J. Racial and Ethnic Health Disparities
https://doi.org/10.1007/s40615-017-0446-x

African Americans, African Immigrants, and Afro-Caribbeans Differ in Social Determinants of Hypertension and Diabetes: Evidence from the National Health Interview Survey

Yvonne Commodore-Mensah[1] · Nadine Matthie[2] · Jessica Wells[2] · Sandra B. Dunbar[2] · Cheryl Dennison Himmelfarb[1] · Lisa A. Cooper[3] · Rasheeta D. Chandler[2]

Received: 3 July 2017 / Revised: 28 October 2017 / Accepted: 30 October 2017

Abstract In the United States (U.S.), Blacks have higher morbidity and mortality from cardiovascular disease (CVD) than other racial groups. The Black racial group includes African Americans (AAs), African immigrants (AIs), and Afro-Caribbeans (ACs); however, little research examines how social determinants differentially influence CVD risk factors in each ethnic subgroup. We analyzed the 2010–2014 National Health Interview Survey, a cross-sectional, nationally representative survey of non-institutionalized civilians. We included 40,838 Blacks: 36,881 AAs, 1660 AIs, and 2297 ACs. Age- and sex-adjusted hypertension prevalence was 37, 22, and 21% in AAs, ACs, and AIs, respectively. Age- and sex-adjusted diabetes prevalence was 12, 10, and 7% in AAs, ACs, and AIs, respectively. In the multivariable logistic regression analyses, social determinants of hypertension and diabetes differed by ethnicity. Higher income was associated with lower odds of hypertension in AAs (aOR 0.86, 95% CI 0.77–0.96) and ACs (aOR 0.55, 95% CI 0.37–0.83). In AAs, those with some college education (aOR 0.79, 95% CI 0.68–0.92) and college graduates (aOR 0.62, 95% CI 0.53–0.73) had lower odds of hypertension than those with < high school education. In AIs, having health insurance was associated with higher odds of hypertension (aOR 1.59, 95% CI 1.04–2.42) and diabetes (aOR 3.22, 95% CI 1.29–8.04) diagnoses. We observed that the social determinants associated with hypertension and diabetes differed by ethnicity. Socioeconomic factors of health insurance and income were associated with a disparate prevalence of hypertension by ethnic group. Future research among Blacks should stratify by ethnicity to adequately address the contributors to health disparities.

Keywords Race ethnicity · Hypertension · Obesity · Diabetes · Immigrants

✉ Yvonne Commodore-Mensah
ycommod1@jhu.edu

[1] Department of Community and Public Health, Johns Hopkins School of Nursing, 525 N. Wolfe Street, Room 419, Baltimore, MD 21205, USA

[2] Nell Hodgson Woodruff School of Nursing, Emory University, 1520 Clifton Road NE, Atlanta, GA 30322, USA

[3] Johns Hopkins School of Medicine and Johns Hopkins Bloomberg School of Public Health, 2024 E Monument, Baltimore, MD 21205, USA

Background

Cardiovascular disease (CVD) is the leading cause of death in the United States (U.S.) and accounts for one in six deaths [1]. Although CVD-related deaths have declined over the past decades, ethnic minorities bear the heaviest burden of CVD risk factors [1]. In the U.S., Blacks are disproportionately affected by two major CVD risk factors—hypertension and diabetes [2, 3], and have a higher incidence of hypertension-related CVD and end-stage renal disease than other racial ethnic groups in the U.S. [4, 5]. Blacks in the U.S. have one of the highest prevalence of hypertension globally regardless of sex and educational level [2]. In Blacks, hypertension explains approximately 50% of the excess CVD risk compared with Whites [1]. Furthermore, Blacks are twice more likely to be diagnosed with diabetes and suffer more target organ damage than Whites [6]. The higher CVD incidence rate in Blacks may be largely attributed to a greater prevalence of hypertension, obesity, and diabetes [7].

The U.S. Census Bureau estimated that in 2016, over 42 million Blacks (Black only or in combination with another race) resided in the U.S., constituting 13.3% of the total population [8]. Current trends in migration have resulted in the diversification of Blacks in the U.S. The racial category of "Black/African American" is an umbrella term that is typically used to lump individuals of African descent, namely African Americans (AAs), Afro-Caribbeans (ACs), and African immigrants (AIs), into one homogeneous group. These groups are often studied as "Blacks" without regard to cultural and socioeconomic differences and varying composition of genetic admixture [9]. Despite these differences, the ethnic composition of Blacks in the U.S. is often disregarded in health disparity research. Combining heterogeneous African descent subgroups into a single category can lead to misleading or incomplete conclusions and may hinder the generalizability of research findings. Important distinctions contribute to differences in sociodemographic characteristics and health among these three ethnic groups.

