

Food insecurity in the United States of America: an examination of race/ethnicity and nativity

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Received: 3 May 2017 / Accepted: 19 October 2017 / Published online: 22 November 2017
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Abstract Food insecurity is a persistent problem in the United States and is disproportionately distributed across racial/ethnic groups, with some evidence that non-Latino blacks and Latinos experience higher rates than non-Latino whites. But no nationally-representative study examines how race/ethnicity affects food insecurity for immigrants in the United States. Using new assimilation theory and the 1999–2010 waves ($N = 32,464$) of the National Health and Nutrition Examination Survey (NHANES), this study investigated the relationship between food insecurity and both race/ethnicity and nativity status. Results, when socioeconomic status is held constant, provide evidence for a nonwhite/white divide in food insecurity for both immigrants and the native-born. That is, blacks and Latinos – regardless of nativity status – are significantly more food insecure than both foreign- and native-born whites. These results provide insight into a continuing pattern of racial/ethnic inequality in the United States.

Keywords Food insecurity · Race/ethnicity · Nativity · Immigrants · NHANES

1 Introduction

In 2015, more than 42 million persons from the United States of America (13% of all individuals) within 15.8 million

households (13% of all households) experienced limited access to sufficient, good quality food (Coleman-Jensen et al. 2016:6–7). This level of food insecurity reflects the continued repercussions of the Great Recession as food insecurity jumped to approximately 16% for individuals and 15% for households in 2008, a substantial increase from around 12–13% for individuals and 11% for households, which characterized most of the 2000s (Coleman-Jensen et al. 2016:6–8). This persistent prevalence of food insecurity has wide-reaching negative implications for the U.S. population because consistent access to nutritious food is necessary for healthy, active living. The absence of nutritious foods can lead to a host of poor health outcomes, including psychological distress, diet-sensitive chronic disease (e.g., hypertension, hyperlipidemia, diabetes), malnutrition, and, paradoxically, obesity. Importantly, food insecurity and its associated poor health outcomes are not equally distributed across the population, with greater concentrations among racial/ethnic minority groups (e.g., Leung et al. 2012).

This study examines the prevalence of food insecurity in the United States along two dimensions: race/ethnicity and nativity. The central contribution here is to explore the intersection of race/ethnicity and nativity using nationally-representative data. This dual focus is important because contemporary immigrants are mostly labeled as racial/ethnic minorities upon their arrival to the United States and, therefore, likely face similar challenges as their same-race/co-ethnic native-born counterparts. While rates of food security differ by race/ethnicity, even net of measures of socioeconomic status (e.g., Alaimo et al. 1998), research also documents that immigrants in the United States struggle with food insecurity (e.g., Kasper et al. 2000; Quandt et al. 2006; Sano et al. 2011).

Immigrants, however, are unique from the native-born population not only in their nativity status, but also English language proficiency and time spent in the United States, among other factors. To understand food insecurity for racial/ethnic

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minority immigrants, we draw upon Alba and Nee's (2003) new assimilation theory. This approach, a reformulation of classical assimilation theory, views race/ethnicity as a social boundary which can facilitate or impede the integration of immigrants into U.S. society. In regard to food insecurity, this theory suggests that immigrants who are racial/ethnic minorities face greater obstacles toward food security than their white counterparts due to persistent and deeply-rooted social inequalities in the United States.

To examine the relationship between food security, race/ethnicity, and nativity, we use ten years of data (1999–2000 to 2009–2010 cycles) from the National Health and Nutrition Examination Survey (NHANES), an annual survey conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. This dataset is ideal for our study because it oversamples non-Latino blacks and Latinos and has information on both nativity and food insecurity. We use a four category ordinal measure of food insecurity (full food security to very low food security) and conventional ordinal regression techniques to test hypotheses related to both race/ethnicity and nativity. This paper offers unique insight into health inequality in the United States with its focus on food insecurity and the intersection of race/ethnicity and nativity. We conclude with an assessment of the implications of racial/ethnic minority and nativity status for food insecurity and offer insight into how food insecurity could be addressed throughout the United States.

