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Racial/ethnic Differences in U.S. Health Behaviors: A Decomposition Analysis

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Abstract

Objective—To quantify contributions of individual sociodemographic factors, neighborhood socioeconomic status (NSES) and unmeasured factors to racial/ethnic differences in health behaviors for Non-Hispanic (NH) Whites, NH Blacks, and Mexican-Americans.

Methods—We used linear regression and Oaxaca decomposition analyses.

Results—Although individual characteristics and NSES contributed to racial/ethnic differences in health behaviors, differences in responses individual characteristics and NSES also played a significant role.

Conclusions—There are racial/ethnic differences in the way that individual-level determinants and NSES affect health behaviors. Understanding the mechanisms for differential responses could inform community interventions and public health campaigns that targeted to particular groups.

Keywords

race/ethnicity; health behaviors; Oaxaca decomposition; health disparities

Introduction

Chronic diseases, including cardiovascular disease, cancer, and diabetes, are the leading causes of death and disability in the U.S., accounting for 70% of deaths each year.[1] Moreover, there are stark differences in chronic disease incidence, prevalence, and mortality by race/ethnicity.[2] For example, African-American, Hispanic, and American Indian or Alaska Native adults are twice as likely as Non-Hispanic (NH) White adults to have diabetes.[3] Age-adjusted death rates for heart disease are also 32% higher among African-Americans than among Whites,[3] and the incidence of coronary heart disease among American Indians and Alaska Natives is nearly double that observed in the general U.S. population.[3]

Healthy behaviors, including a nutritious diet, physical activity, and avoiding tobacco use and excessive drinking, can prevent or control chronic disease,[1] and racial/ethnic differences in these behaviors contribute to the gaps in chronic disease burden.[4,5] Substantial work has shown that individual characteristics, such as education and income, and neighborhood factors influence health behaviors. Lower socioeconomic status (SES) individuals may experience more negative life events (stressors) than higher-SES individuals and may perceive greater negative impact from any given event. Stress is one important and plausible mediator linking SES to health behaviors.[6] Neighborhoods differ in economic conditions and the quality and quantity of resources,[7,8] including availability of recreational facilities;[9,10] healthy, affordable food;[11–13] and adequate health care. These factors can influence diet, physical activity, smoking, alcohol intake and other health behaviors as well.[8,14,15]

Notably, the available evidence suggests that racial/ethnic differences in health behaviors persist even after adjusting for individual and neighborhood factors.[8,15,16] However, one feature of most of the research to date is the implicit assumption that individual and neighborhood factors influence all racial/ethnic groups in the same way. In fact, the effect of both individual and neighborhood characteristics may vary by race/ethnicity, possibly because of unmeasured attributes. For example, educational quality may differ between Blacks and Whites[17] even when they have the same number of years of schooling, leading to differences in the estimated effects of education. Perceived discrimination and degree of acculturation may affect how Hispanics, compared with Whites, use neighborhood resources to maintain health.[18] If the effects of individual and neighborhood factors on health behaviors differ by race and ethnicity, the analyses in many previous studies may be misspecified. Further, the results may be misleading and may not provide as much insight as they could. Understanding how associations between individual and neighborhood factors and health behaviors vary across racial/ethnic groups, and the contribution of such variations to disparities, could suggest ways to improve studies of health behaviors and interventions to improve them.

Our study addresses this gap in the literature by using Oaxaca decomposition to examine differences in diet, sedentary lifestyle, smoking, and alcohol consumption among Non-Hispanic Whites, Non-Hispanic Blacks, and Mexican-Americans. Oaxaca decomposition analysis, widely used in sociology and labor economics, is a statistical method for decomposing overall group differences in an outcome of interest and quantifying the contributions from different components. In this study, we used the method to decompose racial/ethnic differences in health behaviors to quantify the contribution of individual-level variables, NSES and differential response. Our decomposition provides insights that are likely to be useful in the design of interventions and policies to reduce the health impact of harmful health behaviors in different racial/ethnic groups.

Conceptual Framework

We base our research on a social ecological framework, which considers a multileveled set of influences on health behaviors on the individual and neighborhood levels. Specifically, a social ecological framework recognizes that the likelihood that people will engage in healthful behaviors is greatest when they are inclined to do so, have the ability to do so, and when their sociocultural, physical, and socio-economic environments offer the opportunities for doing so.

With such an approach, health behaviors of an individual are guided by layers of influences including the family, proximal social influences such as social networks or neighborhoods, organizational influences such as worksite or community systems or healthcare systems, and larger social influences such as government, policy, or large economic structures. Two important emphases are (1) that the behavior of the individual reflects the influence of all the layers; and (2) that the layers interact in their influence so that, e.g., communities may influence families but families may also influence communities.[19] In our own analyses, we focus on 2 main levels: the neighborhood and the individual. As described below, we capture neighborhood-level influences by neighborhood socioeconomic status (NSES), and include multiple individual-level predictors of health behaviors including age, marital status, nativity, income – all shown in prior research to be important predictors of health behaviors.

METHODS

Data Source and Study Samples

We used geocoded data from the Third National Health and Nutrition Examination Survey (NHANES III), a nationally representative, cross-sectional study of the civilian non-institutionalized population of the United States conducted from 1988 through 1994. The sampling design oversampled Blacks and Mexican-Americans. NHANES III obtained information on study subjects through surveys, physical examinations, and laboratory studies. The data on diet, smoking, alcohol consumption, and sedentary lifestyle are from the surveys.

