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JACC White Paper

Cardiac Care for Older Adults

Time for a New Paradigm

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Advanced Age as a Primary Determinant of Cardiovascular Disease

Recent decades have witnessed striking growth in the number of older adults both in the United States and throughout much of the world, largely due to improved public health, nutrition, and medical care. Between 2000 and 2030, the proportion of the world's population age 65 years and older is expected to increase from 6.9% to 12% (1). In the United States, the "old age" demographic is accelerating even more rapidly (estimated to increase from 12.9% to 20% between 2000 and 2030) as baby boomers enter their senior years (2). Furthermore, by 2050, the subgroup of U.S. seniors age 85 years and older is expected to triple. Ironically, aging also catalyzes fundamental changes that increase susceptibility to cardiovascular disease (CVD) such that CVD is endemic in the burgeoning senior population (3). Already, the prototypical U.S. cardiology patient is an older adult, and management of cardiac issues is fundamentally linked to the frailties and multimorbidities associated with advanced age.

Cardiologists Are Frequently Regarded as the Logical Healthcare Leaders for the Rising Population of Older Adults With CVD

Although many assume that cardiologists are logical healthcare leaders for management of CVD in seniors, the current cardiovascular (CV) armamentarium fails to integrate complexities or needs specific to older patients. Conventional evidence-based standards of CV care were formulated using trial data derived from younger study populations and/or elderly patients who were rigorously screened to exclude common morbidities or frailties of old age (4). As a result, routine CV management often overlooks health problems without a cardiac focus (e.g., cognitive decline, functional limitations, pain, or multimorbidities) even if they bear on how patients experience and process CV healthcare decisions (5). Primary care providers may even choose to avoid cardiology consultation if they perceive that the cardiologist will recommend medications and procedures that are discordant with the patient's overall care priorities (6). Moreover, in some areas of the United States, third-party payers are considering steps to impede referrals to cardiologists for what are perceived to be invasive procedures that add

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little benefit to patient-centered care (7) such as the common use of stents in stable coronary artery disease patients, an issue particularly germane to older adults, given the high age-related prevalence of coronary artery disease.

It is indisputable that the attributable risk of CVD is highest in the senior population (8–10). Therefore, CV caregivers have the greatest potential to favorably impact mortality and morbidity by implementing preventive and interventional therapies in their oldest patients. Yet, this potential is counterbalanced by increased iatrogenic risks as well as myriad medical, social, and even economic concerns that can affect which issues a patient considers his/her paramount concerns. To navigate through these cross-currents, cardiologists require additional proficiencies, that is, insights and skills that require deliberate preparation and training.

The Institute of Medicine's recent report on retooling for an aging America emphasizes the need for fundamental reform in healthcare training and implementation to meet the needs of the older population (11). "The nation needs to move quickly and efficiently," the report indicates, "to make certain that the healthcare workforce increases in size and has the proper education and training to handle the needs of a new generation of older Americans."

We propose that fundamental tenets of CV training and patient management can and should be expanded to better address the complexities of all patients, including skills and insights to better treat the large and growing population of older adults who now comprise the largest subgroup of CV patients. Training should continue to emphasize state-of-the-art technological and medical expertise, but also their individual application, and should ensure that all providers have the skills needed to assess patient preferences, circumvent hazards of hospitalization, facilitate successful transitions from one care setting to the other, engage in useful risk-benefit discussions, and provide care collaboratively within a care team responsive to the needs of the oldest patients. Such enhancements will lead to more individualized care, with better coordination across multiple conditions.

Aging Leads to Changes in the Nature of CVD and its Management

Although chronology is relevant, the process of aging entails more than an accounting of years lived (12). Relative differences in biology (e.g., telomere length, oxidative stress, inflammation, genetic constitution) (13–15), lifelong health habits (e.g., nutrition, exercise, dental care), cardiac risk factors (e.g., hypertension, cholesterol, tobacco, insulin resistance) (16), comorbidities (e.g., infection, chronic obstructive pulmonary disease, renal disease, anemia, arthritis, depression, dementia, vision and hearing deficits), psychology (e.g., interpersonal capacities, self-efficacy, coping skills), social structure (e.g., class, community, access, spouse, family support), economic resources (personal, governmental), and culture (religion, ethnicity, transcendent sense of meaning and purpose) also impact the aging process. Therefore, a more meaningful way to conceptualize "aging" is as a continuum of changes that mount over time, with pace and nature of progression varying depending on each person's circumstances.