AAs make up the large majority of Blacks in the U.S. and their presence dates to European colonization. Historically, over 11 million African slaves (primarily from West Africa) were forcefully migrated from Africa through the trans-Atlantic slave trade to the Western Hemisphere [9]. Approximately 500,000–700,000 of them were brought to the U.S. between 1519 and 1867, and the majority (35%) were sent to Brazil, South America, and Caribbean colonies [10, 11]. The genetic makeup of AAs is shaped by contributions of people from West Africa, Europe, and the Americas with significant variations in West African ancestry observed across the country [12, 13]. Efforts to address CVD disparities have focused primarily on AAs; other ethnic subgroups have been excluded or their data aggregated with data on AAs. It is well known that AAs develop hypertension more often, and at an earlier age, than Whites and Hispanics. From 2011 to 2014, 45% of male AAs and 46.5% of female AAs were noted to have hypertension; these are some of the highest rates in the world [1]. The prevalence of diagnosed diabetes is 14.1% among male AAs and 13.6% among female AAs.

Afro-Caribbean, the shortened form of African Caribbean, describes an individual of African descent whose ancestors were citizens of a Caribbean nation or territory [14]. Approximately four million immigrants from the Caribbean resided in the U.S. in 2014; 90% originated from Cuba, the Dominican Republic, Jamaica, Haiti, and Trinidad and Tobago [15]. In general, ACs have resided in the U.S. longer than any other immigrant group and Jamaicans make up the largest percentage (18%) of foreign-born Blacks [16]. Of these individuals, 59% are U.S. citizens, 45% are married, 46% are homeowners, 51% live in the northeast while 44% live in the south, and 20% have a college degree and the median household income is $43,000 [16]. The median age of ACs is 47 years and English proficiency is high in this group. Although their presence in the U.S. is growing, there is limited, current, published information on the health status of ACs. The majority of studies have been conducted in the United Kingdom (U.K.) and/or the Caribbean or primarily compared ACs to Whites and other non-Black immigrants. Studies conducted in the U.K. and/or the Caribbean have reported a higher prevalence of diabetes among ACs than among West African Blacks, with higher prevalence in women and individuals of low socioeconomic status [17].

Although AIs comprise a smaller percentage of the Blacks in the U.S. than AAs and ACs, there has been a significant increase in the size of this population. In comparison to other immigrants who arrived in the past 5 years, the AI population, which increased 137% between 2000 and 2013, represents one of the fastest growing immigrant populations in the U.S. [10, 18]. There are several factors that account for this phenomenon, including the Refugee Act of 1980 [19] which facilitated the migration of Africans from conflict-ridden countries and the diversity visa lottery program [18]. The five leading countries of origin of AIs in the U.S. are Nigeria, Ethiopia, Egypt, Ghana, and Kenya; together, these five countries accounted for half of the AIs in 2015 [18]. The most popular regions of settlement for AIs are New York, Texas, California, Maryland, New Jersey, Massachusetts, and Virginia [18]. In a comparative study of AAs and AIs, AIs were more likely to have hypertension, diabetes/prediabetes, and visceral adiposity than AAs, but were mostly unaware of their diabetes and prediabetes [20]. Notably, AIs were less likely to be insured than AAs in the study. Ghanaian- and Nigerian-born AIs in Baltimore-Washington, D.C., have high rates of hypertension (40%), overweight/obesity (88%) and diabetes (16%), and low insurance rates (52%) [21]. These findings challenge the "healthy immigrant effect," a well-accepted phenomenon which supposes that foreign-born persons are generally healthier than US-born persons [22, 23].

Per the American Heart Association, the most significant opportunities for reducing disparities in cardiovascular health lie with addressing the social determinants, which are "the circumstances in which people are born, grow, live, work, and age, and the systems put in place to deal with illness." [24]. For instance, having low socioeconomic status is associated with higher CVD risk [25, 26]. Discrimination contributes to lower levels of self-care, mistrust of clinicians, and underutilization of healthcare services [27]. Poor healthcare access (lack of health insurance and no source of usual care) is associated with suboptimal screening for CVD risk [28]. Previous studies have found that greater levels of tangible and emotional social support are associated with lower blood pressure or lower incidence of hypertension [29–31]. Together, these social determinants of health contribute to health behaviors that either enable or prevent optimal cardiovascular health.

The purpose of this study was to examine the social determinants of hypertension and diabetes among three Black ethnic groups in the U.S. We hypothesized that the prevalence of hypertension and diabetes among Blacks and the associated social determinants (specifically income, education, health insurance coverage, and marital status) would vary by ethnicity. This study is in line with the National Heart, Lung, and Blood Institute's Strategic Vision Objective 3 which seeks to "investigate factors that account for differences in health among populations" [32].

Methods

Data Source

We utilized data from the 2010–2014 U.S. National Health Interview Surveys (NHIS) in this investigation. The NHIS is administered annually by the U.S. Bureau of the Census for the National Center for Health Statistics (NCHS) [33] as a cross-sectional, nationally representative survey of non-institutionalized, adult civilians ages 18 years and older. The NHIS includes roughly 45,000 households and about 110,000 persons annually, and utilizes a multistage stratified cluster probability design with an oversampling of Blacks and Hispanic Americans [34]. One adult from each household is randomly selected to obtain detailed information on health indicators, healthcare utilization, and social and demographic characteristics. The full methodology of the NHIS is published elsewhere [34].

