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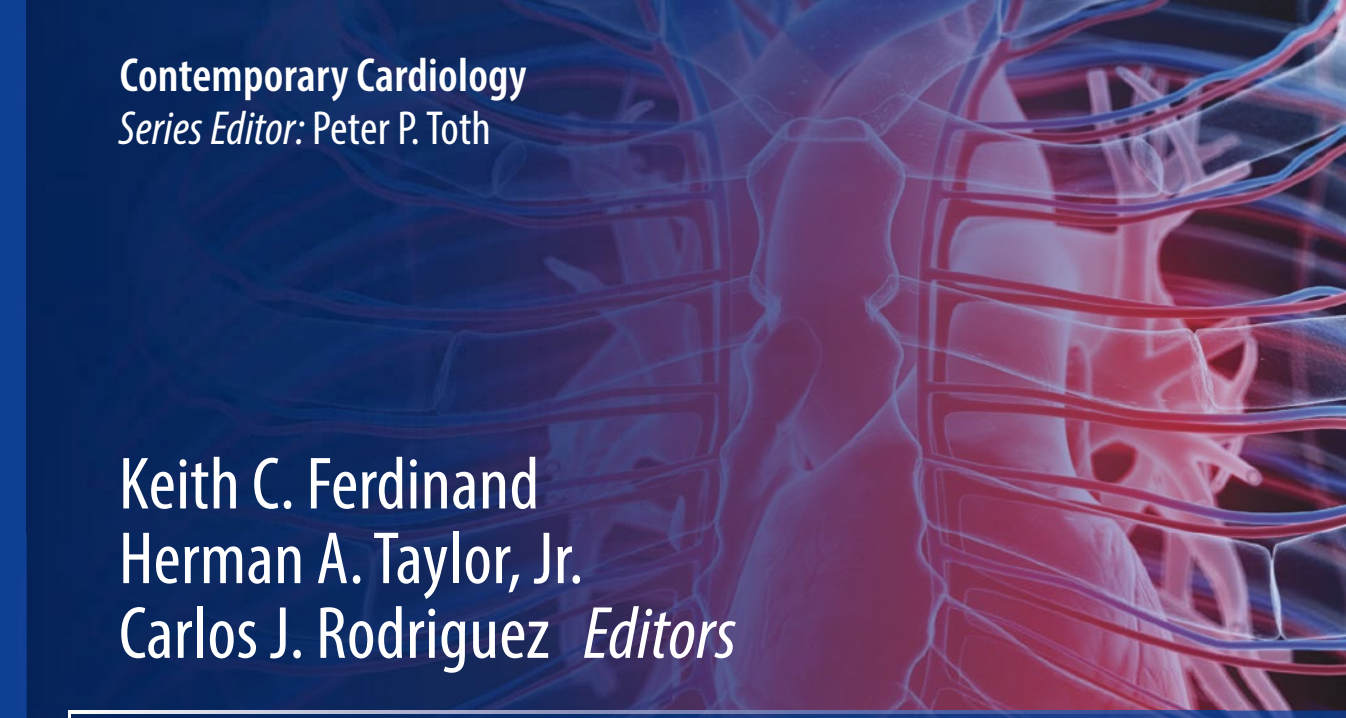

Keith C. Ferdinand
Herman A. Taylor, Jr.
Carlos J. Rodriguez *Editors*

Cardiovascular Disease in Racial and Ethnic Minority Populations

Second Edition

Humana Press

Contemporary Cardiology

Series Editor

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Preface

Social Justice and Health Equity: Identification and Elimination of Cardiovascular Disparities by Race/Ethnicity and Socioeconomic Status

> *The worst part of the storm is going back to clean up. Everything is a total loss. The furniture broke up into splinters. We have not found the chest of drawers which we used to step into the attic. What is not destroyed is so filled with stench & slime that you'll throw it away. …We learned: that communication and cooperation are necessary factors for survival in a disaster; that water is the most destructive force in the world; that ice, electricity, and telephone are precious possessions; that people are great.*
>
> *Yours, Inola*

Excerpts from a letter by my late mother, Inola Copelin Ferdinand, to her sister, Narvalee, after our family's dreadful days outside on the roof, subsequent to the drowning death of my paternal grandfather and many neighbors, and the wide-spread devastation of Hurricane Betsy, Lower Ninth Ward, New Orleans, Louisiana USA, September 9, 1965.