Despite such individual variation, 75 years is often cited as the beginning of old age, in part because it provides a convenient benchmark for research and clinical applications. Likewise, 85 years is often used as a convenient threshold to classify very old age. These designations presume that by 75 and 85 years, respectively, most adults have sustained sufficient aging changes to exhibit clinically relevant differences in physiology and organ function and reserves. Yet, aging remains idiosyncratic, and each senior adult has a unique constellation of age-related vulnerabilities and consequences.

High age-related incidence of CVD arises in part due to broader aging processes, including accumulating morbidities, diminishing homeostasis, and prolonged injurious effects of CV risk factors (3,17). Cardiac disease also stems from insidious age-related changes in CV morphology and function. Vascular stiffening of the central vasculature is, for example, an omnipresent aging phenomenon that usually starts by middle age and leads to progressive rise of afterload stress, myocardial workload, and changes in diastolic perfusion that predispose to functional decrements and ultimately to ischemia, heart failure, arrhythmia, and other CV disorders (18–20). Heart failure with preserved ejection becomes increasingly common as the mounting aortic impedance of senescence is more likely to uncouple from ventricular pumping performance (21). Parallel aging changes in myocytes, endothelial cells, and pacemaker cells further increase vulnerability to coronary artery disease, valve disease, heart failure, arrhythmia, peripheral artery disease, and cerebrovascular disease (20). The relative progression of each of these aging effects varies among individuals, resulting in a diverse range of CV clinical implications. For some seniors, CV aging is manifest only as functional decrements (22), whereas others develop subclinical (23) or overt CVD (3,17,20,24). Although, overall, CVD increases appreciably with age, cardiologists face the challenge of tailoring prevention and treatment priorities relative to each individual's circumstances.

CVD is also usually more hazardous in older patients. It often erupts with multiple simultaneous CVD processes (e.g., acute coronary syndrome, heart failure, and atrial

fibrillation) and in combination with noncardiac pathologies (e.g., pneumonia, renal insufficiency, anemia, chronic lung disease, diabetes, and stroke) (24). Such multisystem disease combinations are more liable to overwhelm the diminished CV reserve capacity of aging, thus leading to adverse outcomes. Medications often compound problems, as age-related changes in absorption and metabolism alter the pharmacokinetics and pharmacodynamics of most drugs. As a result, medication dosing and effects, both beneficial and adverse, often differ from those in younger adults, and it cannot be assumed that the clinical utility of agents shown to be effective in younger individuals necessarily applies to the elderly. Moreover, especially given the likelihood of multiple cardiac and noncardiac diseases occurring simultaneously among older CVD patients, clinically significant drug–drug and drug–disease interactions are ubiquitous, adding to management challenges (25).

Limitations of the Current Therapeutic Paradigm

Despite the glaring pattern of age-related complexity and the precarious onset and progression of disease, the current paradigm of care for older CV patients is relatively rudimentary, mostly an extrapolation from conventional evidence-based CV guidelines. Even the recently revised non–ST-segment elevation myocardial infarction guidelines, which called for special considerations in care of older populations, provided little in the way of concrete recommendations (26). Essentially, cardiologists have begun to approach the margins of the issue, but have yet to deal with it programmatically.

Evidence-based care becomes considerably less certain when analyzed through a lens that exposes relevant aging dynamics. For example, although an impressive array of trial data suggests utility of statins to reduce mortality for older adults (27,28), therapeutic ambiguity persists if the statin constitutes the eighth pill in a complex regimen and/or if the patient has age-related renal insufficiency and/or nebulous muscle aches (29,30). Not only are the salutary effects of a multipill regimen for a frail elder unclear, but diminished access to care, costs, iatrogenesis in relation to age, polypharmacology, and morbidity remain substantial concerns, with absent clarification from the clinical trials on which treatment indications were based, that is, trials that systematically excluded older patients with such complexities (4). Furthermore, data pertaining to adults age 80 years and older remain generally absent, and benchmark mortality endpoints are often of less concern for seniors than quality-of-life issues (e.g., myalgias, polypharmacology, and medication costs).

