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Does the Hispanic Health Advantage Extend to Better Management of Hypertension? The Role of Socioeconomic Status, Sociobehavioral Factors, and Health Care Access

Emily Bacon,

Department of Sociology and Population Program, Institute of Behavioral Science, University of Colorado Boulder, Boulder, Colorado, USA

Fernando Riosmena, and

Department of Geography and Population Program, Institute of Behavioral Science, University of Colorado Boulder, Boulder, Colorado, USA

Richard G. Rogers

Department of Sociology and Population Program, Institute of Behavioral Science, University of Colorado Boulder, Boulder, Colorado, USA

Abstract

Hispanics in the United States (and foreign-born Hispanics in particular) have relatively favorable health given their lower socioeconomic status compared to, for example, non-Hispanic whites. This phenomenon is often called the Hispanic Health Paradox (HHP). This study examines whether the previously documented HHP in hypertension prevalence extends to its management using clinical and self-reported measures from the 2007-2012 National Health and Nutrition Examination Surveys. Multivariate models adjusting for demographic, socioeconomic, and socio behavioral characteristics show an advantage among foreign-born Mexicans in hypertension prevalence relative to non-Hispanic whites (adjusted OR=0.85). However, compared to non-Hispanic whites, foreign-born Mexicans were 38 percent less likely to receive treatment recommendations and, when advised to undergo treatment, were 60 percent less likely to adhere to treatment. Adjusting for healthcare access and utilization dramatically reduces disparities in control between foreign-born Mexicans and non-Hispanic whites, suggesting that insufficient systematic access to and use of quality healthcare erodes the HHP and contributes to the deterioration of health throughout the immigrant experience. Without appropriate interventions, particularly in health care access and utilization, poorer hypertension management among foreign-born Mexicans may negatively affect the Hispanic health profile, increase risk of cardiovascular disease-related mortality, and erode the Hispanic health advantage in the future.

Introduction

Hispanics in the United States exhibit better-than-expected health on several dimensions relative to other racial/ethnic groups with similar or somewhat higher socioeconomic status

(SES) (Markides and Eschbach 2011). As lower SES is generally associated with worse health, this phenomenon is commonly known as the Hispanic Health Paradox (HHP). Most notably, Hispanics have lower mortality rates than non-Hispanic (NH) whites (Elo et al. 2004, Hummer et al. 2000, Markides and Eschbach 2011, Ruiz et al. 2013,). The Hispanic-White advantage is more pronounced among foreign-born than for U.S.-born Hispanics, implying that the HHP deteriorates across these proximate generations (Vega 2009). The HHP is robust to data problems and statistical artifacts (Elo et al. 2004; Hummer et al. 2007; Patel et al. 2004; Turra and Elo 2008), and is particularly strong in cardiovascular mortality and several of its chronic health risk factors (Ruiz et al. 2013). This includes a Hispanic health advantage in hypertension (Franzini, Ribble, and Keddie 2001; Riosmena et al. 2015a) as well as related downstream behavioral risk factors such as smoking (Blue and Fenelon 2011; Fenelon 2013; Lariscy et al. 2015).

The HHP is remarkable given the persistent socioeconomic disadvantages faced by Hispanic populations (Park and Myers 2010), with repercussions such as a lack of consistent access to quality healthcare (Durden and Hummer 2006). Despite the existence of a HHP across a number of non-communicable chronic conditions, healthcare access and quality problems are believed to be some of the intermediate drivers of a Hispanic disadvantage in conditions such as diabetes, obesity, and some types of cancers (Peek et al. 2007, Bowie et al. 2007, Vega et al. 2009). Health care access and delivery problems could have important repercussions for conditions where a health advantage is observed, potentially exaggerating the advantage if certain populations are not being diagnosed (Jurkowski and Johnson 2007) and hindering the capacity to control the condition among those diagnosed. Furthermore, cumulative disadvantage may be intensified for those who have had conditions for a longer period of time because as the disease progresses and becomes more threatening, the need for additional socioeconomic resources and access to health care become more important. Cumulative disadvantage may be the primary reason why Hispanic health deteriorates over time spent in the United States by the immigrant generation as well as across generations (Abraído-Lanza et al. 2006; Riosmena et al. 2015)

Some recent research suggests that the HHP may be fading, particularly as Hispanic populations in the United States and Mexico age and the proportion of more experienced/settled immigrants and U.S.-born individuals increases (Lara et al. 2012, Lariscy et al. 2015, Vega 2009). A way to assess the persistence of the HHP in the future is to examine chronic disease management in conjunction with its prevalence among foreign- and U.S.-born Hispanics compared to other racial/ethnic groups. Assuming a health advantage in chronic disease prevalence, if Hispanics were as or more effective in managing disease compared to other racial/ethnic groups, it would suggest a persistence of the HHP. Alternatively, poor management – especially among those who have been diagnosed for longer – may result in higher rates of serious illness and ultimately mortality, contributing to a potential shift in the relatively favorable Hispanic health profile.