Keith C. Ferdinand

This written note from my mother in 1965 reflects the terrible intersection of social injustice and adverse outcomes, while holding out the hopes and dreams of a better tomorrow. This personal life-changing experience of my childhood was not only reflected in the immediate aftermath of Hurricane Betsy but was unfortunately repeated by thousands in New Orleans post-Katrina and many more nationally during the COVID-19 pandemic. These were terrible storms (Hurricanes Betsy and Katrina, along with disparate minority morbidity and mortality in the COVID-19 pandemic). The United States and, indeed, the world have been deeply affected by the devastating effects of the COVID-19 pandemic. The root causes that fueled the disparate outcomes during Hurricanes Betsy and Katrina harken the need for deeper understanding and action. The social determinants of health (SDOH)—poverty, higher housing density, high-crime neighborhoods, substandard education, and poor access to healthy food—left African Americans, Hispanic/Latinx, and other disadvantaged populations ill-equipped to deal with the ravages of the pandemic [1].

Forward-thinking organizations, such as the Association of Black Cardiologists (ABC), recognize that the COVID-19 pandemic represents an opportunity to decisively address race and ethnic inequalities in cardiovascular (CV) health that fueled and compounded the effects of the coronavirus [2]. One aspect of this once-in-a-century public health crisis has been to reveal

the persistent, distressing, and unacceptable disparities in health among special populations in the United States, including African Americans, Hispanics/Latinx, Native Americans, and other disadvantaged populations. Health life expectancy and care have improved dramatically for all Americans over the last 100 years; nevertheless, the distribution of these benefits has not occurred equitably. Most distressing, there has been a persistent mortality gap between Whites and Blacks since the 1960s, and African Americans have a higher risk for conditions including hypertension, type 2 diabetes, obesity (especially in Black females), stroke, chronic kidney disease, end stage renal disease, myocardial infarction, and overall CV mortality, especially premature cardiac death [3].

Life expectancy in 2017 for non-Hispanic Black males was 71.5 years and 76.1 years for non-Hispanic White males. Among females, non-Hispanic Black's life expectancy was 78.1 years and 81.0 years among non-Hispanic Whites. It is a conundrum that the US life expectancy of Hispanic males (79.1 years) and females (84.3 years) has not been shown to be shorter than that of non-Hispanic Whites. Given the high rates of diabetes and cardiometabolic conditions in Hispanics/Latinx communities, our understanding of the reasons for so-called "Hispanic paradox" remains unclear and may change with disaggregation of Hispanics, more granular data, and the aging of a growing population [4]. On the other hand, the persistent, adverse outcomes in African Americans are not only seen for various forms of cardiovascular diseases (CVD), but also many cancers [5]. Recent analysis on the Black–White differences in CVD mortality, especially in the Southern United States, suggests that socio-economic status (SES) and poor control of CVD risk factors are a substantial proportion of the mortality difference [6]. The data therefore demand implementing national policies addressing SDOH and controlling modifiable risk factors.

On the other hand, understanding the complexity of heart failure risk in African American patients demands not only addressing traditional risk factors, while recognizing the adverse environmental contributions, but also possible genetic aspects. The V122I variant, carried by approximately 3–5% of African Americans, is an increased risk for the most prevalent transthyretin cardiomyopathy (ATTR-CM) [7]. However, regardless of any postulated genetic factors or even traditional risk factors, healthcare system and policy factors predominate as causal factors for much of the death and disability among minorities, including less insurance access, CV and primary care, implicit bias, imbalance in the application of guideline-directed medical therapy, and suboptimal workforce diversity [7].

As with the imbalances in COVID-19 outcomes, CVD disparities reflect a mixture of difficulties faced by minorities such as discrimination, barriers to quality education, lower income, inferior or insecure housing, poor healthcare access, and wealth gaps. This textbook specifically details unique aspects of CVD and associated risk factors in African Americans and Hispanics/Latinx, which will inform targeted programs to address inequities including obtaining reliable information on prevention, providing the medical communities with best practices for treating underlying medical conditions, and ensuring availability and ease of access for preventive and therapeutic

healthcare for all communities. Therefore, recognizing the confluence of race/ethnicity and associated SDOH in persistent imbalances in CVD risks and outcomes, this textbook focuses on two of the largest racial/ethnic groups in the United States, African Americans (14.1% of the population) and Hispanics/Latinx (18.3% of the population).

