The Healthy Migrant Effect: An Examination of Hypertension, Body Mass Index, and Diabetes among African-Born Black Immigrants within the United States

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Abstract

Over the course of the last 50 years, the United States has experienced an upsurge in the rates of immigration from sub-Saharan Africa. Despite this growth being well documented, research examining the health of African immigrants has not kept pace. This study addresses this gap in the literature by examining the healthy migrant effect among African-born blacks by means of three cardiometabolic outcomes from the National Health Interview Survey: hypertension, obesity, and diabetes. Results indicate that, when compared to U.S.-born, non-Hispanic whites, African-born blacks show no significant difference in their odds for hypertension, significantly higher odds for overweight ($p<0.001$), significantly lower odds for obesity ($p<0.001$) and significantly higher odds for diabetes ($p<0.05$). When compared to U.S.-born, non-Hispanic blacks, African-born blacks are at significantly lower odds for hypertension and obesity ($p<0.001$) and show no significant difference in their odds for overweight and diabetes. Interactions of race/ethnicity by duration suggest that African-born blacks have the lowest relative risk for each outcome in the earliest periods of duration. Further, these interactions suggest that as duration increases, health status decline and converges with that of U.S.-born, non-Hispanic whites. These findings provide support for the healthy migrant effect among African-born blacks within the United States.

Keywords: African health; immigrant health; health disparities; NHIS

Introduction

Immigrant populations tend to be healthier and have lower rates of all-cause mortality when compared to those born within the United States. This statement reflects the central premise of the healthy migrant effect – a perspective that has gained tremendous traction in the field of immigrant health research. Much of the research examining this healthy migrant effect has focused on Hispanics, often leaving smaller migrant groups understudied. This becomes problematic as the composition of the foreign-born population in the U.S. changes. Take African-born migrants, the focus of this study, for example. Since the 1970s, African immigration to the U.S. has increased consistently and substantially. Research on the health of this new migrant population was present throughout much of the 1990s up until the mid-2000s but has since declined. The decline in research has led to uncertainty regarding the presence or absence of the healthy migrant effect and how this healthy migrant effect relates to that seen in other migrant populations.

The existing literature on African immigrant health suggests that hypertension rates are lower only when compared to U.S.-born, non-Hispanic black counterparts. Some recent research goes further to contest this argument by stating that African immigrants show not only worse rates of hypertension when compared to U.S.-born, non-Hispanic blacks, but worse cardiovascular health overall. Albeit sparse, the literature looking at overweight and obesity suggest that African immigrants are at lower risk for high BMI, but this often refers to obesity rather than both overweight and obesity. Diabetes, an outcome rather unexamined in the African immigrant health literature, is suggested to be higher. Other findings show that African immigrants may be at heightened risk of undiagnosed pre-diabetic. In a more general sense, there

has yet to be a consensus reached among researchers on the presence or absence of a healthy migrant effect within this group.

This study addresses this gap in the literature by examining the presence or absence of the healthy migrant effect through three cardiometabolic health outcomes: hypertension, body mass index – specifically overweight and obese, and diabetes. The purpose of doing this is to gain further insight into the relative experience of non-Hispanic migrants and to address the health concerns of the rapidly growing African immigrant community. Based on extant literature, I hypothesize first that African immigrants within the United States will display some form of the healthy migrant effect. Second, if African immigrants do show this healthy migrant effect, it will be in a muted form when compared to other foreign-born groups. Finally, the effects of duration for African-born immigrants will be more pronounced than that seen in foreign-born Mexicans and foreign-born, non-Hispanic whites.

Background

African Movement and Immigration to the United States

The voluntary movement of Africans into the U.S. is a relatively recent phenomenon. Following the end of the trans-Atlantic slave trade in 1807, there was essentially zero movement from Africa to the U.S. (Anderson 2017; Capps, McCabe, and Fix 2012; Elo, Mehta, and Huang 2011; Gordon 1998; Kent 2007; McCabe 2011). The century and a half that followed is generally viewed as a period of white-privileged migration; U.S. policies emphasized preference toward European immigrants and all but barred the entrance of immigrants from Africa, Asia, and regions of Central and South America (Elo, Mehta, and Huang 2008; Kent 2007; Massey 1995).

Between the late 1800s and the 1950s, the U.S. saw approximately 30,000 Africans immigrate, many of whom were students (Gordon 1998).

By the late 1960s, African immigration began to increase substantially due to two central points. First, the late 1950s and 1960s were periods of independence for much of the African continent (Takougang 2003). As European colonizers were forced out of power, Africans established sovereign rule. While sovereignty came with obvious benefits, it also came with an increased likelihood of political, economic, and social instability (Takougang 2003). Competition over resources, steep declines in the price of exported goods, lack of reliable employment, and heightened risk of political conflict motivated many Africans to emigrate to regions of Europe and the Americas (Takougang 2003). Former colonial ties and relatively close geographic proximity offered many emigrants secure passage into Europe, often with some semblance of citizenship awaiting them. The decision to emigrate to Europe was also motivated by the absence of legal means to enter the U.S., due to its restrictive immigration laws. In 1965, the U.S. addressed these barriers with the introduction of the Immigrant and Nationality (Hart-Cellar) Act. The Hart-Cellar act relaxed the restrictions in the previous immigration policy, broadened the scope of refugee and asylee classifications and allowances, and established the diversity visa, one of the primary pathways of African immigration (Capps et al. 2012; Elo, Mehta, and Huang 2011; Kent 2007; McCabe 2011; Pierre 2004; Singh and Yu 1996).

In this new period of increased migration, the U.S. experienced a dramatic increase in the number of foreign-born Africans (Mehta, Elo, Engelman, Laudredal, and Kestenbaum 2016). In1970, approximately 0.8% of the foreign-born population of the U.S., or 80,000 people, immigrated from Africa; by 2000 that number had increased over ten-fold to 881,000, and by 2015 over 2 million Africans were living within the U.S. (Anderson 2017; Hintzen and Rahier

2003; Takougang 1995). Three-quarters of African-born migrants racially identify as black and the remaining quarter often identify as white," (Capps et al. 2012; Kent 2007). The two largest national groups in the U.S. are Nigerian and Ethiopian (Anderson 2017; Kent 2007; McCabe 2011). These two countries have been the largest sources of African immigrants since the migration spike began in the 1970s.Egypt, Ghana, Kenya, South Africa, Somalia, Morocco, Liberia, Cameroon, Sierra Leone, Cape Verde, and Sudan are also notable sources of African immigrants to the U.S. (Anderson 2017; Kent 2007). Over three-quarters of African immigrants enter the U.S. through legal means (Capps et al. 2012). Among those who entered through legal means in 2009, 48 percent entered through family relationships, 24 percent through diversity visas, 22 percent as refugees or asylees, 5 percent through employment visas, and the remaining 1 percent through other, miscellaneous methods (McCabe 2011).

African-born blacks report higher levels of education than black Americans and are the second most highly educated immigrant group in the U.S., following Asian Americans (Elo et al. 2008; Elo et al. 2011; Kent 2007; Read and Emerson 2005; Singh and Siahpush 2002). African-born blacks tend to live in higher proportion white neighborhoods when compared to U.S.-born and other foreign-born black populations (Elo et al. 2008). Despite heighted rates of education and lowered rates of segregation, African-born blacks experience the lowest economic returns on education and remain in lower socioeconomic position when compared to U.S.-born, non-Hispanic whites (Butcher 1994; Read and Emerson 2005). What is left unclear is how clearly the healthy migrant effect manifests within the African-born black population.

The Healthy Migrant Effect

Immigrants, particularly those of color, are subject to high rates of socioeconomic disadvantage upon arrival to the U.S. (Gould et al. 2003; Guendelman et al. 1999; Razum et al. 1998; Rumbaut 1997). Immigrants display lowered access to: social resources – education, technical and vocational training, childcare; economic resources – employment opportunities, wages comparable to U.S.-born counterparts; and health care resources – health insurance, culturally competent care, regular sources of primary and preventative care (Gould et al. 2003; Guendelman et al. 1999). These disadvantages suggest that immigrants should report poorer overall health, heightened rates of acute and chronic conditions, and heightened rates of all-cause mortality than those born in the U.S. Literature on immigrant health suggests otherwise. It has been well documented that immigrants, despite significant socioeconomic disadvantage, report superior health and health outcomes when compared to U.S.-born counterparts, including non-Hispanic whites (Abraído-Lanza, Dohrenwend, Ng-Mak, and Turner 1999; Abraído-Lanza, Chao, and Flórez 2005; Hamilton and Hummer 2011; Markides and Eschbach 2005; Palloni and Arias 2004). The question then becomes: why?

