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COUNCIL PERSPECTIVES

What to Expect From the Evolving Field of Geriatric Cardiology

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ABSTRACT

The population of older adults is expanding rapidly, and aging predisposes to cardiovascular disease. The principle of patient-centered care must respond to the preponderance of cardiac disease that now occurs in combination with the complexities of old age. Geriatric cardiology melds cardiovascular perspectives with multimorbidity, polypharmacy, frailty, cognitive decline, and other clinical, social, financial, and psychological dimensions of aging. Although some assume that a cardiologist may instinctively cultivate some of these skills over the course of a career, we assert that the volume and complexity of older cardiovascular patients in contemporary practice warrants a more direct approach to achieve suitable training and a more reliable process of care. We present a rationale and vision for geriatric cardiology as a melding of primary cardiovascular and geriatrics skills, thereby infusing cardiology practice with expanded proficiencies in diagnosis, risks, care coordination, communications, end-of-life, and other competences required to best manage older cardiovascular patients. (J Am Coll Cardiol 2015;66:1286–99) © 2015 by the American College of Cardiology Foundation.

"Education is the best provision for the journey to old age."

—Aristotle (1)

Geriatric cardiology is the practice of cardiovascular (CV) medicine that is adapted to the needs of older adults. To some degree, all cardiologists know this, recognize this, and in varying capacities, practice this. It has thus far largely been a self-taught evolution of skills and style, and usually applied as a means to incorporate thoughtful consideration of age, comorbidities, and patients' wishes in relation to current evidence and guidelines, but with the understanding that, in most cases, there

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are no data-driven standards by which to guide care for this vulnerable population. We are compelled, however, to ask, "Is this enough?"

The cardiology community historically embraces advances in technology, changes in demographics, and national demands for quality reform, all of which stimulate changes and growth in the field. With the development and refinement of cardiac transplantation and advanced cardiac device therapy, the subspecialty of Advanced Heart Failure and Transplant Cardiology was created to enhance the delivery of care for patients in this broad domain. With the growing procedural therapeutic options for cardiac arrhythmias, the subspecialty of Clinical Cardiac Electrophysiology was developed by the CV community to standardize the skills and competencies needed to serve this patient subset. Now, in 2015, there is mounting momentum for yet another period of growth and expansion.

The rationale for geriatric cardiology is propelled in large part by shifting demographics combined with an expanding diagnostic and therapeutic armamentarium. The shift, quite likely a result of advancements in medical care and technology for communicable and noncommunicable diseases, primary and secondary prevention, and scientific discoveries related to disease and improvements in sanitation, has led to a situation in which the dominating CV patient group has outlived current data-driven recommendations. Average life expectancy has increased 30 years since 1900 (2); although <3 million U.S. adults were age 65 years and over in 1900, they will comprise 19% of the population by 2030, including 19 million adults over the age of 85 years. The growth of the age 85+ years group is particularly striking; it is projected to double from its current size by 2036 and triple by 2049 (3).

The magnitude of these demographics is dramatic. For a provider with few older patients it may seem sufficient to rely on a self-taught idiosyncratic geriatric cardiology approach when needed. But, as the percentage of older adults, who are inherently vulnerable to coronary heart disease (CHD), heart failure (HF), atrial fibrillation, hypertension, valvular heart disease, pulmonary hypertension, and other cardiovascular disease (CVD) continues to expand across all dimensions of our specialty, it begs the question of whether current practice standards and guidelines are sufficient to accommodate this burgeoning demographic and whether we are using our resources appropriately and efficiently to serve this complex population.

Aging itself creates distinctive dimensions to CVD management, as both absolute risk reduction and the potential for harm from treatment increase with advancing age. As the percentage of older adults grows to represent a larger proportion of practice patients, the time spent contemplating complex management issues without data-driven answers will inevitably increase and further limit already time-constrained schedules (e.g., which 85-year-old patient with atrial fibrillation should be anticoagulated, when is frailty prohibitive of transcatheter aortic valve replacement [TAVR], and when does dementia preclude percutaneous coronary intervention [PCI]?). The effect of these management decisions will have increasingly measureable implications for hospitals and accountable care organizations (ACOs), whose focus on improving quality metrics will expand in this era of cost containment. From a cost perspective, the consequences are significant—despite representing only 13% of the population in 2010, older adults accounted for 34% of the national health expenditure (4). These costs are increasing rapidly as the older population continues to enlarge (5). Compounding these burdens is that older patients have not only considerable clinical needs, but psychological and social needs too. Many anticipate that the aging baby boomers will demand greater health care resources than the archetypes of older adults who preceded them as a result of their increased engagement and assertiveness in a more consumer-driven health care model, adding to complexity and costs (6). To fulfill that need, we see the mandate to integrate principles of geriatrics with those of cardiology, and to formalize geriatric cardiology as a manifestation of "patient-centered" care for older adults who now constitute our dominant patient group. Although the concept is still in evolution and lacks a full armamentarium of precise tools and skillsets to define the field, the practice of geriatric cardiology is developing toward a distinctive subspecialty with specific skills and services to further advance the care of older patients (**Central Illustration**).