This study examines race/ethnic differences in hypertension prevalence, treatment recommendations and adherence, and control, with a specific focus on patterns among foreign- and U.S.-born Mexican Americans. Hypertension is one of the most common chronic health conditions and, when left uncontrolled, is a primary contributor to

cardiovascular disease (CVD) (Mozaffarian et al. 2015). In 2016, about 30 percent of adults in the United States had hypertension, representing an estimated five-percentage point increase since the mid-1990s (CDC 2017, Cutler et al. 2008; Hajjar and Kotchen 2003). Of the roughly 75 million people ever diagnosed with hypertension in the United States, only about half (54 percent) had their hypertension under control (CDC 2017), though this share has grown in recent years (Farley et al. 2010). Because the proportion of people effectively controlling their hypertension has increased over the past two decades, more research is needed to understand the changing composition of the population affected by this disease and its progression, with racial/ethnic/nativity disparities as an important element in this changing composition. Specifically, it is important to evaluate the hypertension management pathway. Key interventions between hypertension diagnosis and successful management include receiving a prescription for a diuretic or other blood pressure lowering medications and successful adherence to the medication prescription plan.

Racial/ethnic disparities in hypertension prevalence and control have been documented among NH whites, NH blacks, and Hispanics (Hertz et al. 2005; Riosmena et al. 2015b). NH blacks are more likely than NH whites and Mexican Americans to have and be diagnosed with hypertension (over 40 percent were estimated to be hypertensive as of 2010) (CDC 2013). In most studies, NH blacks are more likely than NH whites and Hispanics to adhere to treatment, yet less likely than NH whites to have their hypertension under control (Cutler et al. 2008, Hajjar and Kotchen 2003, Ostchega et al. 2007). Further, foreign-born Mexicans have lower prevalence of hypertension relative to U.S.-born Mexican Americans (Barquera et al. 2008) and NH whites and blacks (Riosmena et al. 2015b). Findings from these studies on hypertension prevalence suggest a Hispanic health advantage in hypertension prevalence and also highlight differences between U.S.- and foreign-born (henceforth USB and FB) Mexican Americans.

There are a number of important limitations to existing studies. Research has not concurrently examined whether the health benefits in hypertension prevalence extend to hypertension management and control for USB and FB Hispanics compared to NH whites and blacks. Additionally, existing studies have not explored whether the social and behavioral factors that are associated with differences in hypertension prevalence are similar to those that influence differences in hypertension management for Hispanics and compared to other racial/ethnic groups. Finally, no studies have examined how patterns of hypertension prevalence and management may contribute to the HHP and its persistence.

This study makes three primary contributions to the literature on the HHP. First, it evaluates the implications of racial/ethnic/nativity differences in the hypertension management pathway for the persistence of the HHP using a multifaceted approach to understanding hypertension management, including examining undiagnosed hypertension, treatment recommendations for hypertension by physicians, treatment adherence, and clinical measures to assess hypertension control. Second, this study explicitly examine show socio behavioral indicators, such as smoking and drinking, as well as SES and healthcare access/ utilization, mediate racial/ethnic/nativity differences in the hypertension management pathway. Third, this study evaluates how these factors affect hypertension control differently depending on the length of time that respondents have been hypertensive. It distinguishes

between those who are recently chronically hypertensive and those who are more likely to have negative health effects from longer-term chronic hypertension. By examining multiple components of the pathway through which hypertension may manifest into cardiovascular risk and by including a variety of potential mediators across individuals with different exposures to hypertension, this study aims to provide a nuanced analysis of the HHP and speculate about its persistence.

Methods

This study uses data from the 2007-2012 National Health and Nutrition Examination Survey (NHANES), a nationally-representative cross-sectional sample of U.S. adults. Each survey cycle, collected in a two-year schedule, includes a complex random sample of between 5,000 and 10,000 respondents from fifteen counties across the country. The survey oversamples NH blacks and Mexican Americans. Although NHANES includes other Hispanic subgroups, the CDC (2011b) cautions against using them to make nationwide generalizations because they are inconsistently oversampled in each survey cycle.

NHANES is a suitable dataset for our study because of its collection of both self-reported questions and clinically measured outcomes for hypertension (Zipf et al. 2013). This allows for the inclusion of respondents with undiagnosed hypertension in prevalence estimates, and for the estimation of the degree of control among those diagnosed. Blood pressure is assessed through a common and easy procedure, creating lower likelihood of missed diagnosis compared to more complicated or invasive procedures that may require blood work or screenings.

We pool data from the 2007-2008, 2009-2010, and 2011-2012 survey cycles to increase the sample size of hypertensive adults across multiple racial/ethnic categories. Adults 20-80 years old were included in the study. Respondents who did not identify as FB Mexicans, USB Mexican Americans, NH whites, or NH blacks were excluded from the analysis. Additionally, pregnant women (N=182) were excluded from the analysis due to temporary changes in blood pressure that can occur during pregnancy, which may not reflect chronic hypertension and would potentially skew results. The final sample size for the analysis was 12,322 adults, including 6,811 NH whites, 3,071 NH blacks, 982 USB Mexican Americans, and 1,458 FB Mexicans.

