently associated with incident cognitive impairment (hazard ratio 1.24, 95% confidence interval 1.05 to 1.48).[67] Use of a hearing aid was associated with better cognitive performance.

Visual impairment is also common among older adults, with macular degeneration, glaucoma, and cataracts all increasing with age. Visual impairment can also lead to medication management limitations, such as misreading labels and medication errors, and/or avoidance of medical appointments owing to fear of navigating new environments. Vision impairment can also lead to social isolation and is associated with decreased function and independence, depression, and poor quality of life.[68 69]

As the population ages, health professionals will increasingly be required to attend to the needs of people with sensory impairments, optimizing communication, quality of life, and independence of these vulnerable older adults. If a sensory impairment is recognized, timely referral for hearing/visual assessment can improve the prescription of appropriate sensory aids and lessen the impact of sensory defects on a patient's overall health. Although this is often coordinated through a patient's primary provider, it remains an important aspect of comprehensive cardiovascular care for an older adult. If a patient has sensory aids, such as hearing aids and glasses, ensuring that these are available and used, as well as use of adaptive devices such as a voice amplifier, is valuable. Furthermore, with the patient's permission, inviting family/care givers to join the medical appointment, and providing written notes, can improve communication in these complex and demanding interactions. Lastly, referring a patient for occupational therapy assessment can be useful to identify pragmatic strategies to mitigate the sensory impairments.

Sensory impairments are common in older adults and can interfere with the provision of optimal cardiovascular care. It is important to observe patients and ask them directly about sensory deficits, referring for appropriate testing and intervention when present. This often improves cardiovascular management, particularly through optimized communication and adherence.

Urinary incontinence

Urinary incontinence, or lack of voluntary control over urination, is common in older people, with estimates of prevalence in community dwelling women of up to 55%.[70] Urinary incontinence is an important problem, as it has adverse effects on health and quality of life, with increased risk of urinary tract infection, pressure sores, sleep disturbance, depression, and social isolation.[71 72]

Among older adults with cardiovascular disease, urinary incontinence is often exacerbated by heart failure, as well as by cardiac risk factors such as obesity, diabetes, hypertension, and smoking.[73] The literature indicates that 35-50% of patients with heart failure have urinary incontinence; it is 2.9 times more prevalent in those with New York Heart Association (NYHA) III or IV symptoms, compared with those with NYHA I-II symptoms.[74 75] The high prevalence of urinary incontinence in heart failure is likely multifactorial, owing to natriuretic peptides attempting to regulate intravascular volume, heart failure medications, and overlapping risk factors for heart failure and urinary incontinence.[74-76] Loop diuretics are often implicated in causing urinary incontinence in patients with heart failure, but the literature is somewhat conflicting. A cross sectional, propensity matched study of 172 older adults (mean age 79 years) found diuretics to be independently associated with urinary frequency (adjusted odds ratio 3.09, 1.20 to 7.97) and urgency (2.50, 1.00 to 6.27) but not with incontinence (1.88, 0.57 to 6.16).[77] By contrast, a cross sectional survey study of 282 patients with heart failure (mean age 67

years) found that furosemide doses above 20 mg daily were associated with incontinence (adjusted odds ratio 2.6, 0.79 to 8.72).[78] Other cardiovascular drugs implicated in urinary incontinence include angiotensin converting enzyme inhibitors, known to cause cough in 5-35% of patients,[79] exacerbating stress incontinence in predisposed people, and α blockers, with a longitudinal study cohort of 959 women aged 72-81 years showing a fourfold greater odds of urinary incontinence with α blocker treatment (adjusted odds ratio 4.47, 1.79 to 11.21); addition of a loop diuretic nearly doubled that risk (8.81, 1.78 to 43.53).[80]

Urinary incontinence has been shown to increase non-adherence to medication, contributing to problems such as uncontrolled hypertension and heart failure decompensation.[78 81] Simple interventions, such as changing the timing of doses to earlier in the day, to lessen night-time problems with incontinence, or changing the type of antihypertensive prescribed may make the urinary incontinence manageable and improve adherence. Alternatively, referral for pelvic physiotherapy or to a urologist/urogynecologist may be indicated in people struggling with urinary incontinence.

It is important to ask patients about urinary incontinence, as many are otherwise often reluctant to mention it. If it is present, the medication list should be assessed and changes made to agents or administration times to reduce the possibility of exacerbating effects. The association of urinary incontinence with medication non-adherence, as well as with adverse effects on health and quality of life, is strong rationale to refer patients to urology/urogynecology for further assessment and treatment if urinary incontinence is persistent.

Falls

Falls are a major cause of morbidity and mortality in older adults. An estimated one in three adults over the age of 65 years and close to half of those ≥80 years have at least one fall annually.[82] Sustaining a fall can result in severe trauma, but even falls that do not cause serious injury are typically consequential, as they can be a sentinel event in an older adult, leading to subsequent functional decline, poorer self-rated health, and a fear of falling that can impair function and quality of life.[83 84] Syncope must be considered in the differential diagnosis of a fall, as patients may experience syncope with no memory of the event.[85] Most falls are multifactorial. Major risk factors for recurrent falls include a history of falls, mobility impairment, cognitive impairment, age, and use of fall enhancing drugs.[86] Several drug types have been associated with increased risk of falls, including both cardiovascular disease and non-cardiovascular disease medications, but it is incumbent on the cardiovascular care clinician to consider the possibility that evidence based cardiovascular disease drugs (for example, vasoactive medications, atrioventricular nodal blocking drugs) may contribute to falls, especially when used in combination with other drugs that impair cognition (for example, benzodiazepines, anticholinergic agents) and in times of exceptional shifts in health (for example, dehydration, anemia, delirium).

