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Disparities in Chronic Disease Prevalence Among Non-Hispanic Whites: Heterogeneity Among Foreign-Born Arab and European Americans

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Abstract We estimated and compared the sex- and age-adjusted prevalence of chronic diseases (diagnosis only and comorbidity) among US- and foreign-born whites from Europe and the Arab Nations and examined associations between region of birth and chronic disease. We evaluated 213,644 adults using restricted data from the National Health Interview Survey (2000–2011) by (1) chronic disease diagnosis only (heart disease, asthma, cancer, diabetes, ulcer, or obesity) and (2) comorbidity (none, diagnosis only, comorbid). We used logistic regression to examine associations between region of birth and chronic disease while controlling for confounders. Foreign-born whites from the Arab Nations had a higher prevalence of being diagnosed with ulcer (4 %) compared to US- and European-born whites (2 %). Foreign-born whites from the Arab Nations had a lower prevalence of comorbid cancer (1 %) and ulcer (3 %) yet had higher estimates of comorbid heart disease (18 %), asthma (5 %), and obesity (13 %) when compared to European-born whites (all $ps < 0.05$). Arab Americans had the highest prevalence of comorbid diabetes (8 %) compared to both European- (5 %) and US-born whites (6 %). In multivariate logistic regression models, Arab Americans had a lower odds of reporting cancer, heart disease, and asthma before and after controlling for covariates. Our study builds on existing literature for Arab Americans as the first study evaluating chronic disease prevalence among foreign-born whites from countries in the Arab League of Nations geographically located in the Middle East. Methodologically robust studies are needed to better understand the influence of acculturation, country of origin, and other characteristics influencing health among foreign-born whites.

Keywords Chronic disease · Nativity · National Health Interview Survey · Immigrant · Arab Americans

Mathematics Subject Classification 62 Statistics, 62–07 Data Analysis

Introduction

Research on immigrant health in the USA is not a new area of interest. In particular, studies have examined disparities in mortality, mental health, preventive health behaviors and chronic disease prevalence, including comorbidities/multimorbidities (from hereafter will be referred to as comorbidities) between US- and foreign-born groups [1–4]. The most common groups included in the discourse on immigrant health are Hispanics and Asians [1], which comprised 80 % of immigrants arriving in the USA from 2005 to 2010 [5]. These studies have compared the health of foreign-born Asians and Hispanics with their US-born counterparts and US-born non-Hispanic whites [6, 7]. They found that the health of the foreign-born is generally better than those born in the USA, but with acculturation, this health advantage diminishes [1]. More specifically, the studies that focused on comorbidities found that minorities (with the exception of Asians) were more likely to have comorbidities compared to non-Hispanic whites [2–4, 8]. The importance of heterogeneity within a racial or ethnic category is readily missed for non-Hispanic

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whites. The non-Hispanic white category consists of individuals from Europe, North Africa, or the Middle East [9]. Very few studies have examined the similarities and differences in health among non-Hispanic whites in general and, specifically, US- versus foreign-born non-Hispanic whites [7, 10–12].

To our knowledge, no studies have evaluated the health status of foreign-born whites from Europe compared to US-born counterparts. Another group of non-Hispanic whites in which health disparities may be readily missed includes individuals from the Middle East. According to the US Census Bureau, a majority of the population from the Middle East identify as Arab [13]. Because the literature focuses on Arab Americans, we will use that term when describing relevant studies. The majority of knowledge about Arab Americans is gleaned from community-based surveys [13–15]. While community surveys are important, many are based on convenience samples that are not representative of the entire Arab American population. Therefore, while these studies may have internal validity, they lack external validity. External validity is crucial because it helps researchers better understand whether health interventions and programs will be effective in other settings and with other populations [16]. Until Arab Americans are recognized as a separate ethnic category, their health and disease status should be disaggregated from that of the white group [9].