Dependent Variables

The study examines hypertension prevalence, management, and control. To measure these constructs, we use four binary outcomes. First, we model hypertension prevalence by assessing whether the respondent has ever been diagnosed with hypertension by a medical professional, or has high blood pressure at the time of the survey (described in more detail below). Second, we examine whether a healthcare professional has ever recommended medication for hypertension to those previously diagnosed. Third, we analyze if the respondent reports adhering to the prescribed/recommended treatment. And fourth, we assess whether hypertension is currently under control.

The first dependent variable, hypertension prevalence, was assessed either by respondent self-report of ever being diagnosed, or if the respondent was measured as hypertensive during the clinical exam. The NHANES survey asks, “Have you ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?” For the clinical diagnosis, this study defines high blood pressure according to the National Heart Lung and Blood Institute guidelines as a systolic blood pressure reading of greater than or equal to 140 mm Hg or a diastolic blood pressure reading of greater than or equal to 90 mm Hg. During the NHANES physical examination, respondents were given between one and four blood pressure readings. NHANES' Integrated Survey Information System (ISIS) protocol was used to calculate average blood pressure across readings (CDC 2008). If respondents had either high systolic or diastolic blood pressure readings after averaging across valid measurements, they were diagnosed as hypertensive, regardless of whether they reported ever being told they were hypertensive by a healthcare professional. The definition of ever hypertensive therefore includes individuals who are unaware of their hypertension in addition to those who have been previously diagnosed. This combined measure is important because rates of undiagnosed hypertension are higher among Hispanics compared to NH whites and blacks, and are particularly high among immigrants (Barcellos 2012). The sample size for the first outcome has an analytic sample size (denominator) of 12,322 respondents.

Receiving a medication prescription for blood pressure lowering drugs is a commonly prescribed treatment for hypertension control. Thus, as the second dependent variable, we examined whether or not patients received treatment recommendations for their hypertension. The NHANES survey asks, “Because of your high blood pressure/hypertension, have you ever been told to take a prescribed medicine?” Only respondents who had ever been diagnosed with hypertension were asked the follow-up about prescribed medication, resulting in an analytic sample size of 4,673 respondents for the second outcome. Notably, NHANES only asks about whether doctors recommend pharmacologic treatment, not other types of lifestyle modifications (e.g. diet and exercise). However, hypertension medication is highly effective, and often more so than behavioral modification (eating less sodium and fat, losing weight, and exercising more) (Bonneux 2011).

The third dependent variable assessed whether respondents who received a medication prescription adhered to treatment. The NHANES survey asks, “Are you now taking prescribed medicine?” This question was asked to participants who reported receiving a medication prescription, resulting in an analytic sample size of 4,172 for the third outcome.

To gauge hypertension control, clinically measured blood pressure readings were used for each respondent who had ever been hypertensive (either diagnosed or undiagnosed). If respondents had been diagnosed with hypertension and had systolic blood pressure readings less than 140 mm Hg and diastolic blood pressure readings less than 90 mm Hg, their hypertension was considered to be under control (Chobanian et al. 2003). All hypertensive respondents who were undiagnosed were considered as not having their hypertension under control. Because control was only assessed among those who had ever been hypertensive, the analytic sample size for the fourth outcome was 5,512 respondents.

Independent Variables

To evaluate demographic, social, and behavioral influences on hypertension prevalence and management, the following independent variables were included in the analysis. Race/ethnicity and nativity variables were combined into four groups: NH whites, NH blacks, USB Mexican Americans, and FB Mexican immigrants.

Our analyses also included two socio behavioral risk factors, two measures of SES, and three sociodemographic characteristics. The sociodemographic characteristics were added as controls or potential confounders in the models, and include gender (male/female), linear age (mean centered) for adults 20-80 years old, and marital status. Marital status is coded as “married/living with partner” or “single/divorced/widowed.”

Socioeconomic, socio behavioral, and health care variables were all examined as potential mediators of the relationship between race/ethnicity and each of the outcomes. SES includes educational attainment level (less than high school education, high school graduate, and some college or more) and full time employment (worked 40 hours or more versus less than 40 hours in the past week). We did not include income as a socioeconomic variable because of its colinearity with education and high percentage of missing values. The socio behavioral risk factors are smoking (never, former, current) and alcohol consumption (never, former, currently consume one drink, 2-3 drinks, or four or more drinks when drinking).

We also controlled for access to and use of healthcare. We assessed whether respondents had healthcare (yes/no); second, whether they had a regular place to go for healthcare (yes/no); and third, times they received healthcare over the past year (0, 1, 2-3, 4-9, 10-12, and 13 or more visits). All models controlled for survey cycle.