We used census tracts as proxies for neighborhoods and merged the NHANES III with tract-level data from the U.S. Census Bureau using geocoded residential addresses. Approximately 86% of the sample was geocoded to a census tract through a match to an exact address or to a street intersection. The remaining 14% of the sample could be matched only to a zip-code or county centroid; we excluded these subjects from our analyses because of concerns about the validity of merging tract-level data based on such matches. Most excluded subjects lived in sparsely populated areas; consequently, our results may not be generalizable to rural residents.

We restricted the study samples to adults age 20 and over. We excluded pregnant women, whose health behaviors are likely to differ from their usual patterns; subjects who categorized themselves as “other” race/ethnicity; and subjects who were missing key variables for the analyses (see below). Our final study samples ranged from 12,648 persons for binge drinking to 13,187 for sedentary lifestyle, and comprised 83% to 87% of the geocoded sample.

RAND Corporation’s Institutional Review Board (IRB) approved the study, and the National Center for Health Statistics’ (NCHS’s) IRB approved the NHANES III survey. Analyses were performed at the NCHS’s secure Research Data Center in Hyattsville, Maryland, and conducted using SAS Version 9.2.

Measures

Study outcomes included dichotomous measures of smoking, binge drinking, and sedentary lifestyle. Smoking was divided into current smokers or nonsmokers and former smokers. A current smoker was considered to be anyone who had smoked at least 100 cigarettes in their life and who smoked cigarettes in the last 30 days. Subjects were considered to have an episode of binge drinking in the past year if they reported consuming 5 or more drinks in a single day. Because of different distributions by gender, for men, we dichotomized the frequency of binge drinking into ≥1 binge drinking episodes per week or <1 binge drinking episode per week. For women, we dichotomized binge drinking into ≥1 binge drinking episodes during the year or none. Sedentary lifestyle was based upon self-report of participation in any activity in the past month including running, aerobics, yard work, dancing, weightlifting, bicycling, swimming, calisthenics, or any other sport or exercise. Respondents who did not report any activity in the past month were categorized as sedentary. Study outcomes also included 2 continuous measures of dietary intake derived from the NHANES III 24-hour dietary recall interview: number of servings per day of fruits and vegetables and percent of total kilocalories from fat.

The individual characteristics used as independent variables in the study included age; gender; race/ethnicity, categorized as Non-Hispanic White, Non-Hispanic Black, and Mexican-American; nativity, categorized as U.S.-born or foreign-born; educational attainment, categorized as grade school only, some high school, high school graduate, or post high school; family income relative to the federal poverty level (FPL), categorized as poor (< 1 times FPL), low income (1–2 times FPL), middle income (2–4 times FPL), or high income (> 4 times FPL); and marital status, categorized as married (includes “living as married”), never married, and other (widowed, divorced, or separated).

On the neighborhood level, we employed NSES, measured using an index of 6 variables measured at the census-tract level: (1) percent of adults older than 25 with less than a high school education; (2) percent male unemployment; (3) percent of households with income below the poverty line; (4) percent of households receiving public assistance; (5) percent of households with children headed only by a female; and (6) median household income. The NSES index is the standardized sum and has a mean of zero and a standard deviation of one; a score greater than zero denotes a tract with NSES above the sample average. The variables in the NSES index were identified using factor analysis and the index has been used in several previous studies.[11,20,21]

Statistical Analysis

We conducted a regression-based Oaxaca decomposition analysis,[22] which was introduced into the labor economics literature to study discrimination in the labor market. The goal of this method is to decompose differences between 2 groups in an outcome of interest into a component due to differences between the groups in their characteristics, and a component due to differences between the groups in the effects of these characteristics on the outcome. In the original application, economists used the method to assess how much of the difference in wages between Whites and Blacks was due to racial differences in relevant attributes, such as educational attainment and work experience, and how much was due to racial differences in the effects of those attributes on wages. Empirical implementation of the method is based on a straightforward algebraic decomposition of the outcome differences, as explained below.

In this study, we used Oaxaca decomposition analysis to decompose racial/ethnic differences in health behaviors into 3 components: (1) a component due to racial/ethnic differences in measured individual characteristics, (2) a component due to racial/ethnic

differences in NSES, and (3) a component due to racial/ethnic differences in the effects of individual characteristics and NSES on health behaviors. We implemented the method as follows.

First, separately for each racial/ethnic group, we estimated a linear regression model for each study outcome. Thus, for dichotomous dependent variables, we estimated linear probability models. We adopted this approach because the traditional Oaxaca decomposition cannot be used with nonlinear models (e.g., logistic or probit regressions). Linear probability models have been used in other decomposition studies and allow for ease of interpretation.[23] With linear models, the mean value of each health behavior for each racial/ethnic group is a simple function of the estimated regression coefficients and the mean values of the individual- and neighborhood-level independent variables. For example, we obtain:

$$\overline{Y}_b = \overline{X}_b' \widehat{\beta}_b + \overline{N}_b' \widehat{\gamma}_b$$

and

$$\overline{Y}_w = \overline{X}_w' \widehat{\beta}_w + \overline{N}_w' \widehat{\gamma}_w$$

where Y represents the health behavior; X is a vector of individual characteristics; N is the NSES index; the subscripts b and w refer to Blacks and Whites respectively; the horizontal bars over Y, X, and N represent mean values; and $\hat{\beta}$ and $\hat{\gamma}$ are vectors of estimated coefficients. Therefore, the mean difference between Whites and Blacks in the health behavior indicator is:

$$\overline{Y}_w - \overline{Y}_b = \left(\overline{X}_w' \widehat{\beta}_w + \overline{N}_w' \widehat{\gamma}_w\right) - \left(\overline{X}_b' \widehat{\beta}_b + \overline{N}_b' \widehat{\gamma}_b\right)$$