Two common problems encountered when treating older adults with cardiovascular disease and falls are assessing risk of bleeding with oral anticoagulants for stroke prevention in atrial fibrillation and assessing risk of falls with antihypertensive drugs and blood pressure targets. Older adults have a greater absolute benefit from oral anticoagulants owing to higher stroke rates, but many clinicians fear the bleeding risk, such that only half of eligible older adults are treated with oral anticoagulants.[87] Prescription of oral anticoagulants should be individualized, weighing risks and benefits, but a previous history of a fall is not a clear contraindication to oral anticoagulants. Risk of falls should always be assessed at the time of prescription of an oral anticoagulant, and, to the extent possible, contributing factors should be mitigated. Opportunities include the deprescription of fall enhancing drugs, treatment of sensory deficits, initiating a home safety assessment by occupational therapy or assessment for a mobility aid, or balance improving exercises. Importantly, falling while taking oral anticoagulants can result in intracranial hemorrhage, but the absolute risk of intracranial hemorrhage with a fall is generally lower than the risk of stroke in older adults. Compared with warfarin, direct oral anticoagulants are associated with a lower risk of intracranial hemorrhage, including traumatic intracranial hemorrhage, as well as lesser neurologic deficit, lower in-hospital mortality, and higher rate of discharge to home when oral anticoagulant related intracranial hemorrhage occurs.[88 89] Therefore, direct oral anticoagulants provide some added safety over vitamin K antagonists for older adults with elevated risks of falls. Also of note, a well known paper published in 1999 constructed a Markov decision model to determine the best treatment strategy for older adults with atrial fibrillation and falls, finding greater quality adjusted life years with warfarin versus aspirin or no oral anticoagulants, regardless of the annual fall risk; an estimated 295 falls per year were needed to offset the benefit of oral anticoagulants.[90]

The value of treating to CPG blood pressure targets versus the risks of falls is another example of the difficult decision making encountered in treating older adults. The SPRINT trial in 2015 showed that intensive lowering of systolic blood pressure to <120 mm Hg was associated with lower rates of fatal and non-fatal major cardiovascular events and death from any cause,[91] which has had significant influence on CPG. Although implementing the intensive blood pressure targets used in SPRINT is conceptually compelling (that is, only 90 patients need to be treated to prevent one death from any cause), intensive blood pressure lowering also results in more numerous serious adverse events, including falls. A retrospective cohort study applied

the SPRINT eligibility criteria to the National Health and Nutrition Survey (NHANES) dataset, resulting in a study population of 2185 people with a mean age of 68.6 years. The analysis showed that implementing SPRINT's intensive blood pressure target could prevent more than 100 000 deaths a year, but at the expense of >56 000 episodes of hypotension, >34 000 episodes of syncope, and nearly 89 000 cases of acute kidney injury annually.[92] Therefore, universal implementation of intensive blood pressure targets will likely provoke benefits as well as detrimental consequences, highlighting the value of individualized blood pressure targets and shared decision making (SDM), particularly in older adults in whom serious adverse events have a higher potential to be injurious or life threatening. Table 2 shows a comparison of the various blood pressure targets in current CPGs.

In clinical practice, asking about history of falls is important, as patients are often reluctant to volunteer such information spontaneously. Falls are not necessarily a contraindication to oral anticoagulants or aggressive blood pressure control, but they are a relevant dimension of risk that should be assessed meticulously and that should prompt efforts to mitigate risks. Blood pressure targets and other clinical targets are best individualized in older adults (especially those with frailty, sarcopenia, diminished function, or relevant comorbidity) on the basis of risk/benefit and shared decisions.

Functional decline

Healthy aging is not merely the absence of disease; it also reflects the avoidance of disability and maintenance of function, as this is key to preserving independence. Functional disability is common in older adults and is associated with poor prognosis, poor quality of life, and higher healthcare costs. In a prospective, multicenter study of 241 older adults (median age 82 years) with multimorbidity, a fifth of patients experienced functional decline or loss of independence over the eight month follow-up, with hospital admission increasing this risk significantly (odds ratio 3.6, 1.6 to 7.7).[101] Given the exponential growth of the older population, identifying those at risk of functional decline, particularly after acute illness and hospital admission, is advantageous, as it allows allocation of resources to the people at the highest risk and efficient use of healthcare resources.