One of the most widely accepted explanations for this "healthy migrant effect" relates to migrant selection. Through this perspective, migrants do not represent a randomly selected group. Rather, migrants are positively selected within their respective regions of origin based on superior physical and psychological health (Elo et al. 2008; Mehta et al. 2016; Palloni and Arias 2004; Riosmena, Kuhn, and Jochem 2017). Healthier persons are then more likely to emigrate which results in an over-representation of healthier individuals in the destination region. As a result, immigrants are perceived to be healthier than the "native born" population, but these effects may not be long lived. As duration within the U.S. increases, the healthy migrant effect diminishes, and health begins to converge with that of the U.S.-born population and, in some

cases, continues to deteriorate (Abraído-Lanza, Chao, and Flórez 2005; Riosmena and Dennis 2012; Riosmena, Everett, Rogers, and Dennis 2015).

The presence of a healthy migrant effect has been most frequently supported in Hispanic immigrant groups, currently the largest immigrant population in the U.S. (Abraído-Lanza, Dohrenwend, Ng-Mak, and Turner 1999; Abraído-Lanza, Chao, and Flórez 2005). As the composition of the foreign-born population continues to change, it remains unclear as to the degree of support for the healthy migrant effect. Elo and colleagues (2008) suggest that black immigrants may experience different, potentially heightened, rates of stress when compared to other, non-black immigrant groups. The reason being that black immigrants will be exposed to different forms of prejudice and discrimination associated with the historically racialized structure of the U.S., including but not limited to, interpersonal discrimination and racism, residential segregation, and income inequality (Elo et al. 2008). This may be particularly relevant for black immigrants from Africa, as they come from minority-white regions where the racial structures are notably different than that within the U.S. (Chandler 2010; Elo et al. 2008; Hamilton and Hummer 2011; Read and Emmerson 2005).

Health and Cardiometabolic Conditions

Research on African-born migrant health has reported important findings, but there does not appear to be a consensus regarding the healthy migrant effect. Some findings suggest that African-born blacks do show signs of the healthy migrant effect and experience superior health when compared to U.S.-born, non-Hispanic blacks (Cunningham, Ruben, and Narayan 2008; Elo et al. 2008; Hamilton and Hummer 2011; Mehta et al. 2016; Okafor, Carter-Pokras, Picot, and Zhan 2013; Poston, Pavlik, Ogbonnaya, Hanis, Haddock, Hyder, and Foreyt 2001; Venters and

Gany 2011). What is less clear is how African-born blacks compare to the racial/ethnic majority, non-Hispanic white, population. Additionally, more recent research has added uncertainty to previously held findings, suggesting that there is no evidence of the healthy migrant effect among African-born blacks. The following section examines each of the three outcomes of interest with regards to African-born blacks.

Hypertension

Hypertension, or "high blood pressure," refers to a situation in which an individual has a systolic blood pressure reading of 140mmHg or higher and/or a diastolic blood pressure reading of 90 mmHg or higher (American Heart Association 2017). Within the U.S., approximately 1/3 of all adults are hypertensive and those who are black/African American, overweight or obese, and/or physically inactive are at a heightened risk of developing the condition (American Heart Association 2017). Hypertension is one of the leading causes of all cardiovascular diseases and deaths both in the U.S. and worldwide (American Heart Association 2017; Poston et al. 2001; van de Vijver, Akinyi, Oti, Olajide, Agyemang, Aboderin, and Kyobutungi 2013). It then comes as no surprise that hypertension is one of the most readily studied health outcomes among African-born groups. Many of these studies have shown that, when compared to U.S.-born, non-Hispanic blacks, African-born blacks are less likely to report being hypertensive (Cooper et al. 1997; Osei and Schuster 1996; Poston et al. 2001; Venter and Gany 2011). This aligns with immigrant health literature, as it is documented that immigrants tend to have lower odds of hypertension (Cunningham et al. 2008; Singh and Siahpush 2002). Another segment of this literature presents contrary findings.

In their 2014 study, O'Connor and colleagues reported that African-born blacks reported higher rates of hypertension than those seen in U.S.-born, non-Hispanic blacks. The authors go on to show that cardiovascular health is worse in their sample of African immigrants as compared to U.S.-born, non-Hispanic blacks (O'Connor et al. 2014). Additionally, the World Health Organization (WHO; 2014) found that hypertension rates are increasing rapidly for most African populations. This presents a conundrum, as it is unclear if African-born blacks are at higher, comparable, or lower risk for developing hypertension when compared to U.S.-born counterparts. Further, it remains unclear how African-born blacks fair when compares to U.S.-born, non-Hispanic whites.

Body Mass Index: Overweight and Obesity

Obesity directly relates to the measurement "body-mass-index" (BMI). While there are some issues with the use of BMI, it is typically used as an indicator of high body fat content and can be used diagnostically. Individuals with a BMI of 30.0 or greater are considered "obese" (Centers for Disease Control and Prevention [CDC] 2018). Obesity is known to increase the risk of hypertension, high cholesterol, diabetes, heart disease, and stroke (CDC 2018). Additionally, obesity has been shown to lower relative quality of life (CDC 2018).

Albeit sparse, literature has shown that African-born blacks have lowered risk for obesity when compared to U.S.-born, non-Hispanic blacks (Elo and Culhane 2010; Read and Emmerson 2005; Singh and Siahpush 2002). Broader immigrant health research suggests that migrant populations are at lower risk for obesity when compared to U.S.-born counterparts (Cunningham et al. 2008; Singh and Siahpush 2002). In accordance with the healthy migrant effect, it is documented that BMI increases with duration in the U.S. (Singh and Siahpush 2002).

Diabetes

Individuals with diabetes have either a non-fasting blood glucose level of 200mg/dL or higher, and/or a fasting blood glucose level of 126mg/dL or higher (Mayo Clinic 2018). The risk of diabetes is higher among overweight (BMI ≥25.0) and obese individuals and those above age 45 (Mayo Clinic 2018). Unlike hypertension and obesity, research has shown that immigrants are at higher risk for diabetes than their U.S.-born counterparts (Cunningham et al. 2008; O'Connor et al. 2014). African-born blacks are more likely to have undiagnosed pre-diabetic and diabetic glucose levels when compared to U.S.-born, non-Hispanic blacks (O'Connor et al. 2014; Ukegbu et al. 2011; Yu et al. 2013).

Data and Methodology

Data and Variables

I use data from the National Health Interview Survey (NHIS) for the years 2002 to 2017. The NHIS is a repeated, cross-sectional survey conducted annually within the U.S. by the National Center for Health Statistics (NCHS). It is designed to monitor and report the health status of non-institutionalized populations in conjunction with important demographic and socioeconomic characteristics. Data are collected throughout the calendar year and subsequently separated into 6 predetermined data files. This study uses data from the Family, Person, and Sample Adult files. All NHIS files were obtained through the NCHS public-access, government website.

The variables included in my analyses are as follow. Hypertension is a dichotomous variable that reflects a self-report of hypertension. The original question for this variable was if a "doctor has ever told you that you have hypertension?" Those answer "yes" receive "1," while all others receive "0." Body Mass Index (BMI) is a categorical variable with four potential outcomes: "1" is underweight (<18.5); "2" is normal weight (18.5-24.9); "3" is overweight (25-29.9); and "4" is obese (≥30.0). Finally, diabetes is a dichotomous variable that reflects the self-reported answer to the question, "has a doctor ever told you that you have diabetes?" Those who answer "yes" receive "1" and all others receive "0." Type 1 and Type 2 diabetes are not differentiated. Year is a continuous measure beginning in 2002 and continuing through 2017. Age remains in its NHIS form as a continuous measure, top-coded at age "85+." For analyses, age is mean-centered and age-squared (age^2) functional form is included. Sex is recoded to the dichotomous "female," in which "1" denotes females and "0" males. Race/ethnic identity was created with three NHIS variables: racial identity, Hispanic identity, and region of birth. Those who report being non-Hispanic white (referent), non-Hispanic black, and Mexican with a region of birth inside the U.S. were identified as such. Foreign-born, non-Hispanic whites and foreign-born Mexicans are simply those who identified their region of birth as anywhere other than the U.S. Finally, African-born blacks are those who racially identified as "black," were not Hispanic, and reported being born in Africa. All other racial/ethnic identities are treated as missing and excluded from analyses. Duration reflects time spent in the U.S. since arrival. This variable is recoded from that of the NHIS to have four categories: Less than 5 years; Between 5 and 10 years; Between 10 and 15 years; Greater than 15 years. For the purposes of these analyses, all U.S.-born respondents are included in the "Greater than 15 years" category.

