Social and Medical Determinants of Cardiometabolic Health: The Big Picture

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Cardiometabolic diseases, including diabetes and heart disease, account for >12 million years of life lost annually among Black adults in the United States. Health disparities are geographically localized, with ~80% of health disparities occurring within ~6000 (16%) of all 38,000 US ZIP codes. Socio-economic status (SES), behavioral and environmental factors (social determinants) account for ~80% of variance in health outcomes and cluster geographically. Neighborhood SES is inversely associated with prevalent diabetes and hypertension, and Blacks are four times more likely than Whites to live in lowest SES neighborhoods. In ZIP code 48235 (Detroit, 97% Black, 16.2% unemployed, income/capita $18,343, 23.6% poverty), 1082 Medicare fee-for service (FFS) beneficiaries received care for type 2 diabetes (T2D) and coronary artery disease (CAD) in 2012. Collectively, these beneficiaries had 1082 inpatient admissions and 839 emergency department visits, mean cost $27,759/beneficiary and mortality 2.7%. Nationally in 2011, 236,222 Black Medicare FFS beneficiaries had 213,715 inpatient admissions, 191,346 emergency department visits, mean cost $25,580/beneficiary and 2.4% mortality. In addition to more prevalent hypertension and T2D, Blacks appear more susceptible to clinical complications of risk factors than Whites, including hypertension as a contributor to stroke. Cardiometabolic health equity in African Americans requires interventions on social determinants to reduce excess risk prevalence of risk factors. Social-medical interventions to promote timely access to, delivery of and adherence with evidence-based medicine are needed to counterbalance greater disease susceptibility. Place-based interventions on social and medical determinants of health could reduce the burden of life lost to cardiometabolic diseases in Blacks.
Ethn Dis. 2015;25(4):521-524; doi:10.18865/ed.25.4.521

Introduction

Cardiometabolic related risk factors and diseases contribute to >12 million years of life lost annually among Blacks in the U.S.[1] Medical determinants account for only 10%–20% of the variance in health outcomes. In contrast, health behaviors, socio-economic and environmental factors, culture, and social support, ie, social determinants, account for ~80%–90% of the variance.[2] In the United States, an estimated 7% of all public expenditures on health are directed to public health and prevention, ie, factors accounting for 80%–90% of variance in health receive <10% of the funding.[3] This is a costly, suboptimal, and unsustainable path to better population health.[4]

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Keywords: Health Disparities, ZIP Code, Race, Heart Failure, Stroke

This summary article represents findings that were presented at the ISHIB2015 conference, Medical and Social Determinants of Cardiometabolic Health, held in New York City on May 14-15, 2015.

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the expenditures in the United States. Yet, England, where national health guidelines more effectively integrate public health promotion strategies with the medical evidence than the United States,[5] ranks ahead of the United States on several measures of population health.[5] Other evidence within the United States has identified an inverse link between public health spending and preventable deaths.[6]

Health Disparities by Race-Ethnicity and Geography

Health disparities by race-ethnicity and geography are well documented.[7-9] In the United States, approximately 80% of health disparities occur in ~6000 or 16% of the nation's 38,000 ZIP codes.[10] The *Eight Americas* report noted that tobacco, alcohol, obesity, blood pressure and cholesterol were likely the most important proximal modifiable factors accounting for adverse health outcomes in the United States and disparities across race-ethnicity and geographic groups.[7] The Chicago Family Case Management Demonstration applied an integrated, multi-method approach that included relocation of a substantial proportion of residents in the most vulnerable public housing projects and provided employment assistance through trained case workers.[11] Although much work remained, pre- and post-surveys showed gains in employment, health, housing and neighborhood conditions as well as reductions in fear and anxiety. The cost for the enhanced program was $2900 per family annually vs $2000 for usual services.

Interventions to Improve Cardiometabolic Health Equity

Successful programs are also being deployed to improve cardiometabolic health equity through diabetes prevention. The Diabetes Prevention Program (DPP)[2] led to a nearly 60% reduction of incident diabetes; the DPP's nutritional and exercise intervention resulted in roughly a 4 kg weight loss and aimed for 150-minutes of physical activity weekly. The DPP was effective across race-ethnicity groups[12] and is being implemented in communities across the United States.[13] The program has translated successfully to several community settings, although evaluation of an entire community is a work in progress.[14] India, which has a growing diabetes epidemic, documented reductions in glucose on youth and adults with pre-diabetes in a resource-poor village after implementing a diabetes prevention and management education program to improve lifestyle patterns and self-management skills.[15]

Neighborhood Characteristics

Neighborhood characteristics impact cardiometabolic health risk. The Reasons for Geographic And Racial Differences in Stroke (REGARDS) study reported a strong relationship between neighborhood characteristics and several cardiometabolic variables.[16] For example, among Black adults aged >45 years at baseline, residence in the most deprived neighborhoods significantly increased odds of obesity, high blood pressure, lower HDL-cholesterol, elevated fasting glucose and markers of inflammation. White adults living in these neighborhoods also had increased likelihood of several cardiometabolic risk factors. However, Blacks were roughly four times more likely to live in the most disadvantaged neighborhoods than Whites.[16]

