ORIGINAL RESEARCH

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Length of Residence in the United States is Associated With a Higher Prevalence of Cardiometabolic Risk Factors in Immigrants: A Contemporary Analysis of the National Health Interview Survey

Yvonne Commodore-Mensah, PhD, RN; Nwakaego Ukonu, MA, MS; Olawunmi Obisesan, PhD, DHEd, MPH, RN; Jonathan Kumi Aboagye, MD, MPH; Charles Agyemang, PhD, MPH; Carolyn M. Reilly, PhD, ANP, RN; Sandra B. Dunbar, PhD, RN; Ike S. Okosun, PhD, MPH, MS

***Background*—**Cardiometabolic risk (CMR) factors including hypertension, overweight/obesity, diabetes mellitus, and hyperlipidemia are high among United States ethnic minorities, and the immigrant population continues to burgeon.

***Methods and Results*—**Hypothesizing that acculturation (length of residence) would be associated with a higher prevalence of CMR factors, the authors analyzed data on 54, 984 US immigrants in the 2010–2014 National Health Interview Surveys. The main predictor was length of residence. The outcomes were hypertension, overweight/obesity, diabetes mellitus, and hyperlipidemia. The authors used multivariable logistic regression to examine the association between length of US residence and these CMR factors.The mean (SE) age of the patients was 43 (0.12) years and half were women. Participants residing in the United States for ≥10 years were more likely to have health insurance than those with <10 years of residence (70% versus 54%, $P<0.001$). After adjusting for region of birth, poverty income ratio, age, and sex, immigrants residing in the United States for ≥10 years were more likely to be overweight/obese (odds ratio [OR], 1.19; 95% CI, 1.10–1.29), diabetic (OR, 1.43; 95% CI, 1.17–1.73), and hypertensive (OR, 1.18; 95% CI, 1.05–1.32) than those residing in the United States for <10 years.

***Conclusions*—**In an ethnically diverse sample of US immigrants, acculturation was associated with CMR factors. Culturally tailored public health strategies should be developed in US immigrant populations to reduce CMR. **(*J Am Heart Assoc*. 2016;5:e004059 doi: 10.1161/JAHA.116.004059)**

Key Words: cardiovascular research • ethnicity • hypertension • migration • obesity

Cardiometabolic risk (CMR), a construct that comprises a cluster of risk factors for cardiovascular disease and type 2 diabetes mellitus, poses one of the largest public health challenges in the United States (US).[1,2] The prevalence of CMR factors such as hypertension (33%), overweight/obesity (69%), diabetes mellitus (9.3%), and hyperlipidemia (34%) remains high in US adults.[2] Prevalence of and morbidity associated with cardiovascular disease is projected to increase approximately 10% by 2030 and will affect nearly 116 million US adults.[3] The estimated total cost related to CMR factors exceeds approximately $110 billion for overweight/obesity,[4] $245 billion for diabetes mellitus,[5] and $273 billion for cardiovascular disease.[3]

Although mortality attributable to CMR has been reduced in the general US population,[2] disparities exist among specific populations defined by race/ethnicity, socioeconomic status, health insurance status, geographic location, disability status, and sex. The CMR burden is particularly high among racial/ethnic minorities in the US.[2,6] African Americans have one of the highest prevalence rates of hypertension in the world[2] and

From the Department of Community and Public Health, Johns Hopkins School of Nursing, Baltimore, MD (Y.C.-M.); Counseling Psychology, Department of Psychology, University of Florida, Gainesville, FL (N.U.); Emory University Rollins School of Public Health, Atlanta, GA (O.O.); Department of Surgery, Johns Hopkins School of Medicine, Baltimore, MD (J.K.A.); Department of Public Health, Academic Medical Center, University of Amsterdam, the Netherlands (C.A.); Nell Hodgson Woodruff, School of Nursing Emory University, Atlanta, GA (C.M.R. S.D.); Department of Epidemiology & Biostatistics, School of Public Health Georgia State University, Atlanta, GA (I.S.O.).