Human capital variables include: educational attainment (by degree), income-to-needs ratio, and insurance status and type. Educational attainment is derived from the "educ" variables in NHIS and is groups into categories based on highest degree obtained: Less than high school; High School/GED/Equivalent; Some college/Associate degree; Bachelor's degree; Graduate/Professional degree. Income-to-needs ratio (INR) is a combination of "rat_cat" variables across survey years to create the following categories: Less than 1.00; 1.00-1.99; 2.00-2.99; 3.00-3.99; 4.00-4.99; 5.00 or Greater. INR is the ratio of family income to a specified poverty threshold. Ratios below 1.00 indicate a familial income below the threshold, whereas any value of 1.00 or greater indicates a family income above the threshold (U.S. Census Bureau 2004). This measure is preferable to self-reported income because it reflects the entire family's income and standardizes ratios based on period-specific poverty thresholds. For replication purposes, the INR used in this study includes imputed values provided by the NCHS. These values are included to address high rates of missingness in income-related questions. Insurance status is a recode of multiple insurance-related questions provided in the NHIS. The finalized categories are: Private insurance (Private and Military/Tricare); Public Insurance (Medicare, Medicaid, Indian Health Service, and State/Government Sponsored); Other (Single Service); and No Insurance.

Health behavior variables include: smoking status and cigarette use, alcohol use, and activity level. Smoking status is coded to reflect those who report being: non/never-smokers; former smokers; and current smokers. Current smokers are then broken down into three groups: 1 pack (20 cigarettes) or less per day; Between 1 and 3 packs per day; 3 packs or more per day. Alcohol use, much like cigarette use, is broken down into three groups: never drinker (<12 alcoholic beverages in their life); former drinker (at least 12 drinks in their life, but none in the

last year); and current drinker (at least 12 drinks in their life and report drinking in last year). Light/moderate activity levels are coded to reflect those who: (1) do not partake in this activity; (2) report between 10 and 150 minutes of this activity per week; and those who (3) report over 150 minutes per week. Vigorous activity is similarly coded but reflects those who: (1) do not partake in this activity; (2) report between 10 and 75 minutes; and those who (3) report over 75 minutes per week. These cutoffs are based on the U.S. Office of Disease Prevention and Health Promotion's adult physical activity recommendations (ODPHP 2018).

Analytical Approach

I conduct multivariate analyses with binomial logistic regression models. These models are most appropriate for analyses as I have opted to use dichotomous dependent variables for two of my three outcomes (see Pampel 2000): hypertension (0 = "No," 1 = "Yes") and diabetes (0 = "No," 1 = "Yes"). I conduct multinomial logistic regression models for the outcome BMI, as BMI is a categorical variable and I am interested in seeing the odds of being overweight or obese as compared to a normal weight. I run independent models for each outcome; each set of models follow the same pattern. Model 1 is a baseline model including year of interview, sex, mean-centered age, the quadratic form of mean-centered age, and racial/ethnic identity. Model 2 introduces education, as it is assumed that migrants obtain their education before arriving. Model 3 introduced a control for duration within the U.S. The final model, Model 4, introduces the remaining covariates for human capital (INR and insurance status) and health behaviors (smoking status, alcohol use status, light/moderate activity levels, and vigorous activity levels).

Akaike's Information Criteria (AIC) and Bayesian Information Criteria (BIC) were calculated following each model. These values were then compared to assess improvement of

model fit between two models based on the relative increase in degrees of freedom (See Equation 1.1).

$$AIC_2 - AIC_1 = |\Delta|$$

[Equation 1.1]

$$BIC_2 - BIC_1 = |\Delta|$$

If the calculated absolute difference between the unrestricted (A/BIC_2) and the restricted (A/BIC_1) exceeded a value of "6" then it was determined to have, at the least, a "strong" degree of improving model fit. Final models report odds ratios for each category based on a defined referent category and are appropriately marked for significance at 99.9% ($p<0.001$), 99% ($p<0.01$), and 95% ($p<0.05$) confidence levels.

Results

Descriptive Results

Just over one-quarter of the total sample, 28.62%, report having been told that they have hypertension by a physician. U.S.-born, non-Hispanic whites, the referent, report a similar, but slightly higher percentage at 29.80%, while foreign-born, non-Hispanic whites report 26.29%. U.S.-born, non-Hispanic blacks report the highest percentage of hypertension at 38.30% and African-born blacks report 17.49%, over half that of U.S.-born blacks. Finally, U.S.- and foreign-born Mexicans report similar percentages of hypertension, at 18.59% and 17.06%, respectively. Foreign-born Mexicans display the lowest weighted percentage of hypertension diagnoses of all 6 racial/ethnic categories.

Within the total sample, 33.85% of respondents report a normal BMI, 32.90% report an overweight BMI, and 26.31% report an obese BMI. Among U.S.-born, non-Hispanic whites 34.72%, 32.82%, and 25.59% report a normal, overweight, and obese BMI, respectively. Foreign-born, non-Hispanic whites report that 39.84% have a normal, 34.61% an overweight, and 18.52% an obese BMI. Among U.S.-born, non-Hispanic blacks, 25.50% report a normal, 30.39% report an overweight, and 37.42% report an obese BMI. Within the African-born black sample, 35.71%, 37.16%, and 18.94% of respondents report a normal, overweight, and obese BMI, respectively. U.S.-born Mexicans report 29.20% at normal BMI, 31.81% at overweight, and 33.35% at obese, while foreign-born Mexicans report 25.14%, 39.17%, and 26.77%, respectively.

Finally, in the total sample, 8.44% of respondents report having been told that they have diabetes by a physician. U.S.-born, non-Hispanic whites report that 7.97% of respondents have diabetes, and foreign-born, non-Hispanic whites report 6.79%. U.S.-born, non-Hispanic blacks report that 11.60% of respondents have diabetes, the highest for any racial/ethnic group. African-born blacks are at the opposite end of the spectrum, reporting the lowest percentage at 5.04%. Finally, U.S.-born and foreign-born Mexicans report similar percentages at 7.15% and 8.69%, respectively. This is the only instance in which a foreign-born group reports a higher percentage than their U.S.-born counterparts.

Table 1 about here

Multivariate Results[1]

Hypertension

The results of sample-weighted, binomial logistic regression models for the outcome "hypertension" are reported in Table 2. The results are reported in odds ratios for ease of interpretation. Model 1 shows that African-born blacks do not have significantly different odds for hypertension when compared to the referent, U.S.-born, non-Hispanic whites, when controlling for year (period), sex, age, and age^2 effects. Similarly, African-born blacks do not have significantly different odds of hypertension when compared to foreign-born, non-Hispanic whites and Mexicans. African-born blacks display significantly lower odds for hypertension when compared to U.S.-born, non-Hispanic blacks ($p<0.001$) and Mexicans ($p<0.05$). In this model, both remaining foreign-born groups report significantly lower odds for hypertension when compared to the referent ($p<0.001$) and U.S.-born, non-Hispanic blacks report significantly higher odds ($p<0.001$).

Maintaining these controls, Model 2 introduces the educational attainment variable. African-born blacks experience little relative change between the two models – the odds for hypertension are still not significantly different than those of the referent or those of foreign-born, non-Hispanic whites. Further, the odds of hypertension are still significantly lower than that of U.S.-born, non-Hispanic blacks ($p<0.001$). The odds ratio for African-born blacks is now significantly lower than that of foreign-born Mexicans ($p<0.001$).

In Model 3, I introduce the covariate for duration of time in the U.S. The odds ratios for U.S.-born groups barely change as this variable does not pertain to them. African-born blacks

[1] AIC and BIC calculations for each unweighted model suggests significant model fit improvement based upon relative increase in degrees of freedom. These AIC and BIC values could not be computed on sample-weighted models; therefore, the unweighted AIC and BIC were used to assess model fit.

experience an upwards shift in their odds ratio but still do not show significant difference from the referent or from U.S.-born Mexicans. U.S.-born, non-Hispanic blacks continue to report significantly higher odds ($p<0.001$) for hypertension when compared to the referent and to African-born blacks. Both foreign-born, non-Hispanic whites ($p<0.01$) and Mexicans ($p<0.001$) report significantly lower odds for hypertension when compared to African-born blacks.

The final model includes measures of all covariates from the "human capital" and "health behaviors" variable groups. In this final, unrestricted model, African-born blacks' odds ratio remains not significantly different than that of the referent and that of U.S.-born Mexicans. Further, African-born blacks report an odds ratio that is significantly lower than that of U.S.-born, non-Hispanic blacks ($p<0.001$), and significantly higher than that of foreign-born, non-Hispanic whites ($p<0.05$) and Mexicans ($p<0.001$).