Adding and subtracting $\overline{X}_b' \widehat{\beta}_w + \overline{N}_b' \widehat{\gamma}_w$ from the right-hand side of the equation and rearranging, we obtain:

$$\overline{Y}_w - \overline{Y}_b = \underbrace{\left(\overline{X}_w' - \overline{X}_b'\right)\widehat{\beta}_w}_{(1)} + \underbrace{\left(\overline{N}_w' - \overline{N}_b'\right)\widehat{\gamma}_w}_{(2)} + \underbrace{\overline{X}_b'\left(\widehat{\beta}_w - \widehat{\beta}_b\right) + \overline{N}_b'(\widehat{\gamma}_w - \widehat{\gamma}_b)}_{(3)}$$

The first component is the difference in the health behavior attributable to Black/White differences in individual characteristics. The second component is the difference in health behaviors attributable to Black/White differences in NSES. These first 2 components constitute the “explained” portion of differences in health behaviors, since they can be attributed to observed differences in variables associated with these behaviors. Of note, the first 2 components in this equation are “weighted” by the regression coefficients from the White sample. Thus, the sum of these 2 components yields the Black/White difference in the health behavior we would expect, given the differences in observed characteristics, if the effect of these characteristics on the behavior of Blacks was the same as for Whites, and both groups retained the observed values of their characteristics. The equation can also be constructed such that the regression coefficients from the Black sample are used as weights, so the decomposition is not unique.

Finally, the third component is attributable to differences between Blacks and Whites in regression coefficients, evaluated at the average values of individual characteristics and NSES for Blacks; this component would vanish if the coefficients in the Black and White regressions were the same. Coefficient differences indicate varying behavioral effects of individual and neighborhood characteristics across racial/ethnic groups, which may be a result of differences in unmeasured attributes, as discussed in the Introduction. This unexplained component would persist even if racial/ethnic differences in observed individual characteristics and NSES were eliminated.

We weighted all analyses using the NHANES examination weights, which account for the sampling design and for survey nonresponse. Further, we corrected standard errors for clustering at the level of census tracts and counties using hierarchical models.

RESULTS

Descriptive Data

Mexican-Americans and Blacks were, on average, younger than Whites (Table 1). Mexican-Americans were much more likely than Blacks or Whites to be foreign-born, and they had much lower educational attainment. Additionally, Mexican-Americans and Blacks had lower family income than Whites. Most (62.8%) Mexican-Americans lived in the West, whereas half of the Blacks lived in the South; Whites were more equally distributed regionally. Mexican-Americans and Blacks were much more likely than Whites to live in low socioeconomic status neighborhoods.

Whites reported the highest daily intake of fruit and vegetables and Blacks reported the lowest, whereas Mexican-Americans had the lowest percentage of caloric intake from fat and Blacks the highest (Table 2). Mexican-Americans had the lowest smoking prevalence, while Blacks had the highest. Mexican-Americans had the highest prevalence of sedentary behavior, followed by Blacks and then Whites. The prevalence of male binge drinking was highest among Mexican-Americans and lowest among Whites. In contrast, female binge drinking was highest among Whites and lowest among Blacks.

Regression Results

Table 3 reports regression results for selected independent variables of particular interest, including gender, income, nativity, educational attainment, and NSES. For each behavior, regression coefficients varied, often considerably, across racial/ethnic groups. This variation in coefficients underscores the value of a decomposition analysis.

Being female was associated with lower daily fruit and vegetable intake among Blacks and Whites, but not among Mexican Americans. Higher NSES was associated with higher fruit and vegetable intake in all groups. The association between educational attainment and fruit and vegetable intake was most pronounced in Blacks. The U.S.-born had lower fruit and vegetable intake than the foreign-born in all 3 racial/ethnic groups. Additionally, higher NSES was associated with higher fruit and vegetable intake in all 3 groups.

Among Whites, being female was associated with consuming a lower percentage of calories from fat. Higher family income was associated with a lower percentage of kilocalories from fat among Mexican-Americans and Blacks, but not among Whites. The U.S.-born had higher fat intake than the foreign-born in all 3 racial/ethnic groups. However, higher NSES was associated with consuming a lower percentage of calories from fat only among Mexican-Americans.

Among Whites and Mexican-Americans, being female was associated with a lower probability of being a current smoker. Higher educational attainment was associated with a lower probability of smoking in all racial/ethnic groups. Among Mexican-Americans and Blacks, the U.S.-born were more likely to be current smokers than the foreign-born. Higher NSES was associated with a lower probability of smoking among Blacks and Whites, but not Mexican Americans.

Among Blacks and Whites, women had a higher probability of being sedentary than men. Lower family income was associated with a higher probability of being sedentary among Mexican Americans and Blacks, whereas lower educational attainment was associated with a higher probability of being sedentary in all 3 racial/ethnic groups. Higher NSES was associated with a lower probability of being sedentary among Mexican Americans and Whites, but not Blacks.