Part of the challenge is that many CV interventions effective in younger patients are more likely to adversely affect older adults, especially those weakened or debilitated by age (31). Contemporary proliferation of drug-eluting stents and antiplatelet therapy, for example, is counterbalanced by increased bleeding risks in older patients (32). Beta-blockers can limit chronotropy and exercise performance. Nitrates can increase falls and syncope. Idiosyncratic effects of age must be anticipated. Complexities are exacerbated by cognitive decline, confusion, mood changes, and loss of appetite, especially in a context of common stresses of hospitalizations, loss of independence, functional declines, polypharmacology, and sensory impairments (vision, hearing, taste). Precise dosing of medications and monitoring are essential, as is thorough assessment of composite life events that impact on CV health and care.

Advanced age and frailty also often confound conventional processes of care. Access to caregivers is often more limited (hindering assessments and monitoring); vision, hearing, and cognitive limitations can complicate comprehension and compliance; arthritis impedes exercise goals; financial constraints and altered taste may frustrate dietary recommendations; finances may also prohibit use of vital ancillary services; even the ability to stand on a scale can become difficult for someone challenged by dizziness, stroke, or Parkinsonism. Therapy that merely extrapolates from standards oriented to younger populations might be fundamentally unsuitable for someone old and frail.

Not only do higher risk–benefit ratios exist among seniors for virtually all CV procedures and interventions relative to the populations from which evidence-based standards were derived, but even if/when study endpoints are reproduced in seniors, many patients may not perceive them as benefits.

The manner and quality of death can also be affected by therapeutic choices in ways far removed from their original therapeutic intent. An implanted cardioverter-defibrillator may, for example, prevent sudden (painless) death, but this "benefit" inevitably increases the likelihood of dying from congestive heart failure, myocardial infarction, cancer, or other noncardiac causes (33,34). Such consequences are often not anticipated and discussed prior to undertaking therapeutic interventions.

Limitations of the current CV healthcare paradigm to care for seniors extend beyond decisions made for an individual patient and relate to the healthcare industry. Over the last decade, access to CV imaging, procedures, and devices have expanded for older adults. There has, for example, been enormous investment in nuclear imaging on the premise of quality (35), often usurping the role of traditional electrocardiogram exercise testing that still might

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have provided sufficient data to address the underlying clinical questions (e.g., prognosis, exercise capacity, and symptoms) without the added expense of imaging (36). These issues are now compounded by the growth of computed tomography and other imaging options that tout clinical benefits, but for which outcomes data are lacking. Although concerns regarding over-reliance on imaging are not exclusive to older patients, prevalence of CVD increases with age (such that application of imaging assessments also escalates) as does a common (but erroneous) assumption that older patients cannot exercise sufficiently for clinically useful nonimaging assessments.

Improving Care of the Older Cardiac Patient

A New Clinical Paradigm

Given the fundamental heterogeneity of aging and its direct bearing on clinical management, improved care for older CV patients is a priority (37). Considerable work lies ahead to achieve what are still sometimes idealized goals that must be better delineated and then promoted amid many contrasting and competing versions of healthcare priorities (Table 1).

Improved CV management for seniors must start with the capacity for comprehensive assessment of each individual's health as well as a multifaceted health context, with therapy then personalized to each patient's situation. Tools to gauge overall health and to link composite health profiles to customized and achievable therapeutic goals are needed. Patients must be engaged in the selection of the management choices bearing on their health, but the medical system (and cardiologists in particular) must achieve processes, organization, and standards that insure that seniors receive lucid, relevant information in a straightforward comprehensible manner.

Although longevity may remain the dominant priority for some older adults, the prospect of excessive pain, hardship (including perceived burden on loved ones), limitation of independence, and/or recurrent hospitalizations may limit appeal of life-prolonging therapies, particularly amidst chronic disease and progressive debilitation. Just as cardiology has cultivated vast insight and expertise oriented to extending longevity, it now is crucial to refine health goals oriented to a

Table 1

New Paradigm of Care

1. Emphasize patient-centered approach to care
   - Develop tools to assess cardiovascular risk in the context of aggregate age-related risk
     - Develop tools to determine realistic goals in the context of each patient's overall health circumstances
       - Incorporate noncardiac comorbidity, functional capacity, and quality-of-life factors into risk-benefit assessment of care options
     - Incorporate patient preferences into care plan
       - Assessment of end-of-life preferences, including development of advance directives, designation of durable power of attorney for health care, and (if appropriate) discussion of palliative care options
   - Assess utility of diagnostic testing relative to overall treatment goals