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Correspondence to: Yvonne Commodore-Mensah, PhD, RN, Johns Hopkins School of Nursing, Department of Community & Public Health, 525 North Wolfe Street, Room 419, Baltimore, MD 21205. E-mail: ycommod1@jhu.edu

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are 30% more likely to die from cardiovascular disease than whites.[7] Hispanics and individuals of Mexican, Caribbean, Central American, South American, or other Spanish-speaking origins have higher rates of CMR factors, such as hypertension, high cholesterol, diabetes mellitus, and obesity, compared with whites.[2]

The percentage of racial/ethnic minorities in the US continues to rise and this diversification will, in part, be attributable to a rise in immigrant populations who will account for approximately 20% of the US population by 2060.[8] Immigrants are affected by unique factors that impact their CMR and subsequent health outcomes.[9] Post-migration socioeconomic challenges, poor education, and lack of health insurance are among some of the most important factors that are associated with increased risk for cardiometabolic disease among immigrants. Generally, immigrants are significantly less likely to graduate from high school compared with nonimmigrants, have lower earnings than US-born residents,[10,11] and are more likely not to have health insurance compared with nonimmigrant whites.[10,11] However, immigrants have been found to have high levels of social support.[12,13] Some studies have shown that high social support is associated with superior health outcomes among immigrants.[14,15] Acculturation, a unique characteristic in immigrants, to some extent is associated with social support and the assimilation of immigrants to the host's sociocultural environment.[16] Acculturation is defined as "the dual process of cultural and psychological change that takes place as a result of contact between two or more cultures and their individual members."[16,17] Proxy measures of acculturation such as length of US residence[18] and languages spoken at home are commonly used in lieu of lengthy scales in population-based studies to minimize participant burden. Acculturation has been associated with poorer health outcomes among US immigrants.[19] Prior studies have indicated that acculturation is associated with increased prevalence of CMR factors among Asian, Hispanic, European, and black immigrants.[20–24] Given the growing size of immigrants in the US and the economic burden associated with CMR, examining the association between acculturation and CMR factors among immigrants in the US may provide further insight on how to frame public health interventions to reduce CMR and associated sequelae among immigrants in the US.

In a prior study[25] examining the relationship between acculturation and cardiovascular disease risk factors among a relatively smaller but diverse pool of US immigrants based on the 2002 National Health Interview Survey (NHIS; N=5230), acculturation was found to be associated with increased odds of obesity, hyperlipidemia, and cigarette smoking. Building on findings of Koya and Egede,[25] we re-examined the association between acculturation and CMR factors among a contemporary, diverse, and larger sample of US immigrants. This study sought more specifically to examine (1) prevalence of CMR factors by length of residence (ie, acculturation) in the US of immigrants, and (2) differences in the association between CMR factors and acculturation among US immigrants stratified by sex. We hypothesize that increased length of stay of immigrants in the US would be associated with much greater odds of CMR factors than recently arrived immigrants to the US. We also theorize that the association between length of residence of immigrants in the US with CMR factors would vary by sex.

Methods

Data source

Data from the 2010–2014 US NHIS were utilized for this study. The NHIS is administered by the US Bureau of the Census for the National Center for Health Statistics (NCHS)[26] as an annual cross-sectional nationally representative survey of civilian noninstitutionalized US adults 18 years and older. Utilizing a multistage stratified cluster probability design with an oversampling of African Americans and Hispanic Americans, the NHIS includes approximately 45 000 households and about 110 000 persons annually.[27] The full methodology of the NHIS is published elsewhere.[27] Respondents provide information on health indicators, healthcare utilization, and social and demographic characteristics. The NHIS uses one randomly selected adult per household to obtain in-depth information on healthcare services, health behavior, and health status.

This study is restricted to 54 984 immigrants (defined as persons living in the US who reported being born outside the US). We pooled and merged data for the 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.[26,27] The year 2012 was considered the midpoint of the 2010–2014 time frame included in the pooled data and so our estimates represent this time point.[27] This study was exempt from institutional review board review because deidentified data published by the NCHS were used in this study.