For both men and women, the probability of being a binge drinker was generally higher among the U.S.-born and the less educated. Among Mexican-American and Black men, lower family income was associated with a higher probability of binge drinking; however, among White women, lower family income was associated with a lower probability of binge drinking. NSES was not associated with binge drinking for women, White men, or Mexican-American men. For Black men, however, higher NSES was associated with a lower probability of binge drinking.

Decomposition Analysis

For each behavior, we summarize the findings of our decomposition analyses in Table 4, which has 2 sections. The top section reports findings for the decomposition of differences in health behaviors between Whites and Mexican-Americans, whereas the bottom section reports the findings for Whites and Blacks. The table shows the overall gap in the left column, and the next 3 columns report the contributions from differences in individual characteristics, differences in NSES, and differential responses to individual characteristics and NSES, respectively.

Explaining Behavior Gaps between Whites and Mexican-Americans

Whites consumed an average of 0.41 more servings/day of fruit and vegetables than Mexican-Americans. Based on their individual characteristics and NSES, Whites would have been predicted to consume 0.74 (0.45 [Table 4, Column 1] + 0.29 [Table 4, Column 2]) more servings than Mexican-Americans. However, group differential responses to individual characteristics and NSES were associated with higher fruit and vegetable intake among Blacks relative to Whites than would have been predicted based on these characteristics. This narrowed the gap between the 2 groups by 0.33 servings/day (Table 4, Column 3).

Whites also consumed a higher percentage of kilocalories from fat than Mexican Americans, by 1.38 percentage points. A substantial portion of this gap, 0.56 percentage points, was explained by differences in the groups' individual characteristics, whereas the difference in NSES contributed 0.04 percentage points. Thus, based on their individual characteristics and NSES, the gap between Whites and Mexican Americans would have been predicted to be 0.60 percentage points (0.56+0.04). However, the sizable differential responses to individual characteristics and NSES led the gap to widen by 0.78 percentage points.

Findings for smoking prevalence were striking. Whites had a higher prevalence of smoking than Mexican Americans, by 6.5 percentage points. Based on their individual characteristics and NSES, however, whites would have been predicted to have a lower—not higher—smoking prevalence than Mexican Americans, by 12.4 percentage points (−8.9 + −3.5). Thus group differential responses to individual characteristics and NSES were associated

with much lower rates of smoking among Mexican Americans relative to Whites than would have been predicted based on these characteristics, which led the gap to swing by 19.0 percentage points in the opposite direction.

Whites were less likely than Mexican-Americans to lead sedentary lifestyles, by 12.6 percentage points. A large part of this gap (10.6 percentage points) was explained by differences between Whites and Mexican-Americans in individual characteristics (7.5 percentage points) and NSES (3.1 percentage points). Thus, for sedentary lifestyle, the contribution from differential responses to individual characteristics and NSES was the smallest of the 3 components.

White men had lower prevalence of binge-drinking than Mexican-American men, by 7.9 percentage points. Interestingly, almost all this gap (7.0 percentage points) was explained by differences between the groups in their responses to individual characteristics and NSES. Specifically, group differential responses to individual characteristics and NSES were associated with much higher rates of binge drinking among Mexican American men relative to Whites than would have been predicted based on these characteristics.

White women had a higher prevalence of binge drinking than Mexican-American women by 5.9 percentage points. As for men, this gap was primarily explained by differences between the groups in their responses to measured individual characteristics and NSES. Based on their individual characteristics and NSES, Mexican American women would have been predicted to have a higher rate of binge drinking than White women, by 2.2 percentage points (−1.9 + −0.3). However, and in contrast to the men, group differential responses to individual characteristics and NSES were associated much lower rates of binge drinking among Mexican American women relative to Whites than would have been predicted based on these characteristics. This resulted in a swing of the gap by 8.1 percentage points in the opposite direction.

Explaining Behavior Gaps between Whites and Blacks

Whites consumed an average 0.98 more servings/day of fruits and vegetables than Blacks. Most of this difference, 0.88 servings, was explained by group differences in individual characteristics (0.46 servings) and NSES (0.42 servings). Differential responses to individual characteristics and NSES contributed an additional 0.10 servings to the gap in fruit and vegetable intake between Whites and Blacks.

Blacks consumed a higher percentage of kilocalories from fat than Whites, by 0.48 percentage points. Based on their individual characteristics and NSES, the gap between Blacks and Whites would have been predicted to be 0.16 percentage points (−0.22 + 0.06), with Blacks consuming more fat. However, the sizable differential responses to individual characteristics and NSES led the gap to widen by 0.32 percentage points.

Whites had a lower prevalence of smoking than Blacks, by 5.5 percentage points. Based on their individual characteristics and NSES, the smoking rate among Whites would have been predicted to be lower than among Blacks by 11.8 percentage points (−6.7 + −5.1). However, group differential responses to individual characteristics and NSES were associated with lower rates of smoking among Blacks relative to Whites than would have been predicted based on these characteristics, which narrowed the gap by 6.3 percentage points.

Whites were less likely than Blacks to have sedentary lifestyles, by 9.2 percentage points. Nearly this entire gap was explained by differences between Whites and Blacks in individual characteristics (4.3 percentage points) and NSES (4.4 percentage points). The contribution

from differential responses to individual characteristics and NSES was small, amounting to 0.6 percentage points.