Table 2 about here

Body Mass Index: Overweight and Obese

The following section discusses the results displayed in Table 3 for multinomial logistic regression models for "BMI". I will first discuss the results for overweight as they compare to normal weight. In Model 1, African-born blacks report significantly higher odds of being overweight as compared to the referent ($p<0.05$) and to foreign-born, non-Hispanic whites ($p<0.001$). African-born blacks also report significantly lower odds for being overweight when compared to U.S.-born, non-Hispanic blacks, Mexicans, and foreign-born Mexicans ($p<0.001$). In Model 2, African-born blacks show nearly identical odds ratios and comparisons. They remain as significantly higher odds for being overweight when compared to the referent ($p<0.05$) and

foreign-born, non-Hispanic whites ($p<0.001$). African-born blacks report significantly lower odds for being overweight when compared to U.S.-born, non-Hispanic blacks ($p<0.01$), Mexicans ($p<0.001$), and foreign-born Mexicans ($p<0.001$). Model 3 shows that African-born blacks have significantly higher odds for reporting being overweight when compared to the referent ($p<0.001$) and foreign-born, non-Hispanic whites ($p<0.001$). African-born blacks show no significant difference for the odds of being overweight when compared to U.S.-born, non-Hispanic blacks and Mexicans, and show significantly lower odds when compared to foreign-born Mexicans ($p<0.001$). In the final model, African-born blacks show significantly higher odds for being overweight when compared to the referent and foreign-born, non-Hispanic whites ($p<0.001$). They show no significant difference in the odds of being overweight when compared to U.S.-born, non-Hispanic blacks and Mexicans, and show significantly lower odds when compared to foreign-born Mexicans ($p<0.001$).

The following section discusses the results for obesity as they compare to normal weight. In Model 1, African-born blacks report significantly lower odds for obesity when compared to the referent ($p<0.001$) and foreign-born, non-Hispanic whites ($p<0.05$). African-born blacks are also at significantly lower odds for obesity when compared to U.S.-born, non-Hispanic blacks ($p<0.001$), Mexicans ($p<0.001$), and foreign-born Mexicans ($p<0.001$). In Model 2, African-born blacks continue to report significantly lower odds for obesity than the referent ($p<0.001$). African-born blacks are also at significantly lower odds for obesity when compared to U.S.-born, non-Hispanic blacks ($p<0.001$), Mexicans ($p<0.001$), and foreign-born Mexicans ($p<0.001$). Model 3 shows that African-born blacks display no significant difference in the odds of obesity when compared to the referent. Foreign-born, non-Hispanic whites show significantly lower odds of obesity when compared to African-born blacks ($p<0.001$). African-born blacks are at

significantly lower odds for obesity when compared to U.S.-born, non-Hispanic blacks ($p<0.001$), Mexicans ($p<0.001$), and foreign-born Mexicans ($p<0.001$). In the final model, African-born blacks continue to show no significant difference in their odds for obesity compared to the referent. Foreign-born, non-Hispanic whites remain at significantly lower odds for obesity when compared to African-born blacks ($p<0.05$). African-born blacks are at significantly lower odds for obesity when compared to U.S.-born, non-Hispanic blacks ($p<0.001$), Mexicans ($p<0.001$), and foreign-born Mexicans ($p<0.001$).

Table 3 about here

Diabetes

Table 4 presents the odds ratio results for binomial logistic regression models for the outcome "diabetes." In Model 1, all racial/ethnic groups report significantly higher odds for reporting diabetes apart from foreign-born, non-Hispanic whites who report significantly lower odds ($p<0.001$). African-born blacks differ slightly from the other groups, as they are closest to the referent and the significance of their odds ratio rests at the $p<0.05$ level. The odds ratio for African-born blacks is significantly higher than that of foreign-born, non-Hispanic whites ($p<0.001$) and significantly lower than that for U.S.-born, non-Hispanic blacks ($p<0.001$), U.S.-born Mexicans ($p<0.001$), and foreign-born Mexicans ($p<0.001$).

The addition of the education control variable in Model 2 results in a convergence of all odds ratios except for African-born blacks, as they approach 1.00, the odds ratio of the referent. African-born blacks see a slight increase in their odds ratio but remain significant at the $p<0.05$ level. African-born blacks remain at significantly higher odds of reporting diabetes when

compared to foreign-born, non-Hispanic whites and are at significantly lower odds when compared to U.S.-born, non-Hispanic blacks ($p<0.001$) and U.S.-born Mexicans ($p<0.05$). There is no significant difference in the odds ratio for diabetes between African-born blacks and foreign-born Mexicans.

In Model 3, the odds ratio for African-born blacks increases and remains significantly different than that of the referent at the $p<0.001$ level. As with previous models, all other racial/ethnic groups, apart from foreign-born, non-Hispanic whites, are at significantly higher odds of diabetes when compared to the referent ($p<0.001$). In this model, the odds ratio for diabetes among African-born blacks is not significantly different than that for U.S.-born, non-Hispanic blacks, U.S.-born Mexicans, and foreign-born Mexicans. Foreign-born, non-Hispanic whites display significantly lower odds for diabetes when compared to African-born blacks.

In the final, unrestricted model, African-born blacks report an odds ratio that is significantly higher than that of the referent at the $p<0.05$ level. All other racial/ethnic groups remain at significantly higher odds for diabetes ($p<0.001$) when compared to the referent except for foreign-born, non-Hispanic whites, who report significantly lower odds ($p<0.05$). African-born blacks have significantly lower odds for diabetes when compared to U.S.-born Mexicans ($p<0.05$) and do not show any significant difference when compared to U.S.-born, non-Hispanic blacks and foreign-born Mexicans.

Table 4 about here

Interaction of Race/Ethnicity and Duration

The following is a discussion of the interaction effects of race/ethnic identity across duration within the U.S. Relative risk ratios are presented for each foreign-born race/ethnic group with reference to the marginal probability of each disorder for U.S.-born, non-Hispanic whites. Figure 1 displays the relative risk ratio for ever being diagnosed with hypertension. African-born blacks report the lowest relative risk of hypertension for those whose duration in the U.S. is less than 5 years. Following this, the relative risk ratio for African-born blacks converges with that of foreign-born Mexicans, showing no significant difference for the remaining three duration categories. African-born blacks also display significantly lower relative risk ratios when compared to foreign-born, non-Hispanic white except for those with a duration of between 10 and 15 years.

Figure 1 about here

Figure 2 displays the relative risk ratios for both overweight and obesity across duration for all three foreign-born groups. African-born blacks have significantly lower relative risk when compared to foreign-born Mexicans and no significant difference when compared to foreign-born, non-Hispanic whites for the earliest duration category. African-born blacks then experience an increase in relative risk, showing no significant difference when compared to that of foreign-born Mexicans for the remaining duration categories. This increase also situates African-born blacks at a significantly higher relative risk ratio for overweight than foreign-born, non-Hispanic whites for the remaining duration categories.

Obesity shows different trends for African-born blacks than that shown in overweight. For all four duration categories, African-born blacks show no significant difference in relative

risk for obesity when compared to foreign-born, non-Hispanic whites. Both groups show low relative risk in the earliest duration category and see gradual increases with increasing duration. African-born blacks show no significant difference in relative risk for obesity when compared to foreign-born Mexicans in the first duration category, but foreign-born Mexicans diverge quickly and become at significant higher relative risk for obesity in subsequent duration categories.

Figure 2 about here

Figure 3 displays the relative risk ratios for diabetes across duration for each foreign-born group. African-born blacks display significantly lower relative risk for diabetes when compared to foreign-born, non-Hispanic whites and Mexicans in the earliest duration category. This changes in the second duration category, as African-born blacks show no significant difference in their relative risk when compared to both remaining foreign-born groups. Two important things happen in the last two duration categories. First, foreign-born Mexicans experience a dramatic increase, which positions them at significantly higher relative risk for diabetes than African-born blacks. Second, the relative risk for African-born blacks follows the same trend as foreign-born, non-Hispanic whites and, while they appear to have lower relative risk, this difference is non-significant.

Figure 3 about here

Discussion

African immigrants are a rapidly growing group within the foreign-born population of the United States. Although there has been research examining African immigrant health there has been a notable lapse since the mid-2000s. The purpose of this study is to examine the health of African immigrants with specific relation to the healthy migrant effect. The existing literature suggests that African immigrants show signs of superior health, and therefore a healthy migrant effect, when compared to U.S.-born, non-Hispanic blacks. Despite this claim, more recent research suggests that this trend of superior health has ended. I use binomial and multinomial logistic regressions to analyze the relative odds of hypertension, overweight/obesity, and diabetes for African-born blacks relative to the core referent, U.S.-born, non-Hispanic whites, along with four other racial/ethnic groups. I perform interactions to further understand the effect of race/ethnic identity across duration for the risk for each outcome relative to U.S.-born, non-Hispanic whites. Findings support my first hypothesis, provide mixed support my second hypothesis, and do not support my third hypothesis.