Study Population

All respondents self-reporting as foreign born were considered immigrants; this definition includes legal permanent residents, naturalized citizens, undocumented immigrants, and those with visas including students or temporary workers. Participants' place of birth data are provided in the NHIS based on the question, "Where were you born?" This variable categorizes respondents in the following 9 mutually exclusive regions of birth: Mexico, Central America, Caribbean Islands (hereafter Mexico); South America; Europe; Russia (and

former Soviet Union areas); Africa; the Middle East; Indian subcontinent; Central Asia; and Southeast Asia. Details on specific countries included in each of the regions are published elsewhere.[26]

Outcomes

Overweight/obesity, hypertension, diabetes mellitus, and hyperlipidemia were the main outcomes. Body mass index (BMI) was calculated using NHIS participants' self-reported height and weight. BMI categories were defined as normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥30 kg/m^2).[28] For this analysis, we dichotomized BMI as either overweight/obese or normal weight. Hypertension, diabetes mellitus, and hyperlipidemia status were self-reported. For instance, hypertension status was assessed with the question, "Have you ever been told by a medical doctor or health professional that you have hypertension, also called high blood pressure?"

Covariates

Using 10 years as a cutoff, we stratified the study population into two groups based on their acculturation (length of residence in the US). This is consistent with the definition of acculturation, in which lower acculturation was defined as residing in the US for <10 years and higher acculturation as residing in the US for ≥10 years.[17] Other variables included 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, ≥75) and sex as a dichotomous variable (male or female). Health insurance status was assessed from a detailed question about multiple sources of insurance and recoded as private, public, and noncoverage. The NCHS created and recoded a poverty income ratio (PIR; 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). We recoded this variable as poor/near poor (<2.00) versus not poor/near poor (≥2). Education status was examined as a categorical variable (less than a high school education versus a high school education or higher). Marital status was examined with the following categories: currently married (living or not living with spouse or partner), previously married (divorced, separated, or widowed), and never married.

Statistical Analysis

All analyses were performed with Stata 2014 (StataCorp, College Station, TX). Sampling weights for the years 2010–2014 were adjusted to account for pooling of the data.[29] We compared the two groups of immigrants (low and high acculturation) by sociodemographic characteristics and prevalence of hypertension, overweight/obesity, diabetes mellitus, and hyperlipidemia. We used chi-square test to assess differences in categorical variables and analysis of variance test for continuous variables. We estimated age-

Table 1. Sociodemographic Characteristics of US Immigrants by Length of Residence in the United States: 2010–2014 National Health Interview Survey

Characteristic (Mean [SE], No. [%])	Total N=54 984	<10 y n=12 317	≥10 y n=42 667	*P* Value
Age	43.2 (0.2)	35.1 (0.2)	45.5 (0.2)	<0.001
Age categories, y, %				
<25	13	21 (0.8)	10 (0.3)	<0.001
25 to 44	44	58 (0.9)	40 (0.5)	
45 to 64	33	17 (0.6)	37 (0.4)	
65 to 74	7	3 (0.2)	8 (0.1)	
≥75	4	1 (0.1)	5 (0.2)	
Female, %	51	50 (0.7)	51 (0.3)	0.557
Poor/near poor	40	50 (1.1)	38 (0.6)	<0.001
<High school education	35	37 (1.0)	34 (0.6)	0.001
Employed	63	65 (1.0)	62 (0.5)	0.013
Marital status, %				
Married/living with partner	70	69 (0.8)	71 (0.4)	<0.001
Previously married	10	6 (0.3)	11 (0.2)	
Never married	20	25 (0.8)	18 (0.3)	
Health insurance coverage, %	67	54 (1.1)	71 (0.6)	<0.001
Region of birth				
Europe	4146 (8)	514 (12)	3632 (88)	<0.001
South America	3546 (6)	829 (23)	2717 (77)	
Mexico	30 146 (55)	5602 (19)	24 544 (81)	
Russia	739 (1)	184 (25)	555 (75)	
Africa	2019 (4)	748 (37)	1271 (63)	
Middle East	1029 (2)	328 (32)	701 (68)	
Indian subcontinent	3417 (6)	1575 (46)	1843 (54)	
Central Asia	3869 (7)	1145 (30)	2724 (70)	
Southeast Asia	6073 (11)	1393 (23)	4680 (77)	

Table 2. Prevalence of Cardiometabolic Risk Factors Among US Immigrants by Place of Birth: 2010–2014 National Health Interview Survey (N=54 984)