White men had lower prevalence of binge drinking than Black men, by 4.2 percentage points. Based on their individual characteristics and NSES, the rate of binge drinking among Whites would be predicted to be lower than among Blacks by 6.6 percentage points (−4.2 + −2.4). However, group differential responses to individual characteristics and NSES were associated with a lower rate of binge drinking among Blacks relative to Whites than would have been predicted based on these characteristics. This narrowed the gap by 2.5 percentage points.

Findings for binge drinking in women were striking. Whites women had a higher prevalence of binge drinking than Black women, by 8.2 percentage points. Based on their individual characteristics and NSES, however, white women would have been predicted to have a lower—not higher—binge drinking prevalence, by 4.0 percentage points (−3.6 + −0.4). Thus group differential responses to individual characteristics and NSES were associated with much lower rates of binge drinking among Black women relative to Whites than would have been predicted based on these characteristics. The result was a swing in the gap of 12.2 percentage points in the opposite direction.

DISCUSSION

This study examined the contributions of individual characteristics and NSES to racial/ethnic differences in 5 health behaviors—fruit and vegetable intake, sedentary lifestyle, percentage of calories from fat, tobacco use, and binge drinking—among Whites, Mexican-Americans and Blacks in the United States. Our analyses build on prior studies that have found associations of age, gender, educational attainment, and income with health behaviors,[2,5,24,25] as well as on recent research published in this journal (*American Journal of Health Behavior*) showing that neighborhood deprivation increases the risk of smoking, sedentary behavior, fat intake, and binge drinking.[8] However, our study advances the research on disparities in health behaviors by conducting a Oaxaca decomposition analysis, which enables us to assess the degree to which racial/ethnic differences may result from differential group responses to measured characteristics. To our knowledge, decomposition analysis has not previously been applied to study disparities in health behaviors.

Consistent with earlier research, we found that individual demographic and socioeconomic factors and NSES had strong independent associations with health behaviors. For each behavior, however, effect sizes varied by race/ethnicity, often substantially, suggesting the potential utility of a decomposition analysis. Indeed, our decomposition analyses found that the contribution to disparities of racial/ethnic differences in the *effects* of measured characteristics was sometimes larger than the contribution of group differences in these characteristics. Our analysis of smoking prevalence in Whites and Mexican Americans provides a particularly striking example of the importance of group differences in the effects of measured characteristics. Thus we found that, whereas Whites' and Mexican Americans' individual characteristics and NSES would predict a lower smoking prevalence among whites, in fact Mexican Americans had lower a lower prevalence of smoking.

Differential effects of individual characteristics and NSES may result from omitted dimensions of variables that we otherwise included in our analyses. For example, our measures of individual socioeconomic status did not capture educational quality or wealth. Differential effects may also be due to individual factors that we were forced to omit from our analyses altogether, due of lack of data, such as attitudes and preferences, culture and degree of acculturation, and experience of discrimination. In a related vein, our measure of

NSES is a proxy measure that stands in for differences across neighborhoods in access to facilities for recreation and exercise, crime, availability of different types of food, quality of public services, and other factors. The range of possible explanations for differential responses makes it difficult to identify with certainty a specific cause for any particular health behavior. Nonetheless, with this caveat in mind, several observations regarding our findings merit discussion.

In comparing Whites' and Mexican Americans' health behaviors, we found that differential responses to individual characteristics and NSES made the dominant contribution to the gap in 4 behaviors: calories from fat, tobacco use, and binge drinking in both genders. These findings are consistent with a major role of cultural differences in the differential responses. Previous studies have documented the importance of differences in dietary practices between Whites and recent Mexican immigrants,[26,27] with the latter generally having healthier diets that are lower in fat.[26,27] Studies have also shown that acculturation to U.S. culture is associated with unfavorable dietary changes among Mexican-Americans.[26–28] Our findings suggest that, in the case of dietary fat, the effects of culture may dominate other factors.

Tobacco use and alcohol consumption are also culturally embedded behaviors. Our findings for tobacco use are especially noteworthy, since the large contribution of differential responses reversed the direction of the gap between Whites and Mexican Americans that would have been predicted based only on their individual characteristics and NSES. In fact, prior studies have found that Mexican immigrants have low rates of smoking rates, and that smoking rates increase with acculturation.[29,30] Notably, people who self-identity as Mexican American are more likely to smoke than those who self-identify as Mexican.[29] Other studies have demonstrated higher smoking rates in second generation and/or those who are U.S. born compared with immigrants.[31,32]

Our findings for binge drinking are even more striking, as we found that the sizeable contributions from differential responses to individual characteristics and NSES were opposite in direction for men and women. Thus Mexican-American men engaged in binge drinking much more frequently than would have been predicted based on their individual characteristics and NSES, whereas Mexican-American women engaged in binge drinking much less often than would have been predicted. This finding is consistent with previous research suggesting that Hispanics (although not a homogeneous population) demonstrate more conservative views of alcohol use than Whites;[33,34] these conservative attitudes are especially likely to influence the drinking behavior of women.[34] Our findings suggest that, as with dietary fat, the effects of culture on tobacco and alcohol use may be the main reason for differential responses to individual characteristics and NSES between Whites and Mexican Americans.