My findings suggest that African-born black respondents show evidence of a healthy migrant effect, which supports my first hypothesis. This is not without qualification. Logistic regression results present the first indications of a healthy migrant effect, with the important caveat of referent group specification. My results suggest that African-born blacks show the strongest evidence of the healthy migrant effect when compared to U.S.-born, non-Hispanic black counterparts. For example, U.S.-born, non-Hispanic blacks have 1.841 times the odds of being diagnosed with hypertension and 2.228 times the odds of being obese as do African-born blacks. These findings resonate with existing literature on African health and immigrant health more broadly (Cooper et al. 1997; Cunningham et al. 2008; Osei and Schuster 1996; Poston et al. 2001; Venter and Gany 2011). Additionally, my findings contradict those of O'Connor et al.

(2014) and provide support for superior cardiovascular health among African-born blacks when compared to U.S.-born, non-Hispanic blacks. These findings are particularly important for practitioners and researchers; the lowered rates of hypertension and obesity suggest that nativity serves some protective effect. On the other hand, African-born blacks display odds ratios statistically indistinguishable from 1.0 for diabetes and overweight, which suggests that nativity serves no protective effect for these outcomes when compared to U.S.-born, non-Hispanic blacks. While these latter findings do not provide support for the healthy migrant effect, they do align with the broader immigrant health literature which argues that foreign-born populations are at higher risk for diabetes than U.S.-born (Cunningham et al. 2008; O'Connor et al. 2014). When compared to U.S.-born, non-Hispanic whites, this study's central referent category, African-born blacks display significantly better health with regards to obesity. African-born blacks show odds statistically indistinguishable from 1.0 for hypertension and significantly higher for diabetes and overweight. In sum, while considering referent category, African-born blacks show evidence of a healthy migrant effect for hypertension and obesity. The protective effect of nativity does not appear to have an impact on the relative odds for diabetes or overweight.

An important finding that was not previously hypothesized is the relationship between diabetes and BMI. Traditionally, diabetes is understood to be positively associated with obesity – a weight increases into obesity, so too does the risk for diabetes (Mokdad, Ford, Bowman, Dietz, Vinicor, Bales, and Marks 2003). Returning to multivariate analyses, one can see that African-born blacks report seemingly contradictory rates of obesity and diabetes. African-born blacks report consistently lower odds for obesity but report equal or higher odds for diabetes. Crosstabulations show that the U.S.-born sample follows the accepted trend as diabetes tends to be concentrated in obese respondents. African-born blacks do not show the same. Rather,

diabetes is centralized among those who report overweight, not obesity. This may be one explanation for the heightened rates of undiagnosed pre-diabetes and diabetes among African-born blacks due to their lower than expected BMI (O'Connor et al. 2014; Ukegbu et al. 2011; Yu et al. 2013). These findings have implications for policy, practice, and research to properly address the health care needs of this and, perhaps, other foreign-born populations.

The healthy migrant effect focuses almost entirely on comparisons between migrants and native-born, but it is worthwhile to understand health within the migrant sample. Elo and colleagues (2008) suggest that black immigrants, particularly those from white-minority countries, may experience worse health when compared to other immigrant groups. The findings presented in this study do not provide clear support for this statement among first generation migrants and, subsequently, provide only partial support of my second hypothesis. Foreign-born, non-Hispanic whites display significantly lower odds for all outcomes when compared to African-born blacks and foreign-born Mexicans. These differences support the notion that being both foreign-born and white has a stronger protective effect upon health than being foreign-born and black (Elo et al. 2008). The relationship is not as clear when African-born blacks and foreign-born Mexicans are compared. African-born blacks display odds not significantly different than 1.0 for diabetes, significantly lower odds for both overweight and obesity, and significantly higher odds for hypertension when compared to foreign-born Mexicans. It can, therefore, be argued that African-born blacks display mild health superiority when compared to foreign-born Mexicans, although this statement is entirely contingent upon outcome. One potential interpretation of these findings is that, rather than focusing entirely on the potential discrimination of black migrants, Elo et al.'s (2008) notion can be extended to minority migrant populations. Both non-white groups display significantly higher odds for each outcome when

compared to foreign-born, non-Hispanic whites, except for hypertension among Mexicans. By expanding the scope of the statement, we may be able to explain more of migrant health disparities. These odds are limited, though. To more clearly understand the health of migrants one must interrogate the role of selection and duration.

Three points must be understood from the models interacting racial/ethnic identity and duration within the U.S. The first point relates to positive health selection, the core explanatory argument of the health migrant effect. In each of the interaction figures, notice that the lowest relative risk ratios are reported in the earliest duration category for African-born blacks. In the absence of absolute measures of health in region of origin and at time of arrival, this finding provides the strongest support for the claim that African-born blacks are healthier closer to the point of arrival when compared to U.S.-born, non-Hispanic whites as well as other African-born blacks with longer duration in the U.S (Elo et al. 2008; Mehta et al. 2016; Palloni and Arias 2004; Riosmena et al. 2017). Second, the healthy migrant effect attests that, with increased duration, relative health superiority diminishes and reported health converges with that of the U.S.-born population. Returning to the figures, I present clear evidence of declining health over time. Let us use diabetes as an example. In the earliest duration category, the relative risk for African-born blacks to report diabetes is 0.3726 compared to the referent. This relative risk increases to 0.8204 by the final duration category – an increase of over double. Although the values differ, this same trend can be seen for both hypertension and BMI. These trends align with the literature on the healthy migrant effect and suggest that there is some form of health deterioration with time spent in the U.S. (Abraído-Lanza et al. 2005; Riosmena and Dennis 2012; Riosmena et al. 2015).

The third element point relates to my hypothesized argument that African-born blacks will experience a more pronounced effect of duration than other foreign-born groups (Elo et al. 2008). The effects of duration are not significantly different for African-born blacks and foreign-born Mexicans for hypertension and overweight. Beginning with hypertension, one can see that the relative risk for African-born blacks remains not significantly different than that for foreign-born Mexicans across duration, particularly the three later categories. Although African-born blacks display significantly lower relative risk in the first duration category, they converge with foreign-born Mexicans and remain not significant different in these three later categories. The effects of duration are not significantly different for African-born blacks and foreign-born, non-Hispanic whites for diabetes and obesity. The duration effects for foreign-born Mexicans is more pronounced for these two outcomes. These four interaction effects suggest that there is variation in the effects of duration by racial/ethnic identity and by outcome, but that African-born blacks do not experience these effects in a meaningfully different way from other foreign-born groups. For example, foreign-born, non-Hispanic whites report the lowest relative risk ratios for all outcomes except for hypertension. In each of these remaining three outcomes, one or both non-white migrant groups are at significantly higher relative risk. Returning to my previous point, I argue that these findings emphasize the differences between white and non-white migrants, rather than black and non-black (Elo et al. 2008).

One should consider the following limitations when reading the results of this study. The NHIS presents only self-report measures. As such, the measures used are likely not accurately capturing all respondents with each respective outcome. Additionally, African immigrants likely display significant variation based on region of origin. These analyses cannot capture this variation, as the NHIS only provides information for general region of birth. Future research

should take time to disaggregate both the African-born and U.S.-born samples. Migrants from Africa represent a largely heterogenous groups and by compiling them into a single category it is impossible to parse out regional and national differences (Hamilton 2014). Recent research suggests that comparing foreign-born groups to U.S.-born does not catch important differences. Rather, researchers should identify U.S.-born groups as "movers" or "non-movers", as it has been suggested that health selectivity plays an important role in within-U.S. migration (Hamilton 2015).