ABBREVIATIONS AND ACRONYMS

ACO = accountable care organization

CHD = coronary heart disease

CV = cardiovascular

CVD = cardiovascular disease

HF = heart failure

PCI = percutaneous coronary intervention

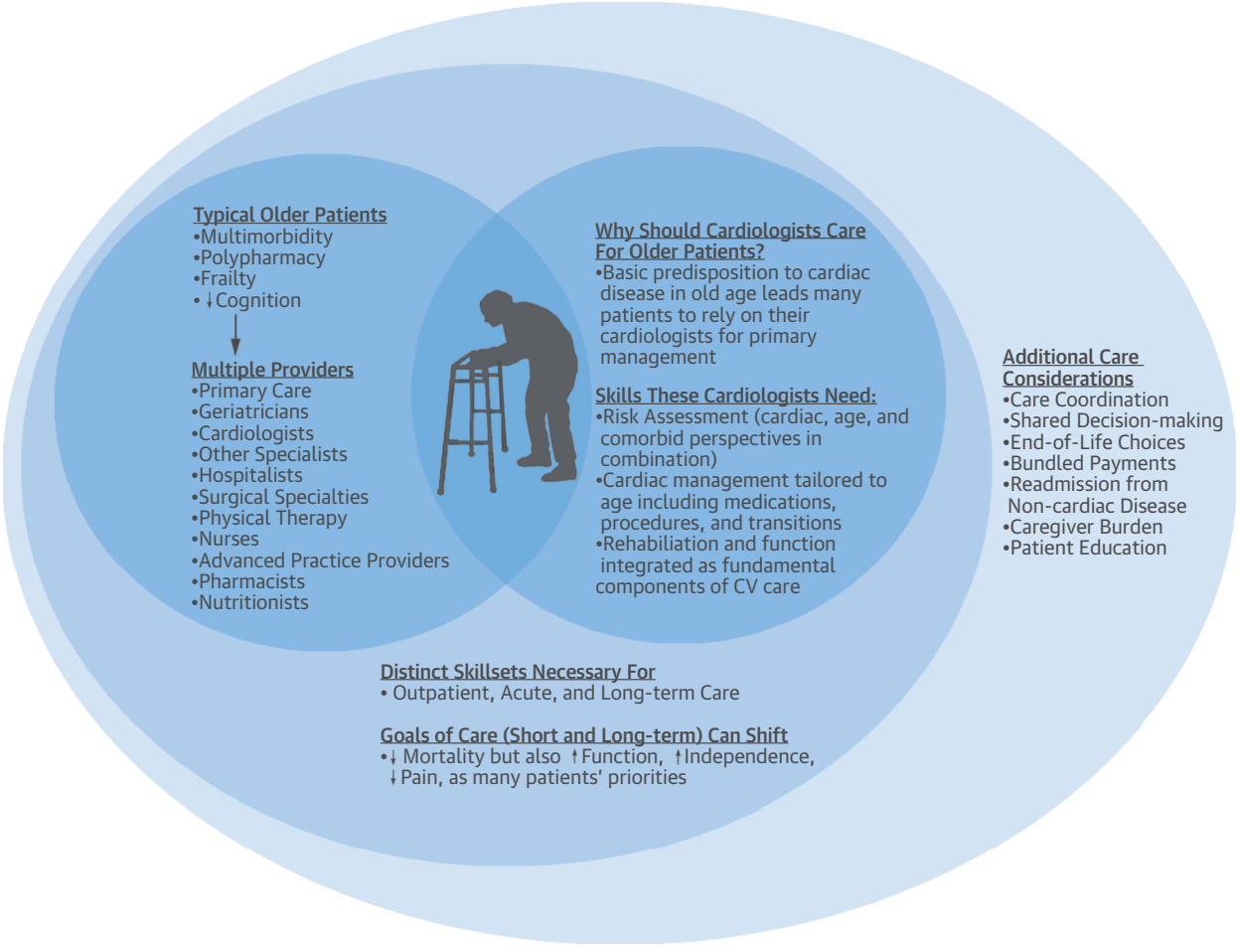
SNF = skilled nursing facility

TAVR = transcatheter aortic valve replacement

CASE STUDY: A GERIATRIC CARDIOLOGY PATIENT

An 81-year-old man presents with shortness of breath, difficulty performing his activities of daily living, and several episodes of substernal chest heaviness at rest. He is accompanied by his daughter. He was diagnosed with CHD many years ago in the setting of worsening angina, and was treated with a drug-eluting stent to a proximal left anterior descending artery stenosis. His medical history is

CENTRAL ILLUSTRATION **Future of Geriatric Cardiology: Proposed Care Model and Skillsets Required by Cardiologists Caring for Geriatric Patients**



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Framework of contributing and resulting factors involved in the assessment and management of the older adult with cardiovascular (CV) disease highlighting the complex interplay among health care providers, patient dynamics, goals of care, systems of care, and the necessary key skills to provide optimum patient-centered care. ↓ = decreased; ↑ = increased.

notable for diet-controlled diabetes mellitus, a 5-cm abdominal aortic aneurysm, Parkinson disease, and mild dementia. Two years ago he was started on fludrocortisone by his primary care physician for frequent falls related to orthostatic hypotension, which improved his symptoms. His medications include aspirin 81 mg daily, carbidopa/levodopa 25 mg/100 mg 4 times daily, selegiline 5 mg daily, pravastatin 20 mg, fludrocortisone 0.15 mg daily, and a multivitamin. His review of systems is significant for recent worsening of his orthostatic symptoms and weight loss. On examination, he is a pleasant, frail-appearing elderly gentleman with body mass index 22.0 kg/m^2, blood pressure (BP) 102/68 mm Hg supine and 79/49 mm Hg standing, and heart rate 63 beats/min supine and 80 beats/min standing. He has 12-cm jugular venous distension and faint expiratory wheezes and bibasilar rales. A frailty assessment reveals weak grip strength, reduced physical activity, and slow gait speed. He scores 23/30 on the Mini Mental State Exam. His primary care physician attempted a trial of loop diuretic therapy for his dyspnea in the setting of volume overload, but he was intolerant due to worsening orthostasis, bothersome nocturia, and 2 recent falls while trying to void in the middle of the night. His daughter is concerned that he

seems more confused than several weeks ago, and thinks the new therapies have worsened the situation without improving his symptoms. At his baseline before presentation he was relatively active, was an avid reader, and enjoyed spending time with his grandchildren.

This case highlights the medical complexity and psychosocial struggles of a typical clinical geriatric cardiology encounter. Although angina and HF symptoms in a middle-aged adult would typically prompt initiation of medical therapy and evaluation for ischemic heart disease, management for this patient requires navigating his personal goals and aspirations as well as his daughter's concerns, interpreting the relationship between the caregiver and patient, and assessing decision-making capacities. In addition, medical management presents a complex tradeoff; treatment of ischemic and HF symptoms is complicated by orthostasis, and thus precludes the use of a typical antianginal regiment (such as beta-blockade, nitrates) or up-titration of loop diuretics. Furthermore, the cardiologist is required to integrate all other contributing and related factors, including medications prescribed by other providers that may contribute to the current symptoms (Parkinson medications), and to determine when to continue evidence-based therapies that may be inappropriate for this frail older adult with a limited life expectancy. The prognosis of the patient in relation to Parkinson disease, frailty, and cognitive impairment is paramount when considering revascularization versus medical therapy for this otherwise engaged and functional older adult. If invasive therapy is considered, procedural complications specific to the geriatric population (e.g., delirium), as well as higher general rates of post-procedural renal failure, infection, and bleeding have to be explained to the patient and caregiver. Furthermore, in the face of multiple coexisting conditions, decision making must be predicated on achieving patient-centered outcomes such as overall function, symptom relief, and survival rather than typical disease-specific outcomes.