The editors are a trio of clinicians and researchers: Herman A Taylor, Jr., MD, MPH, FACC, FAHA, endowed professor and director of the Cardiovascular Research Institute at Morehouse School of Medicine, Atlanta, GA; Carlos J Rodriguez, MD, MPH, FACC, FAHA, the director of clinical cardiology and cardiovascular epidemiology at Albert Einstein College of Medicine, NY; and the lead editor Keith C. Ferdinand, MD, FACC, FAHA, FNLA, FASPC, FNLA, the Gerald S. Berenson Endowed Chair in Preventive Cardiology and professor of medicine at Tulane University, School of Medicine, New Orleans. The editors thank all the esteemed authors for their contributions addressing these inequities and the tolls they have indeed taken (and continue to take).

Dr. Taylor has recently highlighted the importance of recognizing in Blacks the wide heterogeneity in outcomes, suggesting the existence of substantial individual and collective resilience among African Americans. Perhaps, this text will also stimulate discussion and research that explores resilience in a population in which "overcoming" and "bouncing back" from adversities (ranging from minor incidents to legally ordained, chronic and horrific oppression) has been a requirement for survival. Black resilience, as detailed by Dr. Taylor and others, may yield important insights into the phenomenon of human resilience that transcends race [8]. In addition, Dr. Rodriquez has cautioned researchers and public health officials against "lumping" Hispanic/Latinx populations when defining risks and CVD outcomes. Therefore, he is pleased with the detailed efforts of several authors in this text to address the under-recognized need for disaggregation in data from Hispanic/Latinx communities [9].

Hopefully, new legislative initiatives and recent social activism will be able to successfully confront and overcome these unacceptable racial/ethnic disparities in healthcare. The COVID-19 pandemic, while a source of terrible economic and adverse health outcomes, may also be an opportunity to finally and successfully address issues of health equity for all populations regardless of race/ethnicity, sex/gender, social economic status, or geography. We live in a very special country. The United States is one of the wealthiest countries in the world and has demonstrated exceptional leadership in science, medicine, finances, and law, but we overcome these persistent inequities.

Of all the forms of inequality, injustice in health care is the most inhumane.
Martin Luther King, Jr,
Medical Committee for human rights Chicago, IL 1966

New Orleans, LA, USA — Keith C. Ferdinand
Atlanta, GA, USA — Herman A. Taylor, Jr.
Bronx, NY, USA — Carlos J. Rodriguez

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1 Overview and Perspectives: Cardiovascular Disease in Racial/Ethnic Minorities in the Era of COVID-19

Adedoyin Johnson, Bradley Deere, and Keith C. Ferdinand

Introduction

This textbook is urgently needed, as demonstrated by the recent higher adverse outcomes in the COVID-19 pandemic, which can be catastrophic in racial/ethnic minorities and disadvantaged populations. The disparate mortality rate seen in African Americans, Hispanic/Latino Americans, and other racial/ethnic minorities confirms the inadequate societal efforts to eradicate imbalances in cardiovascular disease (CVD) and cardiometabolic risk. African Americans, Hispanic/Latino groups, and other minorities are not genetically predisposed to coronavirus infection but may have a higher incidence of comorbid conditions such as CVD, HTN, diabetes, chronic kidney disease (CKD), and obesity that contribute to higher COVID-19 mortality [39]. This publication is an update to the previous textbook, *Cardiovascular Disease in Racial and Ethnic Minorities* published in 2010 [4]. The various contributors, all leaders in their respective fields, build on many of the concepts and data presented previously with updated information that includes recently developed national guidelines and relevant peer-reviewed literature. Specifically, this textbook focuses on CVD risk factors, morbidity, and mortality in non-Hispanic Black and Hispanic/Latino Americans, the two largest minority populations in the United States.

Hypertension is the most prevalent and potent risk factor for CVD, especially in African Americans. The 2017 American College of Cardiology/American Heart Association (ACC/AHA) and Multi-Society Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults [1] recommends antihypertensive medications for most adults with systolic blood pressure (BP) ≥130 mm Hg or diastolic blood pressure (BP) ≥80 mm Hg to help combat the associated morbidity and mortality. Similarly, the 2018 ACC/AHA Guideline on the Management of Blood Cholesterol [2] and the 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease [3] outline impactful information and provide optimal identification, prevention and management of hypercholesterolemia and associated conditions.

The goal of this collection of evidence-based chapters, including contributions by leading researchers, clinicians, and experts in various fields of study, is to find the best pathways to better understand, decrease, and potentially eliminate persistent and unacceptable disparities in CVD morbidity and mortality. The authors have all provided a comprehensive depiction of current and evolving research in their respective areas, constructing a compilation of current

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considerations and perspectives. This state-of-the-art review of research and clinical practice will hopefully add important information to successfully address ongoing disparities.