This study is restricted to 40,838 Blacks. We pooled and merged data for years 2010–2014 for use in this investigation, merging the sample adult file with the person-level file using established NCHS guidelines for combining NHIS data with the same sample design [33, 34]. This study was exempt from Institutional Review Board review because it used de-identified data published by the NCHS.

Study Population

We included participants who reported their race as Black/African American and represented the following three ethnic groups: (1) non-Hispanic Blacks born in the U.S. (AAs), (2) non-Hispanic Blacks born in the African region (AIs), and (3) non-Hispanic Blacks born in the Caribbean islands (ACs). Participants' place of birth data was derived from the question, "Where were you born?" in the NHIS. The NCHS categorizes foreign-born respondents in the following nine mutually exclusive regions of birth: Mexico/Central America/Caribbean islands; South America; Europe; Russia (and former Soviet Union areas); Africa; the Middle East; the Indian subcontinent; Asia; and Southeast Asia [33].

Outcomes

The main outcomes of this study were hypertension and diabetes, two major risk factors for CVD. Hypertension and diabetes statuses were determined via self-reported information. Hypertension status was determined with the question, "Have you ever been told by a medical doctor or health professional that you have hypertension, also called high blood pressure?" Likewise, the diabetes question was, "Have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?" For females, the question was preceded by the phrase, "Other than during pregnancy" (to exclude cases of gestational diabetes present only during pregnancy). The NHIS does not distinguish between type 1 and type 2 diabetes. However, the majority (90–95%) of diabetes cases in the U.S. are type 2 [35].

Social Determinants of Health

Poverty Status The NCHS created and recoded a poverty income ratio, calculated as the ratio of the midpoint family income divided by the poverty level in dollars as defined by the Census Bureau for the corresponding survey year: < 1.00 [below federal poverty line], 1.00–1.99, 2.00–2.99, 3.00–4.99, and ≥ 5.00. This variable was recoded as poor/near poor (< 2.00) versus not poor/near poor (≥ 2).

Marital Status Because a measure of social support was not available in the NHIS, marital status was used as a proxy measure for social support. Marital status was described using the following categories: currently married (living or not living with spouse or partner), previously married (divorced, separated, and widowed), and never married. This variable was recoded as married versus not married.

Education Status The NHIS assesses educational status with the question "What is the highest level of school you have completed or the highest degree you have received?" This variable was recoded into the following categories: < high school, high school graduate, some college education, and college graduate.

Health Insurance Status Health insurance status was assessed from detailed questions about multiple sources of insurance and recoded as private, public, and non-coverage. This variable is back edited and recoded by the NCHS, and categorized as a dichotomous "Yes" or "No" variable.

Covariates

Other variables examined were age, sex, marital status, access to healthcare (health insurance status), and socioeconomic status (income). We treated age in years as a categorical variable (< 25, 25–44, 45–64, 65–74, and ≥ 75) and sex as a dichotomous variable (male or female). Body mass index (BMI) was calculated using NHIS participants' self-reported height and weight. Categories of BMI included normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥ 30 kg/m^2) [36]. For this analysis, we dichotomized BMI as either overweight/obese or normal weight.

Statistical Analyses

Sampling weights for the years 2010–2014 were adjusted to account for pooling of the data [37]. We compared the three ethnic groups (AAs, AIs, and ACs) by sociodemographic characteristics and prevalence of hypertension and diabetes. We used the analysis of variance test and chi-square statistic to examine differences in continuous and categorical variables, respectively. We calculated the age- and sex-adjusted prevalence of hypertension and diabetes by ethnicity of participants.

We fitted multivariable logistic regression models to determine associations between social determinants of health and the outcomes of hypertension and diabetes, controlling for known confounders. For both outcomes of hypertension and diabetes, we fitted three multiple logistic regression models with the social determinants as the main predictors and adjusted for known confounders such as age, sex, and BMI. A two-tailed alpha with $p < 0.05$ was considered statistically significant. All analyses were performed with Stata 14 ©2014.

Results

Sociodemographic Characteristics

The sociodemographic characteristics of the sample are described in Table 1. The mean age of all participants was 45.8 (± 17.4). Most participants were AAs (90%) with ACs and AIs making up 6 and 4% of the samples, respectively. The three ethnic groups were significantly different in all sociodemographic characteristics that were compared. AAs were less likely to be college-educated and married than AIs and ACs. However, AAs were more likely to report having health insurance than their AI and AC counterparts.