Whereas CV guidelines and standards of care are oriented toward younger adults, most clinicians devise individual strategies to optimize care for their older patients. Indeed, many cardiologists are adept at integrating patient-centered priorities with existing medical science. Nonetheless, the principles of geriatric medicine combined with management and process for older CV patients are not standardized, and core quality metrics for measuring patient-centered outcomes are not sufficiently delineated to teach, implement, or monitor. In a complex system of medical care that involves multiple providers, disparate clinical goals, and often difficult transitions of care, the lack of a formalized process to address the aging ramifications of CVD results in enormous variability of care, with high risks accruing amidst multimorbidity, polypharmacy, cognitive changes, body composition changes, and other aspects of aging. Gaps are especially prominent in trainees who inevitably encounter complex older patients, but who lack the experience and resources for optimizing patient-centered care. As such, the potential for patient and provider dissatisfaction is increasing.

In the case of our patient, the choice to offer invasive versus medical therapy is not clearly informed by clinical trial data. A care plan is developed after navigating through factors that may modulate the effect on almost every therapeutic consideration: for example, the therapy itself (risk-benefit, quality of life, polypharmacy, multimorbidity), the process (method, type, and intensity), and the patient's intrinsic resilience to benefit from any therapy administered (i.e., the ability for a very elderly individual with cognitive impairment to withstand the hospital stay, sedation, and anticoagulation associated with PCI, without experiencing a significant adverse event). Fundamental to decision making are the questions, "When should the primary focus shift to treating symptoms, rather than preventing disease and progression, and at what age should we shift focus away from prevention because the benefits are no longer likely to result within the remaining years of life?"

Management may be best shaped by an evolving perspective of CV care that redirects focus from treatment of symptoms in relation to a primary CV disease, to management oriented to multiple chronic illnesses. Geriatric cardiology epitomizes the principle that CVD is only 1 component of a larger, multidimensional disease state with concomitant geriatric syndromes. Selection of assessments and therapies is best accomplished in the context of the aggregate circumstances.

THE CONCEPT OF GERIATRIC CARDIOLOGY RESPONDS TO THE COMPLEXITY AND DISTINCTIVE NEEDS OF A GERIATRIC PATIENT

The construct of a new discipline begins with defining its purpose. The broad aim of clinical practice dedicated to geriatric cardiology is to better match the provision of CV care to the cumulative conditions, complexities, and preferences of geriatric patients (7). Although cardiologists, like most physicians, aim to provide "patient-centered care" (6), the potential

for therapeutic misalignment is high in a medical specialty where procedures and interventions constitute a significant component of management. Technological advances for older adults, already an area of considerable research and economic investment, will only continue to broaden these therapeutic options.

Aging has a transformative bearing on CVD such that standards applied to younger adults become relatively less reliably aligned with the preferences of geriatric patients (8), as older adults often have reduced capacity to tolerate and even desire medications, devices, and procedures, despite proven benefits in younger populations, and have an increasing number of coexisting conditions that affect health-related quality of life and survival. Even more fundamental, the typical orientation of therapeutics to a single disease, premising benefits focused mainly on morbidity and mortality, is often far afield from the experiences and concerns of older adult CV patients. Most CV diseases in old age tend to occur within CV syndromes, and the effect of multiple diseases transforms illness and management. CV diseases (e.g., CHD, HF, hypertension, and atrial fibrillation) and non-CV diseases (e.g., chronic obstructive pulmonary disease, arthritis, dementia, and gastrointestinal bleeding) tend to occur concurrently, leading to complexities that entail biological (inflammation, cell signaling, mitochondrial changes), multimorbid (polypharmacy, contradicting management priorities), and social (patient values, religion, family dynamics, as well as the logistical and communication barriers related to multiple doctors, nurses, and systems of care) complexities to management. Whereas most clinical recommendations remain premised on standards oriented to morbidity and mortality, geriatric patients' concerns may change to include or even to prioritize qualitative and/or functional objectives. Thus, so-called "evidence-based" rationales by which quality of care metrics are usually determined, and the formative trials on which the standards are based, have largely omitted dimensions of multimorbidity, polypharmacy, symptomatic status, frailty, avoidance of dependency and maintenance of independence, individual patient outcome goals, and/or other issues integral to many geriatric patients' realities (9). Our focus as cardiologists on "disease-specific outcomes" has to be shifted in the geriatric population to a more intense focus on quality of life by improving functionality and reducing daily symptoms, and any trials of therapies in this population should be designed to ascertain these outcomes. Furthermore, as the burden of chronic conditions increases, patients report that the escalating number and complexity of interventions needed to treat each condition becomes as burdensome as the conditions themselves (10,11).

Even in the setting of a single CV disease, the management of the geriatric patient is encumbered by the lack of clinical trial data. Contemporary clinical practice guidelines have mostly relied on ambiguous statements in relation to aging. For example, the 2013 American College of Cardiology/American Heart Association cholesterol guideline (12) states that "additional factors" should be considered when prescribing statins for primary prevention of atherosclerotic cardiovascular disease in patients age >75 years. This reference to "additional factors" implies comorbidities, medication safety profiles, drug-drug interactions, drug-disease interactions, polypharmacy concerns, patient preferences, and other factors, that is, a constellation of complex issues beyond the scope of typical cardiologists and allied providers.

Geriatric cardiology also entails a revised notion of risk assessment, that is, away from the traditional approach of assessing risk in the context of a single disease presentation (i.e., HF with cachexia) and toward a more holistic approach. Cachexia may be a synthesis of advanced HF in combination with frailty and weight loss, poor caregiver support, diminished access to food, occult malignancy, dental or oral issues, altered taste sensitivity and thresholds, and depression. In contradistinction to current models of risk assessment, assessment for the geriatric patient requires consideration of multimorbidity (13), frailty, sarcopenia, cognitive impairment, and social limitations and stressors. Adding to a clinician's challenge, the cumulative effects of aging are not easily quantified. A mounting number of years is a relatively crude index of the aggregate effects of biological, social, economic, and other dimensions of aging. The relative presentation and prognosis of an 85-year-old patient may be entirely different from another with substantially different management implications, with the understanding that there are no standard integrative metrics to guide personalized therapeutic choices. Rather, the skill to incorporate physiological age with biological age is a vital area of expertise within a formalized geriatric cardiology arena.

