



Published in final edited form as:

J Immigr Minor Health. 2012 December ; 14(6): 918–925. doi:10.1007/s10903-011-9566-2.

Immigration Disparities in Cardiovascular Disease Risk Factor Awareness

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Abstract

Background—No previous study has assessed the association between immigration status and awareness regarding a person's own CVD risk factors.

Methods—Using physical examination-based data and participants' self-report of prior diagnosis, we assessed immigration-based disparities in awareness of diabetes, hypertension, hypercholesterolemia, and overweight among 12,124 participants in the 2003-2008 National Health and Nutritional Survey.

Results—Unawareness of CVD risk factors is high among all groups, but tends to be higher among foreign-born English and non-English speaking participants than among US-born participants. Adjusting for demographic factors and access to health care, foreign-born participants are more likely to be unaware of their hypertension and overweight than US-born participants.

Conclusion—Immigrants are more likely than those born in the US to be unaware of their CVD risk factors, and may therefore be less motivated to seek treatment and modify their behavior to prevent negative CVD outcomes.

Keywords

Cardiovascular diseases; risk factors; epidemiology; hypertension; obesity

Introduction

Diabetes,¹ hypertension,² hypercholesterolemia,² and overweight³ are risk factors associated with high cardiovascular disease (CVD) morbidity and mortality. Although these CVD risk factors affect millions of people each year, they are both diagnosable and modifiable.⁴⁻⁷ Once individuals are made aware that they have a risk factor, they may be motivated to undergo medical treatment and make healthy behavioral modifications that include improved diet, physical activity, and smoking cessation. A recent study among overweight

and obese adults found that those who were made aware of their overweight status by a health care provider were significantly more likely to perceive themselves as overweight and to desire to lose weight.⁸ Awareness is a prerequisite for the successful control of diabetes, hypertension, and hypercholesterolemia, which usually requires self-administered medication and significant behavioral modification.⁵⁻⁷

Over the last several decades, educational campaigns and interventions for primary and secondary prevention have attempted to increase knowledge and awareness about CVD and its risk factors.⁹⁻¹³ As a result, diabetic, hypertensive, hypercholesterolemic, and overweight members of many population segments are now increasingly likely to be aware of their own risk factors.¹⁴⁻¹⁸ Despite these successful efforts, there are still disparities in CVD knowledge and risk factor awareness based on income, education, race/ethnicity, and other social factors.^{8, 17, 19-23}

In this study, we use data from the 2003-2008 National Health and Nutrition Examination Survey (NHANES) to examine awareness of diabetes, hypertension, hypercholesterolemia, and overweight among US-born participants, foreign-born participants who speak English, and foreign-born participants who speak a language other than English. To our knowledge, no previous research has assessed whether participants' awareness of their own CVD risk factors varies by immigration and language; however, studies have shown that foreign-born individuals receive medical care less regularly, perceive care to be of lower quality, are less satisfied with care, and receive less preventive care than those born in the United States (US).^{24, 25} We therefore expect awareness of CVD risk factors to be lower among foreign-born participants than among US-born participants. Language discordance between patients and providers also affects the quality of health care interactions and may result in poorer quality care and poorer adherence to treatment.^{26, 27} Thus, we also expect that risk factor awareness among foreign-born non-English speakers will be lower than among both foreign-born English speakers and the US-born.

Methods

We used data from the public use file of the 2003-2008 NHANES. Briefly, NHANES is a continuous series of annual studies designed to assess the health and nutritional status of adults and children in the United States. NHANES uses a complex, multi-stage sampling design to obtain a sample representative of the US population of all ages. A major strength of NHANES is that it has both an interview and a physical examination component, thus CVD risk factor classification is based on more than just self-report. Further details on the sampling strategy and study design employed by NHANES are available elsewhere.²⁸