The burden of CVD remains costly and deadly despite unprecedented advancements in the diagnosis and treatment of CVD. Despite the decline in US cardiovascular mortality over the last several decades, CVD remains the foremost cause of death. Furthermore, there has been a disturbing trend towards an actual increase in CVD mortality with persistent racial/ethnic disparities. African Americans continue to have the highest rate of stroke, heart failure (HF), coronary heart disease (CHD), T2D, HTN, and obesity (in females), compared to other groups [5, 6]. Since the 2010 edition, the several ACC/AHA and Multi-Society Guidelines remain essential to assist clinicians in determining optimal clinical care. The various authors have used these recommendations, along with best recent evidence, to make impactful commentary.

Introduction to Precision Medicine: Minority Populations and Cardiovascular Health

Latrice Landry, PhD, MS, builds on her previous work demonstrating the lack of diversity in genomic databases and how this creates a barrier for precision medicine to be translated into clinical care. Landry elucidates that biomarkers are the mainstay for translational medicine. However, non-European populations are not properly represented. Reviewing the National Institutes of Health (NIH) genome-wide association study catalog, of the 52 hematologic/lymphatic cancer studies and 47 digestive tract cancer studies, none of the studies focused on underrepresented minorities [16]. Since 2015 and beyond, federal efforts have included the precision medicine initiative, with a goal to personalize approaches to health and treating disease. Subsequent programs to maintain and further develop data, such as the All of Us Research Program, seek to carry out this vision. This novel prospective cohort initiative takes into consideration population biases that exist in prior research and leverages the diversity of the United States to account for individual variation [31]. The foundation of the All of Us Research Program takes into consideration structural issues that affect biomedical research and can account for factors related to health disparities. This data repository has promise to usher in personalized and precision medicine. By accounting for individual variation, there is hope for reducing the disparities that exist in CVD prevention, diagnosis, and management.

Lipoprotein(a): A Cardiovascular Risk Factor Affecting Ethnic Minorities

Low-density lipoprotein cholesterol (LDL-C) is an established major risk factor for atherosclerotic development, progression, and increased atherosclerotic cardiovascular disease (ASCVD) [21]. In this chapter, Gissette Reyes-Soffer, MD, Ronald R. Nelson Jr., MD, and Karol Watson MD, PhD, build on their previous work on dyslipidemia and CVD. A prior study demonstrates racial/ethnic disparities in patients with familial hypercholesterolemia, an underdiagnosed, but high-risk group for ASCVD. African Americans were diagnosed at older ages and were 50% less likely to achieve LDL-C <100 mg/dl, which shows significant under-treatment [22]. Research in the future should better elucidate how emerging and known risk factors for CVD affect minority populations. Studies utilizing Mendelian randomization may prove to be a powerful tool to determine mechanisms and potential effects of modifiable exposures and health outcomes. A recent analysis involving 438,952 participants of European ancestry demonstrated that life-long genetic exposure to lower levels of LDL and lower SBP was associated with a significantly lower cardiovascular risk [23]. While Mendelian randomization studies have been successful within CVD research (i.e., providing evidence for causality for biomarkers and drug targets such as Lp(a) and PCSK9, respectively), more work is needed to determine the benefit of this tool for among racial/ethnic minority populations.

Emerging Precision Medicine Concepts and Cardiovascular Health in African Americans and Hispanics

This chapter by George A. Mensah, MD, delves into the current concepts and approaches to tackling medical issues related to precision medicine. Mensah details the importance of rapidly evolving advances within precision medicine and its contributions to CVD. Differences in minority representation in genomic research are noted and the future implications are discussed [17]. Improvements are currently being sought in the African American community to bridge the gap in the delivery of personalized medicine, such as the African American Cardiovascular Pharmacogenetic Consortium (ACCOuNT) group. Their goal is to discover new genetic variants in African Americans associated with cardiovascular phenotypes and to integrate African American-specific sequence variations into clinical guidelines [18]. As a leader in public health, Mensah's work has helped determine best pathways forward to reveal and eliminate disparities in the United States.

The Implementation Frontier: Impact on Cardiovascular Health in Racial and Ethnic Minority Populations

In addition to his work in the emerging field of precision medicine, Mensah introduces the importance of implementation science and its unique potential within the realm of CVD and minority populations. He expertly demonstrates how minority populations are at greatest risk to suffer from the underuse of high-value interventions and overuse of ineffective or low-value interventions. Implementation science is poised to address these disparities and improve the delivery of health care to all racial/ethnic and socioeconomic groups. Using HTN as an example, Black individuals are less likely than White individuals to achieve blood pressure control despite receiving drug treatment. Even when providing equal access to antihypertensive regimens (i.e., in clinical trials), an individual's socioeconomic context is independently associated with worse cardiovascular outcomes and blood pressure control. For instance, participants in the ALLHAT study (Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial) with lower household income had poorer blood pressure control and worse CVD outcomes such as all-cause mortality, heart failure hospitalizations, and end-stage renal disease [32].