GERIATRIC CARDIOLOGY AS A TEACHABLE DISCIPLINE

The need for a framework in which to support and formally instruct the principles of geriatric CV care is also a critical rationale for the new discipline of geriatric cardiology. A formalized geriatric cardiology

skillset would help providers who must immediately have the ability to facilitate effective care for older adults, rather than awaiting years of practice experience to develop practical gestalt. Requisite skills for geriatric cardiology are not intuitive, just as surgical techniques are not intuitive to surgeons and require specific training. Geriatric principles must be delineated and then integrated as a practice standard as key elements of patient-centered care. Likewise, because data are now more readily available through patient-to-provider information streams, data-driven feedback mechanisms can be developed to rapidly refine geriatric assessments, diagnoses, risk stratification, and management choices in patients with geriatric complexities. Geriatric cardiology could be organized to synthesize and incorporate patient feedback mechanisms as components of adaptable, dynamic approaches to older patients.

Although the interest in and compelling need for geriatric cardiology is growing, the specialty of geriatrics has not experienced a similar progression; in fact, the number of individuals taking board certification examinations in geriatric medicine has declined. The enthusiasm for geriatric training in the early years of the practice (14) has never been fully appreciated, as indicated by the fact that only 56% of 455 national fellowship program positions at 145 certified programs were filled in 2014 (15). This compares to 99% enrollment in 824 available CV fellowship positions. There are currently only approximately 7,500 board-certified geriatricians in the United States, despite estimates suggesting that over 30,000 are needed. We are cautiously optimistic but cannot be sure that this pattern will change as shifting demographics create a greater demand for geriatricians. The development of a geriatric subspecialty within the competitive and sought after field of cardiology has the potential to help fill this critical clinical gap and to allow provision of specialty care to the growing senior population if and when specific training tools and programs are developed and supported to establish the field. All CV trainees would benefit from a core knowledge base and skillset (akin to the Core Cardiovascular Training Statement level 1). Opportunities for advanced training and practice are also appropriate both for the treatment of complex patients (e.g., our case study) and programmatic advancement (e.g., refining systemized care for TAVR patients, akin to Core Cardiovascular Training Statement levels 2 to 3) (**Table 1**).

Numerous position papers, conferences, and teaching tools (7,16) have cited the importance of incorporating geriatric principles into the practice of cardiology, but the emphasis has been primarily on "making the case," and they have not provided guidance on how to implement the practice (17). The critical factor: the overall care of the elderly involves skills, knowledge, and attitudes that are not a component of CV training and have to be developed, refined, and cultivated. There are currently few well-demarcated pathways that facilitate dual pathway training in geriatrics and cardiology. Some individuals have completed separate formal training in geriatric and CV medicine, but there has been little programmatic synthesis of the 2 disciplines and/or mechanisms to make this hybrid orientation more popular and accessible. Vanderbilt University stands out with the first clinical fellowship in CV and geriatric medicine supported by the American Board of Internal Medicine, but this has not yet become a

TABLE 1 Summary of COCATS Training Requirements for Geriatric Cardiology

Level I Basic training required of all fellows during a standard 3-year fellowship	• In-depth knowledge of age-related changes in the CV system • Basic knowledge of geriatric assessment skills utilized during clinical assessment • Basic knowledge and experience of applying patient-centered care to the management of older adults
Level II Additional training acquired by a subset of trainees during a standard 3-year fellowship to perform and interpret specific assessments and render specialized care for complex older cardiovascular patients	• Knowledge and understanding of limitations of standard practice guidelines as related to older adults including diagnostics, pharmacotherapy, and interventional therapies • Performance and interpretation of basic geriatric assessment tools utilized for cognition, delirium, and functional status • Advanced knowledge and understanding of managing CVD in the context of multimorbidity including understanding of disease-disease interactions
Level III Additional training and expertise acquired beyond the standard 3-year fellowship program to include training and experience within the field of geriatric medicine and palliative care	• Independent comprehensive knowledge of geriatric cardiovascular assessment and interpretation prior to major interventions (performs range of cognitive, frailty, functional, and social assessments) • Independent identification and management of geriatric impairments and syndromes central to overall holistic approach to care • Comprehensive knowledge and experience discussing and initiating end-of-life care with some basic experience in palliative driven therapies

COCATS = Core Cardiovascular Training Statement; CV = cardiovascular; CVD = cardiovascular disease.

repeated programmatic initiative. In contrast to other integrated training models that have emerged to meet the needs and interests of the medical community (e.g., Med/Derm [combined medicine and dermatology training] or Peds/ER [combined general pediatric medicine and emergency care]) and that foster a new breed of integrative clinicians, the concept of a combined geriatrics/cardiology training program remains exceptional and preliminary.

GERIATRIC CARDIOLOGY IN CLINICAL PRACTICE

A comprehensive vision for the practice of geriatric cardiology remains nascent. Central to the concept are unifying goals of improving and advancing care to the older adult with CVD and tailoring this practice to the needs of the patient within larger health care institutions. From a practical perspective, every cardiologist will benefit from some added training on geriatric complexities of care to foster elemental skills and sensitivities of care. In addition, a cardiologist with more advanced geriatric cardiology skills can consult with other cardiologists or with internists, emergency room physicians, geriatricians, surgeons, or hospitalists on issues specific to the complexity of aging as it affects CVD management. Examples of services that are currently provided by pioneering "geriatric cardiologists" include: 1) performing comprehensive geriatric assessments (grip strength, gait speed, cognition, physical function, fall history, orthostatic vital signs); 2) identifying geriatric impairments that influence management/outcomes; 3) providing risk-stratification for major interventions (e.g., TAVR); 4) addressing polypharmacy, particularly as it pertains to the complex regimen for CV syndromes; and 5) incorporating patient perspectives and goals (e.g., difficult procedures as well as end-of-life, palliative care) in the management of advanced CV disease.

In some instances, geriatric cardiologists provide key enhancements to established clinical teams, for example, as members of TAVR teams, atrial fibrillation teams, or HF teams and/or as consultants to other cardiologists for cases with complex geriatric issues. In some institutions, geriatric cardiologists may perform as an independent service line or department, providing consultation directly to primary care providers, surgeons, or the emergency department.