In comparing Whites' and Blacks' health behaviors, differential responses to individual factors and NSES made the dominant contribution to the gaps in only 2 behaviors: calories from fat and binge drinking among women. Specifically, Blacks consumed a higher percentage of calories from fat in their diets than would have been predicted based on their individual characteristics and NSES. Blacks have different dietary traditions than Whites,[35,36] and these traditions include several foods that are high in fat.[37–40] Conversely, Black women engaged in binge drinking much less often than would be predicted. Studies also suggest that, as in the case of Mexican Americans, Blacks have more conservative views toward alcohol than do Whites.[41] These conservative views may disproportionally affect women. Gender roles tend to vary by ethnicity and culture and these variations can affect the health status of Blacks in the U.S.[42,43] Research has pointed to the role of religiosity in decreasing risk of binge drinking, and thus compiled with research that has shown women to

be consistently more religious than men,[44] this could be one explanation of lower binge drinking than one may have predicted given individual-level characteristics and NSES alone. Among men, we observed higher binge drinking from African American men compared with White men. Other[45] research has shown that Black neighborhoods have more outdoor advertising space than White neighborhoods, and these spaces disproportionately market alcohol and tobacco advertisements.[46,47] This may impact African American men differently than African American women, given literature which has shown differential responses by gender. Jackson[48] notes an inverse association between income and hypertension for African-American women and contrasts this with African-American men.[49] Further, Diez-Roux et al[49] reported that African-American men in Harlem with a college degree had higher levels of hypertension when compared to those with only a high school education. Still, other studies have shown that substance use may be an unhealthy coping response to perceived unfair treatment for some individuals.[50,51]

Naturally, additional unmeasured factors, mentioned earlier, are also likely to influence the differential responses to individual characteristics and NSES across racial and ethnic groups, and quantifying the role of each unmeasured factor is not possible. Consequently, our discussion in the preceding paragraphs must remain speculative. Nonetheless, the observation that, on the whole, differential responses made larger contributions to the gaps in health behaviors between Mexican Americans and Whites than to the gaps between Blacks and Whites offers additional indirect support for the notion that culture may be the major driver of the differential responses between Mexican Americans and Whites. Despite their different histories and traditions, Whites and Blacks in the U.S. share a common culture to a much greater degree than Whites and either Mexican immigrants or less acculturated Mexican Americans do.

Several limitations of our study deserve mention. First, because the NHANES III data are cross-sectional, we were unable to examine the temporal associations among individual characteristics, NSES, and health behaviors. Second, because of the high degree of racial residential segregation in the U.S., Blacks and Hispanics are far more likely than Whites to be poor and to live in poor communities.[52] Thus it may be difficult to eliminate completely the confounding between individual socioeconomic status and NSES in the decomposition analyses. Nonetheless, in our data we found sufficient variation to obtain relatively precise estimates of both individual and neighborhood effects. Third, although NHANES III collects data on a large and representative national sample, rural populations are underrepresented in our study and, consequently, our findings are not generalizable to rural populations. Next, all data is based on self-report and we do not know whether there were differences in reporting bias either by behavior, or related to other characteristics. In a review of the literature, we found very limited evidence to suggest that social desirability response bias was likely to have had a major effect on our findings, though we cannot be sure.[53–55] Last, NSES is a very useful, though non-specific, measure of neighborhood resources.[20] Ideally, we would have detailed data on resources such as parks, recreational facilities, different types of food outlets, crime, and public services, but these data were unavailable.

These limitations notwithstanding, our study underscores the fact that solutions to health disparities are complex, and that policymakers must account for a wide range of factors in designing policies. More specifically, our findings imply that even if social policy were able to equalize socioeconomic characteristics across racial/ethnic groups, we would probably continue to observe differences in health behaviors. Readily measurable characteristics are often the focus of policy recommendations in studies of health disparities (e.g., income transfers, educational interventions, or neighborhood improvements), but little if any attention has been given to the fact that reducing socioeconomic inequality may not eliminate disparities if there are differential responses to key individual and neighborhoods

factors. Understanding the mechanisms for differential responses could inform community interventions and public health campaigns that aim to target particular groups, although dealing with this source of disparities is likely to remain a challenge.

Our findings also suggest a need for more qualitative research that examines the underlying mechanisms for racial/ethnic differences in responses to individual sociodemographic characteristics and NSES. Understanding these mechanisms and the unmeasured factors that might matter is critical for developing successful approaches to reducing disparities in health behaviors. Our study also supports the notion that our current measures that capture socioeconomic influences on health are inadequate. Braveman and colleagues[56,57] have stressed the multidimensional nature of socioeconomic status, and the fact that it can change over the life course. The need for additional work on measure development applies to both the individual and neighborhood levels.

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Table 1

Descriptive Statistics for Independent Variables (n=13,187 unless noted)

	Mexican American		NH Black		NH White	
Variable	**Frequency (unweighted)**	**Percent (weighted)**	**Frequency (unweighted)**	**Percent (weighted)**	**Frequency (unweighted)**	**Percent (weighted)**
Total	3967	6.1%	3997	12.9%	5223	81.0%
Age (mean)	37.8		42.0		46.0	
Male	1829	46.1%	1793	44.9%	2515	48.1%
Female	2138	53.9%	2204	55.1%	2708	51.9%
Nativity						
Foreign-born	2212	55.8%	284	7.1%	307	5.9%
U.S. Born	1755	44.2%	3713	92.9%	4916	94.1%
Education						
Grade School	1630	41.1%	507	12.7%	363	7.0%
Some HS	689	17.4%	752	18.8%	598	11.5%
High School	937	23.6%	1497	37.4%	1727	33.1%
Some College, College+	712	17.9%	1241	31.1%	2535	48.5%
Income to Poverty Ratio (FPL)						
<1 times Income: Poverty	1406	35.4%	1145	28.7%	391	7.5%
1–2 times Income: Poverty	1297	32.7%	1161	29.1%	910	17.4%
2–4 times Income: Poverty	930	23.4%	1208	30.2%	2140	41.0%
>4 times Income: Poverty	335	8.4%	482	12.1%	1782	34.1%
Marital Status						