Function can be assessed by taking an inventory of a person's ability to perform basic activities of daily living (ADLs), such as grooming, bathing, toileting, and transferring, and instrumental ADLs, such as shopping, medication management, and finances. The Older Americans Resources and Services (OARS) ADL scale consists of seven basic ADL items and seven instrumental ADL items, rating independence in performing each. A national survey of geriatricians found that 90% of Canadian geriatricians would consider a drop on the OARS scale of ≥2 points

Table 2 | Comparison of blood pressure targets for older and younger adults in various guidelines to highlight differences

Committee	Publication year	Age	Threshold to start therapy	Blood pressure target
Hypertension Canada[93]	2020	All ages	OBPM ≥140/90 mm Hg; AOBP ≥134/85 mm Hg; ABPM mean ≥130/80 mm Hg; HBPM mean ≥135/85 mm Hg	<140/90 mm Hg (caution: limited or no evidence in institutionalized older adults)
				Diabetes: <130/80 mm Hg
				CKD: consider intensive targets of <120 mm Hg
International Society of Hypertension[94]	2020	<65 years	>140/80 mm Hg	120-130/79-80 mm Hg
		≥65 years		<140/90 mm Hg if tolerated (individualize in context of frailty, independence, and likely tolerability)
NICE[95]	2019	<80 years	OBPM >140/90 mm Hg; ABPM/HBPM mean ≥135/85 mm Hg (measure orthostatic blood pressure in those ≥80 years or with symptoms of orthostatic hypotension)	OPBM <140/90 mm Hg; ABPM/HBPM <135/85 mm Hg
		≥80 years		OBPM <150/90 mm Hg; ABPM/HBPM <145/85 mm Hg (use clinical judgment for those with frailty or multimorbidity)
European Society of Cardiology[96]	2018	<65 years	OBPM ≥140/90 mm Hg; ABPM ≥130/80 mm Hg; HPBM ≥135/85 mm Hg	130-139/70-79 mm Hg in all patients, including independent older adults (frailty, dependency, and expectations of treatment benefit will influence decision in those ≥80 years)
		65-79 years	≥140/90 mm Hg	
		≥80 years	≥160/90 mm Hg	
American College of Cardiology[97]	2017	All ages	≥130/80 mm Hg for adults <65 and ≥65 years, including ABPM ≥130/80 mm Hg, HBPM ≥135/85 mm Hg, and OBPM ≥140/90 mm Hg	Known CVD or 10 year atherosclerotic CVD event risk of ≥10%, CKD, or DM: blood pressure target of <130/80 mm Hg (for non-institutionalized, ambulatory, community dwelling adults ≥65 years). In multimorbidity or limited life expectancy, use clinical judgment, patient preference, and team based approach to assess risk/benefit
American Diabetes Association[98 99]	2016	<80 years	≥140/90 mm Hg	<140/90 mm Hg
		≥80 years		<140-150/90 mm Hg if in good condition, providing DBP >60 mm Hg (if orthostatic hypotension, frailty, or cognitive decline, consider whether blood pressure lowering is worthwhile)
Joint National Committee[8 100]	2014	<60; no DM or CKD	>140/90 mm Hg	<140/90 mm Hg
		≥60; no DM or CKD	>150/90 mm Hg	<150/90 mm Hg
		All ages with DM and/or CKD	>140/90 mm Hg	<140/90 mm Hg

ABPM=ambulatory blood pressure monitoring; AOBP=automated office blood pressure; CKD=chronic kidney disease; CVD=cardiovascular disease; DBP=diastolic blood pressure; DM=diabetes mellitus; HBPM=home blood pressure monitoring; NICE=National Institute for Health and Care Excellence; OBPM=office blood pressure measurement.

to indicate be clinically significant functional decline.[102]

Alternatively, function can be evaluated using physical assessment. Classically, functional capacity in cardiology has been assessed with a cardiopulmonary exercise test, measuring peak oxygen uptake. However, this test requires capacities of strength and balance that are often not possible for many older adults. Therefore, being aware of a broader range of well validated functional assessments is important. The six minute walk test is a submaximal exercise test commonly used to test functional capacity. Normative values are age, sex, and height dependent, but a value of ≤300 m is a common benchmark of poor prognosis. Gait speed is a convenient test to use in many older patients, only requiring a 4 m walk distance. Gait speed of ≥1.4 m/s indicates increased likelihood of functional independence, whereas <0.8 m/s suggests frailty, increased fall risk, and functional dependency in ADLs.[103] The Short Physical Performance Battery (SPPB) incorporates gait speed, balance assessment, and chair rises, taking roughly 10 minutes to administer. A score ≤10 has been shown to predict mobility dysfunction, and a score of ≤6 predicts fall risk and ADL disability.[104 105] The timed up and go test requires a patient to stand from chair, walk 3 m, turn, and return to the chair, taking a seat. A time of >14 s indicates increased fall risk/mobility impairment.[106 107] Lastly, multivariable assessments (for example, the Essential Frailty Toolkit) combine measures of physical function with other cognitive and health measures (for example, hemoglobin, albumin). These can be an efficient means of assessing function and frailty at once, and several have been validated in cardiac patients.[108]