African migrants are a steadily growing population within the United States. As their population grows, it is imperative that researchers devote energy to inform policy, practice, and to draw attention to potential disparities in health and health care. This study contributes to this process by examining three cardiometabolic health outcomes as they relate to the presence or absence of a health migrant effect among African-born blacks. My findings suggest that there is evidence of a healthy migrant effect, particularly when compared to U.S.-born, non-Hispanic blacks. African-born blacks display a sort of health "middle-ground" when compared to foreign-born, non-Hispanic whites and Mexicans. African-born blacks are at significantly higher odds for all outcomes when compared to the former and show significantly higher odds for hypertension and significantly lower odds for BMI when compared to the latter. Finally, there is evidence of positive health selectivity among African-born blacks and a deterioration of health as duration in the U.S. increases. These duration effects are not significantly different than that seen in other foreign-born groups. Taken as a whole, these findings suggest that African-born blacks do display some form of health superiority when compared to U.S.-born populations. I argue that, while this healthy migrant effect is present, African-born blacks are not as protected by nativity as foreign-born, non-Hispanic whites. These findings support the claim that African-born black

migrants have worse health than white migrants, which may suggest an effect based on a black racial identity. The central issue with this is that African-born blacks do equitably or slightly better than Mexicans, therefore suggesting that this may be less of a "black, non-black" and more of a "white, non-white" effect.

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Table 1: Sample-Weighted Descriptive Results by Racial/Ethnic Group – NHIS 2002-2017

	Total Sample	U.S.-Born, Non-Hispanic Whites	Foreign-Born, Non-Hispanic White	U.S.-Born, Non-Hispanic Blacks	African-Born Blacks	U.S.-Born Mexicans	Foreign-Born Mexicans
	%	%	%	%	%	%	%
Total Sample		64.52%	3.18%	10.15%	0.48%	1.12%	4.24%
Has a doctor ever told you that you had Hypertension							
No	71.25%	70.06%	73.59%	62.55%	82.37%	81.27%	82.78%
Yes	28.62%	29.80%	26.29%	37.32%	17.49%	18.59%	17.06%
Missing	0.14%	0.14%	0.1%	0.13%	0.14%	0.14%	0.16%
Body-Mass Index							
Underweight	1.77%	1.77%	1.85%	1.40%	2.05%	1.51%	0.68%
Normal Weight	33.85%	34.72%	39.84%	25.50%	35.71%	29.20%	25.14%
Overweight	32.90%	32.82%	34.61%	30.39%	37.16%	31.81%	39.17%
Obese	26.31%	25.59%	18.52%	37.42%	18.94%	33.35%	26.77%
Missing	5.17%	5.10%	5.19%	5.29%	6.14%	4.13%	8.24%
Has a doctor ever told you that you had Diabetes							
No	90.12%	90.66%	91.76%	86.80%	93.90%	91.44%	90.26%
Yes	8.44%	7.97%	6.79%	11.60%	5.04%	7.15%	8.69%
Missing	1.44%	1.38%	1.45%	1.60%	1.06%	1.42%	1.06%
Sex							
Male	48.21%	48.38%	47.62%	44.19%	55.45%	48.69%	53.36%
Female	51.79%	51.62%	52.38%	55.81%	44.55%	51.31%	46.64%
Age							
18-29	21.62%	19.20%	15.52%	25.47%	27.78%	45.86%	25.24%
30-39	17.72%	15.58%	17.70%	18.86%	30.77%	21.68%	29.53%
40-49	18.73%	18.35%	19.20%	18.64%	22.58%	12.84%	23.15%
50-59	17.35%	18.49%	18.39%	17.15%	12.71%	9.16%	12.03%
60-69	12.64%	14.27%	13.39%	11.13%	4.34%	5.73%	6.41%
70-79	7.54%	8.78%	9.27%	5.86%	1.51%	3.11%	2.70%
80+	4.40%	5.33%	6.53%	2.90%	0.31%	1.61%	0.94%
Educational Attainment							
Less than High School	14.55%	98.80%	9.93%	18.26%	10.78%	19.91%	61.27%
High School/GED	27.05%	27.79%	20.63%	31.03%	18.57%	31.33%	21.34%
Some College/Associate's	29.85%	31.26%	25.31%	32.72%	31.84%	34.68%	10.54%
Bachelor's	18.01%	19.94%	24.05%	11.54%	23.22%	10.11%	3.57%
Graduate/Professional	9.78%	10.62%	18.68%	5.50%	14.89%	3.29%	1.22%
Missing	0.75%	0.50%	1.39%	0.94%	0.69%	0.68%	2.06%
Family Income-to-Needs Ratio*							
Less than 1.00	11.12%	10.01%	10.53%	13.84%	13.70%	12.12%	16.16%
1.00-1.99	16.23%	15.21%	15.77%	18.09%	17.79%	18.63%	22.51%
2.00-2.99	15.52%	15.26%	14.98%	16.02%	16.18%	16.95%	16.20%
3.00-3.99	13.29%	13.52%	13.60%	13.01%	13.59%	14.00%	12.08%
4.00-4.99	11.14%	11.51%	10.51%	10.59%	10.35%	10.00%	9.17%
5.00 or Greater	31.33%	33.24%	33.05%	27.17%	25.89%	26.17%	22.23%
Missing	1.37%	1.25%	1.56%	1.28%	2.50%	2.13%	1.67%
Duration in United States							
Less than 5 Years	1.86%	0.00%	9.29%	0.00%	21.01%	0.00%	9.57%
Between 5 and 10 years	2.22%	0.00%	9.71%	0.00%	25.22%	0.00%	14.86%
Between 10 and 15 years	2.39%	0.00%	10.33%	0.00%	20.58%	0.00%	17.73%
15 years or greater	93.53%	100.00%	70.68%	100.00%	33.19%	100.00%	57.84%
Insurance Status							
No Insurance	10.92%	7.38%	9.55%	13.14%	21.93%	18.00%	39.48%
Private Insurance	58.36%	63.13%	60.12%	49.93%	53.45%	51.88%	28.09%
Public Insurance	26.37%	24.71%	26.20%	33.46%	20.78%	26.50%	30.84%
Other	3.78%	4.40%	3.74%	2.42%	2.57%	2.30%	0.90%
Missing	0.57%	0.38%	0.39%	1.05%	1.28%	1.33%	0.68%
Smoking Status							
Never	58.87%	53.59%	59.22%	63.61%	84.93%	71.54%	75.62%
Former	21.70%	25.26%	25.03%	14.52%	8.42%	13.86%	13.01%
Current: 1 Pack or Less per Day	12.04%	11.86%	10.45%	16.64%	5.47%	11.87%	9.60%
Current: 2 Packs per Day	5.64%	7.34%	3.72%	3.43%	0.62%	1.70%	0.70%
Current: 3 Packs or More per Day	0.66%	0.90%	0.32%	0.26%	0.00%	0.11%	0.04%
Missing	1.10%	1.05%	1.27%	1.54%	0.55%	0.92%	1.03%
Alcohol Use							
Non-Drinker	21.29%	15.91%	22.70%	29.22%	53.12%	24.49%	36.51%
Former Drinker	14.05%	14.85%	9.58%	15.85%	6.77%	10.41%	12.71%
Current Drinker	62.63%	67.29%	65.56%	52.19%	38.33%	63.53%	49.22%
Missing	2.02%	1.95%	2.17%	2.75%	1.78%	1.58%	1.57%
How many minutes per week do you do light/moderate leisure activity?							
None	41.99%	38.05%	41.15%	51.73%	45.62%	44.54%	58.77%
Between 10 and 149 minutes	30.32%	31.93%	29.63%	26.25%	33.78%	29.92%	22.15%
150 minutes or more	23.69%	25.75%	25.17%	17.91%	16.79%	21.52%	16.48%
Missing	4.09%	4.26%	4.05%	4.12%	3.81%	4.02%	2.61%
How many minutes per week do you do vigorous leisure activity?							
None	55.55%	53.23%	55.50%	61.09%	51.85%	53.89%	69.33%
Between 10 and 74 minutes	9.46%	9.08%	8.16%	8.27%	13.23%	8.98%	7.28%
75 minutes or more	30.75%	32.31%	32.26%	26.51%	30.54%	33.66%	20.96%
Missing	4.24%	4.48%	4.08%	4.13%	4.38%	3.47%	2.44%

*Includes NCHS imputed values

Table 2: Sample Weighted Binomial Logistic Regression Output in Odds Ratios: Hypertension – NHIS 2002-2017