Analysis

Nested logistic regressions were conducted for each outcome and results are presented in odds ratios with 95 percent confidence intervals. The race/ethnicity/nativity variable is the primary independent variable. Model 1 includes only race/ethnicity and controls for demographic characteristics. Model 2 adds SES variables as potential mediators. Model 3 is the behavioral risk model, adding smoking and alcohol consumption to demographic and SES characteristics as potential mediators. Model 4 adds healthcare access/utilization variables as potential mediators to the previous models. We conducted an additional analysis for hypertension control. Because the age distribution of the racial/ethnic/nativity groups were quite different, it is possible that younger adults have not had hypertension as long as the older adults, so the impact of the potential mediators may vary depending on the length of time adults have been hypertensive. We stratified adults by those who became hypertensive within the past five years and those who have been hypertensive for more than five years, using the same Models 1-4, to understand whether the effects of SES, socio behavioral factors, and health care access/utilization become more important for those who have had hypertension for longer periods of time.

The only variable with high missingness (7 percent) was alcohol consumption. Missing cases were determined to be missing at random and were imputed using ordered logit multiple imputation techniques from the `mi impute ologit` command in Stata. Results from

imputed models are presented here and were similar to non-imputed models. NHANES survey and sampling weights were applied to all models and descriptive statistics. When combining survey cycles, NHANES recommends multiplying the survey weights by the inverse of the number of waves used. We used three NHANES survey cycles, so we multiplied the survey weights for each individual in a given wave by 1/3. We applied survey weights using the `svyset` command in Stata, adding the new 6-year weight to the specifications for the primary sampling unit (PSU) and strata. We analyzed the data with Stata v.13 (Statacorp 2012).

Results

Table 1 provides descriptive statistics by race/ethnicity and nativity group. FB Mexicans had the lowest prevalence rates of hypertension (17 percent), followed by USB Mexican Americans (24 percent), NH whites (32 percent), and finally NH blacks (42 percent). NH blacks had the highest rates of treatment recommendations (89 percent), and USB Mexican Americans and FB Mexicans had the lowest (76 percent and 77 percent, respectively). FB Mexicans had much lower rates of treatment adherence (74 percent) compared to other groups, which ranged between 86 and 90 percent. NH whites and USB Mexican Americans had the highest rates of hypertension control (60 percent and 58 percent, respectively) compared to NH blacks (55 percent) and FB Mexican Americans (51 percent). Rates of undiagnosed hypertension were higher in groups with lower hypertension rates: 51 percent of FB Mexicans had undiagnosed hypertension, compared to 43 percent of USB Mexican Americans, 40 percent of NH whites, and 28 percent of NH blacks. Additionally, the majority of adults who were aware of their hypertension reported being hypertensive for more than five years.

Table 1 also displays average systolic and diastolic blood pressures for adults who have ever had hypertension to inform whether differences in hypertension control may in part be driven by differences in blood pressure. Racial/ethnic differences in average systolic and diastolic blood pressure were not large among non-hypertensive or hypertensive adults, but reflect prevalence and control patterns inasmuch as non-hypertensive FB Mexicans had the lowest systolic and diastolic blood pressure, but hypertensive FB Mexicans had higher systolic and diastolic blood pressure than NH whites and USB Mexican Americans.

There were large racial/ethnic and nativity differences across most of the independent variables. FB Mexicans were the most socioeconomically disadvantaged group except for employment, where they had the highest rates overall (70 percent employed full time). Across health behaviors, FB Mexicans and NH blacks had the highest rates of never or formerly drinking, yet FB Mexicans and USB Mexican Americans had the highest rates of high alcohol consumption among those who currently drink. FB Mexicans had the lowest smoking rates, followed by USB Mexican Americans and NH whites, with NH blacks having the highest smoking rates. Notably, only 34 percent of FB Mexicans had health insurance, compared to 65 percent or more from every other group. Likewise, only 58 percent of FB Mexicans had a regular place to go for healthcare compared to at least 77 percent among other racial/ethnic and nativity groups.

To further understand hypertension diagnosis among FB Mexicans, we compared the years that adults reported being hypertensive to the duration of time spent in the United States. Duration in the United States is publicly released by NHANES in ordinal categories, so it is not possible to assess precisely whether diagnosis happened in the United States or Mexico if the years hypertensive falls within a duration category (e.g. 6 years hypertensive, and 5-10 years spent in the United States). Still, we found that the vast majority (82 percent) of FB Mexicans reported being diagnosed with hypertension since immigrating to the United States, with 10 percent being more likely to have been diagnosed in Mexico, and 8 percent remaining ambiguous, becoming hypertensive within the range of time spent in the United States (results not shown).

Table 2 presents odds ratios and 95 percent confidence intervals for the nested logistic regressions for each of the four steps in the hypertension management pathway: hypertension prevalence (Panel A), recommended hypertension medication (Panel B), adhered to treatment (Panel C), and hypertension under control (Panel D). Similar to other research on the HHP, adding socioeconomic controls widened the FB Mexican advantage in hypertension prevalence relative to NH whites, whereas socioeconomic controls reduced differences between NH blacks and whites (cf. Model 1 vs. 2, Panel A). After accounting for demographic, socioeconomic, and behavioral characteristics (Model 3, Panel A), FB Mexicans had 36 percent lower odds of ever being diagnosed with hypertension compared to NH whites ($OR=0.64$, $p<.001$). Differences in healthcare access and utilization across groups reduced the differences between FB Mexicans and NH whites, suggesting that undiagnosed hypertension may be driving a portion of the health advantage among FB Mexicans. After accounting for healthcare variables (Model 4, Panel A), the risk of having high blood pressure declined from 33 to 23 percent lower odds ($OR=0.77$, $p<.01$).