We investigated four diagnosable chronic CVD risk factors that can be treated via appropriate behavioral modification and/or medication: diabetes, hypertension, hypercholesterolemia, and overweight. We classified participants as having a CVD risk factor if they either: 1) met criteria for risk factor classification based on the physical examination component of NHANES, or 2) reported taking prescription medication for that risk factor. Thus, we defined participants as having diabetes if their fasting plasma glucose was ≥ 126 mg/dL²⁹ and/or they reported currently taking antidiabetic prescription medication, including sulfonylureas, non-sulfonylureas, insulin, alpha-glucosidase inhibitors, thiazolidinediones, and meglitinides. We defined hypertension as average systolic blood pressure of ≥ 140 mm Hg and/or average diastolic blood pressure of ≥ 90 mm Hg¹⁵ and/or report of taking antihypertensive medication, including angiotensin II inhibitors, beta-adrenergic blocking agents, calcium channel blocking agents, and vasodilators. We considered participants to have hypercholesterolemia if their total cholesterol was ≥ 240 mg/dL³⁰ and/or they reported taking cholesterol-lowering medication, including HMG-COA

reductase inhibitors, fibric acid derivatives, bile acid sequestrants, and cholesterol absorption inhibitors. We defined overweight as body mass index ≥ 25 kg/m².³¹

For each of the four CVD risk factors, we present prevalence and a measure of awareness for US-born participants, foreign-born English speakers, and foreign-born non-English speakers. Awareness of each CVD risk factor is based on data collected in the interview component of NHANES. Participants were asked if they had ever been told by a doctor or other health professional that they had a given CVD risk factor. For example, to assess awareness of hypertension participants were asked, "Have you ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?" We considered participants to be unaware if they were classified as having a CVD risk factor and reported never being told that they had that risk factor. We restrict the measure of awareness to include only participants with a given risk factor in order to preclude variation in CVD awareness from being caused by between-group variation in the actual prevalence of risk factors.

Our independent variable of interest, immigration status, is classified into three groups: 1) the US-born, 2) foreign-born English speakers, and 3) the foreign-born who speak a language other than English. Nativity was determined based on a question in the NHANES interview that asks, "In what country were you born?" We defined participants as foreign-born if they reported being born in any country other than the US. We defined participants as English speakers or non-English speakers based on the language used during the NHANES interview and examination components. We defined participants as non-English speakers if they responded to any part of the interview or examination in Spanish or using an interpreter. Based on this definition, we consider our language variable to be a measure of survey language preference rather than a measure of language fluency or day-to-day language preference.

The categories used for control variables in our multivariate analyses are largely the original categories presented in the NHANES public use file. Demographic control variables include age, gender, marital status, education, family income, and race/ethnicity. Because risk factor awareness is likely related to health care, we also adjusted for three measures of health care access and utilization: insurance status, whether the participant has a regular source of care, and the number of health care visits in the year prior to the interview. Having a regular source of care refers to whether participants have a single, usual place where they go for medical care. It is important to note that having a regular source of care is not a measure of health care utilization, since participants may have a usual place to go for care but may not actually seek care with regularity. The number of health care visits participants made in the year prior to the interview, on the other hand, is a measure of utilization and refers to the total health care visits the participant made to providers of all kinds.

Our sample for this study was restricted to adult participants ≥ 20 years old, about 52.1% of the total NHANES sample, because only this subsample of participants was asked questions regarding previous diagnosis of CVD risk factors. We further restricted our analyses of hypertension, hypercholesterolemia, and overweight to the subsample of participants who received both the interview and physical examination components of NHANES and had complete information regarding their blood pressure, total cholesterol, and body mass index. The final sample for analyses of hypertension, hypercholesterolemia, and overweight consisted of 12,124 participants, or about 39.6% of the total NHANES sample. Our sample for analyses of diabetes was further restricted, because only about half of NHANES participants were included in the fasting subsample. We also excluded participants from the diabetes analyses who reported a total fasting time of eight hours or more. The final sample for diabetes analyses consisted of 5,390 participants, or 17.6% of the total NHANES sample.

All analyses were done using Stata/IC version 11.1. We used sampling weights provided by NHANES along with Stata's family of 'survey' commands to account for the complex design of the study. Because we restricted our analyses to the examination subsample, we used sample weights for the examination subsample rather than the weights for the entire NHANES sample. We used multivariate logistic regression to assess determinants of unawareness among those who were classified as having diabetes, hypertension, hypercholesterolemia, or overweight.