Prevalence of Hypertension and Diabetes by Ethnicity

Age- and sex-adjusted prevalence of hypertension and diabetes is shown in Fig. 1. AAs had a higher hypertension prevalence (37%) than AIs (21%) and ACs (22%) ($p < 0.001$). Similarly, the highest prevalence of diabetes was observed in AAs (12%), followed by ACs (10%) and AIs (7%) ($p < 0.001$). Although not shown in Fig. 1, the prevalence of overweight/obesity was 73% in AAs, 60% in AIs, and 66% in ACs.

Social Determinants of Hypertension and Diabetes by Ethnicity

Associations among social determinants and the outcomes of hypertension and diabetes are presented in Table 2. For the outcome of hypertension, a higher level of education [some college education (aOR 0.79, 95% CI 0.68–0.92); college graduate (aOR 0.62, 95% CI 0.53–0.73)] was associated with a lower likelihood of hypertension among AAs. Among AIs, having health insurance was associated with higher odds (aOR 1.59, 95% CI 1.04–2.42) of hypertension diagnosis. Among ACs, not being poor/near poor was associated with lower odds (aOR 0.55, 95% CI 0.37–0.83) of a hypertension diagnosis.

For the outcome of diabetes, among AAs, a higher level of education was associated with lower odds of diabetes diagnosis. Among AIs, having health insurance and a lower level of education was associated with higher odds (aOR 3.22, 95% CI 1.29–8.04) of diabetes diagnosis while a higher level of education (aOR 0.29, 95% CI 0.10–0.87) and income (aOR 0.44, 95% CI 0.23–0.83) was associated with lower odds of diabetes diagnosis.

Discussion

This nationally representative sample revealed differences in the prevalence and social determinants of CVD risk factors (hypertension and diabetes) among ethnic subgroups of Blacks in the U.S. Over two decades ago, Cooper and colleagues found a consistent gradient of hypertension prevalence, rising from 16% in West Africa to 26% in the Caribbean to 33% in the U.S. [38]. To our knowledge, the RODAM study [39] of Ghanaians residing in rural and urban Ghana and three European cities is the only contemporary epidemiological study of this nature comparing the prevalence of hypertension in Blacks residing in different geographical regions. Our study is another important contribution to the literature on ethnic differences in CVD risk factors among Blacks.

AAs have among the highest prevalence of hypertension in the world and hypertension in AAs accounts for approximately 50% of the excess mortality from CVD in comparison to Whites [2, 40]. The conundrum of why Blacks in the U.S. have a higher prevalence of hypertension remains to be solved, although a list of probable causes has been presented [41]. Nonetheless, it is evident that biology alone does not explain this public health challenge, because as shown in this study, AIs who are primarily of African ancestry had lower hypertension prevalence than AAs. It is reasonable to postulate that an interaction of biology, behavior, and environment may explain the burden of hypertension in Blacks. The prevalence of hypertension in AIs in this study (21%) was considerably lower than estimates in the Afro-Cardiac Study (40%)

Table 1 Sociodemographic characteristics ($N = 40,838$)

Mean (SE)/*N* (%)	AAs (*N* = 36,881)	AIs (*N* = 1660)	ACs (*N* = 2297)	*p* value
Age	42.7 ± 0.2	38.6 ± 0.6	46.6 ± 0.7	< 0.0001
Women	21,746 (59)	791 (48)	1311 (57)	< 0.0001
Educational status				
< High school	8799 (24)	294 (18)	424 (18)	< 0.0001
HS graduate	10,768 (29)	304 (18)	705 (31)	
Some college	11,494 (31)	498 (30)	673 (29)	
≥ College graduate	5820 (16)	564 (34)	495 (22)	
Not poor/near poor[a]	26,050 (71)	1260 (73)	1708 (74)	< 0.0001
Health insurance (yes)[b]	30,346 (82)	1206 (73)	1835 (80)	< 0.0001
Married[c]	10,377 (29)	797 (49)	1085 (48)	< 0.0001
Length of stay ≥ 10 years[d]	–	971(59)	1914(85)	< 0.0001

AAs African Americans, *AIs* African immigrants, *ACs* Afro-Caribbeans, *HS* high school

[a] Reference is Poor/near poor

[b] Reference group is Health insurance(no)

[c] Reference group is not married

[d] Reference group is <10 years

which included Ghanaian- and Nigerian-born AIs [21]. In the "Africans in America Study", systolic and diastolic blood pressure was higher in AIs ($n = 138$) than in AAs ($n = 76$) [20]. Future comparative studies of AAs, AIs, and ACs should further assess gene-environment interactions among these three groups to better understand factors contributing to this paradox.

The social determinants associated with hypertension were considerably different across the three ethnic groups. In AAs, higher socioeconomic status (not poor/near poor or higher levels of education) was associated with a lower likelihood of having diagnosed hypertension and this finding is consistent with previous studies [42, 43]. In AIs, who were more educated than AAs but not ACs, having health insurance was associated with a higher likelihood of a self-reported diagnosis of hypertension. This finding may be explained by the fact that AIs who are insured are more likely to be screened and diagnosed with hypertension than those who do not possess health insurance. This is supported by the fact that AIs had the lowest insurance rate across the three ethnic groups. Fang and colleagues observed that in the Behavioral Risk Factor Surveillance System (which also uses self-reported data), participants who were uninsured were less likely to take antihypertensive medication and visit a doctor within the past year for routine care than insured participants [44].