Cardiovascular disease is the leading cause of premature disability, and the American Heart Association advocates for the use of patient reported functional assessments.[109] Repeat assessments over time can help to identify deficits early and provide opportunities for intervention. A longitudinal cohort study of more than 15 000 patients found that functional decline precedes admission to hospital with cardiovascular disease by an average of two to three years.[110] Therefore, efforts to minimize hospital admissions are worthwhile considerations for older adults who have been identified as having functional deficits, as these admissions would likely compound functional decline and progression of disability and mortality risks. A retrospective cohort study of 463 older adults (mean age 85 years) who underwent transcatheter aortic valve implantation in Japan between 2012 and 2018 showed that hospital acquired functional decline was associated with a higher risk of all cause mortality (odds ratio 2.11, 1.12 to 3.97), independent of sex, body mass index, chronic kidney disease, and preoperative frailty.[111] Other predictors of hospital related functional decline include baseline geriatric syndromes. A prospective cohort study of 189 patients aged ≥75 years and admitted to a cardiology ward found that a third developed functional decline during admission, which was best predicted by cognitive impairment, loss of appetite, depression, and use of a Foley catheter, as well as premorbid mobility impairment.[112] Another prospective cohort study of 119 patients aged ≥70 years undergoing transcatheter aortic valve implantation found that one in five experienced functional decline, which was predicted by a frailty index (odds ratio per 1 point increase 1.57, 1.20 to 2.05).[113] Such novel risk assessments can be used to identify patients who are candidates for multivariable interventions, such as pre-habilitation before a procedure, early ambulation, referral for occupational therapy to enhance functional capacity and reduce demands (for example, walking aid, raised toilet seat), referral for home physical therapy, and enrollment in cardiac rehabilitation on discharge, in coordinated efforts to prevent or aid recovering from hospital associated functional decline.

Adding metrics of functional assessment is an important component of the care of older adults. Repeat assessments can help to identify early functional decline and thereby provide opportunities for intervention and prevention of further disability. Geriatric syndromes such as frailty, mobility impairment, and cognitive impairment predict hospital related functional decline and allow for targeted intervention and resource allocation to those at highest risk, which can prevent or minimize hospital related decline.

Frailty

Frailty is defined as a state of vulnerability and decreased homeostatic reserve, resulting in decreased resilience to physiologic stressors. Frailty is a measure of biologic, rather than chronologic, age and contributes to the heterogeneity among the older adult population; two older adults of the same age may be very different clinically, depending on their degree of frailty. The concept and importance of frailty has been recognized for decades, but no consensus on diagnosis exists. Two prevailing theories of frailty exist—one defines frailty as a physical phenotype involving such deficits as unintentional weight loss, exhaustion, weakness, slowness, and reduced activity[114]; the other defines it as an accumulation of deficits over time, including deficits of cognition, mood, and function, as well as comorbidity.[115] This enduring debate on frailty has resulted in the creation of many frailty assessment tools, without any one gold standard, making diagnosis and estimation of prevalence difficult.

Frailty and cardiovascular disease are intrinsically related, with inflammatory pathophysiology common to both.[116] Frailty has been shown to result in increased incidence of cardiovascular disease, and cardiovascular disease predicts the onset of frailty.[116] Frailty is also more common when cardiovascular disease occurs in the context of multimorbidity. Frailty is a marker for increased risk of adverse outcome in various cardiovascular

conditions and procedures; epidemiologic studies consistently report a twofold or greater increase in morbidity and mortality with frailty.[117] Additionally, people who are frail are two to three times more likely to experience disability and functional decline, falls, and institutionalization, compared with those who are not frail.[118-120] Classically, procedural risk tools have not included frailty, but surgical risk has more recently been refined with the addition of frailty, as measured by gait speed and/or other frailty metrics. A prospective cohort study of more than 15 000 patients aged ≥60 years undergoing cardiac surgery found that gait speed <0.8 m/s improved the prediction of the Society of Thoracic Surgeons risk score on the composite of morbidity and mortality.[121] Moreover, every 0.1 m/s decrease in gait speed correlated with an 11% relative increase in mortality. As more than half of older adults with cardiovascular disease are frail,[116] establishing a diagnosis of frailty is critical, as it contributes valuable prognostic information and adds incremental value to existing risk models,[122] supporting SDM and optimizing care of older adults.

Despite several frailty tools being validated in cardiac populations, no single frailty assessment is recommended, leaving the decision at the discretion of the practitioner. Gait speed is commonly used, as it is a quick and convenient measure to assess physical frailty and identifies people at risk of poor outcomes (for example, in procedures and disease management (heart failure, CHD)).[123-127] Other physical frailty measures such as grip strength (a convenient measure of strength), requiring a dynamometer, and the SPPB, involving combined assessments of balance, gait speed, and chair raises, are options for frailty screening and, with practice, can be performed in minimal additional office time. Multidimensional frailty questionnaires, such as the Edmonton Frail Scale,[128 129] the FRAIL scale,[130] and the Essential Frailty Toolkit,[108 131] have been validated in various areas of the cardiovascular literature for a wide spectrum of cardiovascular diseases and cardiovascular therapeutic prognoses. These tools can often be administered by multidisciplinary healthcare staff starting in the waiting room, easing implementation in cardiovascular clinics, adding valuable information to routine vital signs and allowing enhanced risk prediction in cardiovascular disease.