2 Conceptual framework

2.1 Food insecurity in the United States

The United States Department of Agriculture (USDA) defines food insecurity as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (Coleman-Jensen and Gregory 2014). According to the latest USDA Economic Research Service report on food security in the United States, 42.2 million or 13.4% of all Americans (adults and children) are food insecure (Coleman-Jensen et al. 2016:6–7). The USDA classifies most of the food insecure individuals as “low food security” (9% of all individuals) and almost 5% have “very low” food security.¹ Over the past decade, the percentage of households that are food insecure was essentially static until a large spike associated with the Great Recession in the late 2000s. This was followed by another stable period until a slight decline in the past few years.

¹ Individuals (and households) identified by the USDA as low or very low food security both have difficulty in acquiring food and experience reduced diet quality. Those classified as very low food security also report multiple instances when their food intake was reduced and normal eating patterns disrupted (Coleman-Jensen et al. 2016:4–5)

2.2 Race/ethnicity and food insecurity

Food insecurity is not equally distributed among racial/ethnic groups. In 2015, both blacks and Latinos experienced food insecurity at rates that were substantially higher than that for the nation (12.7%) and the rate for black households (21.5%) was higher than that of Latino households (19.1%) (Coleman-Jensen et al. 2016:14). Further, over the past twenty years, racial/ethnic differences in food insecurity have not improved, with the levels of food insecurity among blacks and Latinos remaining more than 2.5 times that of non-Latino whites (USDA 2015). In contrast to the descriptive USDA reports, regression-based research finds that Mexican Americans are more food insecure than both blacks and whites and this difference remains when accounting for socioeconomic status, including the income to poverty ratio, education and employment status of the family head, participation in the U.S.-based Supplemental Nutrition Assistance Program (SNAP), and health insurance (Alaimo et al. 1998).

There are several explanations for why racial/ethnic minorities might be more food insecure than whites. Fewer financial resources is one reason, as food insecurity is more pronounced in households that are below the poverty line (e.g., Bhattacharya et al. 2004; Olson 1999; Rose 1999). Since blacks and Latinos are disproportionately poor, they are also more likely to be food insecure because they would be less able to purchase food in sufficient quantities and of adequate quality.

In addition to poverty, researchers commonly account for a number of other individual-level indicators of socioeconomic status alongside race/ethnicity. These include unemployment (Alaimo et al. 1998; Kimbro et al. 2012; Ziliak and Gunderson 2012), SNAP participation (Alaimo et al. 1998; Chilton et al. 2009; Schanzenbach et al. 2014), lack of health insurance (Alaimo et al. 1998), disability status (Anderson et al. 2014; Bartfeld and Dunifon 2006; Schanzenbach et al. 2014; Ziliak and Gunderson 2012), and homeownership (Anderson et al. 2014; Bartfeld and Dunifon 2006; Schanzenbach et al. 2014; Ziliak and Gunderson 2012).

Further, other important factors that have been examined concurrently with race/ethnicity in studies of food insecurity include education (Alaimo et al. 1998; Chilton et al. 2009; Jensen and Zhylyevskyy 2013; Ryabov 2016; Schanzenbach et al. 2014; Ziliak and Gunderson 2012), gender (Anderson et al. 2014; Ziliak and Gunderson 2012; Ryabov 2016), social capital (Martin et al. 2004), incarceration status (Turney 2014; Wallace and Cox 2012), and household structure (Balistreri 2012; Hernandez and Pressler 2013; Jensen and Zhylyevskyy 2013; Ryabov 2016; Ziliak and Gunderson 2012), including children in the household (Bartfeld and Dunifon 2006; Chilton et al. 2009; Jensen and Zhylyevskyy 2013; Schanzenbach et al. 2014).

Blacks and Latinos are likely to be more food insecure than whites for reasons beyond individual-level differences in socioeconomic status. One contributing factor is spatial inequality or the uneven distribution of resources over a particular area. This contributes to food insecurity because black and Latino neighborhoods often have relatively limited access to quality food sources when compared to socioeconomically similar white neighborhoods (e.g., Block et al. 2004; Gordon et al. 2011; Larson et al. 2009; Powell et al. 2007). One example of a lack of access is that areas that are poorer and/or are comprised of predominantly racial/ethnic minorities (independent of socioeconomic status) have fewer supermarkets than neighborhoods that are predominantly white and/or affluent (Moore and Diez-Roux 2006; Morland et al. 2002; Powell et al. 2007; Raja et al. 2008; for a review, see Beaulac et al. 2009). Furthermore, blacks have to travel the farthest distances to grocery stores when compared to neighborhoods that are predominately white, regardless of the economic characteristics of the neighborhoods (Helling and Sawicki 2003; Moore and Diez-Roux 2006; Powell et al. 2007; Zenk et al. 2005). This lack of access has a number of implications, including the reduction of expenditures on – and therefore consumption of – fruits and vegetables, an important source of nutrition for food security (Ryabov 2016).