(%, 95% CI)	Europe n=4146	South America n=3546	Mexico n=30 146	Russia n=739	Africa n=2019	Middle East n=1029	Indian subcontinent n=3417	Central Asia n=3869	Southeast Asia n=6073
Hypertension*	20 (18–22)	17 (15–19)	20 (20–22)	25 (2029)	22 (17–23)	22 (17–26)	18 (16–20)	18 (16–20)	23 (21–26)
Overweight/ obese*	59 (57–62)	58 (54–61)	71 (70–72)	61 (51–70)	61 (57–65)	59 (54–64)	46 (54–64)	32 (29–34)	41 (38–44)
Diabetes mellitus	6 (5–7)	6 (4–7)	10 (9–10)	6 (3–8)	7 (5–9)	9 (6–12)	9 (7–11)	6 (4–6)	8 (7–10)
Hyperlipidemia	10 (9–11)	8 (7–10)	8 (7–9)	7 (4–9)	5 (4–7)	9 (6–12)	9 (7–11)	8 (7–10)	10 (9–11)

CI indicates confidence interval.
*$P<0.05$ from chi-square test.

and sex-adjusted prevalence of overweight/obesity, hypertension, diabetes mellitus, and hyperlipidemia by length of residence in the US.

We tested for effect modification of sex on the relationship between length of residence and CMR factors by including an interaction term (sex×length of residence). We used multivariable logistic regression analyses to determine the association between length of US residence and overweight/obesity, hypertension, diabetes mellitus, and hyperlipidemia, adjusting for known confounders. For each of the four outcomes (overweight/obesity, hypertension, diabetes mellitus, and hyperlipidemia), we fitted 3 multiple logistic regression models with length of US residence as the main predictor (reference group <10 years) controlling for age, poverty status, health insurance, sex, and region of birth. In addition to these covariates, BMI was included as a covariate in the model with diabetes mellitus, hypertension, hyperlipidemia as the outcomes. These covariates were included because of their clinical importance, our bivariate findings, and previous studies, which have shown that these variables confound the relationship between acculturation and CMR factors.[25,30] A 2-tailed alpha with $P<0.05$ was considered statistically significant.

Results

Sociodemographic Characteristics

The basic sociodemographic characteristics of the study participants (n=54 984) stratified by length of residence in the US are presented in Table 1. There were statistically significant differences in age, rates of poverty, employment, and marital status in participants residing in the US for ≥10 years compared with those with <10 years of residence in the US ($P<0.01$). Participants residing <10 years in the US were younger, better educated, and more employed compared

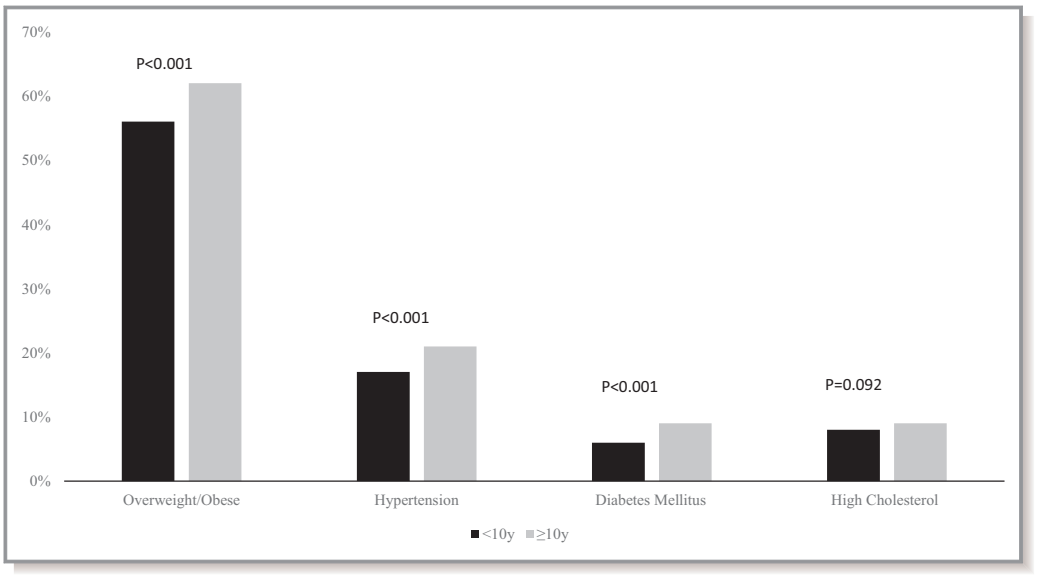

Figure. Age- and sex-adjusted prevalence of hypertension, overweight/obesity, diabetes mellitus, and high cholesterol by length of US residence.