In ACs, there was an inverse association between income and diagnosed hypertension. The Migration Policy Institute estimated that the Caribbean immigrant population in the U.S. had lower median household incomes ($41,000) compared to both the total AIs ($49,000) and AAs ($55,000) in 2014 [15]. A scoping review on hypertension by the U.S. Caribbean Alliance for Health Disparities Research Group documented that hypertension and its related complications were most prevalent in persons with low socioeconomic status

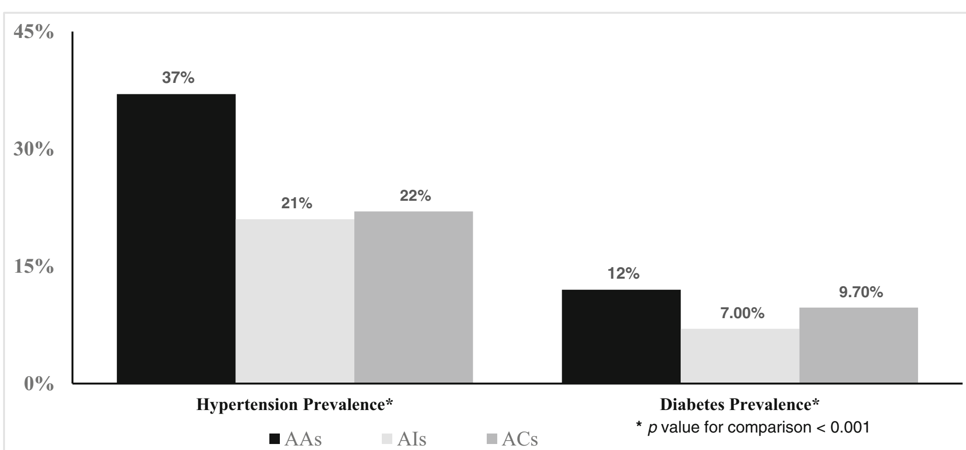

Fig. 1 Age- and sex-adjusted prevalence: hypertension and diabetes

Table 2 Multivariable logistic regression analyses of the associations among social determinants, hypertension, and diabetes by ethnicity ($N = 40,838$)

	Hypertension aOR (95% CI)			Diabetes aOR (95% CI)		
	AAs ($N = 36,881$)	AIs ($N = 1660$)	ACs ($N = 2297$)	AAs ($N = 36,881$)	AIs ($N = 1660$)	ACs ($N = 2297$)
Not poor/near poor	**0.86 (0.77–0.96)**	0.81 (0.46–1.44)	**0.55 (0.37–0.83)**	0.89 (0.77–1.03)	**0.44 (0.23–0.83)**	0.67 (0.43–1.05)
Educational status						
< High school	Ref	Ref	Ref	Ref	Ref	Ref
High school graduate	0.87 (0.76–1.01)	1.40 (0.64–3.03)	0.77 (0.46–1.26)	0.87 (0.76–0.99)	0.63 (0.13–2.91)	0.63 (0.32–1.23)
Some college	**0.79 (0.68–0.92)**	0.74 (0.33–1.51)	1.15 (0.70–1.89)	0.91 (0.77–1.07)	**0.29 (0.10–0.87)**	0.74 (0.35–1.59)
College graduate	**0.62 (0.53–0.73)**	0.90 (0.37–2.19)	0.83 (0.48–1.41)	**0.60 (0.49–0.73)**	0.30 (0.10–1.05)	0.76 (0.38–1.55)
Health insurance coverage	0.99 (0.89–1.10)	**1.59 (1.04–2.42)**	1.09 (0.72–1.65)	1.02 (0.89–1.16)	**3.22 (1.29–8.04)**	1.07 (0.64–1.77)
Married	1.07 (0.97–1.18)	1.33 (0.88–2.01)	1.12 (0.80–1.55)	1.03 (0.92–1.15)	1.11 (0.59–2.06)	0.68 (0.44–1.05)

Wealth-poverty income ratio > 2; model adjusted for age, sex, and overweight/obesity status

AAs African Americans, *AIs* African immigrants, *ACs* Afro-Caribbeans, *HS* high school, *aOR* adjusted odds ratio, *Ref* reference group, Bold- $p<0.05$

[45]. ACs in the U.S. who may be highly educated but have low income may be at risk for poor hypertension outcomes. Hence, public health strategies to improve hypertension screening in vulnerable populations should also be directed toward ACs.