Whether frailty can be intervened in or reversed, potentially changing prognosis and allowing risk modification pre-procedurally, is not fully elucidated. Meta-analyses and systematic reviews suggest that the best evidence is for physical exercise, specifically multicomponent, supervised exercise regimens such as cardiac rehabilitation, as well as nutritional supplementation in combination with exercise; however, evidence remains limited.[132-136]

Frailty provides valuable prognostic information that can aid greatly in risk prediction, management choices, and associated decision making. Frailty does not denote futility, although it can often highlight the value of alternative pathways of management when procedural hazards seem excessive owing to high frailty related risks. Numerous frailty assessment tools exist, many validated in cardiac patients, leaving the final choice of which to use to the individual clinician. An unfortunate consequence of such ambiguity is that many cardiology providers omit consideration of frailty entirely, missing an important and more holistic assessment of risk. Collaboration with a geriatric medicine specialist well versed in assessing frailty may be beneficial in more complex patients and on multidisciplinary heart teams assessing patients who need intervention or surgery, to ensure that accurate and comprehensive risk assessment can be incorporated into shared pre-procedure decision making.

Sarcopenia

Sarcopenia is defined as a progressive and generalized muscle disorder, resulting in decreased muscle quantity and quality and decreased physical performance.[137] Sarcopenia is highly prevalent in older adults; a cross sectional analysis of four longitudinal studies involving 337 healthy, community dwelling men and women aged 64-93 years reported a prevalence of sarcopenia of 23% in women and 27% in men.[138] In the subgroup of those aged ≥80 years, the prevalence increased to 31% of women and 53% of men.[138] Sarcopenia impairs mobility, increasing the risk of falls and fractures; decreases function, impairing one's ability to perform ADLs; increases disability, contributing to loss of independence and institutionalization; and decreases quality of life.[139-141] It also increases risk of hospital admission, healthcare costs, and mortality risk.[139 140 142]

Sarcopenia and cardiovascular disease are interrelated, likely owing to common inflammation related physiology, with several observational studies reporting increased risk of cardiovascular disease in older adults with decreased muscle mass and strength.[143 144] Frailty also shares a similar inflammatory basis, with considerable overlap between sarcopenia and physical frailty, as well as the classic frailty phenotype including slowness, weakness, and reduced physical activity.[145] A prospective cohort study of 2987 adults (mean age 50.1 years) found that lower muscle mass was associated with increased risk of cardiovascular disease, particularly when thigh circumference was below a threshold of 60 cm. This was independent of abdominal/general obesity, lifestyle, and traditional cardiovascular risk factors.[143] Sarcopenia has also been found to be a predictor of poor outcome in cardiovascular disease. A prospective cohort study of 475 patients who underwent successful percutaneous coronary intervention found that sarcopenia independently predicted all cause mortality (hazard ratio 4.07, 1.95 to 8.45) and major adverse cardiovascular events (3.76, 2.27 to 6.23), even after propensity matching.[144]

Any patient reported symptom suggestive of sarcopenia, such as falls, feeling "weak," slow gait, or difficulty rising from a chair, should prompt further investigation; alternatively, screening can be done using the validated five item SARC-F questionnaire.[137 146 147] Low muscle strength is the best clinical indicator of sarcopenia, so common diagnostic tools such as grip strength, chair rise test (five times sit to stand), gait speed, and SPPB can be used to diagnose sarcopenia in clinical practice. Additionally, muscle quantity can be evaluated by techniques including magnetic resonance imaging or computed tomography.[137]

Although evidence on treatment of sarcopenia remains limited, nutritional protein supplementation has been shown to improve body composition and inflammatory markers, with evidence that excess protein (1-1.2 g/kg body weight/day) may improve muscle mass and physical function.[148 149] Additionally, multicomponent exercise and exercise in addition to protein supplementation are the most well supported therapeutic interventions for sarcopenia,[150 151] suggesting that cardiac rehabilitation has the potential to moderate the vulnerability and poor prognosis associated with sarcopenia.

Cardiovascular clinicians should be aware of the signs and symptoms of sarcopenia, as it is prevalent in cardiovascular disease and negatively affects outcome. Sarcopenia should trigger concerns about limitations of procedures and other aspects of care, including potential changes in drug pharmacokinetics and pharmacodynamics. Judicious care and vigilant monitoring are indicated. Shared decisions are paramount. Evidence for treatment is limited, but multicomponent exercise programs and increased protein intake may improve sarcopenia.

Shifting priorities when caring for older adults with cardiovascular disease

Prioritizing individual patients' therapeutic goals and preferences

The management of cardiovascular disease in older adults is complex and varies from patient to patient, as the population is very heterogeneous. In recent years, the concept of person centered care, placing individual patients and their values and preferences at the focus of the healthcare process and decision making, has gained momentum and is now considered a pillar of healthcare quality.[152 153] Person centered care requires assessment of the individual's cardiac condition, placed into context with other medical conditions and geriatric syndromes, but also requires clarification of the patient's health priorities, as care aligned with an individual's priorities can improve outcome and reduce treatment burden.[154] This process includes establishing patients' personal goals for their treatment, such as preservation of function and independence and avoidance of treatment burden and hospital admission. The practice of person centered care can be challenging, as it is an unfamiliar way of practicing medical decision making, often occurring in complex patients in whom the best treatment is uncertain. A qualitative study of decision making aligned with patients' priorities suggests that starting with a single priority mattering most to the patient, maintaining focus on function, and basing decision making on the patient's priorities, rather than disease, can help to guide clinicians with this approach to care.[155]