ELEMENTS OF GERIATRIC CARDIOLOGY

The specific competencies of geriatric cardiology have yet to be officially defined and endorsed by the American Board of Internal Medicine or by a CV society, but the formalization of geriatric cardiology provides an opportunity to delineate specific proficiencies that fill critical gaps of care. Improved skills in diagnosis, risk assessment, disease management, and process of care are vital competencies that respond to unmet needs in older CV patients. Similarly, expertise is needed to more consistently guide care for older CV patients who are struggling to live independently amidst mounting health and physical constraints, and to achieve high quality and patient-centered standards of care for older patients in long-term facilities. Geriatric cardiology also entails skills to facilitate rehabilitation opportunities; enhance communications with older patients, patients' families, and other providers; and mitigate caregiver burdens (Table 2).

DIAGNOSIS. Diagnostic assessment for older adults with CVD is inherently complex. Prototypical CV symptoms of pain, dyspnea, dizziness, exercise intolerance, and other complaints are less specific in the context of age-related systemic physiological attritions. Consequently, CVD is commonly overlooked in the differential diagnosis and is underestimated even if considered. Treatment delays are notorious, and even when implemented, the utility of therapy often remains uncertain, leading to common scenarios of unmethodical debate and further delays (18). Paradoxically, in other circumstances CVD can be overdiagnosed and overtreated among older adults. The increasing reliance on imaging (e.g., perfusion imaging or computed tomography scanning for CHD) or serological (e.g., brain natriuretic peptide for HF) (19) assessments can lead to CVD diagnoses that have more to do with age-related vasculature and physiological changes than disease, but that trigger treatments with the potential to generate greater risk than benefit amidst multimorbidity, polypharmacy, frailty, falls, and other complexities of care. Diagnoses of hypertension, obesity, or cachexia are also indexes that have complex implications in relation to age. Vascular stiffening may, for example, determine systolic BP, but BP measurements fail to quantify the more clinically relevant parameter of end-organ perfusion, and thus, BP management may inadvertently confound optimal management decisions. Likewise, common presenting symptoms such as dyspnea, for example, are affected by aging via a multitude of mechanisms and are often more complex than volume overload, angina, or parenchymal lung disease. Compounding this difficulty is the complexity of assessing volume status amidst venous insufficiency, decreased skin turgor, and oral mucosa that can be drier due to mouth breathing or

TABLE 2 Key Roles for Geriatric Cardiology

Diagnosis	• Assessing symptoms amidst multimorbid conditions and multiple causes • Interpretation of diagnostic testing in context of age • Diagnosing cardiac disease in relation to geriatric syndromes (falls, dizziness, syncope, weakness)
Risk assessment	• Comprehensive assessment prior to TAVR, LVAD, heart transplant, and cardiac surgery • Comprehensive cardiac risk assessment prior to noncardiac surgery • Immediate and short-term risk assessment and prognosis in the very elderly
Disease management	• Reduction of polypharmacy and adverse drug side effects to align with patient preferences and improve compliance • Symptom and disease management in alignment with patient goals of care • Management of disease processes intimately linked to CVD (frailty, cognitive impairment, disability)
Processes of care	• Coordination and implementation of specific processes of care to improve transitions (readmission reduction programs, bundle payments) • Providing continuity of cardiovascular care across care settings (geriatric clinic without walls)
Physical activity and rehabilitation	• Implementation of streamlined pathways to facilitate cardiac rehabilitation • Coordination and access to advice for cardiac rehabilitation staff
Skilled nursing facilities and long-term care	• Implementation of care pathways for common cardiac diseases (heart failure) • On site "clinics" and advice for care teams • Prevention of hospital admissions
Communications	• Goals of care discussions • End-of-life care discussions
Caregiver burden and support	• Coordinating multidisciplinary CVD team to allow streamlined access to support services • Recognition of caregiver burden and crises

CVD = cardiovascular disease; LVAD = left ventricular assist device; TAVR = transcatheter aortic valve replacement.

medication side effects. Incorporating the pathophysiology of aging and its effect on pulmonary and vascular organ systems in differential diagnosis, as well as teaching awareness of the peculiarities of volume assessment in older adults, are examples of components of geriatric cardiology expertise and practice.

Factors such as multimorbidity, frailty, polypharmacy, cognitive impairment, functional status, transitional care, and goals of care (**Table 3**) can also affect presenting symptoms and management decisions. For example, in the setting of HF among older adults, the burden of multimorbidity is extremely high, with over 50% of individuals having 5 or more coexisting chronic conditions, including a high prevalence of both frailty and cognitive impairment, which can affect their prognosis. This often results in numerous primary and shared causes for a presenting symptom and a more advanced stage when disease is finally diagnosed. For example, the diagnosis of a discrete condition such as HF in an older adult with dyspnea is complicated by the coexistence of other conditions such as chronic pulmonary disease. Indeed, there is growing agreement that a broader cardiopulmonary syndrome may better describe the clinical entity experienced by many older adults than separate discrete conditions such as HF and chronic pulmonary disease (20). The practice of geriatric cardiology also entails skills to gauge multimorbidity as well as complementary skills to assess and integrate frailty (21,22), cognition (23,24), polypharmacy (25), and even patients' goals of care (26). The potential for teachable and distinct tool sets are still being refined, but even current data suggest the value of these domains on risk assessment and management, as well as their ironic underutilization (27).

RISK ASSESSMENT. In comparison with younger individuals, risk assessment also entails a broader range of factors that affect outcomes. Traditional disease factors (e.g., tobacco use, diabetes, and BP) become coupled with aging-related risks (e.g., falls, confusion, caregiver support, and polypharmacy). Although greater morbidity and mortality risks of CVD usually imply greater absolute risk lowering benefits of therapy, there is also the potential for complications. Iatrogenesis, hospital-associated delirium, and lengths of hospital stay are increased. Developing expertise to better assess and integrate these factors into risk assessment begins with first understanding the pathobiology and effect of aging as well as multimorbidity. This understanding comes from a command of the current published data, as well as deliberation of these factors routinely in clinical practice. Two other issues that complicate risk assessment is that the outcomes valued by older adults such as function, symptom relief, and well-being are not measured with current assessment tools, and the purported absolute risk benefit may not be realized in the face of competing conditions that may determine outcomes more strongly than individuals' CV diseases.