To begin the work of uncovering the health of Arab Americans, a few researchers have analyzed data from the census [17, 18] (the only health data available are related to disability) and the National Health Interview Survey (NHIS) to obtain representative estimates of selected health conditions among Arab Americans [19–21]. Because the NHIS includes only foreign-born Arab Americans, it limits the ability to make inferences about US-born Arab Americans. Nevertheless, using these data to better understand the health of foreign-born Arab Americans is important because it builds on the limited existing literature and establishes a future research agenda for Arab American health.

The objectives of this study are to estimate and compare the sex- and age-adjusted prevalence of various chronic diseases among US- and foreign-born whites from Europe and the Arab Nations and examine the associations between region of birth and various chronic diseases while controlling for potential confounders.

Methods

Data Collection

We combined 12 years (2000–2011) of National Health Interview Survey (NHIS) data. The NHIS uses a multistage sample design to collect demographic and health information using face-to-face interviews among a representative sample of the US population. Details of the NHIS sampling design, oversampling of ethnic minorities, and data collection methods have been reported previously [21, 22].

Sample Participants

The NHIS collected data from 984,160 persons from 388,072 families and 378,180 households from 2000 to 2011. We limited our sample to all non-Hispanic white adults (ages ≥18 years: n = 213,624), who answered questions about place of birth (including whether they were born in one of the 50 states or Washington D.C., whether they were born abroad to American parents, and whether they were a citizen by birth or naturalization) and diagnosed health conditions (US-born = 205,763, foreign-born = 7861) (see Fig. 1).

Measures

Independent Variables

We developed the independent variable by combining nativity status (US- or foreign-born), race/ethnicity (non-Hispanic white), and region of birth (US, Europe, the Arab Nations). Details of how the NHIS determines these three variables and how our variable was created were reported previously [23,

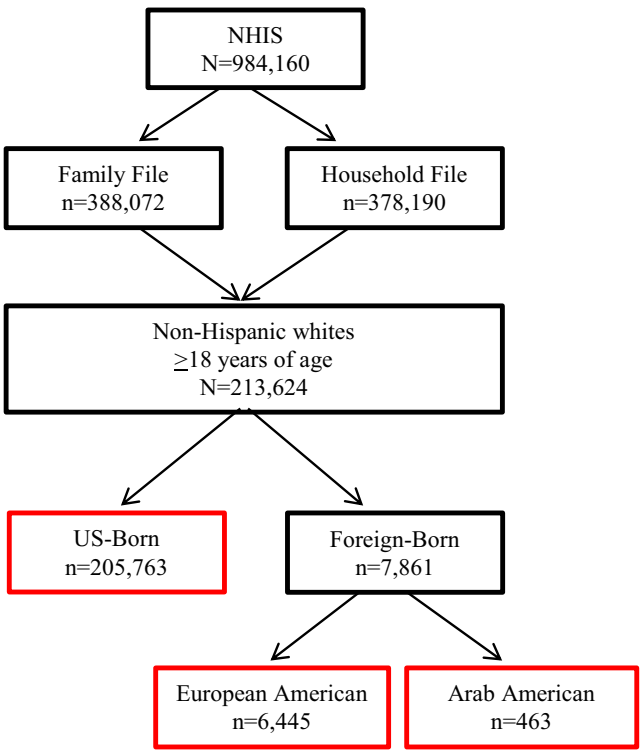

Fig. 1 Flow diagram of the sample, NHIS 2000–2011

24]. Prior studies estimating the disease burden among foreign-born Arab Americans have evaluated participants who indicated they were born in one of the countries in the Middle Eastern region designation by the NHIS. This geographic region includes countries which are not a part of the Arab League of Nations (i.e., Iran). Therefore, we identified 15 countries which overlap with the 25 countries included in the NHIS Middle East region of birth and the 22 countries that comprise the Arab League of Nations. We created an Arab Nations region of birth category which includes the following 15 countries: Arab Palestine, Bahrain, Gaza Strip, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, United Arab Emirates, West Bank, and Yemen. We requested and compiled data from the National Center for Health Statistics (NCHS) Research Data Center because "country of birth" is a restricted variable in the NHIS [25].