Table 3. Multivariable Adjusted Odds of Overweight/Obesity Among US Immigrants: 2010–2014 National Health Interview Survey

	AOR	95% CI
Length of residence		
<10 y	Ref	Ref
≥10 y	1.19*	1.10 to 1.29*
Age	1.01*	1.00 to 1.01*
Not poor/near poor	0.89*	0.83 to 0.96*
Region of birth		
Mexico	Ref	Ref
South America	0.57*	0.48 to 0.68*
Europe	0.60*	0.53 to 0.68*
Russia	0.64*	0.43 to 0.95*
Africa	0.68*	0.56 to 0.83*
Middle East	0.61*	0.48 to 0.76*
India	0.36*	0.31 to 0.42*
Central Asia	0.19*	0.16 to 0.22*
Southeast Asia	0.29*	0.25 to 0.33*
Sex	0.78*	0.75 to 0.83*
Health insurance	0.96	0.89 to 1.03
Married (yes)	1.36*	1.26 to 1.47*

AOR indicates adjusted odds ratio; CI, confidence interval.
*P<0.05.

with participants residing in the US for ≥10 years (P<0.01). The rate of marriage/living with partners and health insurance coverage were higher among those residing in the US for ≥10 years compared with those residing for <10 years (P<0.01). As shown in Table 1, more immigrants originated from Mexico (55%) compared with immigrants from Southeast Asia (11%), Europe (8%), Central Asia (7%), South America (7%), and Indian subcontinent (6%), Africa (4%), Middle East (2%), and Russia (1%).

Prevalence of CMR Factors by Region of Birth of Immigrants

There was notable heterogeneity in the age- and sex-adjusted prevalence of CMR factors by region of birth as illustrated in Table 2. The prevalence of hypertension and overweight/obesity differed significantly by region of birth. As shown, the prevalence of hypertension was highest in Russian immigrants (25%) while the prevalence of overweight (71%) and diabetes mellitus (10%) were highest in Mexican immigrants. European and South Asian immigrants reported higher prevalence of hyperlipidemia (10%) than other immigrants, but this difference was not statistically significant.

Prevalence of CMR Factors by Length of Residence

As shown in Figure 1, the age- and sex-adjusted prevalence of CMR factors by length of residence suggests that the prevalence of hypertension, overweight/obesity, and diabetes mellitus were associated with increased length of US residence and indicated by the much higher prevalence in immigrants who have resided in the US for ≥10 years than immigrants with <10 years of residence in the US.

Adjusted Odds of CMR Factors by Length of Residence

The results of the multivariable logistic regression analysis examining the relationship between the respective CMR factors and length of residence are presented in Tables 3 through 6. In summary, after adjusting for age, sex, poverty status, health insurance, region of birth, and marital status, respondents residing in the US for ≥10 years were significantly more likely to be overweight/obese (Table 3) and have diabetes mellitus (Table 4) and hypertension (Table 5), as compared with participants with <10 years of residence. After fitting an interaction term between sex and length of residence, we observed that sex was an effect modifier for the outcomes of diabetes mellitus (P=0.019) and high cholesterol (P=0.002), hence stratified analyses are presented in Tables 4 and 6. Men who had resided in the US for ≥10 years had a higher odds of diabetes mellitus than women who had resided in the US for ≥10 years (P=0.019). For the outcome of hyperlipidemia, women who had resided in the US for ≥10 years had a higher likelihood of diagnosis than those with <10 years of residence. However, this relationship was not observed in men.

Discussion

We sought to examine the contribution of acculturation, operationalized as length of US residence, on the prevalence of CMR factors in a contemporary and ethnically diverse sample of immigrants. Our findings support our hypothesis that increased years of US residence is associated with a higher prevalence of CMR factors, specifically hypertension, overweight/obesity, and diabetes mellitus. However, we did not observe an association between acculturation and hyperlipidemia in this study.