The utility of standardized risk assessments to discriminate which very old adults will benefit or be harmed by a specific management strategy or intervention becomes less reliable (**Table 3**). Presence of

TABLE 3 Key Geriatric Factors That Fundamentally Affect Routine Cardiovascular Care

	Diagnosis	Prognosis	Disease Management	Processes of Care
Multimorbidity *Presence of 2 or more chronic conditions (>70% of older adults)*	• Affects and/or complicates disease presentation • Includes chronic diseases (DM, arthritis, COPD) and geriatric syndromes (falls, incontinence, weight loss)	• Significantly affects short- and long-term disease prognosis • Risk assessment for CVD is complex and inaccurate in context of multimorbidity	• Primary management of CVD may exacerbate comorbid conditions • Chronic coexisting diseases may preclude guideline-directed therapies	• Multiple providers, care settings, transitions of care • Requires integrative skillset in regard to working within the multidisciplinary CVD team and across specialties
Frailty *Loss of physiological reserve and vulnerability to stressors*	• Under-recognized, numerous scales utilized Diagnostic tools: • Fried frailty criteria: hand grip strength, gait speed, physical activity, weight loss, exhaustion • Clinical frailty scale • SPPB	• Associated with increased risk of incident CVD and dementia • Associated with increased risk of adverse outcomes (falls, hospitalization, disability, mortality, procedural complications)	• Potentially modifiable so should be included in management strategies	• Frailty assessment as an integrated process of CVD care
Polypharmacy *Use of 4 or more chronic medications*	• Drug-drug/drug-disease interactions or complication can be attributed to presenting problem	• Associated with adverse events, hospitalizations, mortality	• Compliance and undertreatment can result from financial and logistical barriers • Pharmacodynamics/ pharmacokinetics and drug interactions affect dosing	• Drug reconciliation across transitions including provider and facility transitions • Changing formularies over systems of care
Cognitive impairment *Decline in cognitive abilities to include memory, language, thinking, and judgment*	• Globally under-recognized and underdiagnosed Impaired cognition may affect or delay presentation Diagnostic tools: • MMSE • MiniCOG • MoCA	• Commonly associated with CVD and frailty • Independently associated with significantly higher short- and long-term morbidity and mortality in CVD	• CVD associated with and potential risk factor for worsening cognition • Impaired cognition involves barriers to self-care management and adherence	• Impaired cognition may affect successful transitions of care and communication
Functional status/disability *ADLs for basic self-care independence* *IADLs for independent living*	• Impairment may have direct link to diagnosis (inability to wash and dress due to exertion-precipitated chest pain secondary to IHD) Diagnostic tools: • Katz/Bristol ADL scale • Lawton/Barthel IADL index	• Associated with risk of adverse outcomes, complications, and mortality	• Impaired functional status may affect disease management such as medication administration or daily weighing • Barriers to completing hospital and doctors' visits	• Acute CVD event may precipitate worsening in functional status • CVD management may occur over multiple health care transitions
Goals of care/advanced care planning *Patient preferences, shared decision making, health care proxies, living wills, and utilization of end-of-life care practices*	• Alignment of goals of care with diagnostic testing • Diagnostic certainty vs. symptom management preferences • Quality-of-life diagnostics in setting of end-of-life care	• Inclusive of patient-centered outcomes; independence, functional status.	• Patient-centered shared decision making • Therapeutic alignment with patient goals	• Complication/ difficulties of identifying primary responsible provider • Changing or maintaining goals of care across transitions • Loss of documentation

ADL = activities of daily living; COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; DM = diabetes mellitus; IADL = independent activities of daily living; IHD = ischemic heart disease; MiniCOG = Mini Cognitive Assessment; MMSE = Mini Mental State Examination; MoCA = Montreal Cognitive Assessment; SPPB = Short Physical Performance Battery.

cognitive impairment and frailty in a patient with HF will, for example, significantly increase the risk of hospital admissions, disability, procedural complications, and mortality (28). At the center of this is the understanding that, for a patient who has already reached his or her anticipated life expectancy, the relevance and utility of predicting 10-year mortality may have less priority than predicting future quality of life and the likelihood of maintaining independence. A geriatric cardiologist can help clarify immediate-term (days to weeks) goals versus short-term (within 1 year) goals (i.e., relief of symptoms, consideration of advanced directives, and perhaps exercise therapy for improved quality of life) versus longer-term goals (midterm [between 1 and 5 years] as well as long-term [5 years or longer]) (i.e., disease prevention, such as statin therapy or cancer screening).

DISEASE MANAGEMENT AND CARE COORDINATION. Management of CVD remains fundamentally oriented toward individual diseases, including application

of multiple individual disease-specific guidelines without integration. A key mandate for geriatric cardiology is to guide CV management as a multimorbid disease, considering the effect of the aging process on therapeutic intervention. Even if patients are relatively robust, complications and side effects from commonly prescribed medications must be anticipated and circumnavigated in the geriatric population. Doses suitable for younger adults may lead to unforeseen effects amidst age-related changes in pharmacokinetics, pharmacodynamics (29), volume of distribution (reduction in plasma protein levels, lean body mass, fat, and total body water with age) bioavailability (11), and renal (30) or hepatic clearance, especially in the context of disease. Even when CVD is unambiguous (e.g., acute non–ST-segment elevation myocardial infarction), management can be inherently uncertain as age-related differences in pharmacodynamics and pharmacokinetics intensify the risks of detrimental consequences from basic therapeutic choices. The prevalence of medication-related adverse effects may be affected by increased drug-drug interactions; drug-disease interactions (31), including therapeutic competition, in which treatment of 1 condition worsens a coexisting condition; and drug-host interactions, such as the age-related changing and slowing of reflexes and adrenergic and parasympathetic systems resulting in a lower likelihood of tolerance (25,32). Absolute risk benefit may be high in the absence of competing conditions when using potent therapies as a critical step to mitigate dire disease-related morbidity and mortality (e.g., revascularization and anticoagulation), but risks for iatrogenesis (infection, confusion, and bleeding) as well as therapy-related burden (e.g., transportation, transitions for supplemental care, cost, and pain) also rise disproportionately. Formal training in pharmacology, methods to ensure adherence in the setting of cognitive impairment, adherence techniques, and understanding preferred drugs in relevant dyads and triads of multiple chronic conditions are essential to geriatric cardiology disease management. In addition, the avoidance of therapeutic competition and the minimization of treatment burden are skills that must be mastered.