Dependent Variables

The dependent variable of interest in this study was chronic disease. The NHIS measures individual chronic diseases by asking participants "have you ever been told by a doctor or other health professional that you had" any of a list of selected chronic diseases [22]. Based on sample size and previous research among Arab Americans [26], selected chronic diseases of interest in this study were heart disease, asthma, cancer, diabetes, ulcer, and obesity. Based on previous research [27], we examined chronic disease prevalence in two ways. First, we measured each chronic disease individually. Respondents were asked whether they had ever been told by a doctor or other health professional that they had asthma (yes or no); a stomach, duodenal, or peptic ulcer (yes or no); cancer (yes or no); and diabetes (yes or no) [22]. For the purposes of this study, those who responded that they were borderline diabetic were classified as not having diabetes. To measure heart disease, the NHIS asks participants if they have ever been told by a doctor or other health professional that they had hypertension, coronary heart disease, angina pectoris, a stroke, a heart attack, and any other heart condition or heart disease [22]. We created a dichotomous variable (yes or no) to include respondents who reported that they had one or more of these heart diseases. Obesity was determined by body mass index (BMI) scores. The NHIS measures BMI by asking respondents their height and weight and calculating it as weight (kg) divided by height (m^2) [22]. We dichotomized BMI measurements to determine the prevalence of obesity (BMI < 30 kg/m^2 not obese; BMI > =30 kg/m^2 obese).

Second, we created variables to determine whether participants had only one or multiple diagnoses. We developed six new variables to determine the comorbidity of each disease. For example, participants who reported that they did not have heart disease (no diagnosis) were compared to those who had heart disease (diagnosis only) and those who had heart disease in addition to one or more other diseases (diagnosis comorbid). This process was repeated for the other five diseases of interest in this study (diabetes, asthma, ulcer, cancer, obesity).

Covariates

Covariates examined included demographic (sex, age, and marital status), socioeconomic status (education, employment, and imputed poverty ratio), health care (health insurance coverage, place most often receive care, seen a GP or health professional in the last 12 months), behavioral risk factors (smoking), and length of time living in the USA as a proxy for acculturation. Due to low response rates for income levels, multiple imputation methods using five sets of imputed values per year were performed. Details of the multiple imputation methods the NHIS uses for income have been reported previously [28].

Analysis

Descriptive statistics were obtained to report demographic, socioeconomic status, health care, risk factor, and acculturation characteristics. We used weighted chi-squares to determine statistically significant differences between US- and foreign-born non-Hispanic whites from Europe and the Arab Nations for each covariate.

We estimated the sex- and age-adjusted prevalence of having heart disease, asthma, ulcer, diabetes, cancer, and obesity (no diagnosis, diagnosis only, diagnosis comorbid) for individuals from Europe (including Russia and former USSR areas) and the Arab Nations. We used logistic regression to examine the association between region of birth (US, Europe, and the Arab Nations) among whites (independent variable) and the prevalence of having heart disease, asthma, ulcer, diabetes, cancer, and obesity (outcome variables) while controlling for potential confounders. The following logistic regression models were used: crude, unadjusted estimates (model 1); demographic effects (model 2) adjusted for age, sex, and marital status; socioeconomic effects (model 3) adjusted for variables in model 2 plus education, employment, and imputed poverty ratio; health access effects (model 4) adjusted for variables in model 3 plus health insurance coverage and place most often received care; risk factor effects (model 5) adjusted for variables in model 4 plus smoking history; and acculturation effects (model 6) adjusted for variables in model 5 plus years in the USA.

We used SAS 9.3 and SUDAAN version 10 to account for the sophisticated weighting in the NHIS sample design, imputed income, and adjustment for age and sex. Weights were adjusted (divided by 12) for combined years of NHIS data. Because of the use of restricted data to create the Arab Nations region of birth category among foreign-born non-Hispanic

whites, we obtained approval for de-identified data from the NCHS Research Ethics Review Board [25].