Results

Our sample consists of 12,124 participants 20 years of age or older. Descriptive statistics for the sample are presented in Table 1. The subsample is extremely similar to the full NHANES sample. There are no substantial differences between our subsample and the full sample, however minor differences include that participants in the subsample are slightly more likely than those in the full sample to be married (66.0% vs. 64.1%), to have more than a high school education (57.1% vs. 55.4%), to have family income greater than 400% FPL (36.9% vs. 35.9%), and to be White (72.8% vs. 71.0%).

Table 2 presents the prevalence of CVD risk factors and risk factor awareness by immigration status. Over two-thirds of participants are overweight or obese, and over half of the overweight and obese are unaware of their overweight status. Unawareness among the overweight and obese is considerably higher among foreign-born English speakers (66.8%) and foreign-born non-English speakers (66.5%) than US-born participants (53.9%) ($p < .001$). Unawareness of hypertension is also higher among foreign-born English speakers (32.8%) and foreign-born non-English speakers (36.0%) than US-born participants (24.9%) ($p < .001$). Unawareness of hypercholesterolemia is highest among foreign-born non-English speakers (48.1%) but relatively similar among foreign-born English speakers (29.5%) and US-born participants (30.5%) ($p < .001$). There are no significant differences by immigration status regarding awareness of diabetes.

Table 3 presents four logistic regression models predicting unawareness of CVD risk factors by immigration status, unadjusted for other factors. Model 1 shows that there are no significant differences in diabetes awareness between US-born participants and either foreign-born English speakers or foreign-born non-English speakers. Model 2 shows that, among those with hypertension, foreign-born English speakers are 47% more likely than the US-born to be unaware ($p < .05$) and foreign-born non-English speakers are 70% more likely than the US-born to be unaware ($p < .001$). Model 3 shows that there are no significant differences between foreign-born English speakers and the US-born in hypercholesterolemia awareness, but foreign-born non-English speakers are more than twice as likely as the US-born to be unaware of their hypercholesterolemia ($p < .001$). Model 4 shows that, among the overweight and obese, both foreign-born English speakers and foreign-born non-English speakers are about 70% more likely than US-born participants to be unaware of their overweight ($p < .001$ in both cases).

Table 4 presents four logistic regression models predicting unawareness of CVD risk factors based on immigration status, race/ethnicity, age, sex, marital status, education, family poverty, health insurance status, having a regular source of care, and the number of health care visits made in the year prior to the interview. Model 1 shows that, after adjusting for all other factors, there are no significant differences by immigration status in diabetes awareness. Model 2 shows that, even after adjusting for other factors, foreign-born English speakers and foreign-born non-English speakers are still more likely than the US-born to be unaware of their hypertension ($p < .05$ in both cases). Model 3 shows that, in contrast to the unadjusted model, there are no significant differences between foreign-born non-English

speakers and the US-born in awareness of hypercholesterolemia. Model 4 shows that, after adjusting for other factors, unawareness of overweight is still higher among foreign-born English speakers ($p < .001$) and foreign-born non-English speakers ($p < .01$) than among the US-born.

Table 4 also indicates that there may be a dose response relationship between unawareness of CVD risk factors and the number of health care visits made in the year prior to the interview. In general, an increase in health care visits is associated with a decrease in unawareness. After adjusting for other factors, there appears to be little impact of insurance status on unawareness. Having a regular source of care, however, is associated with a 43% decrease in the odds of being unaware of hypertension ($p < .05$).

Discussion

In this study, we demonstrated that awareness of overweight, hypertension, and hypercholesterolemia varies significantly based on immigration status. Further, after adjusting for demographic factors and access and utilization of health care services, foreign-born participants remain significantly more likely than the US-born to be unaware of their hypertension and overweight. One possible cause of this gap in awareness is that foreign-born populations may be less likely to receive preventive health care services than other populations. In a study among Latinos, Rodriguez and colleagues found that foreign-born citizens, permanent residents, and undocumented immigrants are less likely than the US-born to have had their blood pressure checked in the past two years.²⁵ The same study also found that undocumented immigrants are much less likely than the US-born to have had their cholesterol checked in the past five years.²⁵ Previous research also suggests that immigration- and language-based disparities exist for a range of preventive services, such as immunization, dental care, and cancer screening, in addition to screening for CVD risk factors.^{32, 33} Low awareness of CVD risk factors may be just one of the consequences that results from low coverage of preventive services among immigrants.