2. Screen for coexisting geriatric syndromes and comorbidity (e.g., cognitive function, disability, and frailty in patients ≥75 years of age)
   - Incorporate standardized geriatric tools (e.g., gait speed, "get up and go" test, Mini-Mental State Examination, and so on)
   - Screen for depression and/or anxiety
   - Screen for caregiver stress, home support

3. Purposefully manage pharmacological regimen
   - Adapt dosing regimen and targets of therapy emphasizing tolerability and affordability
     - Use weight- and renal-adjusted dosing (if appropriate)
     - Focus on potential drug–drug and drug–disease interactions
     - Assess relative risk and benefit of additional medications
     - Utilize services of a geriatric pharmacist (if available)
   - Increase vigilance for drug side effects/intolerance
     - Enlist assistance of care providers
     - Reconcile medication during all care encounters (particularly following care transitions)
       - Simplify medication regimen if possible ("unprescribe")
         - ✓ Ensure provision of tools (e.g., pillboxes, written instructions)

4. Emphasize the importance of transitions of care
   - Improve methods of communications among caregivers and with patients; plan for collaborative follow-up and assessment to prevent gaps or overlaps in care delivery
     - Use nurse clinicians or pharmacists to provide added support
     - Provide clear contact information for all patients when questions arise.
     - Ensure transparency in care across providers through more effective utilization of electronic medical records and traditional methods of correspondence
     - Create a central repository listing all medications, doses, and frequencies
   - Provide patient education designed to promote self-care behaviors and foster adherence to medications, diet, activity recommendations, and other health-promoting behaviors
   - Make greater utilization of rehabilitation services, including facility- and home-based programs, as well as greater utilization of home health services, including home monitoring

spectrum of alternate endpoints, that is, quality of life, functional capacity, reduced hospitalizations, and independence. The evidence-based foundation of CV medicine must expand to achieve insights and rationales that support and guide these nonmortality objectives.

Although in some cases, clarification of therapeutic objectives may be as simple as direct patient inquiry, this process will often be confounded by affect, cognitive decline, social pressures, and/or family dynamics, especially in situations involving advance directives or healthcare proxies. Furthermore, given that aging is dynamic, therapeutic goals may fluctuate relative to advancing age and circumstances. Interviewing techniques and assessment strategies must be efficient, sensitive, and reliable for recurrent assessments for a wide range of personalities and settings.

Risk stratification is a related dimension of assessment that is particularly important in assessing eligibility of older adults for CV procedures (38–40). The goal is not to restrict treatment, but to better select patients for therapy who are most likely to benefit. The decision to undertake revascularization should be based, not solely on results of imaging procedures and anatomical criteria, but on aggregate patient circumstances. Coronary anatomy is relevant, but so too are comorbid features (e.g., renal, pulmonary) that impact procedural success and complications. Likewise, even technically successful revascularizations may culminate suboptimally if cognitive, comorbid, and social limitations were not recognized and addressed prior to undertaking the procedure. Beyond conventional parameters of coronary anatomy and comorbidities, seminal work by Fried et al. (41) highlights that many aspects of frailty also impact CV outcomes; for example, unintentional weight loss, weakness, self-reported exhaustion, slowness of gait speed, low activity, and poor grip strength are important considerations. Assessments once seen as "soft" or subjective (e.g., fatigue, weakness, gait speed) are now increasingly acknowledged as providing important prognostic information. Such innovative assessments have been reinforced by tools to increase their reliably and objectivity (42–45), which are important refinements to refute those who still see them as soft and inconsequential. Cognition (delirium risk) (46), social support, and mood (depression) (47) must be considered in assessing risk. Concomitant pharmacotherapy should also be taken into consideration; for example, chronic need for warfarin increases bleeding risk following percutaneous coronary intervention, and may affect the choice of antiplatelet therapy or the type of stent to deploy (i.e., bare-metal vs. drug-eluting stent) (48).

For patients prioritizing quality of life, function, independence, and other clinical goals over longevity benefits, therapeutic strategies must shift. Although digoxin did not reduce mortality in the DIG (Digitalis Investigation Group) trial, more important may be its benefit in reducing heart failure symptoms and related hospitalizations in older patients (49). Although milrinone for systolic HF may be associated with increased mortality risk, its potential to increase function and quality of life may seem worth that risk to an elderly patient (50). Even therapeutic bastions like beta-blockers may seem less useful for frail heart failure patients whose vulnerability to chronotropic incompetence (and potential need for a pacemaker with associated procedural risks and other adverse outcomes) and functional decrement may outweigh their life-prolonging benefits.