Results

Descriptive Results

Several differences were observed between US- and foreign-born whites from Europe and the Arab Nations (see Table 1). The mean age was significantly lower among foreign-born adults from the Arab Nations (39.7 years) when compared to European-born (50.4 years) and US-born adults (47.4 years). Foreign-born adults from the Arab Nations were less likely to be married/living with their partner, live above the poverty level, be employed, have a usual source of care, or have health insurance compared to US- and foreign-born white adults (all *p*s < 0.0001). However, foreign-born white adults from the Arab Nations were more likely to report having a bachelor's degree or higher (40.1 %) when compared to US-born (28.2 %) and foreign-born whites from Europe (36.2 %). Foreign-born adults from the Arab Nations were less likely to smoke (34.6 %) when compared to US- (47.6 %) and European-born counterparts (44.5 %). A majority (68.6 %) of foreign-born white adults from Europe lived in the USA for 15 years or longer compared to only 45.5 % from the Arab Nations.

Prevalence of Selected Chronic Diseases

Table 2 reports the age- and sex-adjusted prevalence of selected chronic diseases (no diagnosis, diagnosis only, or diagnosis comorbid) within the white population. When examining each diagnosis only, foreign-born whites from the Arab Nations had lower estimates of heart disease (9 %), asthma (1 %), and cancer (1 %) when compared to US-born and foreign-

Table 1 Selected characteristics of sample for US- and foreign-born whites from Europe and the Arab Nations, NHIS 2000–2011, *N* = 213,644

	Non-Hispanic whites			*p* value*
	US-born (*N* = 205,763) Weighted % (SE)	Foreign-born		
		Europe[a] (*N* = 6445) Weighted % (SE)	Arab Nations (*N* = 463) Weighted % (SE)	
Mean (SD) age in years	47.4 (0.09)	50.4 (0.30)	39.7 (1.03)	<0.0001
Male sex	48.3 (0.14)	45.6 (0.72)	55.5 (2.66)	0.0001
Marital status				<0.0001
Never married	17.3 (0.18)	12.4 (0.56)	21.9 (2.49)	
Married/live with partner	65.4 (0.19)	68.2 (0.70)	66.1 (2.80)	
Divorced/widowed/separated	17.3 (0.12)	19.4 (0.50)	12.0 (1.75)	
Education				<0.0001
Less than HS	11.2 (0.15)	13.1 (0.51)	18.2 (2.62)	
HS/GED	29.9 (0.20)	24.7 (0.68)	22.0 (2.25)	
Some college/associate's	30.7 (0.16)	26.0 (0.66)	19.7 (2.01)	
Bachelor's or higher	28.2 (0.25)	36.2 (0.77)	40.1 (3.85)	
Imputed poverty level (≥200 %)	76.0 (0.24)	73.5 (0.84)	48.9 (3.35)	<0.0001
Not employed	36.9 (0.19)	42.32 (0.69)	49.3 (2.99)	<0.0001
Have health insurance	88.4 (0.12)	86.46 (0.57)	77.0 (2.74)	<0.0001
Place most often receive care				<0.0001
Clinic/health center	15.6 (0.24)	12.8 (0.61)	15.1 (2.31)	
Doctor's office/HMO	81.2 (0.25)	83.9 (0.65)	76.6 (3.23)	
No usual source of care	3.2 (0.07)	3.3 (0.27)	8.3 (2.28)	
Current non-smoker	52.4 (0.19)	55.5 (0.73)	65.4 (2.71)	<0.0001
Length of time in the USA				<0.0001
Born in the USA	100.0 (0.00)	–	–	
Less than 15 years	–	31.4 (0.84)	54.5 (3.71)	
15 years or more	–	68.6 (0.84)	45.5 (3.71)	