Contrary to the experience of Mexican immigrants, USB Mexican Americans had similar odds of hypertension prevalence compared to NH whites after accounting for all covariates (Model 4, Panel A). The largest differences in hypertension prevalence were between NH black and white adults: across all models and compared to NH whites in Panel A, NH blacks were more than twice as likely to have hypertension.

Panel B in Table 2 presents racial/ethnic differences in the likelihood of receiving a treatment recommendation for hypertension from a healthcare professional. Comparing likelihood of treatment recommendations reveals that, at baseline (Model 1), FB Mexicans are 30 percent less likely, USB Mexican Americans are not statistically different, and NH blacks are almost twice as likely to receive a recommendation to take medication compared to NH whites. These estimates do not change drastically for NH blacks and USB Mexican Americans after adding additional covariates (Models 2-4, Panel B). However, accounting for socioeconomic status and health behaviors widens the gap between FB Mexicans and NH whites, making FB Mexicans 38 percent less likely to receive a treatment recommendation (Model 3, Panel B). Similar to Panel A, accounting for healthcare access and utilization closes much of the gap between FB Mexicans and NH whites, with no statistically significant difference.

Panel C in Table 2 displays differences in treatment adherence by race/ethnicity for those who were recommended treatment from a healthcare professional. For FB Mexicans and NH whites with similar demographic, SES, and health behavior characteristics, there is a dramatic gap in treatment adherence. Although SES appears to mitigate some of the difference, accounting for differences in health behaviors further exacerbates the FB Mexican-NH white gap, wherein FB Mexicans are about 60 percent less likely to adhere to treatment compared to NH whites (Model 3, Panel C). Healthcare again diminishes this gap, making FB Mexicans statistically as likely to adhere to treatment for hypertension as NH whites. There are no statistically significant gaps in treatment adherence for USB Mexican Americans and NH Blacks compared to NH whites.

Panel D in Table 2 presents differences in hypertension control. In contrast with prevalence results but similar to patterns in treatment recommendations and adherence, FB Mexicans had about 37 percent lower odds of hypertension control compared to NH whites before accounting for SES, health behaviors, or health care access/utilization (Model 1, Panel D). This disadvantage was relatively unaffected by SES and socio behavioral factors (Models 2 and 3, Panel D). However, FB Mexican-NH white differences in hypertension control were drastically reduced after accounting for healthcare access and utilization (Model 4, Panel D). Indeed, the lower odds of control among FB Mexicans are no longer statistically significantly different from NH whites (OR=0.85, 95 percent CI=0.65, 1.11).

Finally, it is notable that USB Mexicans have very similar levels of hypertension control compared to NH whites (i.e., lower across all models, but not statistically significant in any of them). NH blacks have about 23-24 percent lower odds of hypertension control compared to NH whites across models ($p < .001$ for each).

To further examine the differences in control, Table 3 examines the likelihood of hypertension control stratified by duration since diagnosis, divided in two groups – those who have been diagnosed in the past five years, and those who have had hypertension for more than five years. Most notably, the FB Mexican disadvantage in control is driven by those diagnosed more than five years prior to the survey (and as mentioned earlier, who were likely diagnosed while already in the United States). For this group (shown in Panel B, Table 3), FB Mexicans have 38 percent lower odds of having their hypertension under control relative to NH whites (Model 1). Among this group, gradually adding SES controls and, to a greater extent, socio behavioral factors, reduced these disparities to 37 and 33 percent lower odds respectively (Models 2 and 3, Panel B). Finally, adding healthcare variables (Model 4) reduced the FB Mexican-NH white disparity even further (to 11 percent) and rendered a difference that was not statistically significant. In sharp contrast, FB Mexican-NH white differences in control among those diagnosed less than 5 years prior to the survey were somewhat smaller and not statistically significant in any of the models in Panel A. Also in contrast to the results for Mexican immigrants, for whom differences were larger among those with longer times since diagnosis, USB Mexican American and NH black differences to NH whites were smaller among those diagnosed more than five years prior to the survey. As in Panel B, these differences were consistently low (17-20 percent) and never statistically significant for USB Mexican Americans, and consistently large (36-50 percent) and highly significant ($p < .001$) for NH blacks across all models and both panels in Table 3.

Discussion

This study shows a clear health advantage in hypertension prevalence among FB Mexican adults relative to US-born Mexican Americans, as well as NH blacks and whites. USB Mexican Americans exhibit a moderate disadvantage in the prevalence of high blood pressure relative to NH whites, one that is much smaller than that of NH blacks. A relatively small disadvantage compared to whites (especially compared to the black-white disadvantage) indicates that USB Mexican Americans experience a weaker form of the HHP at best (see Riosmena et al. 2013).