A comprehensive, evidence-based approach to implementing interventions is needed to reduce the burden of CVD risk factors and disparities in a cost-effective manner. For instance, the Heart Outcomes Prevention and Evaluation 4 (HOPE 4) program, a cluster-randomized controlled trial, implemented community-based interventions that addressed barriers to effective disease management. The intervention group had a significant reduction in the Framingham Risk Score for 10-year risk (−11.2%) in addition to greater absolute reduction in systolic blood pressure, total cholesterol, and LDL-cholesterol levels when compared to standard-care group [33]. It will be critical for future implementation research to consider barriers to care and account for potential harms or lack of benefit of interventions to improve CVD disparities in high-burden populations.

Genomic Approaches to Hypertension

Genetic variants associated with susceptibility for various CVD conditions are delineated by Ivor J. Benjamin, MD, FAHA FACC, and other authors. Benjamin initiates a detailed understanding of genetics, genomics, and human disease. Recent data have shown that African Americans and Hispanic/Latino Americans represented 14% and 3%, respectively, of NIH-funded genome-wide association studies (GWAS) using the Research Portfolio Online Reporting Tools (RePORT) [15]. One of the key themes underlying the work of Benjamin and others is the need for diversity in large-scale genome-wide

association studies (GWAS). There is a large over-representation of participants of European ancestry in genetic research. As of 2019, only 3.8% of polygenic studies involved African, Hispanic/Latino, or Indigenous peoples [29]. When analyzing datasets over decades, most studies included exclusively European ancestry participants 67% and another 19% included only East Asian ancestry participants [30]. Additionally, research has found that the predictive performance of European ancestry-derived PRS was lower among those in non-European ancestry samples [29]. Given the over-representation of participants of European ancestry in genetic datasets, more studies will be needed before genetic research can be translated into clinical practice. Elucidating the causes of differences in genetic risk score distributions across populations and risk score relationships to phenotypes may help address current gaps. Until well-powered GWAS in diverse populations are available, the benefit of PRS as a precision medicine tool remains unclear.

Heart Failure in African Americans and Hispanic Americans: A Persistent and Disproportionate Burden in Underrepresented Minorities

The care available for HF patients is influenced by different variables, such as access to ambulatory care, presence of comorbid conditions, and racial/ethnic disparities. Clyde W. Yancy, MD, MSc, MACC, FAHA, MACP, Quentin R. Youmans, MD, and Ike S. Okwuosa, MD, discuss the various factors in this chapter. A study documented differences in readmission rates of racial/ethnic groups after HF hospitalization in a large hospital system in New York City. Readmission was substantially higher among Hispanic/Latino patients at 30 and 90 days and 90 days for Black patients when compared to White patients [13]. A key priority moving forward will include strategies that improve tools and concepts within the realm of risk prediction. A better understanding of the unique aspects of HF risk factors among racial/ethnic minorities may offer opportunities for implementing primordial or primary prevention. Cumulative exposure to modifiable risk factors is largely responsible for HF. Data continue to indicate that racial/ethnic minorities, particularly young and middle-aged African Americans, experience a higher burden of HF-related CVD mortality. When compared to White men and women, the age-adjusted HF-related CVD death rates were 2.6- and 2.97-fold higher for young Black men and women, respectively [34]. Age-adjusted rates for heart failure-related CVD death are increasing. Given that the HF rates in African Americans are more pronounced among younger adults and significant disparities exist, identifying those at higher risk and preventing heart failure development is paramount.

Heterogeneity, Nativity, and Disaggregation of Cardiovascular Risk and Outcomes in Hispanic Americans

As previously documented from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) [8], Fatima Rodriguez, MD, MPH, FACC, and Vanessa Blumer, MD, add to our understanding of the importance of nativity and disaggregation in the disease burden of a heterogeneous Hispanic/Latino population. Disaggregation of Hispanic/Latino subgroups has revealed marked heterogeneity in CVD mortality. Data show significant differences in premature CVD mortality among Hispanic/Latino subgroups with years of potential life loss that persists over a decade [11]. These findings emphasize the importance of a comprehensive evaluation of demographics and ancestry when implementing measures to improve cardiovascular health of diverse, minority populations. Additionally, NIH funding for clinical research involving racial and ethnic minorities will need to match the proportion and significance of disease burden [31]. Appropriate funding that addresses health disparities is critical for future research funding and prioritization.