[a] Europe includes whites born in Europe, Russia (and former USSR areas)

*All *p*s < 0.05

Table 2 Age- and sex-adjusted prevalence of chronic diseases and their comorbidities for US- and foreign-born whites from Europe[a] and the Arab Nations disaggregated by region of birth, NHIS 2000-2011, $N = 213,644$

	No diagnosis % (SE)	Diagnosis only % (SE)	Diagnosis comorbid % (SE)	*p* value
Heart disease[b]				
US-born	66.0 (0.00)	12.0 (0.00)	22.0 (0.00)	<0.0001*
Foreign-born				
Europe	71.0 (0.01)	13.0 (0.00)	16.0 (0.01)	
Arab Nations	73.0 (0.02)	9.0 (0.02)	18.0 (0.02)	
Asthma				
US-born	88.0 (0.00)	4.0 (0.00)	7.0 (0.00)	0.0050*
Foreign-born				
Europe	93.0 (0.00)	3.0 (0.00)	4.0 (0.00)	
Arab Nations	94 (0.01)	1.0 (0.01)	5.0 (0.01)	
Cancer				
US-born	91.0 (0.00)	2.0 (0.00)	7.0 (0.00)	0.2114
Foreign-born				
Europe	93.0 (0.00)	2.0 (0.00)	5.0 (0.00)	
Arab Nations	99.0 (0.01)	1.0 (0.00)	1.0 (0.00)	
Diabetes				
US-born	93.0 (0.00)	1.0 (0.00)	6.0 (0.00)	0.0991
Foreign-born				
Europe	94.0 (0.00)	1.0 (0.00)	5.0 (0.00)	
Arab Nations	90.0 (0.02)	1.0 (0.01)	8.0 (0.02)	
Ulcer				
US-born	92.0 (0.00)	2.0 (0.00)	6.0 (0.00)	0.0009*
Foreign-born				
Europe	93.0 (0.00)	2.0 (0.00)	4.0 (0.00)	
Arab Nations	93.0 (0.02)	4.0 (0.01)	3.0 (0.01)	
Obesity[c]				
US-born	73.0 (0.00)	11.0 (0.00)	17.0 (0.00)	<0.0001*
Foreign-born				
Europe	79.0 (0.01)	10.0 (0.00)	12.0 (0.00)	
Arab Nations	76.0 (0.02)	11.0 (0.02)	13.0 (0.02)	

[a] Europe includes whites born in Europe, Russia (and former USSR areas)

[b] Heart disease determined by participants reporting ever had hypertension, coronary heart disease, angina, heart attack, stroke, or any other type of heart condition

[c] BMI calculated as weight (kg)/height (m^2). Obesity determined by a BMI ≥30 kg/m^2

*$p < 0.05$

born whites from Europe. Foreign-born whites from the Arab Nations had similar estimates for diabetes (1 %) as European- and US-born whites and similar estimates for obesity (11 %) when compared to US-born whites. Foreign-born whites from the Arab Nations had twice as high estimates of ulcer (4 %) as foreign-born whites from Europe (2 %) and US-born whites (2 %). When examining comorbidity, foreign-born whites from the Arab Nations had a lower age- and sex-adjusted prevalence of comorbid cancer (1 %) and ulcer (3 %). However, they had higher estimates of comorbid heart disease (18 %) and asthma (5 %) and obesity (13 %) when compared to European-born whites (all *p*s < 0.05). Foreign-born whites from the Arab Nations had the highest estimates of comorbid diabetes (8 %) when compared to both European-born (5 %) and US-born white adults (6 %).