In sum, the similarity in the rates of food insecurity between blacks and Latinos in the USDA report (Coleman-Jensen et al. 2016) suggests that blacks and Latinos encounter comparable obstacles to acquiring food of sufficient quantity and quality. It is curious that a previous study on racial/ethnic differences in food insecurity finds that blacks and whites have statistically equivalent levels of food insecurity and that Mexican Americans are more food insecure than both of these groups (Alaimo et al. 1998). In light of the racial/ethnic inequalities in access to food identified above and methodological differences between our study and that of Alaimo and her colleagues (see below) we are hesitant to test a hypothesis based upon the results of this older study. Therefore, we hypothesize that, net of socioeconomic status, non-Latino blacks (Hypothesis 1) and Latinos (Hypothesis 2) will have higher food insecurity than non-Latino whites.

2.3 Immigration, new assimilation theory, and food insecurity

2.3.1 *New assimilation theory and food insecurity*

Given that the majority of immigrants to the United States in recent decades have been nonwhite (see Acosta and La Cruz 2011; Gambino et al. 2014; Grieco 2010), it is necessary to address nativity status when examining racial/ethnic inequality in food security. To this end, we draw upon Alba and Nee's (2003) new assimilation theory.

Assimilation theory has long been used to understand immigrant experiences in the United States. It captures the process where by minority or immigrant group members adopt cultural patterns of the majority or host population (Gordon 1964). This theory has been successfully used to explain the experiences of European immigrants at the turn of the twentieth century. For example, “new” European immigrants from southeastern Europe were initially not considered white upon their arrival to the United States; however, over multiple generations these immigrants assimilated with the “old” European immigrants to form a white racial group (e.g., Alba 1990; Allen 1994; Ignatiev 1995; Jacobson 1998). In this way, the distinctiveness of ethnicity as a social boundary that shaped individuals' daily experiences eroded over time, resulting in decreasing relevance of ethnic origins in relation to other ethnic groups.

Due to deeply rooted and highly institutionalized racial/ethnic inequality in the United States (Omi and Winant 1994), immigrants of various racial/ethnic backgrounds are unlikely to follow the path of European immigrants at the turn of the twentieth century. Alba and Nee (2003) argue that assimilation must recognize that race/ethnicity is a social boundary and its distinction is embedded not only in a variety of social, economic, and cultural differences at the individual level but also in large social structures and institutional constraints. Immigrant incorporation in U.S. society undoubtedly depends on the social, financial, and human capital they possess, and yet importantly, also depends on the ways they can apply resources within existing racial/ethnic structures and institutions. As a result, subject to similar structural barriers, immigrant incorporation patterns are likely to hinge on how well their native-born racial/ethnic counterparts fare in U.S. society.

2.3.2 *Immigrants and food insecurity*

A growing body of research has examined food insecurity among adult immigrants by largely focusing on particular immigrant groups within unique geographic areas. For example, a qualitative study of food insecurity among Latino immigrants in North Carolina reported high rates of food insecurity with 70% of families worried that they would run out of food and over 50% classified as food insecure (Quandt et al. 2006; see also Quandt et al. 2004). Further, over 40% of legal immigrants from Latin America, Cambodia and Vietnam who lived in California, Texas, and Illinois were food insecure (Kasper et al. 2000). Another qualitative study documented consistent and intermittent food insecurity among ten Latino immigrant mothers living in rural Oregon and Iowa (Sano et al. 2011). A quantitative study focusing on Los Angeles and New York that surveyed 3400 immigrant families found that almost one-third were food insecure, which was substantially higher than the rates for native-born families (Capps

et al. 2002). In contrast to these studies, a nationally-representative report from the USDA documents that food insecurity is higher among Latino noncitizens (24.4%) than citizens (19%) (Rabbitt et al. 2016). Together, these studies, among others, suggest levels of food insecurity that are substantially higher for Latino immigrants than the U.S. average of 13% (see Coleman-Jensen et al. 2016).