Cardiovascular Epidemiology in Hispanics/Latinos: Lessons Learned from HCHS/SOL

In this chapter, Cesar J Herrera, MD, Manuel Haché, MD, and Carlos J. Rodriguez, MD, MPH, continue to build on previous studies, especially newer data from Prevalence of Hypertension, Awareness, Treatment, and Control in the HCHS/SOL [8]. Hispanic/Latino Americans are heterogeneous and there is difficulty making accurate statements regarding CVD risk and disease across such diverse and large subpopulations. Nevertheless, understanding the epidemiology of CVD burden in Hispanic/Latino Americans is paramount. As highlighted in this chapter, health risks differ greatly among Hispanic/Latino individuals, who may be of any self-identified race or admixture based on the presence of DNA. This complexity of genetic origin makes general comments regarding CVD burden in Hispanic/Latino populations difficult and at times inexact when compared to non-Hispanic/White populations. There is a differential burden of CVD risk including T2D and HTN among Hispanic/Latino groups. Hispanic/Latino individuals have been noted to have increased triglycerides levels which appears to be inversely associated with data seen among various nationals within the subpopulations studied [9]. Furthermore, Central Americans were shown to have higher prevalence of valvular heart disease [10]. Finally, given that Hispanic/Latino Americans are the largest racial/ethnic minority population in the United States and are on average 15 years younger than White Americans, preventive efforts to reduce CVD risk factors such as T2D and obesity must be ongoing research priority [11].

Lessons Learned from the Jackson Heart Study (JHS)

As highlighted in this chapter by Ervin R. Fox, MD, MPH, Solomon K. Musani, PhD, Frances C. Henderson, EdD, Adolfo Correa, MD, MPH, and Herman A. Taylor, MD, MPH, the Jackson Heart Study continues to make important contributions to the field of CVD epidemiology in African Americans. The longitudinal investigation of genetic and environmental risk factors associated with CVD has paved the way for effective interventions to reduce risk burden. Yet, the epidemiology of CVD is shifting with the ongoing obesity and diabetes epidemic and understanding risk factor trends is an active research priority, particularly among young adults. Prospective cohort studies such as the Jackson Heart Study (JHS) will continue to enrich our understanding of CVD epidemiology and play a critical role in the advancement of cardiovascular health disparities research [36, 37]. Racial/ethnic disparities in HF incidence and outcomes are markedly prevalent and identifying vulnerable individuals with pre-clinical HF phenotypes may offer opportunities for prevention. In turn, a recent JHS study identified a malignant preclinical, high-risk phenotype that was independently predictive of incident HF in this African American population [38]. Another study including JHS participants found that the population-attributable risk of CVD associated with HTN was 32.5% [26]. These data highlight the importance of the JHS contribution to our understanding of CVD in vulnerable populations and pave the way for those who may benefit from targeted preventive efforts.

Cardiovascular Disease Risk Factors in the Hispanic/Latino Population

Overall diabetes prevalence is increased among racial/ethnic groups. Obesity and metabolic syndrome and diabetes in African and Hispanic/Latino Americans are discussed by Jonathan Velez-Rivera, MD, and Leonor Corsino, MD, MHS, FACE. Some of the topics explored include bariatric surgery of which racial disparities in long- and short-term weight loss outcomes are being documented [24, 25]. Recent data have shown that African Americans have higher risks for postoperative complications, readmission, and re-intervention within 30-days post-operation for Roux-en-Y gastric bypass (LRYGB) or laparoscopic sleeve gastrectomy (LSG) bariatric sur-

gery [25]. Metabolic issues vary by race/ethnicity. Our understanding is informed by a growing body of research that demonstrates the impact of metabolic syndrome on racial/ethnic populations. For instance, T2D is disproportionately prevalent among Hispanic/Latino Americans when compared to White or Black Americans. Within this subgroup, the burden of metabolic syndrome and diabetes is greater in Mexican Americans compared to White individuals or Puerto Rican individuals, whereas African Americans have increased diabetes and HTN. Finally, features of metabolic syndrome vary by group and within groups and abdominal adiposity is a factor that may portend an increased risk [2].