While prior research has shown an advantage in hypertension prevalence, less work has examined hypertension management by Hispanic immigrants, particularly looking at the role of different risk factors, duration since diagnosis, and the pathway through which hypertension control is often obtained (recommended treatment and treatment adherence). FB Mexicans have approximately 35 percent lower odds of successful hypertension control compared to NH whites, with socioeconomic and socio behavioral factors failing to account for much of these differences. FB Mexicans who have had hypertension for five or more years represent a group that would likely face greater challenges in managing the condition. FB Mexicans also demonstrated a stark disadvantage in adhering to treatment recommendations in particular while exhibiting a lesser disadvantage in receiving medication recommendations in the first place.

After accounting for healthcare access and use, FB Mexican–NH white disparities in all aspects of hypertension management were greatly reduced. Although estimates still suggest that FB Mexicans are less likely to effectively manage hypertension than NH whites, differences are not statistically significant after accounting for health insurance status, having a regular place to go for healthcare, and the number of visits in the past year. When examining healthcare characteristics individually (results not shown), we found each contributes separately to reducing the disparity between FB Mexicans and NH whites, suggesting that it is not just insurance status that accounts for closing the disparity gap, but also healthcare access and utilization among those with insurance.

Indeed, the greater relevance of healthcare in explaining the FB Mexican–NH white gap in hypertension control stems in part from much lower insurance rates of the foreign-born (notably, healthcare variables did not have nearly as important a role in reducing disparities among USB Mexican American and NH blacks relative to NH whites). Slightly more than half of all FB Mexicans are unauthorized to work or live in the United States (Gonzalez-Barrera and Lopez 2013). This irregular legal status may not only translate into poor working conditions with limited job benefits (including health insurance), but also precludes individuals from accessing public and less expensive forms for healthcare via government programs like Medicaid or even via the state or federal insurance exchanges created by the Affordable Care Act (ACA; Ortega et al. 2015).

Micro-level discriminatory practices are also likely to be present, as demonstrated in differences in treatment recommendations by race/ethnicity and nativity. Healthcare professionals are more likely to recommend medication for NH whites than for FB

Mexicans. Past research on a variety of health conditions has demonstrated that healthcare professionals are less likely to recommend the most effective treatments to patients of color (Van Ryn et al. 2006, Saha et al. 2003). Yet beyond the HHP, results in this study are surprising in that, compared to NH whites, NH blacks are much more likely to receive a treatment recommendation, whereas USB and FB Mexicans are less so. These differences are attenuated by healthcare access and utilization for USB and FB Mexicans, but not for NH blacks.

In addition to this study's insights into racial/ethnic disparities and the HHP in particular, they also confirm the idea of negative adaptation or acculturation in immigrant health by showing a deterioration of the HHP from prevalence to control and over time spent in the United States. Indeed, the importance of access to and utilization of healthcare was especially true for FB Mexicans who had been diagnosed more than five years prior to the survey. Because longer time since diagnosis should generally translate into better, not worse, chronic disease control (see results for other groups in Table 3), this pattern could highlight the processes of cumulative disadvantage especially likely to take hold on the undocumented by way of chronic healthcare undercoverage and underutilization (see Abraído-Lanza et al. 2006; Riosmena et al. 2015a). On the whole, this study also shows a large amount of health inequality in hypertension within the FB Mexican population, a fact that is oftentimes glossed over in discussions of the HHP.

This study has several limitations which, nonetheless, are unlikely to influence our main conclusions. Previous research on the HHP suggests that sick or older migrants may return to countries of origin, creating a select group of healthier migrants who remain in the United States (Arenas et al. 2015; Turra and Elo 2008; Riosmena et al. 2013). Although the lower prevalence rates of hypertension among Mexican immigrants may be attenuated due to return-related, health-selective attrition, hypertension control would also likely be attenuated, suggesting that Mexican immigrants may have even lower levels of hypertension control than reported. Likewise, undocumented migrants may be wary of participating in health surveys, potentially contributing to underreporting or biased reporting of immigrants. If poorer undocumented (and thus, likely sicker) migrants were less likely to be included in the NHANES, the differences in hypertension control between FB Mexicans and NH whites could be greater than what has been reported in this study.

Amore important limitation of this study is the cross-sectional nature of the NHANES data. The best method of tracking hypertension prevalence and management is through longitudinal, clinical reports. NHANES is able to capture undiagnosed hypertension at the time of the survey, which allows for inclusion of a large portion of hypertensive respondents who are overlooked in surveys that rely solely on self-reported diagnosis. However, the data structure prevents us from ascertaining how long respondents have been undiagnosed, or whether undiagnosed hypertension reflects more acute forms of hypertension.

Despite these caveats, the public health implications of this study lie in the importance of healthcare access and utilization for FB Mexicans living in the United States. The ACA has effectively improved healthcare access for millions of Americans, many of whom have low SES (Blumenthal and Collins 2014). At the same time, however, the ACA has done little to

improve access for FB residents, particularly those who are undocumented (most of whom have been in the country for more than a decade)(Passel and Cohn 2016). The analysis was conducted on data from the 2007-2012 NHANES, as the ACA was rolling out. When health insurance was interacted with survey year (results not shown), health insurance increasingly improves the odds of hypertension management for U.S. adults overall. But because FB Mexicans are often unable to obtain health insurance, they would not receive the potentially increasing benefits of having health insurance.