In terms of racial/ethnic inequality among immigrants and in line with new assimilation theory, we can expect that race/ethnicity will affect the prevalence of food insecurity for immigrants in much the same way as their same-race/co-ethnic native-born counterparts. That is, low income and poverty are barriers to purchasing food in enough quantity and of sufficient quality to reduce immigrants' food insecurity. Further, spatial inequality will contribute to an absence of supermarkets and an abundance of fast food restaurants and convenience stores for black and Latino immigrants.

But why might nativity status matter for food insecurity in the United States, independent of immigrants' race/ethnicity and their socioeconomic status? One factor may be immigrants' legal status as illegal immigrants are not eligible for federal assistance such as welfare or SNAP, and they may be fearful of seeking aid from other sources, including charitable organizations (Capps et al. 2002; Hadley et al. 2008; Munger et al. 2014; Nunnery and Dharod 2017; Quandt et al. 2006; van Hook and Balistreri 2006). Related, naturalization reduces food insecurity as naturalized citizens are less food insecure than their immigrant peers (Capps et al. 2009). Part of the advantage of naturalization may be due to how long immigrants have lived in the United States as immigrants with shorter durations are likely to be more food insecure (Capps et al. 2009; Chilton et al. 2009; Dharod et al. 2013; Hadley and Sellen 2006; Hadley et al. 2010; Kaiser et al. 2002). Further, immigrants' social networks, including family and friends, may be smaller and less helpful for navigating U.S. society, particularly where grocery stores are few and far between (Munger et al. 2014; Sano et al. 2011). Another factor may be immigrants' level of English proficiency. Lower levels of proficiency create obstacles for employment, increase barriers to accessing governmental and charitable food assistance, and also make shopping for food that much more difficult (Capps et al. 2002; Hadley et al. 2010; Kaiser et al. 2002; Kasper et al. 2000; Munger et al. 2014). Last, immigrants often send remittances to relatives in their native countries. This unique financial hardship reduces their ability to purchase good quality food in sufficient quantities in the United States (Munger et al. 2014; Nunnery and Dharod 2017; Quandt et al. 2006; Sano et al. 2011).

In sum, we can use the above literature to hypothesize that, net of socioeconomic status, the foreign-born are more food insecure than the native-born (Hypothesis 3). Because immigrants face similar challenges as their native-born same-racial/

co-ethnic counterparts, we expect that the same pattern of racial/ethnic inequality in food security for native-born racial/ethnic groups will be also evident among immigrants. Therefore, we hypothesize that, net of socioeconomic status, both non-Latino black (Hypothesis 4) and Latino (Hypothesis 5) immigrants are more food insecure than white immigrants.

2.4 Implications of food insecurity

Racial/ethnic minorities are disproportionately affected by the negative health outcomes that are associated with food insecurity (Walker et al. 2010). Individuals who are food insecure are more likely to experience higher rates of cardiovascular problems, hypertension, and diabetes (Dinour et al. 2007; Larson et al. 2009; Seligman et al. 2009). Food insecurity is also associated with worse mental and developmental health when compared to those who are not food insecure, including higher rates of depression, fatigue and poor self-esteem (Alaimo et al. 2001; Gundersen 2009; Seligman et al. 2009). Further, food insecurity can affect cognitive functioning, and children who are food insecure have poorer social and academic development (Alaimo et al. 2001).

Paradoxically, those who are food insecure are more likely to be obese than people who are not food insecure (e.g., Dinour et al. 2007; Larson and Story 2011; Townshend et al. 2001; Wilde and Peterman 2006). Environmental factors play an important role in contributing to this obesity paradox, including restricted economic and geographic access to quality foods found in supermarkets and grocery stores and relatively greater access to an overabundance of unhealthy foods found in fast food restaurants and convenience stores (Block et al. 2004; Gordon et al. 2011; Larson et al. 2009). Indeed, areas that have higher concentrations of racial/ethnic minorities are more likely to have fewer healthy food options (Block et al. 2004; Grier and Kumanyika 2008; Freeman 2007). For example, in New Orleans, fast food restaurants are geographically concentrated within predominantly black and low-income neighborhoods, which have nearly double amount of fast food restaurants compared to white neighborhoods (Block et al. 2004). As a result, convenience stores and fast food restaurants in neighborhoods like these are a primary source of food, offering many high-fat and high-calorie foods and few, if any, fresh foods (e.g., Freeman 2007). In this way, nutritious food is often replaced with less expensive food, which is often energy-dense and high in sodium and saturated fat. Individuals who repeatedly experience food insecurity may also over-consume food when they have it available to them because they expect to soon be food insecure again (e.g., Polivy 1996; Urbaszat et al. 2002).