The age- and sex-adjusted prevalence of diabetes in AAs in our study (12%) is similar to previous estimates published by the Centers for Disease Control and Prevention [46], but estimates in AIs (7%) and ACs (9.7%) are lower than the previously published studies [21, 45, 47]. However, it is plausible that diabetes and hypertension prevalence is underestimated in AIs and ACs as they are more likely to have limited access to healthcare than their AA counterparts and may have higher rates of undiagnosed diabetes [48]. In the "Africans in America Study," AIs (8%) had a higher prevalence of undiagnosed diabetes (8 versus 0%) and prediabetes (35 versus 22%) than AAs [20]. The International Diabetes Federation also estimates that Sub-Saharan Africa has the highest (78%) percentage of undiagnosed diabetics globally [49]. Hence, AIs may actually have worse cardiometabolic health and may have poor access to healthcare to detect cardiometabolic conditions.

The social determinants associated with diabetes differed significantly across the three ethnic groups. In AAs, a higher level of education was associated with a lower likelihood of self-reported diabetes. A decade later, our findings are similar to Borell's earlier analysis [50] which showed that persons with less than high school education were almost twice as likely to report having diabetes as those with at least a bachelor's degree. However, in their study, although non-Hispanic Blacks had the highest prevalence of diabetes, there was no association between education and self-reported diabetes. Other studies have also found an inverse association between education and diabetes [51]. In our study, AIs with some college education were less likely to report a diabetes diagnosis than those with less than high school education. However, AIs who had health insurance were three times more likely to have self-reported diabetes than their counterparts without health insurance. In a study of the association between health insurance and diabetes status in the NHIS, Casangrande and Cowie [51] observed that for individuals ages 18–64 years, high health insurance cost was the main reason for not possessing health insurance, irrespective of diabetes status (51.5% of diabetic and 46.5% of nondiabetic individuals). Furthermore, those with higher levels of education were more likely to be insured than those with less than high school education. However, in our study, although AIs had the a higher level of education and AAs, they were the less likely to have health insurance. Additional studies are needed to understand barriers to health insurance coverage among foreign-born Blacks.

Although regional cohort studies such as the Jackson Heart Study, Reasons for Geographic and Racial Differences in Stroke (REGARDS) Study, Genetics of Hypertension Associated Treatments (GenHAT) Study, and Bogalusa Heart Study provide opportunities to understand disparities in CVD risk and outcomes in Blacks, none of these studies include substantive representation of AIs and ACs, or if they do, their outcomes are not reported separately. This gap in knowledge may be attributed to recruitment strategies that target AAs and exclude foreign-born Blacks. The considerable heterogeneity of the current Black population in the U.S. provides a unique opportunity to investigate risk factors for hypertension and diabetes as well as factors that protect Black ethnic subgroups from hypertension and diabetes despite exposure to deleterious environmental factors.

Despite the strengths of this study, there are limitations which must be considered. The cross-sectional design of this study precludes any causal inferences about the association between social determinants and hypertension and diabetes. Marital status was used as a proxy for social support and may not fully capture this latent construct. This may explain the non-significant associations which were observed between social determinants and our outcomes. Also, hypertension and diabetes statuses were self-reported, which may have resulted in an underestimation of the true prevalence of these conditions in the immigrants who may have a lower awareness of these conditions [52]. Lastly, the relatively smaller samples of AIs and ACs in comparison to AAs, may have resulted in less precise estimation of hypertension and diabetes prevalence.

Conclusions

Our analysis of data from a large population-based survey suggests that the social determinants of hypertension and diabetes within AAs, AIs, and ACs differ by ethnicity. In AAs, income and education level were the strongest social determinants of hypertension and diabetes. In AIs, health insurance coverage and education level were the strongest social determinants of hypertension and diabetes. In ACs, income was the strongest social determinant of hypertension.

Given the growing number of foreign-born Blacks in the U.S., a paradigm shift in current approaches to research among African descent populations is needed to inform population health interventions to improve the cardiovascular health of Blacks. If the burden of CVD is to be effectively reduced in Blacks, the underlying contributors to CVD risk factors, including social determinants, need to be understood within ethnic groups who are of African descent. An important distinction that is necessary for future investigations on disparities in hypertension and diabetes outcomes is that the Black population in the U.S. is not homogenous. Although AAs, AIs, and ACs share African ancestry, genetic admixture, cultural differences, and differences in social determinants of health influence their health outcomes differentially.

Funding Yvonne Commodore-Mensah was supported by a Career Development Award through The Johns Hopkins Institute for Clinical and Translational Research (ICTR) 5KL2TR001077-05. Lisa A. Cooper was supported by a grant from the National Heart, Lung, and Blood Institute (K24HL083113).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethics Approval This article does not contain any studies with human participants performed by any of the authors. We did not obtain ethics approval from our institution Ethical Review Board because de-identified and publicly available data was used from the National Center for Health Statistics in this study. There were no identifying data for participants in the dataset used in this study.

Informed Consent Informed consent was obtained from all individual participants included in the study by the National Center for Health Statistics.