A central premise of geriatric cardiology disease management is that of team-based care. Treating the geriatric patient requires input from, and integration across, the patients team of physicians, advanced practice nurses and physicians assistants as well as nurses, pharmacists, midlevel providers, nutritionists, speech pathologists, physical and occupational therapists, social workers, and palliative care and hospice consultants. Pharmacists who provide critical help to mitigate drug interactions, advanced practice nurses who not only provide primary cardiovascular care but also help navigate non-CV medical aspects of the patient's presentation, as well as caregivers who are oriented to the psychosocial components of illness are all paramount to the care of the complex and multifaceted geriatric cardiology patient. Although they provide complementary expertise, multiple team members can lead to the fragmentation of care and may contribute to treatment burden. Team care requires designation of a natural "quarterback," such as the geriatric cardiologist, responsible for integrating care across providers and ensuring that care is consistent with patients' outcome goals and care preferences. Although coordinating care has traditionally been under the domain of the primary care provider, decisions regarding medications, devices, procedures, and ongoing monitoring may increasingly require CV expertise; the geriatric cardiologist has the distinctive capacity to enhance insights and effective management.

Another substantial component of care for older adults involves coordinating care across transitions. An older adult recently hospitalized for an acute care event may, for example, experience multiple transitions between services and settings, for example, care transitions between emergency departments, inpatient units, post-acute care settings (skilled nursing facilities, inpatient rehabilitation, home health), and outpatient clinic follow-up. Transitions entail complex multimorbid management issues, multiple systems of care, and high potential for confusion from language and documentation along the way. At each point of transition the older adult is vulnerable to adverse events. A fundamental precept of geriatric cardiology is orientation to and emphasis on all steps of transitional management as essential parts of aggregate care. Communication (as described in the next section) is a key skill needed to ensure safe and effective transitions.

Adherence is especially difficult among older adults. Reasons include poor coordination of recommendations from multiple clinicians and care recommendations that are beyond the capability of caregivers and patients because of impediments such as cognitive impairment, visual and hearing limitations, physical disabilities, and often, limited financial or social resources. Poor adherence also can evolve when recommendations are not commensurate with each patient's idiosyncratic goals and preferences (33). Although multiple tools to improve adherence, including medication lists, electronic reminders, pill organizers and dispensers, and remote monitoring

devices, have been promoted, suboptimal medication management remains entrenched. Undoubtedly, steps to ensure that treatment recommendations are consistent with patients' goals, preferences, and capabilities and minimize treatment burden across all conditions are at least as important as adherence tools in improving adherence.

COMMUNICATIONS AND CAREGIVER SUPPORT. Helping a geriatric patient navigate through the array of therapeutic options in contemporary cardiology practice requires effective communication with patients and their families. Communications are elemental to delineate patient preferences and to align management with these choices. The discussions entail uncertainty, changes in quality of life, death and dying, palliative and hospice care, as well as the nuanced risks and benefits of therapeutic choices. For most clinicians, effective communication is a skillset that must be learned and honed, especially for patients who are often limited by sensory, cognitive, and language limitations (34,35).

Communication skills also relate to the capacity to coordinate among clinicians. Many older cardiac patients receive care by many providers concurrently, frequently in numerous care systems, leading to discrepancies in priorities of care, medications prescribed, and overall medical management. One crucial communication skill is the ability to elicit specific, actionable, and reliable outcome goals and preferences that need to drive decision making in older adults with multiple and complex health conditions. Most cardiologists and physicians in general may not wish to acquire this skill or not have the time to carry out goals elicitation, but they must ensure that a trained and skilled member of the team is available to carry out this fundamental activity.

Communication skills are also inherently necessary to navigate predictable family dynamics. As older patients lose the ability to adequately care for themselves, the caretaker becomes more central to the clinical care and decision-making. Mounting stress and fatigue among caregivers are common, along with triggers of caregiver frustration (e.g., worsening incontinence, gait instability, and/or cognition). The geriatric cardiologist can hone skills of understanding and empathy and can also provide key insights regarding medications, procedures, and other considerations that can mitigate or inadvertently exacerbate these tensions.

PHYSICAL ACTIVITY AND REHABILITATION. There is substantial evidence (36–38) that increased physical activity and exercise-based cardiac rehabilitation significantly benefits older adults not only through improving CV indexes and mortality but also by improving functional status, psychological disorders, and cognitive function. Despite the remarkable benefits reported, cardiac rehabilitation programs continue to be underutilized by older patients with CVD, including low initiation and maintenance rates (39,40). The causes are multifactorial and include low referral rates by CV providers, poor communication to patients and families of the significant benefits, and barriers to maintenance (e.g., transport, cost, psychosocial, lack of motivation, physical limitations, fear/anxiety, and concerns about inadequacy). Even when educated on the benefits, both providers and patients may be concerned about the safety of a physical activity program amongst a myriad of multimorbid conditions. However, it is likely that this older inactive population would benefit the greatest (41,42). Geriatric cardiologists are ideally suited to facilitate cardiac rehabilitation and other programs that promote physical activity and that help achieve healthful as well as qualitatively beneficial outcomes (e.g., independence, functional gains, and self-efficacy).

POST-ACUTE CARE: SKILLED NURSING FACILITIES AND LONG-TERM CARE. Cardiologists and specialists in general have not traditionally had a routine presence in the post-acute care setting because they were largely not needed after longer lengths of hospital stay in which to stabilize patients. As legislation and financial incentives encourage prompter acute hospital discharge (43), older and sicker patients who were once followed by several consulting specialists for the duration of a prolonged hospital stay are being discharged rapidly to skilled nursing facilities (SNFs) and long-term care facilities under the care of already burdened generalists without routine communication with their specialty providers. Despite inherent problems, the application of post-acute care is increasing, and Medicare increasingly looks to skilled facilities to improve quality metrics and reduce hospital readmissions (44). A total of 14% of Medicare fee-for-service beneficiaries had at least 1 post-acute care stay in 2010, costing $54.7 billion. Of those beneficiaries with 6 or more chronic conditions, 49% had at least 1 post-acute care stay that was associated with a 30% higher hospital readmission rate (45). Anticipated legislation is expected to soon link SNF payments to performance.