3 Data and methods

To examine the effects of race/ethnicity and nativity on food security, we used data from the National Health and Nutrition Examination Survey (NHANES). NHANES has been conducted yearly by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC) since 1999 and samples approximately 5000 participants from fifteen locations each year using a multistage probability sampling design. The locations are selected from a sampling frame that includes all 50 states and the District of Columbia; however the specific locations selected cannot be disclosed in the public-use data due to privacy concerns (Johnson et al. 2013). Data are released in two-year cycles and are nationally representative of the U.S. resident civilian non-institutionalized population. NHANES oversamples Latinos, non-Latino blacks, those below 130% of the federal poverty level, and those older than age 80.

This study combined data from the 1999–2000 to the 2009–2010 cycles; cycles in which the food security questions were asked. Our sample consisted of 32,464 adults aged 20 years and older, the age at which NHANES asks respondents about their educational attainment and marital status.

3.1 Outcome variable

The NHANES food security module includes questions on participants' food situations at home and food assistance benefits (i.e., those associated with SNAP) received within the previous 12 months (NCHS 2013). The adult food security component uses a 10-item survey, which was developed by the USDA and also appears in the Food Security Supplement of the Current Population Survey (Coleman-Jensen et al. 2016). The questions address behaviors and/or social conditions that are characteristic of households and individuals that do not have sufficient access to food. For example, the survey asks how often in the last twelve months the respondent has worried that s/he would run out of food before there was money to buy more, how often s/he ran out of food, and if s/he can afford to eat balanced meals. The questionnaire also addresses other food security-related behaviors such as reducing the size of meals or skipping meals altogether (NCHS 2013).

For our outcome variable, we used the adult food security category variable created by NHANES. This ordinal variable has four categories with adults assigned to one of the categories based on the number of affirmative responses to the 10 adult-only food security questions. Adults with zero affirmative responses are classified as “full food security” ($N = 24,189$). Here, we assigned a value of zero and treated this category as our reference. Adults with one or two affirmative answers have “marginal food security” and are

assigned a value of one ($N = 2971$). “Low food security” (assigned value of two) is classified as having three to five affirmative answers ($N = 2722$). Finally, adults with six or more affirmative responses have “very low food security” (assigned value of three; $N = 1686$).

3.2 Explanatory variables

We used two sets of explanatory variables: combinations of race/ethnicity with nativity and socioeconomic status. To create the first set of variables, we recoded the race/ethnicity question (non-Latino black, Latino,² non-Latino other race, and non-Latino white) and the NHANES country of birth question to create a native- and foreign-born category for each of the four major racial/ethnic groups (reference = native-born non-Latino whites).³ The “other race” category included Asians and multiracial participants.⁴

For our second set of explanatory variables, we measured socioeconomic status with the ratio of family income to poverty and educational attainment. The ratio of income to poverty is a continuous variable, which was calculated by NHANES using family income data and the poverty guidelines issued by the Department of Health and Human Services specific to family size and state and top-coded at five by NHANES due to privacy concerns. Education attainment was recoded into four dichotomous variables: less than high school (reference), high school, some college and bachelor's degree or higher.

3.3 Control variables

The control variables in this study were the length of time in the United States (in years), age and its square, marital status, gender, household size and the survey wave. For length of time in the United States, we assigned native-born respondents a value of zero. Age was measured in years at the time of the study and was top-coded by NHANES at 80. Marital status was recoded into a series of dichotomous variables: married (reference), separated or divorced, cohabitating, never married, or widowed. Gender was also measured dichotomously (1 = female). The total number of people in the household was a continuous variable and was top-coded at seven by NHANES. Last, we included a categorical variable for the wave of the survey (the 1999–2000 wave was the reference).