Estimating longevity or prognosis can be useful in assisting patients to establish their therapeutic goals, particularly when done in collaboration with all physicians caring for the patient. Prognostication tools are useful,[156] although prognostication, particularly in non-cancer illness, is only an approximation. A prospective cohort study described 343 physicians' survival estimates for 468 terminally ill patients, finding that only 20% of predictions were accurate (within 33% of actual survival), with 63% being overly optimistic and 17% being overly pessimistic.[157] Systematic reviews have found similar results, with clinicians consistently overestimating survival and no one physician type being more accurate than others.[158] Consideration of time to benefit versus time to harm is pertinent to longevity. Time to benefit is defined as the time for a population to realize the intended benefit of a therapy, and time to harm is the time required for a therapy to cause harm.[159] Consideration of risk/benefit trade-offs is necessary, particularly in older adults or those with reduced longevity. Despite the imprecise nature of prognostication, consideration of time to benefit allows the clinician to focus on whether a clinically relevant benefit could be realized in a time relevant to the individual's estimated life expectancy and whether the time to harm is shorter or longer than the time to benefit.[159]

Lastly, consideration of quality of life, treatment burden, and patient motivation is important when assisting a patient in determining health related priorities and practicing person centered care. A patient with reasonable quality of life may wish to pursue certain treatment options, despite some level of risk, whereas a person with limited quality of life may not be willing to accept the same risk. Treatment burden refers to the effect on function and wellbeing imposed by the disease and its treatment.[160] It is patient specific and affects patients' families as well. Assessing treatment burden can enable a clinician to tailor treatments to best achieve a patient's goals of care. Lastly, being aware of patients' motivation, what gives them enjoyment and quality, allows the clinician to gain buy-in from the patient regarding treatment plans, as achievements important to the individual can be targeted as treatment goals. Communication with the patient to establish such priorities is essential, as these can be quite variable and may be different from what the clinician expects.

Clarifying each patient's values and preferences is essential to facilitating care aligned with the patient's priorities, optimizing communication, and maintaining a strong patient-provider relationship. Assisting patients to prioritize their treatment

goals often requires an estimate of prognosis and consideration of time to benefit and time to harm for therapeutic interventions. Additionally, asking about quality of life, treatment burden, and personal priorities can aid the clinician to align care to each individual's preferences.

Importance of shared decision making

The concept of SDM has gained a great deal of attention and prioritization recently, in part owing to its relevance for the expanding population of older adults, as medical treatment decisions in this cohort are less well supported by literature. The concept of SDM involves building a good patient-clinician relationship and engaging the patient and any care givers in the decision making process. The communication is bidirectional, with patients providing information on their values and preferences and clinicians providing clear and comprehensible, evidence based information on options for care, often using decision aids to counsel on risks and benefits.

Decisions about many common cardiovascular diagnoses benefit from SDM, such as the weighing of bleed risk versus stroke risk with oral anticoagulation in atrial fibrillation and the appropriateness of various cardiac procedures, such as coronary artery bypass grafting, transcatheter aortic valve implantation, or a ventricular assist device. Decision aids have been established to assist in these difficult discussions and are available online (for example, https://carethatfits.org/). They often use pictographs to visually convey numerical information more effectively, facilitating the understanding of risk/benefit. However, decision aids often use traditional risk scores, which fail to take into account geriatric syndromes, once again undercutting the full spectrum of relevant clinical considerations. Additionally, a recent systematic search found 25 online decision aids for cardiovascular disease prevention, all having only moderate actionability and all requiring a higher reading level than the literacy rate of the general population.[161] Thus, future development of decision aids should focus on improvements in actionability, readability, and generalizability to older adults. Other areas of focus for future research in cardiovascular care of older adults, as well as relevant future research questions, can be seen in box 1 and the "Research questions" box.

Despite challenges and limitations to SDM shown in figure 3, many proven benefits exist, including improved knowledge of disease and treatment options by patients, increased participation of patients in care, improved satisfaction of patients, reduced decisional conflict, and increased value congruence between patients and physicians.[164-169]

In the treatment of older adults, medical treatment decisions are often complex and less supported by the literature compared with younger adults, necessitating individualized SDM. This entails collecting information from patients on their values and preferences and providing a comprehensible estimation of risks and benefits based on current evidence and clinical judgment, thus allowing the patient to play an active role in decision making. Established decision aids can assist in the SDM process but fail to incorporate geriatric conditions relevant to prognosis, limiting their accuracy in older adults.

Guidelines

The major societies worldwide are just beginning to incorporate recommendations into CPGs regarding the nuanced care needed in treating older adults with cardiovascular disease. One area that has greater representation in the guidelines is hypertension management in older adults, although much variability exists in the recommendations (table 2).