Several lines of evidence have shown that acculturation to Western society is associated with hypertension.[31–34] Acculturation is said to increase blood pressure (BP) through stressors associated with migration and cultural and behavioral changes (in diet, physical activity, smoking) that occur after migration. Regarding the stress pathway, acculturation

Table 4. Multivariable Adjusted Odds of Diabetes Mellitus Among US Immigrants: 2010–2014 National Health Interview Survey

	Total N=54 984		Men n=25 891 (47%)		Women n=29 093 (53%)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Length of residence						
<10 y	Ref	Ref	Ref	Ref	Ref	Ref
≥10 y	1.43*	1.17 to 1.73*	1.65*	1.28 to 2.13*	1.25*	1.02 to 1.55*
Age	1.05*	1.05 to 1.06*	1.05*	1.05 to 1.06*	1.05*	1.04 to 1.05*
Not poor/near poor	0.78*	0.68 to 0.90*	0.73*	0.62 to 0.87*	0.83*	0.71 to 0.97*
Region of birth						
Mexico	Ref	Ref	Ref	Ref	Ref	Ref
South America	0.58*	0.43 to 0.79*	0.58*	0.40 to 0.84*	0.59*	0.42 to 0.82*
Europe	0.54*	0.44 to 0.66*	0.54*	0.42 to 0.69*	0.53*	0.41 to 0.69*
Russia	0.51*	0.28 to 0.91*	0.52*	0.28 to 0.97*	0.49*	0.24 to 0.99*
Africa	0.80	0.58 to 1.11	1.02	0.68 to 1.52	0.59	0.41 to 0.84
Middle East	0.93	0.62 to 1.41	0.85	0.58 to 1.26	1.01	0.55 to 1.88
India	1.12	0.86 to 1.45	1.12	0.86 to 1.45	1.12	0.79 to 1.59
Central Asia	0.56*	0.44 to 0.71*	0.58*	0.43 to 0.80*	0.54*	0.40 to 0.73*
Southeast Asia	0.92	0.75 to 1.13	0.92	0.70 to 1.20	0.92	0.74 to 1.14
Sex	0.97*	0.90 to 1.06*	–	–	–	–
Health insurance	1.09	0.95 to 1.24	1.07	0.89 to 1.28	1.11	0.94 to 1.32
Married (yes)	0.89*	0.80 to 0.98*	1.17*	1.07 to 1.29*	1.10*	1.00 to 1.20*
BMI	1.01*	1.01 to 1.02*	1.01*	1.01 to 1.02*	1.01*	1.01 to 1.02*

AOR indicates adjusted odds ratio; BMI, body mass index.
*$P<0.05$.

to Western society is associated with a decrease in social support (a protective factor) and increased job demands,[35,36] which contribute to hypertension. While migration to the US creates an avenue for employment and economic well-being, the stress of adjusting to a new environment contributes to BP elevation. A meta-analysis by Steffen et al[31] examining the strength of the association between acculturation and BP observed that overall effect sizes associated with acculturation were 0.28 for systolic BP and 0.30 for diastolic BP, with increasing acculturation to Western society related to higher BP. Immigrants with higher levels of acculturation had an average of 4 mm Hg higher BP than those with lower levels of acculturation; this is similar to the effect sizes of traditional CMR factors including poor diet and physical inactivity.

Migration results in changes in obesogenic behaviors and environments that contribute to overweight/obesity. Prior studies have found that immigrants from low- to medium-income countries who have migrated to and reside in high-income countries are more susceptible to overweight and obesity than their local counterparts.[37,38] The unhealthy weight gain is estimated to occur after 10 to 15 years of residence in the host country, after which the overweight and obesity rates approach or exceed that of the host population.[39,40] Several studies have also shown positive correlations between length of residence in high-income countries and weight gain.[41,42] In our study, we observed that for both sexes, even after adjusting for known sociodemographic variables, those residing in the US for more than a decade were more likely to be overweight/obese than newer residents. Two factors may account for this phenomenon. First, dietary acculturation—shifts from traditional diets of vegetables, meats, and whole grains to highly processed, high-fat, and high-sugar foods that are popular and readily available in the US[43]—occurs when immigrants migrate to the US. The limited availability of ethnic foods in the host country may compound this problem, with immigrants choosing readily available unhealthy foods, such as snacks and fast food, over their traditional diets. Second, physical activity levels may change upon migration to the US. Physical activity acculturation and the increased frequency of sedentary activities with increased years of US residence contribute to overweight/obesity.[43] Prior studies of Asian and Hispanic