Similarly, rationale for stents, devices, and surgery must be reconsidered in terms of their value with respect to the personalized clinical goals of each patient. Whereas the utility of revascularization to increase life expectancy may seem nebulous, its value may seem relatively clear cut if improved function, quality of life, and independence are the primary therapeutic objectives (51). Treatment pathways can be delineated in ways that help patients, families, and allied caregivers understand which older patients are most likely to benefit. Likewise, procedures can be refined and standardized to better facilitate these goals (e.g., type of stent, hybrid procedures, and/or adjunctive therapy). The onus is on cardiologists to achieve technological and methodological advances to best assure excellent outcomes for seniors, and to disseminate these refinements as priorities. Bivalirudin and fondaparinux may, for example, be better antithrombin agents for older adults undergoing percutaneous coronary intervention (52–54). Sheath sizes, antiplatelet therapy, and other clinical processes may be better tailored to specific patient criteria. Similar approaches to minimize age-related renal toxicity, delirium, and other morbidity are all mandated.

Fundamental strategies of therapy may also change to better manage the risks and limitations associated with age, and to achieve outcomes that are particularly valued. The recent report of success with transcutaneous aortic valve implantation (TAVI) in patients ineligible for traditional valve surgery provides an excellent example of how technological advances may better facilitate successful patient-oriented outcomes (e.g., improved independence and quality of life) for patients who would be unlikely to benefit from traditional therapeutic strategies (55).

Improving Communications and Transitions for Older CVD Patients

Improved communications are vital to all dimensions of care. Many older adults have natural barriers to optimal communication due in part to diminished cognitive and memory capacities, auditory and visual impairments, and

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limited social support, as well as the complexity of their medical issues (i.e., it is simply hard for many to understand the concepts). Communications are critical for patients to grasp complex concepts of aggregate health risk and be able to make personalized healthcare choices. Given these typical obstacles, language and learning tools can be refined and standardized to be more effective. Not only can doctors, nurses, and other staff be better trained to communicate with older patients by adapting to individual patient's health literacy, education level, cognitive function, and culture, but hearing, vision, and learning props can be integrated at key junctures of care. Well-coordinated information can also be provided to families, spouses, and others involved with a patient's care, being careful not to undermine the patient's autonomy and right to make choices, but rather to insure consistency, clarity, and a shared sense of information. Equally important, information should be readily available to all caregivers involved in each patient's care (i.e., primary care physicians, hospitalists, other specialists, nurses, physical therapists, and nutritionists) with the goals of consistency in information exchange and minimizing iatrogenesis. A related priority is that cardiologists communicate effectively with their medical colleagues. Optimal CV care demands a team approach to address the complexities of older patients. CV management must be coordinated within the caregiving team; unambiguous and timely information flow and documentation are essential (56).

Communications also relate to the ability of CV specialists to hear senior patients (i.e., not only as part of the process to determine personalized therapeutic goals, but as a means to gauge the efficacy of therapy). Especially given that many nonmortality endpoints rely on qualitative parameters, listening and hearing are elemental components to assess caregiving quality and effectiveness (57).

Cardiac rehabilitation can be better utilized to reduce morbidity and mortality, improve quality of life, increase functional capacity, reduce readmissions, and reduce healthcare costs for elderly patients (58). Cardiac rehabilitation specifically responds to challenges experienced by most older CVD patients, that is, multimorbidities and complex medication regimens. Unfortunately, access remains a substantial impediment, and there has been little in the current healthcare financial environment to ease this problem. Although many older patients are not referred because they are deemed too frail, these patients often achieve the greatest benefit.

Improved transitions of care have also been demonstrated to confer significant value for seniors (59–61). Certainly, cardiac rehabilitation can help in the transition of cardiac patients to home, but transitions also pertain to those entering the hospital, transferring between hospital units, or returning to home after rehabilitation. Transitions are often particularly detrimental among those with multimorbidities and frailty, especially those with cognitive and sensory (vision/hearing) limitations. Steps that reinforce communications, consistency in medications, diminished confusion and agitation, and timely follow-up will best ensure successful outcomes, as well as help relieve stress, improve quality of life, and increase long-term adherence.