Because of the healthcare access/use limitations of the FB Mexican population along with the aging and changing composition of Hispanics in the United States, the findings of this study are with consistent scholars' predictions that the HHP may diminish in the future (Goldman 2016; Lariscy et al. 2015). Although odds of developing hypertension may be lower among Mexican immigrants, those with the condition are less likely to manage it and thus are more likely to suffer the negative effects of the progression of hypertension, including CVD and death. Furthermore, USB Mexican Americans are more likely to develop hypertension and equally likely to manage hypertension compared to NH whites, which would result in an overall increase of Hispanics with hypertension in the United States.

Future research should continue to provide policy directives to improve migrant health and reduce racial/ethnic health disparities by examining other chronic conditions and using data that allow for the tracking of chronic disease management over time. This study is among the first to examine racial/ethnic and nativity differences in hypertension prevalence and multiple forms of management in the context of the HHP and suggests that insufficient systematic access to and use of quality healthcare may erode the HHP and explain the deterioration of health throughout the immigrant experience.

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Table 1
Descriptive Statistics by Race/Ethnicity and Nativity among Adults in the United States, 2007-2012

	NH white (N=6,811)	NH black (N=3,071)	U.S.-born Mexican American (N=982)	Foreign-Born Mexican (N=1,458)
	% /mean (n)	%/mean (n)	% /mean (n)	%/mean (n)
Outcomes:				
1. Ever hypertensive	32% (2180)	42% (1290)	24% (236)	17% (248)
2. Received treatment recommendation	87% (5926)	89% (2733)	76% (746)	77% (1123)
3. Adhered to treatment	90% (6130)	86% (2641)	86% (845)	74% (1079)
4. Hypertension under control	60% (4087)	55% (1689)	58% (570)	51% (744)
Additional hypertension characteristics				
Hypertension undiagnosed	40% (2724)	28% (860)	43% (422)	51% (744)
Hypertensive 5+ years	60% (4087)	62% (1904)	52% (511)	51% (743)
Mean systolic blood pressure for non-hypertensive	117.6	118.8	115.7	116.4
Mean diastolic blood pressure for non-hypertensive	70.6	69.8	69.2	68.6
Mean systolic blood pressure for ever-hypertensive	129.3	133.2	130.1	131.4
Mean diastolic blood pressure for ever-hypertensive	70.9	74.5	73.1	72.8
Demographic & social characteristics				
Mean Age	49.3	44.9	39.7	40.7
Female	52% (3542)	56% (1720)	48% (471)	44% (642)
Married	66% (4495)	41% (1259)	58% (570)	73% (1064)
Less than high school	13% (885)	24% (737)	28% (275)	67% (977)
High school graduate	23% (1567)	27% (829)	27% (265)	16% (233)
Some college or more	64% (4359)	49% (1505)	46% (452)	16% (233)
Employed Full Time	63% (4291)	57% (1750)	65% (638)	70% (1021)
Health behaviors				
Never Drinker	8% (545)	13% (399)	10% (98)	16% (233)
Former Drinker	17% (1158)	18% (553)	13% (128)	18% (262)
Current: 1 Drink	27% (1839)	21% (645)	15% (147)	13% (190)
Current: 2-3 Drinks	31% (2111)	33% (1013)	31% (304)	22% (321)
Current: 4+ Drinks	16% (1090)	15% (461)	32% (314)	30% (437)
Never Smoker	50% (3406)	57% (1750)	60% (589)	66% (962)
Former Smoker	28% (1907)	16% (491)	18% (177)	19% (277)
Current Smoker	21% (1430)	28% (860)	22% (216)	16% (233)
Healthcare characteristics				
Health insurance	86% (5857)	75% (2303)	65% (638)	34% (496)
Regular place for healthcare	90% (6130)	88% (2702)	77% (756)	58% (846)

	NH white (N=6,811)	NH black (N=3,071)	U.S.-born Mexican American (N=982)	Foreign-Born Mexican (N=1,458)
	% /mean (n)	%/mean (n)	% /mean (n)	%/mean (n)
Mean annual healthcare visits	2.2 (2-3 visits)	2.1 (2-3 visits)	1.8 (1 visit)	1.2 (1 visit)

Estimates adjusted for NHANES survey weights and imputed values.

Source: National Health and Nutrition Examination Survey (NHANES).