Comparison of the European Society of Cardiology (ESC), American College of Cardiology (ACC), American Heart Association (AHA), and Canadian Cardiovascular Society (CCS) shows that the ACC and AHA have been the most proactive in publishing literature in this area, with entire

Box 1: Future directions to improve cardiovascular disease management in older adults

1. Increasing representation of older adults, including those with multimorbidity and other geriatric syndromes, into large cardiovascular trials, allowing generalizability of the evidence to the growing older adult population
2. Increased representation of outcomes relevant to older adults in large cardiovascular trials, such as disability-free survival, physical and cognitive function, quality of life, and treatment burden
3. Development of quality measures for older adults with multimorbidity, functional impairment, or frailty and cardiovascular disease that can be used for quality improvement and performance measures
4. Development of a single, simple, robust frailty metric, validated in various cardiovascular disease states, recommended for use by cardiovascular clinicians. This would improve uptake of frailty measures in patients with cardiovascular disease and improve research in frailty outcomes with a uniform standardized assessment tool
5. Advancement of telemonitoring systems for patients with mobility or health problems resulting in difficulty attending in-person appointments and those residing in post-acute care or long term care, along with quality improvement research investigating the use of these systems to avoid hospital admissions
6. Increasing collaboration between geriatric specialists and cardiovascular specialists, including the representation of geriatric experts on multidisciplinary cardiovascular care teams used in the management of valvular heart disease, heart failure, and other traditional cardiovascular disease problems

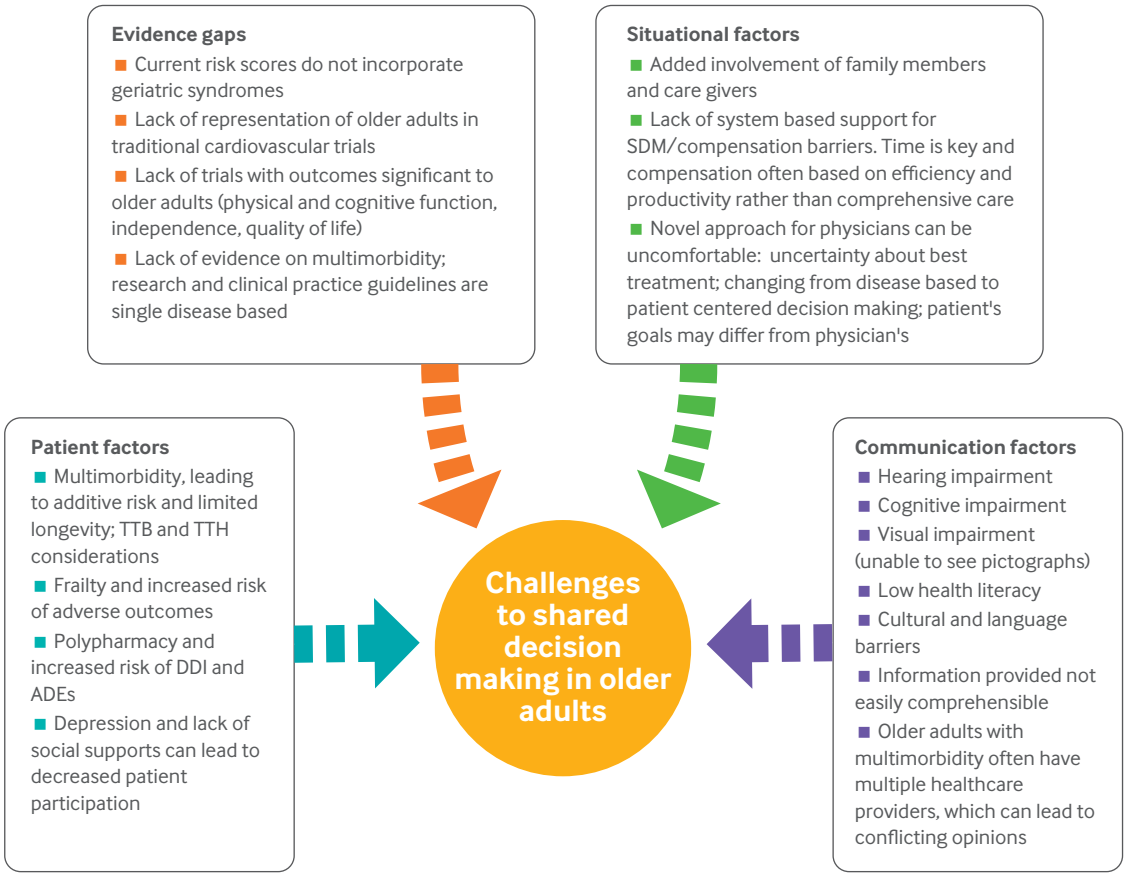

Fig 3 | Challenges in shared decision making (SDM) when caring for older adults.[162 163] ADEs=adverse drug events; DDI=drug-drug interactions; SDM=shared decision making; TTB=time to benefit; TTH=time to harm

Table 3 | Identifying and managing common geriatric conditions as part of cardiovascular disease management