References

1. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R et al. Heart disease and stroke statistics—2017 update: a report from the American Heart Association. Circulation 2017.
2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and stroke statistics—2016 update: a report from the American Heart Association. Circulation. 2016;133:e38–e360.
3. Heisler M, Smith DM, Hayward RA, Krein SL, Kerr EA. Racial disparities in diabetes care processes, outcomes, and treatment intensity. Med Care. 2003;41:1221–32.
4. Lloyd-Jones DM, Hong Y, Labarthe D, Mozaffarian D, Appel LJ, Van Horn L, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic impact goal through 2020 and beyond. Circulation. 2010;121:586–613.
5. Albertus P, Morgenstern H, Robinson B, Saran R. Risk of ESRD in the United States. Am J Kidney Dis. 2016;68:862–72.
6. Ward BW, Schiller JS, Goodman RA. Multiple chronic conditions among US adults: a 2012 update. Prev Chronic Dis. 2014;11:E62.
7. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Borden WB, et al. Heart disease and stroke statistics—2013 update: a report from the American Heart Association. Circulation. 2013;127:e6–e245.
8. U.S Census Bureau. Quick facts: United States. 2016; 2017.
9. Commodore-Mensah Y, Dennison Himmelfarb CR, Agyemang C, Sumner AE. Cardiometabolic health in African immigrants to the United States: a call to re-examine research on African-descent populations. Ethnicity Dis. 2015;25:373–80.
10. Capps R, McCabe K, Fix M. New streams: black African migration to the United States. Migration Policy Institute 2011.
11. BBC News. Quick guide: the slave trade. British Broadcasting Corporation 2007; 2016. http://news.bbc.co.uk/2/hi/africa/6445941.stm
12. Bryc K, Auton A, Nelson MR, Oksenberg JR, Hauser SL, Williams S, et al. Genome-wide patterns of population structure and admixture in West Africans and African Americans. Proc Natl Acad Sci U S A. 2010;107:786–91.
13. Bryc K, Durand EY, Macpherson JM, Reich D, Mountain JL. The genetic ancestry of African Americans, Latinos, and European Americans across the United States. Am J Hum Genet. 2015;96:37–53.
14. Agyemang C, Bhopal R, Bruijnzeels M. Negro, Black, Black African, African Caribbean, African American or what? Labelling African origin populations in the health arena in the 21st century. J Epidemiol Community Health. 2005;59:1014–8.
15. Zong, J. & Batalova, J. Caribbean immigrants in the United States 2016; 2017. https://www.migrationpolicy.org/article/caribbean-immigrants-united-states
16. Anderson M. A rising share of the U.S. Black population is foreign born 2015; 2016.
17. Bennett NR, Francis DK, Ferguson TS, Hennis AJ, Wilks RJ, Harris EN, et al. Disparities in diabetes mellitus among Caribbean populations: a scoping review. Int J Equity Health. 2015;14:23–015-0149-z.
18. Anderson M. African immigrant population in the U.S. steadily climbs. 2017; 2017. http://www.pewsocialtrends.org/2015/04/09/a-rising-share-of-the-u-s-black-population-is-foreign-born/
19. 96th Congress. Refugee Act of 1980. 1980; 96–212. https://www.gpo.gov/fdsys/pkg/STATUTE-94/pdf/STATUTE-94-Pg102.pdf
20. O'Connor MY, Thoreson CK, Ricks M, Courville AB, Thomas F, Yao J, et al. Worse cardiometabolic health in African immigrant men than African American men: reconsideration of the healthy immigrant effect. Metab Syndr Relat Disord. 2014;