Financial Emancipation From the Current Paradigm of Health Care

Although a comprehensive discussion of the implications of aging on healthcare finances is beyond the scope of this manuscript, reimbursement for healthcare services must become better aligned with, and more mindful of, age-related dynamics. Current reimbursement strategies provide incentive for performance of high-tech diagnostic and therapeutic procedures and disincentive for physicians to spend extra time discussing management options and patient preferences with older patients Furthermore, low-tech therapies, such as patient education, smoking cessation, and cardiac rehabilitation are poorly compensated or not compensated at all, despite their proven benefit in reducing CVD risk and/or improving outcomes. The fact that cardiac rehabilitation enrollment falls to <12% of eligible elderly CVD patients is a glaring example (58,62) of an underutilized low-tech therapy that has been clearly associated with both life-enhancing and life-prolonging benefits. Although an abundant literature speaks to typical barriers, including limited physical access (many cannot drive), spousal responsibilities (particularly women who cannot participate due to caregiving obligations for their husbands), and finances (even the co-pay is prohibitive to many) (59), there has been little effort to overcome these obstacles as an integral component of healthcare reform legislation. Other low-tech options that merit greater application include community and home-care exercise programs, transportation services, spousal care services, and homecare providers (to help older patients organize medications, shopping and cooking, and physician appointments and bills). Although additional study is needed, all of these services would likely be greatly valued by many elderly CVD patients, thereby improving quality of life. There is also significant potential for these services to improve clinical outcomes, including hospitalization rates, and lower overall costs of care.

Including Family in the Spectrum of Care

In general, goals to improve CV care for seniors pertain not only to the older patient, but to the family caregivers whose lives are commonly consumed with and/or mired in the patient's health issues. Cardiology has rarely addressed the

extensive caregiver burdens that result from complex CV medication regimens, CV-related functional impairments and dependencies, procedures, and other aspects of CV care, despite awareness that associated morbidity and mortality risks for caregivers are significant (63). Steps to personalize therapeutic goals, enhance communications, and improve transitions will benefit not only patients, but family caregivers as well.

End-of-Life Planning in the Spectrum of Care

End-of-life issues should also be better incorporated into routine management. Open discussion about mortality can help ease feelings of isolation, depression, and even self-blame for treatment failure among patients nearing the end of life (64). Accepting the inevitability of death as part of the normal human life trajectory, rather than as an enemy to be avoided at all times, can help refocus management choices away from options that may no longer be useful or relevant. A recent study highlights that implantable cardioverter-defibrillators are rarely deactivated for hospice patients, with many futile and painful shocks in the last months of life (55). Thresholds for therapeutic curtailment for devices as well as medications should be established a priori and implemented when appropriate, without drama, guilt, or delay. Often this requires that physicians and allied caregivers teach patients and families about reasonable expectations. This requires insight, nuance, language, and end-of-life sophistication to help patients make well-informed decisions.

Personalized approaches to care may also help contain costs. Many have decried disproportionate soaring CV healthcare expenditures during the last weeks of life (65,66). More widespread use and implementation of advance directives, including honoring patients' expressed wishes, will facilitate appropriate curtailment of aggressive care, including hospitalization, in patients approaching the end of life. Additionally, alternative approaches to care, such as home hospital and hospice, should become increasingly accepted by the medical community and supported by payers as being valid and cost-effective methods for providing medical care in appropriately selected patients.

Integrating Geriatrics Into CV Care

Although cardiologists have a long tradition of providing outstanding care for CV disorders, cardiology has not prioritized tools and techniques to manage CVD as part of a multisystem approach to care. Cardiologists could learn from geriatricians, that is, clinicians specifically trained to assess different systems in juxtaposition to one another, and to design management plans that extend across different dimensions of health. Geriatricians also have better tools to modify care relative to cumulative aging changes, mounting disabilities, and to consider quality of death as part of standard care. In other words, geriatricians provide a useful language and process that can be used to augment quality and capacity of cardiac specialists to meet the needs of their older patients (67).

The American College of Cardiology recently launched a new Council on Cardiovascular Care for Older Adults. Almost simultaneously, the American Heart Association established a new committee on Cardiovascular Disease in Older Populations. These steps reflect awareness of the need to address the aging issue programmatically. Both groups are in their infancy, but provide opportunity to advance the issues addressed in this document and to facilitate integration of geriatric cardiology into mainstream CV care.

Research and Education

Research is essential to determine optimal strategies to care for older patients with CVD. It is critical that clinical datasets include comorbidity, polypharmacy, and frailty in order to better define the impact of these factors on prognosis and response to therapy. Outcomes must also be broad, and inclusive of function, quality of life, and iatrogenesis, since these dynamics are integral to the assessment of therapeutic efficacy.