	Mexican American		NH Black		NH White	
Variable	**Frequency (unweighted)**	**Percent (weighted)**	**Frequency (unweighted)**	**Percent (weighted)**	**Frequency (unweighted)**	**Percent (weighted)**
Other	487	12.3%	1081	27.0%	946	18.1%
Single	721	18.2%	1137	28.4%	742	14.2%
Married	2759	69.6%	1780	44.5%	3535	67.7%
Region						
Midwest	431	10.9%	849	21.2%	1385	26.5%
Northest	57	1.4%	720	18.0%	1217	23.3%
South (including Texas)	986	24.9%	2015	50.4%	1476	28.3%
West	2493	62.8%	413	10.3%	1145	21.9%
Neighborhood Socioeconomic Status						
Mean (st deviation)	−0.67	−1.03	1.06	1.33	0.22	0.78

Table 2

Health Behaviors Summary Statistics

	Mexican American		NH Black		NH White	
Variable	**n**	**Mean (St. dev)**	**n**	**Mean (St. dev)**	**n**	**Mean (St. dev)**
Diet						
Fruit and Vegetable Intake	3825	4.57 (3.40)	3814	3.99(3.38)	5034	4.90 (3.53)
Calories from Fat (percentage%)	3832	32.31 (9.12)	3836	34.16 (9.65)	5046	33.83 (9.35)
	n	**Percentage**	**n**	**Percentage**	**n**	**Percentage**
Smoking (%)						
Yes	918	23.15 %	1394	34.88 %	1536	29.41 %
No	3048	76.85 %	2601	65.12 %	3687	70.59 %
Sedentary Activity (%)						
Sedentary	1040	26.22 %	873	21.86 %	644	12.33 %
Moderate or Vigorous Exercise	2927	73.78 %	3123	78.14 %	4579	87.67 %
Binge Drinking - Males (%)						
Yes	445	23.64 %	343	19.8 %	372	15.73 %
No	1436	76.36 %	1389	80.2 %	1997	84.27 %
Binge Drinking - Females (%)						
Yes	244	13.03 %	219	10.59 %	524	19.01 %
No	1629	86.97 %	1852	89.41 %	2230	80.99 %

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Table 3

Regression Results

	Fruits and Vegetables			Percent Calories from Fat			Smoking			Sedentary Behavior			Female Binge Drinking			Male Binge Drinking		
	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|
Mexican American																		
Female	−0.34	0.57	0.55	−0.87	1.10	0.43	−0.09	0.04	0.02	0.04	0.03	0.16						
Income																		
<1x FPL	−0.75	0.58	0.20	−1.84	0.79	0.02	0.13	0.05	0.01	0.07	0.04	0.04	−0.03	0.05	0.56	0.04	0.03	0.24
1 - < 2x FPL	−0.55	0.52	0.28	−1.85	0.83	0.03	0.08	0.04	0.06	0.02	0.03	0.39	−0.02	0.05	0.72	0.08	0.03	0.01
2 - <3x FPL	−0.37	0.44	0.40	−1.35	0.81	0.10	0.02	0.04	0.52	0.01	0.02	0.73	−0.03	0.04	0.44	0.08	0.03	0.01
3 - <4x FPL	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.
US Born	−0.90	0.17	<.0001	2.16	0.38	<.0001	0.08	0.02	0.00	−0.06	0.02	0.00	0.14	0.02	<.0001	0.11	0.03	<.0001
Education																		
Grade School	−0.98	0.28	0.00	−2.18	0.51	<.0001	0.10	0.03	0.00	0.13	0.02	<.0001	0.06	0.03	0.02	0.17	0.04	<.0001
Some High School	−0.98	0.26	0.00	−1.26	0.56	0.03	0.12	0.04	0.00	0.06	0.02	0.01	0.06	0.03	0.03	0.18	0.03	<.0001
High School	−0.38	0.19	0.05	−0.40	0.48	0.40	0.02	0.02	0.25	0.05	0.02	0.00	0.02	0.03	0.49	0.12	0.03	0.00
Some College and College +	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.
Neighborhood Socioeconomic Status	0.12	0.06	0.06	−0.33	0.15	0.02	−0.01	0.01	0.35	−0.04	0.01	0.00	0.00	0.01	0.65	−0.01	0.01	0.17
Non-Hispanic Black																		
Female	−0.83	0.30	0.01	1.50	0.95	0.12	−0.03	0.05	0.51	0.13	0.03	<.0001						
Income																		
<1x FPL	−0.64	0.37	0.08	0.62	0.79	0.44	0.24	0.05	<.0001	0.09	0.03	0.00	0.02	0.03	0.56	0.10	0.04	0.00
1 - < 2x FPL	−0.52	0.35	0.14	1.05	0.69	0.13	0.17	0.05	0.00	0.08	0.02	<.0001	−0.02	0.03	0.41	0.07	0.03	0.03
2 - <3x FPL	0.09	0.26	0.74	1.37	0.72	0.06	0.13	0.04	0.00	0.04	0.02	0.06	−0.03	0.02	0.22	0.03	0.03	0.30
3 - <4x FPL	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.
US Born	−0.63	0.33	0.06	5.97	0.55	<.0001	0.26	0.03	<.0001	0.01	0.03	0.74	0.09	0.02	<.0001	0.09	0.03	0.00
Education																		
Grade School	−1.00	0.30	0.00	0.38	0.56	0.50	0.13	0.03	<.0001	0.13	0.03	<.0001	0.06	0.03	0.05	0.02	0.03	0.50
Some High School	−0.80	0.22	0.00	0.42	0.51	0.41	0.20	0.03	<.0001	0.08	0.03	0.01	0.09	0.03	0.00	0.08	0.04	0.02
High School	−0.52	0.15	0.00	0.09	0.48	0.84	0.10	0.02	<.0001	0.01	0.02	0.39	0.02	0.02	0.26	0.07	0.02	0.00