21. Commodore-Mensah Y, Hill M, Allen J, Cooper LA, Blumenthal R, Agyemang C, Himmelfarb CD. Sex differences in cardiovascular disease risk of Ghanaian- and Nigerian-born West African immigrants in the United States: the Afro-Cardiac Study. J Am Heart Assoc 2016; 5:https://doi.org/10.1161/JAHA.115.002385.
22. McDonald JT, Kennedy S. Insights into the 'healthy immigrant effect': health status and health service use of immigrants to Canada. Soc Sci Med. 2004;59:1613–27.
23. Kennedy S, McDonald JT, Biddle N. The healthy immigrant effect and immigrant selection: evidence from four countries. Social and Economic Dimension of an Aging Population (SEDAP) 2006; 164.
24. Havranek EP, Mujahid MS, Barr DA, Blair IV, Cohen MS, Cruz-Flores S, et al. Social determinants of risk and outcomes for cardiovascular disease: a scientific statement from the American Heart Association. Circulation. 2015;132:873–98.
25. Pollitt RA, Rose KM, Kaufman JS. Evaluating the evidence for models of life course socioeconomic factors and cardiovascular outcomes: a systematic review. BMC Public Health. 2005;5:7.
26. Diez Roux AV, Detrano R, Jackson S, Jacobs DR Jr, Schreiner PJ, Shea S, et al. Acculturation and socioeconomic position as predictors of coronary calcification in a multiethnic sample. Circulation. 2005;112:1557–65.
27. Shavers VL, Fagan P, Jones D, Klein WM, Boyington J, Moten C, et al. The state of research on racial/ethnic discrimination in the receipt of health care. Am J Public Health. 2012;102:953–66.
28. Harris MI. Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. Diabetes Care. 2001;24:454–9.
29. Clark R. Self-reported racism and social support predict blood pressure reactivity in Blacks. Ann Behav Med. 2003;25:127–36.
30. Levenstein S, Smith MW, Kaplan GA. Psychosocial predictors of hypertension in men and women. Arch Intern Med. 2001;161:1341–6.
31. Strogatz DS, Croft JB, James SA, Keenan NL, Browning SR, Garrett JM, et al. Social support, stress, and blood pressure in black adults. Epidemiology. 1997;8:482–7.
32. National Heart Lung and Blood Institute. Charting the future together: the NHLBI strategic vision. 2016. 2016; https://www.nhlbi.nih.gov/sites/www.nhlbi.nih.gov/files/NHLBI-Strategic-Vision-2016_FF.pdf
33. National Center for Health Statistics. National Health Interview Survey, 2010-2014. Public-use data file and documentation 2015; 2016.
34. Parsons VL, Moriarity C, Jonas K, Moore TF, Davis KE, Tompkins L. Design and estimation for the national health interview survey, 2006-2015. Vital Health Stat. 2014;2(165):1–53.
35. American Diabetes Association. (2) Classification and diagnosis of diabetes. Diabetes Care 2015; 38 Suppl:S8-S16.
36. NHLBI Obesity Education Initiative Expert Panel on the identification, evaluation, and treatment of obesity in adults (US). Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. Bethesda (MD): National Heart, Lung, and Blood Institute; 1998 Sep. Available from: https://www.ncbi.nlm.nih.gov/books/NBK2003/
37. National Health Interview Survey. Variance estimation and other analytic issues, NHIS 2006-2014-2006. 2015; 2016.
38. Cooper R, Rotimi C, Ataman S, McGee D, Osotimehin B, Kadiri S, et al. The prevalence of hypertension in seven populations of West African origin. Am J Public Health. 1997;87:160–8.
39. Agyemang C, Beune E, Meeks K, Owusu-Dabo E, Agyei-Baffour P, Aikins A, et al. Rationale and cross-sectional study design of the Research on Obesity and type 2 Diabetes among African Migrants: the RODAM study. BMJ Open. 2014;4:e004877–2014-004877.
40. Institute of Medicine. Unequal treatment: confronting racial and ethnic disparities in health care (with CD). Washington, DC: The National Academies Press; 2003. 10.17226/12875.
41. Fuchs FD. Why do black Americans have higher prevalence of hypertension?: an enigma still unsolved. Hypertension. 2011;57:379–80.
42. Grotto I, Huerta M, Sharabi Y. Hypertension and socioeconomic status. Curr Opin Cardiol. 2008;23:335–9.
43. Brummett BH, Babyak MA, Siegler IC, Shanahan M, Harris KM, Elder GH, et al. Systolic blood pressure, socioeconomic status, and biobehavioral risk factors in a nationally representative US young adult sample. Hypertension. 2011;58:161–6.
44. Fang J, Zhao G, Wang G, Ayala C, Loustalot F. Insurance status among adults with hypertension—the impact of underinsurance. J Am Heart Assoc 2016; 5:https://doi.org/10.1161/JAHA.116.004313.
45. Bidulescu A, Francis DK, Ferguson TS, Bennett NR, Hennis AJ, Wilks R et al. Disparities in hypertension among black Caribbean populations: a scoping review by the U.S. Caribbean Alliance for Health Disparities Research Group (USCAHDR). Int J Equity Health 2015; 14:125–015–0229-0.
46. Centers for Disease Control and Prevention National diabetes fact sheet: national estimates and general on diabetes and prediabetes in the United States, 2011. U S Department of Health and Human Services, Centers for Disease Control and Prevention 2011.
47. Hyman DJ, Ogbonnaya K, Pavlik VN, Poston WS, Ho K. Lower hypertension prevalence in first-generation African immigrants compared to US-born African Americans. Ethn Dis. 2000;10:343–9.
48. Venters H, Gany F. African immigrant health. J Immigr Minor Health. 2011;13:333–44.
49. International Diabetes Federation. IDF diabetes atlas—home. 2015; 2016. http://www.diabetesatlas.org/
50. Borrell LN, Dallo FJ, White K. Education and diabetes in a racially and ethnically diverse population. Am J Public Health. 2006;96:1637–42.
51. Stark Casagrande S, Cowie CC. Health insurance coverage among people with and without diabetes in the U.S. adult population. Diabetes Care. 2012;35:2243–9.
52. Langellier BA, Garza JR, Glik D, Prelip ML, Brookmeyer R, Roberts CK, et al. Immigration disparities in cardiovascular disease risk factor awareness. J Immigr Minor Health. 2012;14:918–25.