Today's expanding arena of clinical datasets at the American College of Cardiology and throughout the world provide abundant opportunity to assess the efficacy of diagnosis and risk stratification, to assess the impact of specific treatments on relevant clinical outcomes (e.g., quality of life and health status), and to help refine overall clinical decision making to optimize older patients' care and outcomes. However, inclusion of functional and health status indexes into large registries and trial databases often remains encumbered by concerns regarding additional costs (who should pay for exercise assessments?), lack of standardization (how can qualitative measures be as objective as a mortality endpoint?), and high variance (particularly in regard to functional measures such as a 6-min walk). Yet, in the face of the prominent upsurge in the geriatric demographic, these methodological challenges must be resolved (68,69); steps to integrate functional (70) and qualitative measures as standards are essential research goals.

Research can also address the complex relationship between aging and disease such that CVD in the elderly may be prevented by constitutive steps that modulate mechanisms of aging that predispose to disease. It is fascinating, for example, that caloric restriction may better allay age-related alterations in left ventricular diastolic filling parameters than pharmacological modalities (71). Modification of

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oxidative stress and/or telomere shortening by caloric restriction or other novel therapies outside the current therapeutic paradigm may prove to be more effective than conventional medications for moderating morbidity in older CV patients (72).

The aging theme can also be trivialized by studies that do not focus on the real complexities of age. Whereas many studies claim merit simply on the basis of studying subsets of older patients, the challenge is to determine if and how less highly-selected seniors may be distinct and whether there are fundamentally better healthcare choices and processes for senior patients. Research must facilitate the tools, skills, systems, and capacities needed to better deal with the complex older adults who are our real patients.

It is conspicuous that several major CV syndromes that are relatively exclusive to older adults (e.g., isolated systolic hypertension, heart failure with preserved ejection fraction, calcific/degenerative aortic stenosis) (73,74) remain poorly understood and/or treated. Improved understanding of the biology of these disorders should lead to opportunities for new therapies, both pharmacological and biological (75), as well as a greater appreciation for the benefits of lifestyle modifications (76). In a related theme, many CV issues that increase in prevalence with aging often become categorized as primarily CV issues, such that pertinent geriatric dimensions are overlooked. For example, although atrial fibrillation increases markedly with age, it is usually managed as a complex CV issue, typically emphasizing electrophysiological, cardiac, hemodynamic, and vascular parameters. In contrast, age-centric dimensions of atrial fibrillation care, such as polypharmacology, functional capacity, and bleeding risks, are less routinely stressed.

In view of the crucial need for clinical and basic research on CV disease in the older population to address its rapidly escalating impact, it is increasingly important to forge collaborative relationships amongst the key federal institutes, such as the National Institutes of Health, the Food and Drug Administration, Center for Medicare Services, Agency for Healthcare Research and Quality, and others, as well as nonprofit organizations to spawn research that will better inform clinical decision making, policy, and reimbursement issues.

Linked to these broad clinical and research objectives is a need to disseminate principles of geriatric cardiology to CV caregivers and patients so that they are better equipped to work together in developing a care plan most suited to the patient's needs and expectations. Despite an increasingly robust literature focused on geriatric cardiology, it is remarkable that aging has yet to become a top educational priority for CV providers. Ironically, there is no longer a mainstream geriatric cardiology journal in the United States, in part because publishers are skeptical that such a journal can be published profitably; yet, it is critical that geriatric perspectives be infused into management of all forms of CVD prevalent in older adults.

Conclusions

Mainstream cardiology has become, de facto, geriatric cardiology, but it still lacks a systematic approach that incorporates age-related complexities into routine clinical decision making. The cardiology community must grow and adapt standards of evidence-based care to older patients, who now constitute the dominant patient population. Cardiology must embrace a broader paradigm that extends beyond the CV system, synthesizing multisystem aging, comorbidities, polypharmacy, psychosocial factors, and personal preferences into an individualized approach to care. Transitioning to this new paradigm is essential to ensure provision of optimal care for our older patients with CVD, both for clinical outcomes and patient satisfaction. A new generation of clinical trials and high-quality observational studies and registries are essential if we are to refine standards and methods for requisite care. New approaches and skills geared toward the elderly must be refined and inculcated into routine care if cardiologists are to preserve a benchmark of excellence and clinical relevance.

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