	Fruits and Vegetables			Percent Calories from Fat			Smoking			Sedentary Behavior			Female Binge Drinking			Male Binge Drinking		
	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|	Coeff	Std Error	P > |t|
Some College and College +	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.
Neighborhood Socioeconomic Status	0.15	0.05	0.00	0.20	0.12	0.10	−0.02	0.01	0.00	−0.01	0.01	0.20	−0.01	0.01	0.10	−0.02	0.01	0.01
Non Hispanic White																		
Female	−0.64	0.22	0.00	−1.30	0.65	0.05	−0.11	0.02	<.0001	0.04	0.02	0.01						
Income																		
<1x PIR	−0.33	0.45	0.45	−1.62	1.15	0.16	0.02	0.05	0.75	0.03	0.04	0.42	−0.08	0.05	0.08	−0.02	0.04	0.57
1 - < 2x FPL	−0.17	0.31	0.59	0.20	0.66	0.77	0.01	0.03	0.78	0.03	0.02	0.20	−0.13	0.03	<.0001	0.01	0.03	0.70
2 - <3x FPL	−0.29	0.20	0.14	0.08	0.59	0.89	−0.02	0.02	0.41	0.00	0.02	0.75	−0.08	0.02	0.00	0.01	0.02	0.59
3 - <4x FPL	0.00	.	.	0.00	.	.							0.00	.	.	0.00	.	.
US Born	−1.00	0.28	0.00	2.38	0.68	0.00	0.04	0.04	0.31	−0.05	0.03	0.09	0.01	0.03	0.72	0.07	0.03	0.01
Education																		
Grade School	−1.38	0.25	<.0001	1.04	0.62	0.09	0.12	0.03	<.0001	0.16	0.03	<.0001	0.00	0.03	0.88	0.02	0.03	0.49
Some High School	−1.02	0.17	<.0001	0.66	0.51	0.19	0.26	0.03	<.0001	0.07	0.02	<.0001	0.09	0.03	0.01	0.08	0.03	0.01
High School	−0.58	0.13	<.0001	0.41	0.37	0.28	0.14	0.02	<.0001	0.05	0.01	<.0001	0.04	0.02	0.03	0.03	0.02	0.23
Some College and College +	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.	0.00	.	.
Neighborhood Socioeconomic Status	0.33	0.09	0.00	0.04	0.25	0.86	−0.04	0.01	<.0001	−0.03	0.01	<.0001	0.00	0.01	0.80	−0.02	0.01	0.13

The FPL is the ratio of family income to poverty threshold for a family of that size (using Census Bureau definitions of family poverty threshold). As the FPL increases, income increases.

Table 4

Decomposition of Differences in Health Behaviors between NH Whites and Mexican Americans and NH Whites and NH Blacks*

		Column 1	*Column 2*	*Column 3*
Whites compared to Mexican Americans	**Overall difference between Whites and Mexican Americans**	**Difference due to Individual-level Factors**	**Difference due to Neighborhood SES**	**Difference due to differential effects of individual and neighborhood factors**
Daily servings of fruit & vegetable intake	0.41	0.45	0.29	−0.33
Percentage of calories from fat	1.38	0.56	0.04	0.78
Smoking (%)	6.5%	−8.9%	−3.5%	19.0%
Sedentary lifestyle (%)	−12.7%	−7.5%	−3.1%	−2.1%
Binge drinking - Men (%)	−7.9%	0.9%	−1.8%	−7.0%
Binge drinking - Women (%)	5.9%	−1.9%	−0.3%	8.1%
Whites compared to African Americans	**Overall difference between Whites and Blacks**	**Difference due to Individual-level Factors**	**Difference due to Neighborhood SES**	**Difference due to differential effects of individual and neighborhood factors**
Daily servings of fruit & vegetable intake	0.98	0.46	0.42	0.10
Percentage of calories from fat	−0.46	−0.22	0.06	−0.32
Smoking (%)	−5.5%	−6.7%	−5.1%	6.3%
Sedentary lifestyle (%)	−9.2%	−4.3%	−4.4%	−0.6%
Binge drinking - Men (%)	−4.2%	−4.2%	−2.4%	2.5%
Binge drinking - Women (%)	8.2%	−3.6%	−0.4%	12.2%

*Differences are calculated as the value among NH Whites minus the Mexican American or NH Black value, so that positive (+) values indicate that Whites have higher values, whereas negative (−) values indicate that Blacks or Mexican Americans have higher values.