Logistic Regressions of Hypertension Prevalence, Recommended Treatment, Treatment Adherence, and Control among Adults in the United States, 2007-2012

Table 2

Model 1: Demographic		Model 2: SES		Model 3: Health Behaviors		Model 4: Health Care	
OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Panel A: Hypertension Prevalence (N=12,322)							
Race (NH white)							
NH Black	2.18*** (1.94, 2.46)	2.07*** (1.84, 2.34)	2.13*** (1.90, 2.39)	2.17*** (1.92, 2.44)			
USB Mexican American	1.21+ (0.99, 1.49)	1.13 (0.92, 1.39)	1.10 (0.89, 1.37)	1.15 (0.91, 1.45)			
FB Mexican	0.76* (0.62, 0.94)	0.65** (0.52, 0.83)	0.64*** (0.51, 0.81)	0.77* (0.60, 0.98)			
Constant	0.65 (0.58, 0.72)	1.00 (0.80, 1.25)	0.89 (0.69, 1.14)	0.46 (0.32, 0.65)			
Panel B: Recommended Hypertension Medication (N=4,673)							
Race (NH white)							
NH Black	1.77*** (1.38, 2.26)	1.75*** (1.37, 2.22)	1.74*** (1.36, 2.22)	1.76*** (1.37, 2.27)			
USB Mexican American	0.81 (0.58, 1.14)	0.80 (0.56, 1.13)	0.78 (0.55, 1.11)	0.79 (0.57, 1.10)			
FB Mexican	0.70+ (0.49, 1.01)	0.65* (0.42, 1.00)	0.62* (0.40, 0.98)	0.75 (0.47, 1.19)			
Constant	3.91 (2.69, 5.67)	4.24 (2.55, 7.05)	4.25 (2.23, 8.12)	1.60 (0.72, 3.56)			
Panel C: Adhered to Treatment Recommendation (N=4,172)							
Race (NH white)							
NH Black	0.99 (0.76, 1.29)	1.00 (0.77, 1.28)	0.98 (0.76, 1.26)	0.95 (0.72, 1.25)			
USB Mexican American	0.95 (0.52, 1.75)	1.02 (0.56, 1.85)	1.11 (0.58, 2.15)	1.27 (0.67, 2.41)			
FB Mexican	0.39*** (0.24, 0.62)	0.48** (0.31, 0.76)	0.40*** (0.25, 0.64)	0.71 (0.40, 1.24)			
Constant	3.90 (2.90, 5.24)	3.46 (2.55, 4.70)	5.87 (2.81, 12.27)	0.46 (0.18, 1.15)			
Panel D: Hypertension Under Control (N=5,512)							
Race (NH white)							
NH Black	0.76*** (0.67, 0.86)	0.76*** (0.67, 0.86)	0.77*** (0.68, 0.87)	0.76*** (0.67, 0.86)			

	Model 1: Demographic		Model 2: SES		Model 3: Health Behaviors		Model 4: Health Care	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
USB Mexican American	0.83	(0.61, 1.13)	0.84	(0.62, 1.14)	0.86	(0.63, 1.17)	0.90	(0.65, 1.25)
FB Mexican	0.63***	(0.50, 0.80)	0.63***	(0.48, 0.81)	0.64**	(0.50, 0.83)	0.85	(0.65, 1.11)
Constant	1.29	(1.07, 1.55)	1.31	(1.06, 1.62)	1.06	(0.77, 1.46)	0.31	(0.21, 0.48)

+p<.1,
*
p<.05,
**
p<.01,

p<.001

Results account for complex sampling design and imputed values; all models are cumulative.

Source: NHANES 2007-2012

Table 3
Logistic Regressions of Odds of Hypertension Under Control by Years Hypertensive in the United States, 2007-2012

Model 1: Demographic		Model 2: SES		Model 3: Health Behaviors		Model 4: Health Care	
OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Panel A: Hypertensive Less than Five Years (N=1,650)							
Race (NH white)							
NH Black	0.50 ***	(0.37, 0.67)	(0.38, 0.70)	0.51 ***	0.52 ***	(0.37, 0.72)	0.54 *** (0.38, 0.75)
USB Mexican American	0.80	(0.48, 1.36)	0.83	(0.48, 1.44)	0.80	(0.46, 1.40)	0.82 (0.47, 1.45)
FB Mexican	0.82	(0.53, 1.28)	0.88	(0.53, 1.48)	0.85	(0.50, 1.44)	0.98 (0.61, 1.58)
Constant	3.03	(2.03, 4.51)	2.47	(1.39, 4.37)	1.87	(0.82, 4.26)	0.93 (0.41, 2.11)
Panel B: Hypertension Five or More Years (N=2,897)							
Race (NH white)							
NH Black	0.63 ***	(0.53, 0.76)	0.63 ***	(0.53, 0.75)	0.64 ***	(0.54, 0.76)	0.63 *** (0.53, 0.74)
USB Mexican American	0.83	(0.52, 1.33)	0.84	(0.53, 1.35)	0.86	(0.54, 1.36)	0.87 (0.55, 1.38)
FB Mexican	0.62 *	(0.39, 0.99)	0.63 *	(0.40, 1.00)	0.67+	(0.43, 1.03)	0.89 (0.54, 1.44)
Constant	2.48	(1.86, 3.32)	2.72	(2.02, 3.66)	2.20	(1.41, 3.44)	0.85 (0.41, 1.73)

+p<.1,

* p<.05,

** p<.01,

*** p<.001

Results account for complex sampling design and imputed values; all models are cumulative.

Source: NHANES 2007-2012