Multivariable Results

In unadjusted analyses (Table 3, model 1), foreign-born whites from the Arab Nations had a 93 % lower odds of reporting cancer (OR = 0.07, 95 % CI = 0.02, 0.23), 54 % lower odds of reporting heart disease (OR = 0.46, 95 % CI = 0.35, 0.62), and 53 % lower odds of reporting asthma (OR = 0.47, 95 % CI = 0.31, 0.73) compared to US-born whites. Results were not statistically different for diabetes, ulcer, and obesity estimates. Cancer, asthma, and heart disease estimates among

Table 3 Crude and adjusted odds ratios (95 % confidence intervals) for chronic disease prevalence (one diagnosis only) comparing foreign- to US-born white population, 2000–2011 NHIS, $N = 213,644$

	Model 1 (crude)[a]	Model 2 (demographic effects)[b]	Model 3 (socioeconomic effects)[c]	Model 4 (health access effects)[d]	Model 5 (risk factor effects)[e]	Model 6 (acculturation effects)[f]
US-born	1.00	1.00	1.00	1.00	1.00	1.00
Heart disease						
Foreign-born						
Europe	0.93 (0.87, 0.99)	0.84 (0.79, 0.89)	0.81 (0.76, 0.87)	0.82 (0.77, 0.88)	0.83 (0.77, 0.88)	0.60 (0.51, 0.70)
Arab Nations	0.46 (0.35, 0.62)	0.62 (0.46, 0.83)	0.54 (0.40, 0.72)	0.58 (0.42, 0.80)	0.60 (0.43, 0.83)	0.46 (0.33, 0.65)
Asthma						
Foreign-born						
Europe	0.52 (0.46, 0.59)	0.52 (0.46, 0.59)	0.51 (0.45, 0.58)	0.52 (0.45, 0.60)	0.52 (0.45, 0.60)	0.40 (0.32, 0.51)
Arab Nations	0.47 (0.31, 0.73)	0.47 (0.30, 0.72)	0.42 (0.27, 0.64)	0.50 (0.31, 0.78)	0.51 (0.32, 0.81)	0.43 (0.27, 0.69)
Cancer						
Foreign-born						
Europe	0.87 (0.78, 0.97)	0.80 (0.71, 0.89)	0.75 (0.67, 0.84)	0.76 (0.68, 0.84)	0.76 (0.68, 0.85)	0.30 (0.20, 0.45)
Arab Nations	0.07 (0.02, 0.23)	0.10 (0.03, 0.31)	0.09 (0.03, 0.29)	0.10 (0.03, 0.33)	0.11 (0.03, 0.34)	0.05 (0.01, 0.16)
Diabetes						
Foreign-born						
Europe	0.90 (0.81, 1.02)	0.85 (0.76, 0.95)	0.82 (0.73, 0.92)	0.86 (0.77, 0.96)	0.86 (0.77, 0.97)	0.69 (0.49, 0.96)
Arab Nations	0.95 (0.60, 1.50)	1.36 (0.88, 2.11)	1.22 (0.77, 1.94)	1.30 (0.80, 2.12)	1.33 (0.81, 2.17)	1.15 (0.66, 1.99)
Ulcer						
Foreign-born						
Europe	0.85 (0.75, 0.95)	0.81 (0.72, 0.91)	0.80 (0.71, 0.90)	0.78 (0.69, 0.89)	0.81 (0.71, 0.92)	0.60 (0.45, 0.81)
Arab Nations	0.84 (0.55, 1.29)	0.98 (0.64, 1.49)	0.84 (0.55, 1.30)	0.75 (0.46, 1.23)	0.81 (0.49, 1.32)	0.63 (0.36, 1.11)
Obesity						
Foreign-born						
Europe	0.73 (0.68, 0.79)	0.71 (0.66, 0.77)	0.73 (0.68, 0.78)	0.73 (0.67, 0.79)	0.73 (0.67, 0.79)	0.54 (0.46, 0.65)
Arab Nations	0.81 (0.62, 1.05)	0.86 (0.66, 1.11)	0.89 (0.68, 1.17)	1.03 (0.77, 1.38)	1.03 (0.77, 1.38)	0.86 (0.62, 1.18)

[a] Unadjusted, crude estimates

[b] Adjusts for age (<45 years as referent), sex (female as referent), and marital status (married as referent)