The SNF provides a setting to optimize health care resources, as patients discharged to SNFs for ongoing medical therapy have ready access to physical and occupational therapy, speech pathology, nutrition

consultation, and social resources. It provides an opportunity to incorporate the multidimensional team in management of complex patients and have a patient-centered approach to care without the acuity and cost of a hospital stay. The potential role of the geriatric cardiologist to address and manage the needs of older frail adults with HF, who are at the highest risk of hospital readmission, through structured care plans could meet an underserved clinical area and improve quality metrics.

Options such as direct admission and utilization of SNF services (nursing care, intravenous therapies, and accurate fluid and weight measurements) for older patients in the community may be opportunities for improved resource utilization and cost containment.

PALLIATIVE CARE AND END-OF-LIFE DECISIONS. Geriatric cardiologists and palliative care experts overlap in their orientation to management of CVD in the context of advanced pathology and compounding multimorbidites. However, whereas geriatric cardiologists are oriented to the crossroads of management by guiding prevention and remediation as well as end-stage management, palliative care experts are relatively more exclusively oriented to patients experiencing predominant decline.

Collectively, both the geriatric cardiologist and palliative care experts have formidable potential to work in a synergistic fashion; the geriatric cardiologist can distinguish (and facilitate) effective treatment amidst dynamic contexts, and the palliative care experts have the skills to adjust care when relief and comfort become principal concerns. Such coordination of geriatric cardiology and palliative care experts is well-suited to team-based management.

Geriatric cardiologists can also facilitate and advance precepts regarding end-of-life decision making, including decisions about resuscitation and even when to forgo treatment perceived as futile. Guiding advanced directives is also critical, that is, anticipating and facilitating patient-centered management if/when patients lose the capacity to make their own decisions. In each instance, the geriatric cardiologist is an important source not only of medical insight and expertise, but also of legal proficiency and capacities to integrate family dynamics, financial issues, and spiritual concerns. The geriatric cardiologist also serves as an important guide to the surrogate decision maker, with the key skills to help the surrogate navigate a predictable complexity of stress, anxiety, guilt, and moral distress for a patient who can no longer make his or her own decisions (46).

FINANCIAL ASPECTS OF GERIATRIC CARDIOLOGY

The time taken to implement geriatric cardiology precepts may seem to run counter to the pressures in our current health care environment to increase efficiency and reduce costs. A geriatric cardiology encounter starts with listening to the patient's goals, assessing impairments (such as cognitive impairment or frailty), reconciling medications, and addressing opportunities for rehabilitation, end-of-life concerns, and other complexities that add time to the clinical encounter. Similarly, it entails the predictable time demands of organizing with nurses, physical therapists, and other providers linked to each patient, as well as the time needed for extended conversations with patients and family members, all of which are currently nonreimbursable services (47). The assessment of function is integral to the process, and consulting with caregivers in other specialties is usually required. All of these aspects make geriatric cardiology financially challenging within a traditional fee-for-service setting.

Nonetheless, the premise of increasing the care value that is promulgated by ACOs resonates with themes and metrics of geriatric cardiology, and the management efficiencies achieved by geriatric cardiology expertise may ultimately prove to be cost saving by better ascertaining which patients are likely to benefit from which therapy and thereby mitigating the quagmire of prolonged lengths of stay, iatrogenesis, rehospitalization, and other unintended expensive consequences of care.

In addition to ACOs, the Centers for Medicare & Medicaid Services Hospital Readmissions Reduction Program has incentives to reduce readmissions and provides another critical rationale for geriatric cardiology as a cost-saving element of care (44). Readmissions are heterogeneous and are often unrelated to the index event (48). Logically, CV expertise that is able to better link geriatric risks to CV management will be better equipped to reduce preventable readmissions. Additionally, better understanding a patient's and family's goals in the final year(s) of life might obviate the reflexive hospitalization(s) that occur when someone in an assisted living or long-term care facility becomes sick. These strategies are as yet untested in trials and represent an opportunity for research.

Bundled payments are another area where geriatric cardiologists can play a role in improving outcomes and, consequently, hospital reimbursement. The Bundled Payments for Care Improvement Initiative (BPCI) was launched in January 2013 and links payments for multiple services in a single acute

episode, with the goal of reducing incentives for individual services provided as well as decreasing fragmentation (49). The majority of cardiac diagnoses included in the BPCI are procedure-related, including cardiac valve surgery (including endovascular interventions such as TAVR), coronary artery bypass graft surgery, pacemaker implantation, and PCI. A geriatric cardiologist provides expertise suited to accurately assess procedural risk, patient selection, and the consequences of multimorbidity before the procedure, as well as providing expertise in post-procedure care and transitions that may potentially reduce costs.

Similarly, geriatric cardiologists provide skills and perspectives that are complementary to the disease-specific CV management teams. Valvular heart disease, atrial fibrillation, HF, and other diseases are now often treated by consensus among multiple providers with synergistic skills. Geriatric cardiology adds a unique perspective as part of the same service in orientation to procedures, medications, broader metrics of outcomes, and limits of traditional care that all contribute to improved efficiencies and efficacy of therapy.

SUMMARY

On first review of our case study, 1 typical path is for the cardiologist to manage the patient in alignment with published guidelines for unstable CHD. Alternatively, others may simply "eyeball" the patient and conclude that he is too frail for a procedure and that conservative therapy is the only option. In contrast, geriatric cardiology starts with the patient and family and delineates goals of care using skills that reflect a distinctive thought process and implementation of care. In this case, quality of life and, hence, symptom control was the primary goal, and given the absence of any straightforward medical therapy, an argument for coronary intervention was made. However, the informed patient and family declined options for a procedure and chose plans for comfort care overseen by the geriatric cardiologist.

We continue to see more patients like our case study. As we ride the crest of expanding aging demographics, new technologies, and new legislation, cardiology providers must refine new processes of care that are patient-centered and that foster the best care for our new prototypical patients and circumstances. Our mandate is to optimize care, and our opportunity is to invigorate practice patterns with training in geriatric principles that overlap with cardiology and to instill new standards of diagnostics, risk assessment, and disease management into our practice. Geriatric cardiology is evolving as the appropriate approach for this challenge.

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