Progress in ASCVD Risk Assessment in African American and Hispanics

Peter W F Wilson, MD, expands on identifying the risk of ASCVD and its profound implications on the natural history of CVD. ASCVD risk assessment continues to evolve. There is marked heterogeneity across sex, race/ethnicity, family history, and socioeconomic status which may result in under- or overtreatment of individuals. To estimate an individual's 10-year risk for hard CVD events, the 2018 Multi-Society Guideline on the Management of Blood Cholesterol and 2017 Multi-Society Guideline for High Blood Pressure in Adults [1, 2] recommend the use of the US-derived pooled cohort equations (PCE). However, factors such as socioeconomic status, acculturation level, and ancestry or country of origin (i.e., Mexican vs Puerto Rican) pattern risk burden in Hispanic/Latino Americans. Black women consistently demonstrate greater ASCVD risk when compared to White women. And while the PCE appears to be accurate in Black subjects, there is no separate PCE available for Hispanic/Latino subjects [2]. Inclusion of ancestry or country-specific race/ethnicity along with consideration of socioeconomic status may improve risk estimation in racial/ethnic minority populations. Given the recent increase in CVD mortality rates in certain groups, particularly among young adults and racial/ethnic minorities [13], progress is needed to better identify those at increased risk of ASCVD in order to guide prevention efforts. Technological advances such as artificial intelligence may improve CVD risk prediction. For instance, a Machine Learning-based risk calculator outperformed the ACC/AHA Risk Calculator by recommending less drug therapy while missing fewer cardiovascular disease CVD events [14]. However, the potential for these tools to improve risk prediction and assist with clinical decision-making among racial/ethnic minority groups is yet to be determined.

Cardiovascular Disease in Minorities: Unique Considerations Hypertension in African and Hispanic Americans

Kenneth A. Jamerson, MD, and Samar Nassar, PhD, MPH, offer a comprehensive and relevant review of this important topic and provide additional insight regarding the impact of the leading risk factor for mortality and disability in the United States [21]. The impact of HTN among African Americans is especially profound with an estimated CVD population-attributable risk of 33%; meaning that up to 1 in 3 cases of CVD in Black adults is attributed to HTN [26]. While there is promise for effective novel HTN pharmacologic therapies such as SGLT2 inhibitors, brain aminopeptidase A inhibitors, and neprilysin inhibitors, primordial prevention may offer the greatest impact to reduce the burden of HTN-related CVD. Preventing CVD risk factors and maintaining ideal cardiovascular health over the life course will likely prove to be the most impactful intervention to reduce the burden of metabolic disorders among African and Hispanic/Latino Americans. By harnessing the ability of machine learning to analyze and integrate vast amounts of data from multiple sources ("-omics" data, health records, imaging, environmental and lifestyle data such as heart rate, blood pressure,

physical activity, dietary habits, and sleep quality), there is the possibility to glean valuable insights into the epidemiology of HTN and CVD risk.

Weight Loss, Lifestyle, and Dietary Factors in CVD in African Americans and Hispanics

In this chapter, the relationship between weight loss, diet, and CVD is explored by Jamy Ard, MD, Nia Schwann Mitchell, MD, Tiffany Carson, Stephanie L. Fitzpatrick, and Chiadi Ndumele, MD, PhD, FAHA. Current evidence shows that African and Hispanic/Latino American women are inclined to lose less weight than other racial/ethnic groups due to numerous factors [19]. Among overweight patients with increased ASCVD, African and Hispanic/Latino American women were less likely to report a healthy diet and physical activity when compared to White Americans [20]. Additional consideration should be given to how weight loss is tracked (i.e., body mass index (BMI), weight, visceral adiposity) and the social environment contribution to cardiometabolic health. CVD mortality rates have plateaued and are likely increasing largely due to the obesity and diabetes epidemic. Thus, understanding the primary drivers of these epidemics will be critical to optimize early preventive care strategies. Dr. Ard and co-authors expertly navigate the nuances of this broad, important topic and relevant research.

Coronary Calcium Scoring in African American and Hispanic Patients

Robert Gillespie, MD, and Matthew Budoff, MD, offer an invaluable perspective on coronary artery calcification (CAC) and ASCVD in racial/ethnic minorities. Providing an excellent historical perspective and highlighting future directions, the authors establish the powerful predictive value of CAC in asymptomatic patients. The use of CAC scan scoring via computed tomography (CT) is increasingly recognized as a valuable tool to further risk estimation either upward or downward among patients at intermediate risk of ASCVD [3]. Given a large proportion of patients who fall at intermediate risk based on pooled cohort equations, measuring CAC has definite value. Importantly, this tool refines risk and may offer potential life-saving therapies or avoid unnecessary therapeutic interventions. The potential utility of this approach for improving CVD risk assessment is evident and will continue to be important in the era of personalized and precision cardiovascular health. The possibility of integrating patient data with artificial intelligence technology such as machine learning may improve CV imaging diagnostic efficacy ushering in a new era of CVD diagnosis and management.