An interesting finding of our study is that while awareness of overweight, hypertension, and hypercholesterolemia appears to vary by immigration status, no such pattern exists for diabetes. This implies that either patients or providers treat diabetes differently than other CVD risk factors, however understanding exactly how and why this occurs is beyond the scope of our data. Potential explanations might include a wide range of factors, such as: differences in patients' baseline knowledge about diabetes compared to other CVD risk factors; differences in how insurance providers or health care organizations approach screening for different risk factors; or differences in the procedures that providers must follow to measure and diagnose diabetes compared to other CVD risk factors. Further research will be necessary to better understand exactly why there are immigration-based disparities in awareness of overweight, hypertension and hypercholesterolemia but not awareness of diabetes.

A further consideration related to our diabetes findings is that our data precede the adoption of hemoglobin A1c as the standard diagnostic test for diabetes.³⁴ There are several notable differences between hemoglobin A1c and fasting plasma glucose as diagnostic tests: First, testing using hemoglobin A1c is much more convenient as it does not require fasting. This increased convenience may lead to more testing and better diagnosis of diabetes, resulting in a decrease in unawareness among diabetics. On the other hand, hemoglobin A1c testing is more expensive than fasting plasma glucose and therefore may not be universally available, especially for low income populations or those lacking health insurance. Further, A1c levels are artificially inflated among African Americans compared to other race/ethnicities, so the test may not be equally good among all populations.³⁴

This study has several strengths and weaknesses. The most obvious strength is that we used a national data set that combines both interview and examination components. Another strength is that our multivariate analyses included only participants who were classified as having a given risk factor; this precluded the demonstrated variation in CVD awareness among social groups from being caused by underlying differences in risk factor prevalence. We were also able to adjust for insurance status, having a regular source of care, and frequency of care, so access to health care was likely not the source of variation in awareness. A limitation of our study is that NHANES does not contain data on the quality or breadth of health care services received by participants. Similarly, NHANES does not include information regarding the length of time foreign-born respondents have spent in the US or any additional factors other than language that may affect acculturation. It is therefore likely that we missed important heterogeneity between immigrant groups.

Another limitation of our study is that several of our variables are based on self-reported data and, as such, are subject to recall bias and social desirability bias. In particular, awareness of CVD risk factors is based on participants' self-reports of provider diagnosis and may be due to recall bias. Despite this, we believe diagnosis of a CVD risk factor to be a major life event that NHANES participants would not easily forget. Similarly, NHANES does not ask participants in-depth questions about fluency and use of English or other languages. We inferred participants' language status based on whether they responded to the NHANES survey in English, Spanish, or through an interpreter. Due to this, we may have classified some people as English speakers who do not primarily communicate in English. Alternatively, we may have classified some people as non-English speakers who are fully bilingual but chose to respond to the survey in Spanish or using an interpreter. It is also possible that some foreign-born participants felt pressured to misreport their country of birth, due to perceptions regarding an anti-immigrant social or political climate. We believe such bias would be minimal, however, as NHANES staff make clear that all data collected is both private and confidential. Regardless, any misclassification of risk factor awareness, immigration status, or language may have biased our findings.

A further consideration regarding our findings is that the measure of 'awareness' we used may differ between diabetes and hypercholesterolemia versus hypertension and overweight. As discussed, we defined participants as unaware of a CVD risk factor if they reported having never been diagnosed with that risk factor by a health professional. Due to the expertise necessary to accurately measure and diagnose diabetes and hypercholesterolemia, it is likely that participants' awareness of these risk factors would almost always stem from interactions with health professionals. On the other hand, participants could potentially measure their own height and weight, calculate their BMI, and ascertain their own overweight status. Similarly, people could diagnose their own hypertension by measuring their blood pressure status using automated blood pressure machines that are available at many supermarkets and pharmacies. It is feasible, therefore, that people could be aware that they are overweight or hypertensive despite having never been told so by a health professional. Although such a scenario is feasible, we believe it unlikely that NHANES participants are calculating their own BMI or measuring their own blood pressure in sufficient quantities to significantly bias our results. Further, we believe that receiving a risk factor diagnosis from a health care provider has its own inherent value, as previous research indicates that such diagnosis can be an important catalyst for healthy behavior change.⁸

Conclusions

A conceptual model for understanding how people perceive their weight status can be useful for clinicians that seek to prevent overweight among their patients, health program planners

that design weight interventions, and researchers that are interested in understanding the many pathways through which social factors influence overweight outcomes.