Condition	How to identify condition	Management
Multimorbidity	Ask patient about any previous diagnoses for which they have seen a doctor or taken medication	Be aware of increased risk of adverse events and poor outcomes. Individualize all treatment decisions; engage in SDM
Polypharmacy	Ask patient to bring an up-to-date medication list to clinic visit	Consider deprescribing if PIM or DDI identified or if medication no longer has a net clinical benefit or no longer fits with patient's values/preferences
Cognitive decline	Ask patient "Have you noticed a change in your memory?" Ask family member/care giver "Have you noticed any change in the patient's memory?" Mini-Cog screening tool	Refer to geriatric medicine for management with or without treatment of dementia. Be aware of increased risk of delirium; institute early delirium prevention strategies in hospital
Vision impairment	Ask question "Have you noticed a change in your vision lately?"	Refer to optometrist or ophthalmologist for assessment and treatment
Hearing impairment	Observe patient during interaction for hearing difficulties. Ask question "Do you have problems hearing me/your loved ones?"	Refer for hearing examination and hearing aid candidacy. Use voice amplification device for interview
Urinary incontinence	Ask question "Do you have problems with leaking urine?"	Assess for contributing drugs. Refer for pelvic floor physical therapy. Refer to urology/urogynecology
Falls	Ask question "Have you fallen in the past year?"	Assess for fall risk enhancing drugs; if present, deprescribe. Assess for symptoms of orthostatic hypotension and check orthostatic vitals; if present, consider blood pressure leniency. Refer for OT home safety assessment. Refer for OT mobility assessment, with or without mobility aid. Refer to physical therapy for balance exercises
Functional decline	Ask about basic and instrumental ADLs; 6 minute walk test; gait speed over 4 m; SPPB test; TUG test	Early mobilization to prevent/limit hospital related deconditioning. Multicomponent exercise plus protein supplementation may help. OT to help with interventions to reduce task demands
Frailty	Gait speed over 4 m; grip strength with dynamometer. SPPB; Edmonton Frail Scale; FRAIL Scale; Essential Frailty Toolkit	Limited evidence on reversibility; trial of multicomponent exercise plus protein supplementation. Be aware of adverse outcomes; do frailty assessment to improve traditional risk scores and aid in SDM
Sarcopenia	Ask question "Are you weaker or slower when walking or getting out of a chair?" SARC-F questionnaire; grip strength; chair rise test (5 × sit-to-stand); gait speed over 4 m; SPPB	Limited evidence for intervention; trial of multicomponent exercise and protein supplementation

ADL=activity of daily living; DDI=drug-drug interactions; OT=occupational therapy; PIM=potentially inappropriate medications; SDM=shared decision making; SPPB=Short Physical Performance Battery; TUG=timed up and go.

guidelines dedicated to the treatment of older adults with cardiovascular disease published as far back as 2007.[170-173] The ACC has also published many scientific statements specific to broadening awareness of treatment of cardiovascular disease in older adults and has ensured incorporation of important geriatric factors such as frailty in most recently published guidelines.[174-180]

The ESC and CCS do not have guidelines dedicated to management of the older adult. However, both have started to incorporate important factors in treating older adults, such as frailty, falls, cognitive impairment, and SDM, into their recent guidelines.[181-184]

Conclusion

Overall, the burgeoning population of older adults and the prevalence of cardiovascular disease in this population oblige cardiac specialists, and everyone taking care of older adults with cardiovascular disease, to become familiar with the fundamentals of geriatric medicine, summarized in table 3. This requires an awareness of the overlap of cardiovascular disease with multimorbidity and other geriatric conditions, as well as a high degree of vigilance by the clinician, as many geriatric conditions that can significantly affect the management and prognosis of cardiovascular disease can easily be overlooked—for example, cognitive and sensory impairments, delirium, sarcopenia, and frailty. It also mandates a complete frameshift in treatment priorities, away from traditional stringent adherence to guidelines, toward individualized, patient centered care, founded in communication, balancing risks and benefits, and SDM, and focusing on the patient's health related priorities, such as maintenance of function and quality of life, often in the absence of robust literature. Although challenging and at times quite arduous, the practice of geriatric aligned cardiac care is rewarding, providing true patient priority based care to a vulnerable and often overlooked population.

RESEARCH QUESTIONS

- How does multimorbidity affect the outcome of various cardiac conditions and treatment options, such as in acute coronary syndrome or valvular heart disease or with cardiac surgery or antiarrhythmic therapy?
- How can geriatric conditions such as frailty and multimorbidity be included into risk prediction scores in a more standardized and comparable way?
- What is the best way to modify frailty and sarcopenia? Do markers exist to determine which patients will benefit most from exercise, diet, or novel pharmacologic approaches?
- How do patient aligned care and shared decision making affect patients' adherence to treatment plans? Can this be modified further with motivational approaches?

HOW PATIENTS WERE INVOLVED IN THE CREATION OF THIS ARTICLE

A patient's son expressed his appreciation for the practice of individualized, geriatric centered, cardiovascular care. He was agreeable to sharing his perspective in a short reflection on his parent's care. He was given the opportunity to review and comment on the first draft of the manuscript but did not elect to make any changes.

"My mother is from Poland. She doesn't speak English. She is 90 years old. She fell (due to syncope, for which she received a pacemaker) and had a bleed in her brain. Thankfully, she has done well, didn't need surgery, and has recovered to baseline. The first doctor we spoke to told us my mother should no longer be on warfarin and I accepted that. However, you told us that the risk of not being on warfarin is of stroke, which is terrifying to her and me, as we saw my father go through that. He lost everything the day he had his stroke. His ability to talk, to walk, to enjoy life. My mother wouldn't want to live like that. I appreciate knowing the risks and benefits of being on a blood thinner and not. I also appreciate the discussion of drugs other than warfarin, as these weren't brought up before. I am my mother's protector. I translate and help her make decisions. I can't do that if I don't have all of the information. I now feel like I have enough information that I can help her make a decision on this. My mother is fearful of stroke. She rarely falls. We want to start on one of the newer blood thinners, when you feel it is safe to do so. Some people may be afraid of bleeding; in my family, we are afraid of stroke."

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