Epidemiology CVD in African Americans

To address disparate CVD morbidity and mortality, it is important to document the extent of various conditions with specific data related to health disparities. Virginia J Howard, PhD, FAHA, FSCT, sets the table for understanding the unique aspects of CVD epidemiology in African American populations. By 2030, CVD prevalence in the United States is projected to be 40.5% and CVD total direct medical costs are projected to triple [12]. Progress in CVD epidemiology is critical to assess disease burden and risk factors for health in African American populations. The burden of CVD continues to shift and evolve while health disparities persist. Howard has detailed our best understanding of the extent and nature of CVD morbidity/mortality and provides a road map by which clinical research and interventions can better address areas of concern. In addition to her landmark REGARDS study (Reasons for Geographic and Racial Differences in Stroke) [7], Howard's writing provokes needed insights. Dr. Howard and colleagues explore basic epidemiology of

prevalence, incidence, and mortality and set the stage for others to further detail unique aspects of risk factors, specifically as related to non-Hispanic Black or African Americans in comparison to other race/ethnic groups.

Cardiac Amyloid Heart Disease in Racial/Ethnic Minorities: Focus on Transthyretin Amyloid Cardiomyopathy

In this chapter, amyloid cardiomyopathy, Icilma V. Fergus, MD, FACC, Matthew Maurer, MD, and Kevin Alexander, MD, FACC, build on previous work regarding transthyretin cardiac amyloidosis (TTR CA) in US Black individuals. The authors noted that the valine-to-isoleucine substitution at codon 122 on the transthyretin (TTR) gene was more common in Black subjects compared to the wild type mutation that was predominantly White subjects. US Black individuals with the Val122Ile mutation were misdiagnosed and underdiagnosed because it mimics hypertrophic hypertensive heart disease and other common pathologies such as diabetes, obesity, and HTN are considered as the main reasons without adequately considering all options. Hence compared to White Americans, Black Americans presented with more advanced disease despite genetic testing and non-invasive methods such as nuclear imaging that can aid diagnosis [27]. Additional evidence of cardiac amyloid (CA) underdiagnoses in African Americans is suggested by geographic disparities which found that temporal and regional trends in age-adjusted mortality rates of CA were greater by proximity to amyloidosis centers rather than regions with greater proportion of Black residents in the United States [35]. This regional variability suggests an underdiagnoses of CA among African Americans and highlights the prevalent racial disparities in diagnosing and reporting amyloid mortality. With non-invasive nuclear medicine techniques for identifying TTR CA and the advent of disease modifying therapies (TTR stabilizers and TTR silencers) [28], there is an opportunity to improve early diagnosis and change the natural history of this relentless form of HF.

Imaging for the Assessment and Management of Cardiovascular Disease in Women and Minority Populations

Carola Maraboto Gonzalez, MD, Vanessa Blumer, MD, and Robert C. Hendel, MD, summarize the expansive and evolving field of CV imaging. They highlight the value of CV imaging with CVD risk assessment while optimizing diagnoses and management. From facilitating catheter-based treatment of atrial fibrillation or improving identification of individuals with ATTR cardiomyopathy, imaging continues to drastically improve the diagnosis and management of CVD. In this multimodality imaging era, the appropriate use of emerging and novel technology is critical for improving outcomes in diverse populations. Citing work from population-based studies, they report key racial/ethnic differences across multiple imaging modalities and CVD and emphasize the importance of diagnostic accuracy and reference values by race and gender. The authors insightfully address current multimodality imaging techniques and clinical implications for racial/ethnic minorities while developing a strong case for their application in CV risk assessment in underrepresented, underserved populations. The early diagnosis of CVD is necessary to appropriately address specific interventions that are needed to decrease morbidity and mortality. While advanced imaging is often less utilized in racial/ethnic minorities, barriers based on insurance status or access must be overcome so unique findings can be revealed that may better help target appropriate interventions.

In the final analysis, unique aspects of cardiovascular disease and associated risks remain complex and at times difficult to fully understand, nevertheless as identified by the unacceptable disparities in COVID-19 hospitalizations and death, adverse outcomes in African Americans and Hispanic/Latino Americans must be identified, addressed, and eventually

eliminated. It is therefore important to continue to accumulate data and develop concepts that lead to not only better understanding of unique aspects of CVD and cardiometabolic risks in minorities but most importantly appropriate intervention.

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