We believe that the substantial variation among immigrant groups in risk factor awareness observed in this study may have significant implications for long-term cardiovascular health. People who are unaware of their disease status will be less motivated to seek treatment and make healthy behavioral modifications to reduce their risk of negative health outcomes. To increase awareness, culturally- and linguistically-appropriate messages should be developed and targeted towards immigrant populations to provide education about cardiovascular disease and the importance of being screened for risk factors. Educational campaigns, resource directories, and outreach efforts should also be used to help immigrants navigate our complex health care system and direct them to specific primary care providers that can provide culturally competent care. When immigrants do seek care, they should be screened for CVD risk factors and offered other preventive services as appropriate.

Acknowledgments

This study was funded by grant number 1-P50 HL105188-01 of the National Heart, Lung and Blood Institute (NHLBI).

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Table 1
Descriptive Statistics for a Subsample of Respondents from the 2003-2008 National Health and Nutrition Examination Survey, n=12,124

	No.	%
Immigration and Language Status		
US-born	9,485	85.2
Foreign-born English	1,007	8.2
Foreign-born non-English	1,632	6.6
Age		
20-40	4,420	39.6
41-64	4,646	44.0
65+	3,058	16.4
Gender		
Male	6,201	51.5
Female	5,923	48.5
Marital Status		
Married	7,580	66.0
Single	1,853	15.6
Divorced/Widowed/Separated	2,691	18.5
Education		
<High School	3,418	17.8
High School	2,941	25.1
>High School	5,765	57.1
Family Income (% FPL)		
0-100%	2,271	12.3
101-200%	3,188	20.2
201-300%	1,954	15.9
301-400%	1,483	14.8
>400%	3,228	36.9
Race/Ethnicity		
White	6,238	72.8
Black	2,407	10.4
Mexican American	2,298	7.8
Other Latino	696	3.7
Other/Multi	485	5.3
Insured		
No	2,577	17.7
Yes	9,547	82.3
Regular Source of Care		
No	1,719	13.6
Yes	10,405	86.4
# Medical Visits in Last Year		

	No.	%
None	1,909	15.5
1	2,123	19.3
2-3	3,075	26.8
4-9	3,141	24.8
10+	1,876	13.6
Exam-Diagnosed Risk Factors		
Diabetes	743	10.1
Hypertension	4,773	33.4
High Cholesterol	4,104	30.8
Overweight or Obesity	8,524	67.9

Note: No. is unweighted; % is weighted

Table 2
Weighted Percent Prevalence of CVD Risk Factors and Unawareness by Immigration and Language Status, 2003-2008 National Health and Nutrition Examination Survey (n=12,124)

	US-Born	Foreign-Born English	Foreign-Born non-English	Total	p
	% (SE)	% (SE)	% (SE)	% (SE)	
Diabetes (n=5,390)					
Exam-Diagnosed	10.1 (0.57)	7.3 (1.64)	13.3 (1.45)	10.1 (0.50)	0.057
Unaware (n=743)	28.7 (2.45)	28.3 (7.44)	25.2 (5.06)	28.4 (2.29)	0.833
Hypertension					
Exam-Diagnosed	35.1 (0.64)	25.3 (1.56)	20.8 (1.79)	33.4 (0.63)	<0.001
Unaware (n=4,773)	24.9 (0.91)	32.8 (3.60)	36.0 (2.94)	25.9 (0.91)	<0.001
High Cholesterol					
Exam-Diagnosed	31.7 (0.76)	27.6 (1.84)	23.6 (1.46)	30.8 (0.68)	<0.001
Unaware (n=4,104)	30.5 (1.39)	29.5 (2.86)	48.1 (3.06)	31.3 (1.22)	<0.001
Overweight					
Exam-Diagnosed	68.7 (0.80)	57.7 (2.07)	70.1 (1.56)	67.9 (0.72)	<0.001
Unaware (n=8,524)	53.9 (0.82)	66.8 (2.74)	66.5 (1.62)	55.7 (0.77)	<0.001

Note: The sample size for diabetes is smaller than for other risk factors because not all NHANES participants are allocated to the fasting subsample. The sample for each 'unaware' measure consists of only participants who were exam-diagnosed with that risk factor.

