International Journal of Cardiology 202 (2016) 433–440

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Review

Worldwide disparities in cardiovascular disease: Challenges and solutions

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ARTICLE INFO

Article history:
Received 29 July 2015
Accepted 21 August 2015
Available online 28 August 2015

Keywords:
Cardiovascular disease
Disparities
Disparate care
Worldwide

ABSTRACT

The 20th century saw cardiovascular disease ascend as the leading cause of death in the world. In response to the new challenge that heart disease imposed, the cardiovascular community responded with ground breaking innovations in the form of evidence based medications that have improved survival, imaging modalities that allow for precise diagnosis and guide treatment; revascularization strategies that have not only reduced morbidity, but also improved survival following an acute myocardial infarction. However the benefits have not been distributed equitably and as a result disparities have arisen in cardiovascular care. There is tremendous data from the United States demonstrating the many phenotypical forms of disparities. This paper takes a global view of disparities and highlights that disparate care is not limited to the United States and it is another challenge that the medical community should rise and face head on.

1. Introduction

At the dawn of the 20th century, little was known about cardiovascular disease (CVD), and not much attention or resources were devoted to combating or understanding the pathology [1–3]. Yet today while CVD remains the leading cause of death, advances in cardiovascular medicine have resulted in a nearly 50% reduction in the rate of death due to heart disease and stroke over the last several decades [4]. These striking improvements in outcomes have not been equitable and the field of cardiovascular medicine is now challenged with the impact of disparate cardiovascular outcomes as a function of race, ethnicity, gender, and socioeconomic status.

2. Worldwide burden of cardiovascular disease and disparate care (Fig. 1)

By 2030 CVD is projected to account for 25 million deaths worldwide [5,6]. CVD has surpassed infectious diseases in developing nations as the leading cause of death [6,7]. Historically, the health status of societies worldwide has been heavily influenced by socioeconomic status (SES) (the measure of education, income, and occupational status). With industrialization, there has been a shift in the causes of death from nutritional deficiencies and infectious diseases to degenerative diseases such as CVD [6,8].

This shift in health status was described in 1971, by Omran, and is termed the theory of "Epidemiologic transition [9]." CVD was initially thought to be a disease of the affluent; however, 80% of deaths occur in low to middle income nations [10]. Yusuf described the epidemiologic transition of heart disease with the industrialization of nations in four phases [8]. Phase one is characterized by circulatory diseases secondary to infections such as rheumatic heart disease and cardiac muscle disorders from nutritional deficiencies. Phase two is characterized by improved nutritional status and a lower infectious disease burden with an increase in cardiovascular diseases related to hypertension.

During phase three, there is improved life expectancy. Diets are higher in saturated fats and there is an increased prevalence of high-risk behaviors such as smoking. Non-communicable diseases surpass communicable diseases and atherosclerotic CVD becomes most prevalent. The fourth phase is marked by increased efforts towards prevention and nations are therefore able to delay the onset of CVD to later decades of life [8]. Despite varying stages of industrialization, all nations share similar risk factors for the onset of CVD. These risk factors include, smoking, hypertension, alcohol use, high cholesterol, relative physical inactivity, and obesity [8]. As each phase of the epidemiologic transition progresses, disparities in cardiovascular disease are evident.

3. Disparate care defined

In the publication *Unequal Treatment*, the Institute of Medicine defined health disparities as "racial or ethnic differences in the quality of healthcare that are not due to access related factors or clinical needs, preferences and appropriateness of intervention" [11]. Operationally, a health care disparity is a preventable difference in an indicator of health of different population groups defined by race, ethnicity, sex, educational level, socioeconomic status and geography [12,13].

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http://dx.doi.org/10.1016/j.ijcard.2015.08.172
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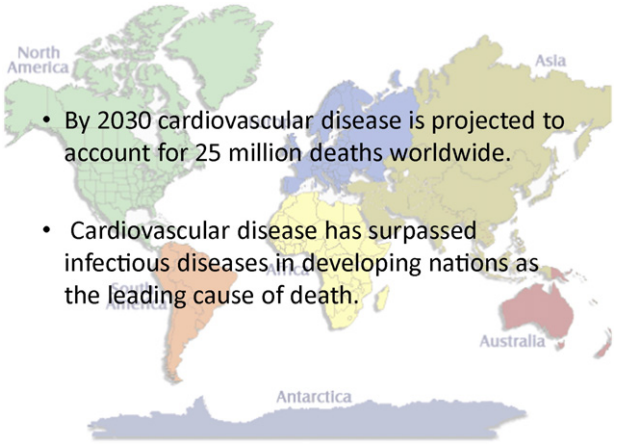

Fig. 1. The worldwide rise of cardiovascular disease.

4. Disparities in the United States (Fig. 2)

Disparate care has been a longstanding problem in the United States (US), with proven contribution to excess morbidity and mortality in affected populations. After a long history of racial segregation and institutionalized inequity in the United States, enactment of Title *VI* in the Civil Rights Act of 1964 prohibited federal funds from being appropriated to organizations or programs that engaged in racial segregation or other forms of discrimination. Further progress was made with the implementation of Medicare in 1966, regulating more than 1000 hospitals to integrate their medical staff, waiting rooms and hospital floors [14].