Greater Susceptibility to Stroke with Elevated Blood Pressure in Blacks than Whites

Not only is hypertension more prevalent in Blacks than Whites, but both hypertension and pre-hypertension appear to increase risk for stroke more in Blacks than Whites. The REGARDS investigators demonstrated a greater susceptibility to stroke with pre-hypertension (Hazard Ratio 1.39) and Stage 1 hypertension (Hazard Ratio 3.71) in Black than White adults aged <65 years.[17] The disparities in susceptibility appeared to attenuate progressively with increasing age at 65–74 and ≥75 years compared with the group <65 years. The greater prevalence of hypertension, greater susceptibility to hypertension and lower hypertension control rates in Black than White adults all contribute to large disparities in stroke-related outcomes.

Poor Hypertension Control Among Blacks

Lesser control of hypertension in Black than White adults further magnifies disparities in clinical outcomes. Blacks are more likely to have uncontrolled hypertension, which is not attributable to awareness or treatment of hypertension as both are higher in the Black than White population, but because of lower control of hypertension among Blacks than Whites with treated hypertension.[18,19] The racial

disparity in hypertension control tends to decline with increasing age, which aligns with other factors contributing to an age-related decline in the Black-White stroke disparity.[20] Lower rates of health insurance among Black than White adults aged <65 years contributes to the racial disparity in hypertension control. Hypertension control rates are virtually identical in privately and publicly insured patients, despite the fact that the demography, income and education of publicly and uninsured adults are similar and different from privately insured adults aged <65 years.[21] Greater equity in health insurance, public or private, could reduce race-ethnicity disparities in cardiovascular risk factor control in pre-Medicare age adults.

Adverse Health Outcomes by ZIP Code

An unfortunate example of adverse health outcomes in a low socioeconomic community is provided by ZIP code 48235 in Detroit.[22] This ZIP code has a declining population estimated at 46,414 residents in 2013. In ZIP code 48235, 94% of residents are Black, 16.2% are unemployed, per capita income is $18,343, and 23.6% live below the federal poverty level. In 2012, 1082 Medicare fee-for service (FFS) beneficiaries in this ZIP code received care for type 2 diabetes (T2D) and coronary artery disease (CAD).[23] These beneficiaries accounted for 1082 unique inpatient admissions or an average of one for each beneficiary and 839 unique emergency department visits. The mean cost in 2012 per beneficiary was $27,759, and 2.7% died. These numbers were modestly worse than the national numbers for Black Medicare beneficiaries with diabetes and coronary artery disease. Nationally in 2011, 236,222 Black Medicare FFS beneficiaries had 213,715 unique inpatient admissions and 191,346 unique emergency department visits.[23] The mean cost was$25,580/beneficiary/year with annual mortality of 2.4%.

The time for constructive action is now.

Time for Constructive Action

Describing health disparities is insufficient. Effective action is imperative. In 1976, Rutstein et al began a conversation about "unnecessary, untimely deaths," which they defined as "conditions from which, in the presence of timely and effective medical care, *premature* death should not occur."[24] They suggested that the single case of death (illness/disability) should trigger the question, "Why did it happen?" with the understanding that given existing medical knowledge not every single case is preventable/ manageable.

The National Minority Quality Forum broadened the definition from Amendable Mortality to Amendable Acute Events to include medical error, disability, hospitalization, emergency room visit, and premature mortality.[23] In this context, it remains important to look at the single acute event and ask, "Why did it occur?" Equally significant are persistent patterns of Amendable Acute Events. These persistent patterns are defined as health disparities. A disparity exists when a patient cohort has a higher probability of an acute event than is warranted given the existing state of medical knowledge or is exposed to a continuous risk that is not investigated for the purpose of amendment.

Excellent population health can be achieved through healthy lifestyles, safe environments that support health and prevent disease, and timely access to, use of, and adherence with evidence-based health care.[2–6,25] National, state, and local health care guidelines, policies, and budgets that generally support this approach are likely to improve population health and reduce health care expenditures. Given that the majority of disparities in the United States are geographically localized to 16% of ZIP codes, we advocate for demonstration projects that generate positive outcomes and are economically feasible and sustainable. These practical demonstration projects, informed by prior experience,[26,27] would include broadly collaborative initiatives with local patient and community stakeholders to intervene on modifiable social and medical determinants that account for significant variance in priority health outcomes. These collaborative interventions should focus on reducing both the excess prevalence of cardiometabolic risk factors and the disproportionate impact those risk factors impose on the health of vulnerable populations.

Successful models that meet these criteria are positioned for dissemination, with appropriate tailoring, across many other at-risk communities. The cost of poor health is far more than economic and adversely impacts the ability of individuals to reach their potential and contribute to the well-being of their families and the broader community. Ultimately, the quality of life for all is enhanced when health equity is achieved responsibly.

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