Table 5. Multivariable Adjusted Odds of Hypertension Among US Immigrants: 2010–2014 National Health Interview Survey

	AOR	95% CI
Length of residence		
<10 y	Ref	Ref
≥10 y	1.18*	1.05 to 1.32*
Age	1.06*	1.05 to 1.06*
Not poor/near poor	0.82*	0.74 to 0.90*
Region of birth		
Mexico	Ref	Ref
South America	0.79*	0.67 to 0.94*
Europe	0.98	0.85 to 1.13
Russia	1.33	0.99 to 1.78
Africa	1.01	0.79 to 1.30
Middle East	1.09	0.80 to 1.49
India	0.93	0.77 to 1.13
Central Asia	0.86	0.72 to 1.02
Southeast Asia	1.26*	1.08 to 1.48*
Sex	1.00*	0.94 to 1.07*
Health insurance	1.20*	1.09 to 1.32*
Married (yes)	0.81*	0.74 to 0.87*
BMI	1.01*	1.01 to 1.02*

AOR indicates adjusted odds ratio; BMI, body mass index.
*$P<0.05$.

immigrants suggest that higher acculturation may be associated with less physical activity.[43,44] Since low-income and low educational status are strongly associated with low leisure-time physical activity,[45] it is likely that socioeconomic challenges that immigrants face may limit their ability to engage in leisure-time physical activity. Culturally tailored programs to improve physical activity levels in immigrants may improve CMR factors but also prevent diseases such as coronary heart disease, diabetes mellitus, and heart attacks.

Behavioral changes that occur upon migration to the US may contribute to the development of diabetes mellitus in immigrants. Prior studies[46,47] have observed mixed findings on the association between acculturation and diabetes mellitus; this is not unusual because the health effects of acculturation vary by country of origin. Although our findings suggest that immigrants residing in the US for more than a decade have higher odds of reporting a diabetes mellitus diagnosis, it is possible that this relationship may not be consistent across all of the regions examined. The association between acculturation and diabetes mellitus was stronger in male immigrants than female immigrants, a finding consistent with a previous study in Latinos where acculturation was assessed with length of residence, language proficiency, current and desired environments, and ethnic identity.[48] Using the NHIS 2007–2010, Brian et al[49] also observed that acculturation, measured with nativity, language spoken at home, and length of US residence, was associated with a higher prevalence of diabetes mellitus in US Latino adults, a relationship only partly explained by BMI and weight-related behaviors such as total dietary calories and physical inactivity. Notably, most studies examining the relationship between acculturation and CMR factors in immigrants have focused primarily on Hispanic and Asian immigrants with very few addressing other immigrant population.

In this study, we observed that female immigrants residing in the US for more than a decade were significantly more likely to report hyperlipidemia than newer residents. This finding conflicts with findings from Koya et al[25] of higher odds of hyperlipidemia with increasing years of US residence in men but not women. In the landmark Hispanic Community Health Study/Study of Latinos (HCHS/SOL), Rodriguez et al[50] observed that longer US residence was associated with higher odds of hyperlipidemia awareness, treatment, and control. Given the impact of hyperlipidemia on cardiometabolic outcomes, it is important that additional studies be conducted in various immigrant groups to understand how the acculturation process may influence the development and treatment of hyperlipidemia.

Our results showed a significant difference in health insurance coverage between long-term versus newer residents. While this may not be a direct measure of utilization of health screening services, it raises the possibility of bias and under-reporting of CMR factors as a result of underdiagnosis in newer immigrants even after adjusting for this as a possible confounder. It is possible that more acculturated immigrants report CMR/diseases because they are more likely than newer immigrants to have had adequate evaluation and diagnoses by healthcare providers.