In 1979, then Surgeon General Julius Richmond issued a report entitled *Healthy People*; *The Surgeon General's report on health promotion and disease prevention*, highlighting objectives that would improve the nation's health by 1990. This was followed by the Healthy People initiatives focusing on disparate care. The current goal for Healthy People 2020 is to achieve health equity, eliminate disparities, and improve the health of all groups [15].

4.1. Disparate care and socioeconomic status (SES)

In the United States, SES is a known predictor of disparate care [16,17]. Individuals in the lower socioeconomic group have a disproportionate burden of cardiovascular mortality and morbidity. Traditional CVD risk factors have also been shown to be more prevalent in these groups [18,19].

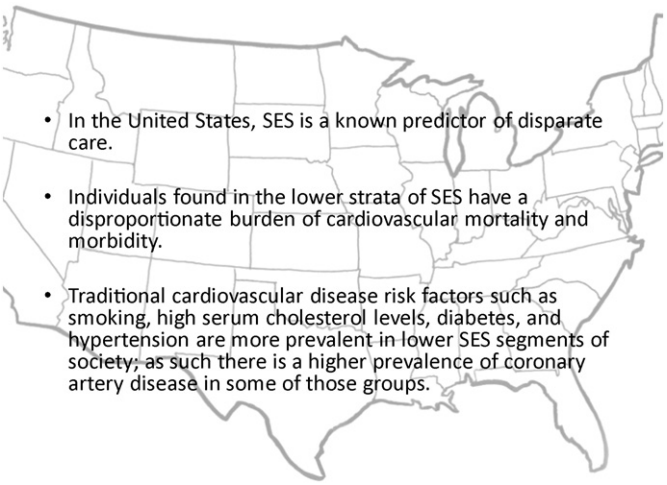

Fig. 2. Disparate care in the United States.

Those with lower SES often encounter frequent barriers to risk factor modification, including smoking cessation, dietary modifications, adequate physical activity and optimum medical therapy. Barriers encountered include decreased access to care (i.e., practitioners, medications, and timely interventions), limited options for safe outdoor activity, greater exposure to tobacco products and vendors, and fewer resources for healthy eating [20,21]. In a large study by Shishnebor et al. involving 30,000 individuals undergoing stress testing, an association was found between impaired functional exercise capacity and abnormal heart recovery in those with lower SES. This finding accounted for a major proportion of the correlation between SES and mortality [20].

Low SES is associated with lower educational attainment, whereas higher educational attainment has proven to be protective and associated with better CVD outcomes [16,22]. Conventional risk assessment tools, such as the 2013 *Atherosclerotic Cardiovascular Disease (ASCVD) risk score*, do not incorporate the impact of low SES or social environments in the projection of outcomes [23]. African Americans and Hispanics comprise a disproportionate number of those considered to have low SES [24].

4.2. Disparate care and race

From 2000 to 2010, the US population increased by 9.7%, totaling just over 300 million [25]. White Americans account for 72% of the population but the racial composition is rapidly changing. Between 2000 and 2010 there was a 43% increase in the Hispanic demographic, expanding the largest minority subgroup to 16% of the overall population [25]. Black Americans increased by 12.3%, and now account for 13% of the U.S. population [25]. The Asian American population grew four-times faster than the overall population, and the Native American population increased by thirty-nine percent [25].

By 2050, population projections anticipate an increasingly diverse racial composition without a 'racial majority' in the U.S. [26], Thus, understanding and addressing the burden of CVD across all racial-ethnic groups is imperative to continue efforts to reduce overall morbidity, mortality, and escalating costs from CVD. White and Black Americans have a similar prevalence of cardiovascular disease, estimated at 11.7% and 10.9%, respectively. Prevalence amongst Hispanics and Asians is lower at 8% and 6%, respectively [4]. Despite similar disease prevalence in White and Black Americans, mortality rates are disproportionately higher amongst Blacks [12,27].

As of 2008, the overall death rate from CVD in the United States was 244.8 per 100,000 individuals [4]. Death rates amongst White Americans, were 287.2 per 100,000 for males and 200 per 100,000 for females. Amongst Black Americans the rate of death climbs to 390 per 100,000 for males and 277.4 per 100,000 for females [4]. Multiple factors contribute to this disparity in Black Americans, including, higher incidence of cardiac risk factors, barriers to disease-modifying lifestyle changes, and reduced access to care aggregated by more frequent delays in clinical recognition and treatment initiation [27,28].

A comparison of the Black American cohort in the Jackson Heart Study (JHS) and a matched cohort in the Framingham Study, across all body mass index (BMI) groups, confirmed that Black Americans have a higher prevalence of diabetes, hypertension, and hypercholesterolemia compared to White Americans [29,30]. The Jackson Heart study also showed a lack of awareness and disparity in treatment of Black Americans with hypercholesterolemia. Though 55% of Black Americans between the ages of 35 to 49 were aware of their hypercholesterolemia diagnosis; only 23% received treatment. Amongst those ages 50 to 64, 60% were aware that they had hypercholesterolemia, but only 47% received standard of care treatment [31]. Subsequent studies have shown disparities in the quality of care provided to African Americans as evidenced by lower rates of diagnostic coronary angiography and revascularization [32–34].