	Model 1	Model 2	Model 3	Model 4
Year (2002)	1.017 ***	1.021 ***	1.021 ***	1.022 ***
Female (Male)	0.863 ***	0.855 ***	0.855 ***	0.837 ***
Mean-Centered Age	1.068 ***	1.068 ***	1.067 ***	1.062 ***
Mean-Centered Age^2	0.999 ***	0.999 ***	0.999 ***	0.999 ***
Race/Ethnicity (U.S. Born, NH White)				
Foreign-Born, Non-Hispanic White	0.761 ***	0.793 ***	0.829 ***	0.833 ***
U.S.-Born, NH Black	2.105 ***	1.950 ***	1.947 ***	1.887 ***
African-Born Black	0.878 †	0.905	1.039	1.025
U.S.-Born Mexican	1.088	0.988	0.986	0.985
Foreign-Born Mexican	0.779 ***	0.605 ***	0.643 ***	0.652 ***
Degree (Less than High School)				
High School/GED/Equivalent		0.829 ***	0.828 ***	0.882 ***
Some College/Associate Degree		0.764 ***	0.763 ***	0.850 ***
Bachelor's Degree		0.553 ***	0.553 ***	0.660 ***
Graduate/Professional Degree		0.498 ***	0.498 ***	0.613 ***
Duration (15+ Years in U.S.)				
Less than 5 Years			0.698 ***	0.671 ***
Between 5 Years and 10 years			0.800 **	0.765 ***
Between 10 Years and 15 Years			0.820 ***	0.814 ***
Human Capital				
Income-to-Needs Ratio (Less than 1.00)				
1.00-1.99				0.965
2.00-2.99				0.984
3.00-3.99				0.968
4.00-4.99				0.964
5.00 or Greater				0.932 ***
Insurance (Private Insurance)				
No Insurance				0.913 ***
Other Insurance				1.093 **
Public Insurance				1.291 ***
Health Behaviors				
Smoke Status (Never Smoker)				
				1.183 ***
Current: 1 Pack or Less per Day				0.975
Current: Between 1 and 3 Packs per Day				1.028
Current: 3 Packs or More per Day				1.160 *
Alcohol Use (Never Drinker)				
Former Drinker				1.133 ***
Current Drinker				0.949 ***
Light/Moderate Exercise Activity (None)				
Participate Less than 150 Minutes per Week				0.993
Participate 150 Minutes or More per Week				0.909 ***
Vigorous Exercise Activity (None)				
Participate Less than 75 Minutes per Week				0.879 ***
Participate 75 Minutes or More per Week				0.735 ***
Constant	8.02e-16	2.12e-19	3.04e-19	7.48e-20

(†p < .10; *p < .05; **p < .01; ***p < .001)
N=332,078

Table 3: Sample Weighted Multinomial Logistic Regression Output in Odds Ratios: BMI – NHIS 2002-2017

	Model 1	Model 2	Model 3	Model 4
Normal Weight (BMI 18.5-24.9)	*Base Outcome*			
Overweight (BMI 25-29.9)				
Year (2002)	1.009 ***	1.011 ***	1.011 ***	1.010 ***
Female (Male)	0.445 **	0.443 *	0.443 ***	0.431 ***
Mean-Centered Age	1.016 ***	1.017 ***	1.017 ***	1.014 ***
Mean-Centered Age^2	0.999 ***	0.999 ***	0.999 ***	0.999 ***
Race/Ethnicity (U.S. Born, NH White)				
Foreign-Born, Non-Hispanic White	0.873 ***	0.902 ***	0.951 †	0.946 †
U.S.-Born, NH Black	1.454 ***	1.421 ***	1.419 ***	1.388 ***
African-Born Black	1.160 *	1.174 *	1.327 ***	1.279 ***
U.S.-Born Mexican	1.584 ***	1.536 ***	1.532 ***	1.470 ***
Foreign-Born Mexican	1.775 ***	1.728 ***	1.863 ***	1.743 ***
Degree (Less than High School)				
High School/GED/Equivalent		1.084 ***	1.083 ***	1.063 ***
Some College/Associate Degree		1.082 ***	1.079 ***	1.042 *
Bachelor's Degree		0.880 ***	0.880 ***	0.826 ***
Graduate/Professional Degree		0.780 ***	0.780 ***	0.732 ***
Duration (15+ Years in U.S.)				
Less than 5 Years			0.756 ***	0.747 ***
Between 5 Years and 10 years			0.812 ***	0.798 ***
Between 10 Years and 15 Years			0.973	0.968
Human Capital				
Income-to-Needs Ratio (Less than 1.00)				
1.00-1.99				1.018
2.00-2.99				1.014
3.00-3.99				1.047 *
4.00-4.99				1.053 *
5.00 or Greater				1.011
Insurance (Private Insurance)				
No Insurance				0.965 †
Other Insurance				1.116 ***
Public Insurance				1.077 ***
Health Behaviors				
Smoke Status (Never Smoker)				
Former				1.079 ***
Current: 1 Pack or Less per Day				0.775 ***
Current: Between 1 and 3 Packs per Day				0.690 ***
Current: 3 Packs or More per Day				0.691 ***
Alcohol Use (Never Drinker)				
Former Drinker				1.080 ***
Current Drinker				1.039 *
Light/Moderate Exercise Activity (None)				
Participate Less than 150 Minutes per Week				1.061 ***
Participate 150 Minutes or More per Week				0.964 *
Vigorous Exercise Activity (None)				
Participate Less than 75 Minutes per Week				1.025
Participate 75 Minutes or More per Week				0.872 ***
Constant	1.61e-08	6.45e-10	1.15e-09	4.42e-09

Obese (BMI ≥30.0)				
Year (2002)	1.033 ***	1.039 ***	1.038 ***	1.040 ***
Female (Male)	0.654 ***	0.650 ***	0.650 ***	0.599 ***
Mean-Centered Age	1.016 ***	1.016 ***	1.015 ***	1.008 ***
Mean-Centered Age^2	0.999 ***	0.999 ***	0.999 ***	0.998 ***
Race/Ethnicity (U.S. Born, NH White)				
Foreign-Born, Non-Hispanic White	0.587 ***	0.636 ***	0.710 ***	0.697 ***
U.S.-Born, NH Black	2.265 ***	2.064 ***	2.060 ***	1.902 ***
African-Born Black	0.725 ***	0.752 ***	0.983	0.854
U.S.-Born Mexican	2.085 ***	1.858 ***	1.848 ***	1.694 ***
Foreign-Born Mexican	1.537 ***	1.214 ***	1.411 ***	1.210 ***
Degree (Less than High School)				
High School/GED/Equivalent		0.947 **	0.945 **	0.972
Some College/Associate Degree		0.885 ***	0.882 ***	0.939 **
Bachelor's Degree		0.503 ***	0.502 ***	0.549 ***
Graduate/Professional Degree		0.397 ***	0.398 ***	0.446 ***
Duration (15+ Years in U.S.)				
Less than 5 Years			0.510 ***	0.446 ***
Between 5 Years and 10 years			0.676 ***	0.620 ***
Between 10 Years and 15 Years			0.808 ***	0.773 ***
Human Capital				
Income-to-Needs Ratio (Less than 1.00)				
1.00-1.99				1.019
2.00-2.99				1.036
3.00-3.99				1.041 †
4.00-4.99				1.048 †
5.00 or Greater				0.979
Insurance (Private Insurance)				
No Insurance				1.013
Other Insurance				1.241 ***
Public Insurance				1.197 ***
Health Behaviors				
Smoke Status (Never Smoker)				
Former				1.194 ***
Current: 1 Pack or Less per Day				0.624 ***
Current: Between 1 and 3 Packs per Day				0.536 ***
Current: 3 Packs or More per Day				0.648 ***
Alcohol Use (Never Drinker)				
Former Drinker				1.170 ***
Current Drinker				0.920 ***
Light/Moderate Exercise Activity (None)				
Participate Less than 150 Minutes per Week				1.011
Participate 150 Minutes or More per Week				0.811 ***
Vigorous Exercise Activity (None)				
Participate Less than 75 Minutes per Week				0.925 ***
Participate 75 Minutes or More per Week				0.585 ***
Constant	8.70e-29	1.77e-33	5.61e-33	2.11e-34

(†p < .10; *p < .05; **p < .01; ***p < .001)
N=332,078

Table 4: Sample Weighted Binomial Logistic Regression Output in Odds Ratios: Diabetes – NHIS 2002-2017