Table 3
Four Unadjusted Logistic Regression Models Predicting Unawareness of Risk Factor Status among Participants with Diabetes, Hypertension, High Cholesterol, and Overweight (National Health and Nutrition Examination Survey 2003-2008)

	(1) Diabetes	(2) Hypertension	(3) High Cholesterol	(4) Overweight
Immigrant Status				
US-born	Ref.	Ref.	Ref.	Ref.
Foreign-born/English	0.980 (0.374)	1.470* (0.237)	0.954 (0.148)	1.723*** (0.216)
Foreign-born/non-English	0.838 (0.224)	1.699*** (0.222)	2.113*** (0.293)	1.694*** (0.127)
n	743	4773	4104	8524

Exponentiated coefficients; Standard errors in parentheses

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

Table 4
Four Logistic Regression Models Predicting Unawareness of Risk Factor Status among Participants with Diabetes, Hypertension, High Cholesterol, and Overweight (NHANES 2003-2008)

	(1) Diabetes	(2) Hypertension	(3) High Cholesterol	(4) Overweight
Immigrant Status				
US-born	Ref.	Ref.	Ref.	Ref.
Foreign-born/English	1.132 (0.647)	1.522* (0.246)	0.782 (0.138)	1.730*** (0.241)
Foreign-born/non-English	0.648 (0.253)	1.636* (0.353)	1.071 (0.224)	1.491** (0.182)
Race/Ethnicity				
White	Ref.	Ref.	Ref.	Ref.
Black	0.471** (0.129)	0.687** (0.0862)	0.980 (0.108)	1.047 (0.0821)
Mexican American	0.631 (0.235)	0.845 (0.140)	0.995 (0.155)	0.750** (0.0713)
Other Latino	0.426 (0.239)	0.587 (0.208)	0.757 (0.207)	0.579*** (0.0821)
Other/Multi	0.249 (0.191)	0.653 (0.192)	1.309 (0.331)	0.826 (0.131)
Age	1.005 (0.0109)	0.999 (0.00341)	0.974*** (0.00329)	0.995*** (0.00139)
Male	1.260 (0.332)	1.137 (0.115)	0.952 (0.103)	1.570*** (0.0938)
Marital Status				
Married	Ref.	Ref.	Ref.	Ref.
Never Married	1.027 (0.655)	1.424* (0.233)	1.236 (0.218)	0.816** (0.0614)
Divorced or Separated	0.675 (0.172)	1.189 (0.131)	1.200 (0.122)	1.032 (0.0775)
Education				
<High School	Ref.	Ref.	Ref.	Ref.
High School	1.481 (0.371)	1.017 (0.129)	0.863 (0.129)	1.030 (0.0808)
>High School	1.431 (0.470)	1.033 (0.138)	0.761 (0.115)	0.969 (0.0734)
Family Poverty (%FPL)	0.940 (0.0909)	0.974 (0.0332)	0.917* (0.0331)	0.927*** (0.0157)
Insured	1.205 (0.496)	1.083 (0.174)	0.923 (0.137)	1.050 (0.117)
Regular Source of Care	0.436 (0.265)	0.573* (0.120)	0.830 (0.166)	0.848 (0.0766)
# Medical Visits in Last Year				
None	Ref.	Ref.	Ref.	Ref.
1	0.551 (0.432)	0.438*** (0.0820)	0.561** (0.112)	0.670*** (0.0531)

	(1) Diabetes	(2) Hypertension	(3) High Cholesterol	(4) Overweight
2-3	0.249* (0.168)	0.234*** (0.0458)	0.244*** (0.0406)	0.439*** (0.0438)
4-9	0.156** (0.106)	0.143*** (0.0322)	0.236*** (0.0360)	0.309*** (0.0296)
10+	0.100** (0.0724)	0.142*** (0.0280)	0.255*** (0.0481)	0.333*** (0.0338)
n	743	4773	4104	8524

Exponentiated coefficients; Standard errors in parentheses

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$