[c] Adjusts for variables in model 2 plus education (bachelor's degree or higher as referent), employment (employed as referent), and imputed poverty ratio (≥200 % as referent)

[d] Adjusts for variables in model 3 plus health insurance coverage (yes as referent) and place most often received care (doctor's office/HMO as referent)

[e] Adjusts for variables in model 4 plus smoking history (no as referent)

[f] Adjusts for variables in model 5 plus years in the USA (US-born as referent)

foreign-born whites from the Arab Nations remained statistically significant (Table 3, model 5) after adjusting for demographic, socioeconomic, health insurance, access, and health utilization effects; behavioral risk factors; and length of time in the USA.

Discussion

The objective of this study was to estimate and compare prevalence estimates and associations of various chronic diseases by nativity status and between individuals from Europe and the Arab Nations. The two main findings were (1) foreign-born whites from the Arab Nations have lower estimates of heart disease, asthma, and cancer when compared to US-born counterparts before and after adjustment of potential confounders and (2) estimates of comorbid heart disease, asthma, obesity, and diabetes are higher among foreign-born whites from the Arab Nations when compared to European-born counterparts.

Our first main finding was that foreign-born whites from the Arab Nations have lower estimates of heart disease, asthma, and cancer when compared to US-born counterparts. While several studies exist that examine comorbidities [2–4, 8], none focus on the heterogeneity within the non-Hispanic white category. Using the NHIS, Dallo and Borrell found that 13.4 % of Arab Americans had self-reported hypertension compared to 24.5 % of whites [19]. However, studies using community-based convenience samples found self-reported hypertension estimates as high as 44 % [29]. In 2011, the NHIS reported that 8 % of adults had heart disease and 8 % of adults had ever been told they had some form of cancer [30]. According to non-probability sample community studies in Michigan, up to 7.6 % of Arab Americans reported having heart disease and 11.4 % had cancer [29]. Other more rigorous studies using larger probability samples found that Arab Americans with cancers had higher estimates of certain types of cancer when compared to other whites. Schwartz and colleagues found that Arab and Chaldean Americans in Detroit, Michigan, had greater than expected proportions of the following types when compared to whites: 63 % liver, 44 % thyroid, 29 % leukemia, 28 % Hodgkin's, 26 % brain, 25 % kidney, and 24 % urinary bladder [31]. Other research conducted in California found Arab Americans had significantly higher estimates for cancers of the stomach, liver, thyroid, leukemia, and male breast when compared to whites [32]. However, given that these studies of Arab Americans used either convenience samples or were limited geographically (Michigan or California), any conclusions about heart disease and cancer risk are tentative and await further verification. Similar results were found when evaluating asthma prevalence. According to community studies, asthma prevalence ranged from 5.4 % to 15.7 %. Jamil and colleagues found that 9.4 % of Arab Americans and 5.4 % of Chaldean Americans in Michigan self-reported asthma [13, 33]. Other research by Johnson and colleagues found a combined asthma prevalence of 15.7 % among Arab Americans (8.2 % doctor-diagnosed, 7.5 % self-reported) [34] and significant comorbidity between asthma and other chronic conditions, such as hypertension [35, 36]. Although these results may be lower than other racial groups in Michigan (11.1 % blacks, 14.3 % Hispanics), they are higher than national estimates (8 %) [30] and previous research examining asthma prevalence among foreign-born non-Hispanic whites (6.6 %) [7]. In addition, Arab Americans may live in areas of high pollution, which may explain the higher asthma estimates [35]. This suggests that Arab Americans who live in concentrated areas (i.e., Michigan) may be different from those nationally. In addition, many of the community studies were non-probability, convenience samples which affects their validity in generalizing to other populations.