	Model 1	Model 2	Model 3	Model 4
Year (2002)	1.019 ***	1.026 ***	1.025 ***	1.028 ***
Female (Male)	0.827 ***	0.812 ***	0.812 ***	0.761 ***
Mean-Centered Age	1.075 ***	1.073 ***	1.073 ***	1.063 ***
Mean-Centered Age^2	0.999 ***	0.999 ***	0.999 ***	0.999 ***
Race/Ethnicity (U.S. Born, NH White)				
Foreign-Born, Non-Hispanic White	0.794 ***	0.826 ***	0.863 **	0.891 *
U.S.-Born, NH Black	2.036 ***	1.821 ***	1.819 ***	1.649 ***
African-Born Black	1.252 *	1.312 *	1.565 ***	1.326 *
U.S.-Born Mexican	2.014 ***	1.769 ***	1.763 ***	1.754 ***
Foreign-Born Mexican	1.893 ***	1.355 ***	1.454 ***	1.414 ***
Degree (Less than High School)				
High School/GED/Equivalent		0.764 ***	0.763 ***	0.866 ***
Some College/Associate Degree		0.699 ***	0.698 ***	0.876 ***
Bachelor's Degree		0.431 ***	0.431 ***	0.616 ***
Graduate/Professional Degree		0.410 ***	0.410 ***	0.625 ***
Duration (15+ Years in U.S.)				
Less than 5 Years			0.680 *	0.617 **
Between 5 Years and 10 years			0.669 ***	0.599 ***
Between 10 Years and 15 Years			0.728 ***	0.702 ***
Human Capital				
Income-to-Needs Ratio† (Less than 1.00)				
1.00-1.99				0.995
2.00-2.99				0.975
3.00-3.99				0.965
4.00-4.99				0.955
5.00 or Greater				0.871 ***
Insurance (Private Insurance)				
No Insurance				0.894 **
Other Insurance				1.091 *
Public Insurance				1.384 ***
Health Behaviors				
Smoke Status (Never Smoker)				
Former				1.207 ***
Current: 1 Pack or Less per Day				0.845 ***
Current: Between 1 and 3 Packs per Day				0.938 †
Current: 3 Packs or More per Day				1.370 ***
Alcohol Use (Never Drinker)				
Former Drinker				1.167 ***
Current Drinker				0.610 ***
Light/Moderate Exercise Activity (None)				
Participate Less than 150 Minutes per Week				0.932 ***
Participate 150 Minutes or More per Week				0.815 ***
Vigorous Exercise Activity (None)				
Participate Less than 75 Minutes per Week				0.841 ***
Participate 75 Minutes or More per Week				0.633 ***
Constant	1.34e-18	1.35e-23	2.24e-23	2.37e-25

(†p < .10; *p < .05; **p < .01; ***p < .001)
N=332,078

Figure 1: Marginal Probabilities for Hypertension for Foreign-born Groups by Duration in the United States – NHIS 2002-2017

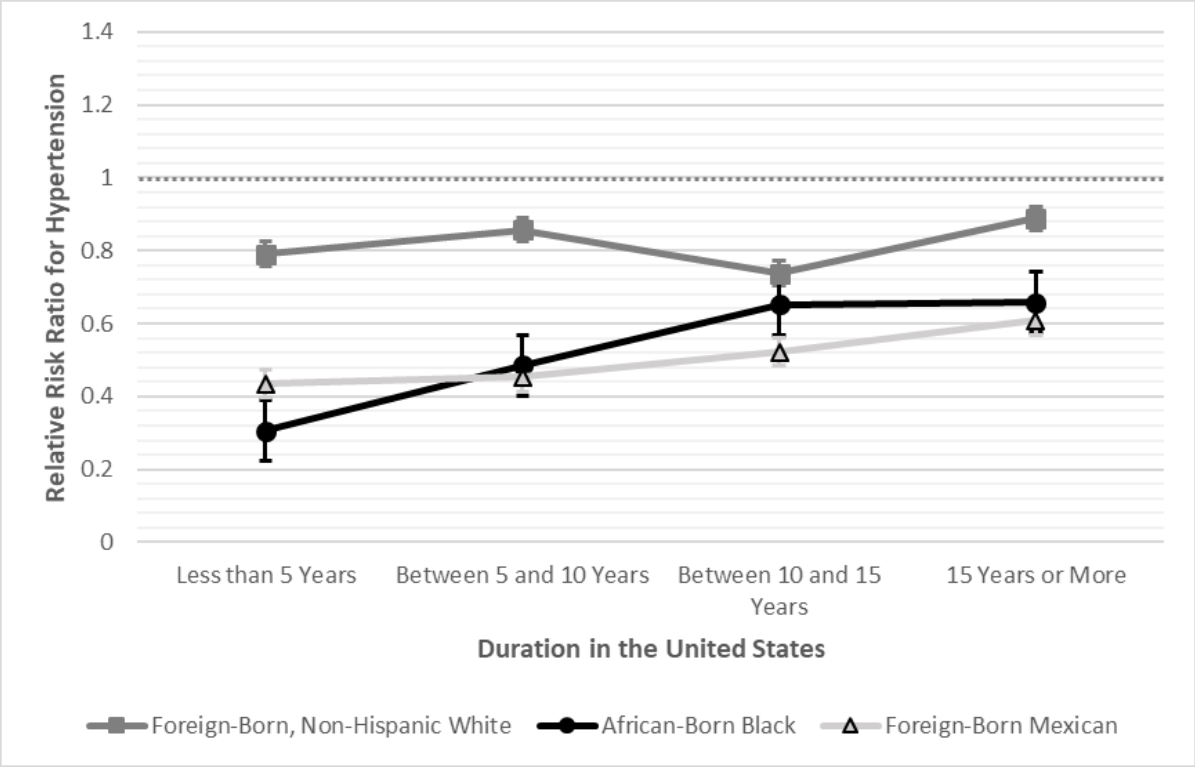

Figure 2: Marginal Probabilities for Obesity for Foreign-born Groups by Duration in the United States – NHIS 2002-2017

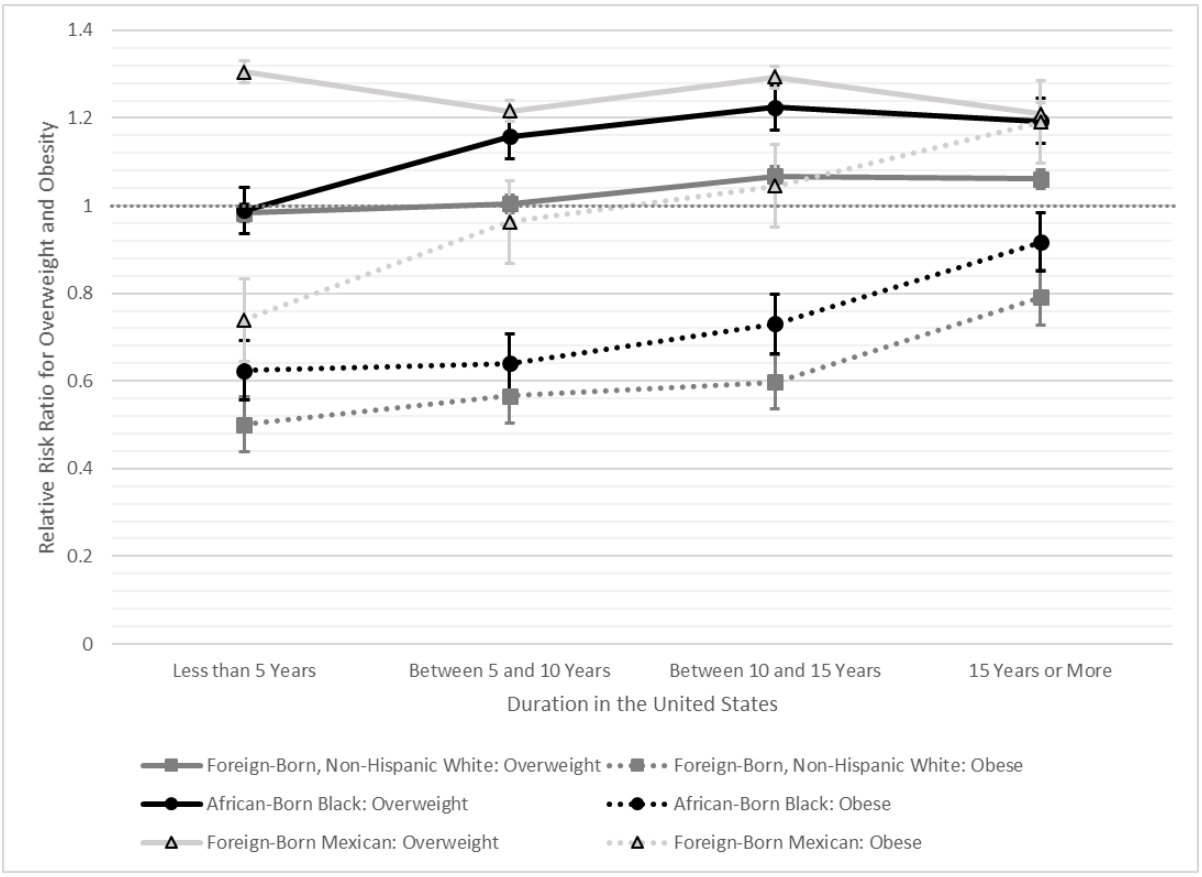

Figure 3: Marginal Probabilities for Diabetes for Foreign-born Groups by Duration in the United States – NHIS 2002-2017