Study Limitations

Several limitations to this study must be considered in the interpretation of our findings. First, CMR factors were obtained through self-report, as is all information in the NHIS; it is possible that the prevalence of hypertension, overweight/obesity, diabetes mellitus, and hyperlipidemia may be overestimated or underestimated. The limitation is inherent in the NHIS as all information is obtained through self-report. It is also difficult to ascertain whether language barriers in the participants who were not native English speakers affected the accuracy of the self-reported data. Second, length of US residence is one of several proxy measures of acculturation and does not fully reflect the complex process of acculturation like validated bidimensional acculturation measures.

Table 6. Multivariable Adjusted Odds of Hyperlipidemia Among US Immigrants: 2010–2014 National Health Interview Survey

	Total N=54 984		Men n=25 891 (47%)		Women n=29 093 (53%)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Length of residence						
<10 y	Ref	Ref	Ref	Ref	Ref	Ref
≥10 y	1.05	0.90 to 1.24	0.89	0.71 to 1.10	1.36*	1.07 to 1.72*
Age	1.04*	1.04 to 1.05*	1.03*	1.03 to 1.04*	1.05*	1.04 to 1.05*
Not poor/near poor	0.99*	0.86 to 1.13*	1.03	0.84 to 1.26	0.94*	0.79 to 1.13*
Region of birth						
Mexico	Ref	Ref	Ref	Ref	Ref	Ref
South America	1.04*	0.82 to 1.32*	1.27	0.93 to 1.74	0.80*	0.58 to 1.11*
Europe	1.14	0.95 to 1.37	1.08	0.85 to 1.38	1.21	0.92 to 1.58
Russia	0.72	0.46 to 1.26	0.79	0.49 to 1.27	0.66	0.37 to 1.18
Africa	0.59*	0.43 to 0.83*	0.72	0.46 to 1.13	0.43*	0.27 to 0.68*
Middle East	1.02	0.69 to 1.50	0.91	0.61 to 1.35	1.19	0.56 to 2.56
India	1.11	0.82 to 1.51	1.20	0.82 to 1.74	0.96	0.55 to 1.67
Central Asia	0.93	0.72 to 1.19	0.99	0.70 to 1.41	0.87	0.63 to 1.21
Southeast Asia	1.20*	1.01 to 1.41*	1.45*	1.12 to 1.88*	0.95	0.74 to 1.24
Sex	0.72*	0.64 to 0.82*	–	–	–	–
Health insurance	1.37*	1.16 to 1.61*	1.63*	1.31 to 2.04*	1.09*	0.90 to 1.33*
Married (yes)	1.08	0.93 to 1.25	0.82*	0.69 to 0.98*	0.99	0.88 to 1.12
BMI	1.01	1.00 to 1.01*	1.00	1.00 to 1.01	1.01	1.00 to 1.01

AOR indicates adjusted odds ratio; BMI, body mass index.
*$P<0.05$.

Third, the cross-sectional nature of our study precludes us from making any causal inferences. Fourth, it is also possible that there may be residual confounding, which may account for the association between length of US residence and the prevalence of these CMR factors. Fifth, the sample represents only immigrants from broadly defined groups who participated in the NHIS, and our findings may not apply to the entire immigrant population in the US.

Conclusions

We observed that in both sexes of an ethnically diverse sample of US immigrants, acculturation was associated with a higher prevalence of certain CMR factors. Immigrants residing in the US for ≥10 years were more likely to report a history of hypertension, overweight/obesity, and diabetes mellitus but not hyperlipidemia than those who had resided in the US for <10 years. As the US continues to diversify, it is important to understand the evolution of CMR factors in new immigrants to prevent adverse health outcomes such as myocardial infarction, stroke, and kidney disease. Because different acculturation experiences among immigrants in the US may contribute to their risk for CMR factors, it may be necessary to examine unique associations between CMR factors and acculturation separately among US immigrant subgroups. Future longitudinal studies of diverse immigrant groups may provide crucial information on which socioeconomic, behavioral, environmental, and epigenetic factors contribute to CMR in immigrants to inform the development of culturally tailored interventions to mitigate CMR. Specifically, research examining the uptake of primary care and health screening services between newer versus long-term immigrants is needed. Targeted interventions to screen for CMR factors and educate immigrant populations are also needed.

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Disclosures

None.

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