Our second main finding emphasizes the need to disaggregate Arab Americans from European-born counterparts. Out of the six chronic conditions examined in this study, four were higher among foreign-born whites from the Arab Nations when compared to European-born adults: ulcer (4 % diagnosis only), heart disease (18 % comorbidity), asthma (5 % comorbidity), and obesity (13 % comorbidity). Furthermore, comorbid diabetes was highest among foreign-born whites from the Arab Nations (8 %) when compared to US-born (6 %) and European-born (5 %) counterparts. As previously mentioned, it is not possible to compare our findings with other national data, because such studies do not exist. To our knowledge, no community studies have examined ulcer prevalence among Arab Americans. Dallo and Borrell (2006) found that 51 % of Arab Americans and 57 % of whites were overweight or obese using NHIS data [19]. However, few community-based studies have evaluated overweight or obesity among Arab Americans. Using adiposity measurements, Jaber and colleagues found that one third (33.9 %) of Arab Americans were obese [37], which is slightly higher than the age-adjusted national prevalence of 32.6 % for non-Hispanic whites yet slightly lower than the overall prevalence of 34.9 % for all adults. Dallo and Borrell also found that 4.8 % of foreign-born adults from the Middle East region of birth self-reported that they had diabetes compared to whites (6.9 %) using NHIS data [19]. Studies in Michigan using convenience samples of Arab Americans found a self-reported diabetes prevalence range from 7.0 to 19.3 % [14, 29]. Given that one third of diabetes cases in the USA are undiagnosed [22], we can conclude that the prevalence is underrepresented in these studies.

It is not clear or consistent as to why Arab Americans may fare better for some conditions and worse for others. Studies among Arab Americans are just beginning to surface. One explanation is that Arab Americans may follow the pattern of the Healthy Migrant Effect [38, 39], where they arrive to

their host country in better health than the general population. With acculturation to US society, their health begins to deteriorate [40, 41]. Further research, especially longitudinal studies, is needed to better understand how health changes as duration in the USA increases.

This study has various strengths and limitations. Among the strengths of this study are the use of multiple years of a national representative sample and the large sample size, which allow the ability to control for numerous potential confounders. Furthermore, the ability to examine region of birth and chronic conditions is unique to the NHIS and allowed us to examine an understudied population. Our study unmasks differences that may not be revealed when evaluating foreign-born adults from the Middle East as a representation for Arab Americans. The current study limited the sample to non-Hispanic whites born in the USA versus those born in the Arab Nations or Europe. Research that includes these samples is consistent with our findings, although other studies focused on conditions such as disability [18], hypertension, and diabetes [19] and general health status [20]. The current study not only examines nativity status but also adds to this literature by disaggregating the non-Hispanic white category into those from the Arab Nations and Europe/Russia. Our study adds to existing research evaluating Arab Americans using restricted data from the NHIS. This study also had limitations that may have affected the findings. The use of self-report data can be problematic. However, self-report data for chronic conditions has been shown to be consistent with physician's diagnosis [42, 43]. Lastly, because heart disease is comprised of multiple chronic conditions, the prevalence of heart disease may be underestimated. Using this definition of heart disease is consistent with other studies that focused on heart disease prevalence using data from the NHIS [44].

To our knowledge, this is the first study to estimate chronic conditions among subgroups of whites. Our study adds to existing research evaluating Arab Americans using restricted data from the NHIS. The findings suggest that Arab Americans may be at a greater risk of developing chronic diseases compared to other white groups. Future studies should inquire about specific countries of birth and acculturation status. In addition, better understanding the individual's environmental conditions in their country of origin would shed light on the host country's influence on their health.

Results and conclusions in this paper are those of the authors and do not necessarily represent the views of the Research Data Center, the National Center for Health Statistics, or the Centers for Disease Control and Prevention [25].

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethical approval was obtained by the National Center for Health Statistics prior to initial data collection. This study analyses de-identified public-use data. For this type of study, formal consent is not required.

Informed Consent Informed consent was obtained from all individual participants included in the study prior to initial data collection by the National Center for Health Statistics. This study analyses de-identified public-use data. For this type of study, formal consent is not required.

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