² The panethnic Latino category cannot be disaggregated into ethnicities in the public-use NHANES data (NCHS 2013).

³ We shorten the label for racial/ethnic groups by dropping “non-Latino” for the rest of the paper.

⁴ The “other race” participants were combined into this single category by NHANES and cannot be disaggregated in the public-use data (National Center for Health Statistics (NCHS) 2013).

3.4 Analytic method

We used ordered logistic regression because the NHANES measure of adult food insecurity is an ordinal categorical variable. An ordered logistic regression model estimates the probability of a given response within an outcome variable with more than two discrete response categories where the categories are ranked in some way (Agresti and Finlay 2009).⁵

We specified four variable-nested ordered logistic regression models that tested our hypotheses. Model 1 introduced the race/ethnicity and nativity combinations. Models 2 and 3 added the ratio of income to poverty and educational attainment, respectively. The final model (Model 4) added the control variables. All models were adjusted for the NHANES complex sampling structure.⁶ To address missing data, we used the multiple imputation, then deletion (MID) procedure (von Hippel 2007). For each regression equation, we used SAS Proc MI to create five datasets using the variables in the particular model. After imputation, we removed observations with missing values on the particular outcome variable (again, for each regression equation) and then conducted our analyses. Results were returned with SAS Proc MIAnalyze.⁷ To aid in making comparisons between groups, we tested for equality of coefficients within the same model with Wald tests (Long 1997: 92–93).

4 Results

Table 1 shows the weighted descriptive statistics of the outcome, explanatory, and control variables for the full sample and for each racial/ethnic group, by nativity. Focusing first on the ordinal measure of the outcome variable, for race/ethnicity, we saw preliminary support for Hypotheses 1 and 2: both blacks and Latinos had a higher level of food insecurity than whites. In terms of nativity, there was mixed preliminary evidence for Hypothesis 3. Black and Latino immigrants were more food insecure than their native-born peers, though the

difference was smaller for blacks. In contrast, foreign birth appeared to favor whites (though again, the difference was small) and members of the “other race” category in terms of food insecurity. As with their native-born peers, black (Hypothesis 4) and Latino (Hypothesis 5) immigrants were more food insecure than white immigrants.

For the socioeconomic explanatory variables, the mean ratio of income to poverty in the full sample was 3.0, with one-fifth having less than a high school education and one-quarter having a bachelor’s degree or greater.

Inequality in socioeconomic status was evident both within and between the racial/ethnic subgroups. Whites had the highest ratio of income to poverty, with the native-born possessing higher socioeconomic status than the foreign-born, while foreign-born Latinos had the lowest ratio. For education, foreign-born “other race” and whites were more highly educated (when we looked at the proportion with a bachelor’s degree or higher) and foreign-born Latinos were the least educated.

Figure 1 provided more insight into food security by race/ethnicity and nativity. In the full sample, more than 80% had full food security but this differed substantially by racial/ethnic group. Whites had the greatest proportion in the full food security category, independent of nativity status (90% for foreign-born whites and 89% for native-born whites). In contrast to whites, foreign-born Latinos had the lowest proportion for full food security, and blacks (regardless of nativity status) were similar to native-born Latinos. Similarly, the proportions of white respondents (regardless of nativity status) in the categories of marginal, low, and very low food security were all less than the corresponding categories for blacks and Latinos. Among nonwhite immigrants, foreign-born Latinos were more food insecure than foreign-born blacks.

4.1 Regression results

Table 2 presents the variable-nested ordered logistic regression models of the relationship between race/ethnicity, nativity status, and household food insecurity. Model 1 had the race/ethnicity and nativity variables. In this model, we observed both race/ethnicity and nativity effects for blacks and Latinos: Latino immigrants were the most food insecure followed by native-born Latinos and black immigrants. For “other race” and white immigrants there was no statistical difference with the reference group, native-born whites.

Model 2 added the ratio of income to poverty. This variable was statistically significant and indicated that a higher ratio of income to poverty decreased food insecurity. When the ratio of income to poverty was added, the coefficients for all nativity status and race/ethnicity variables that were statistically significant in Model 1 were reduced.

⁵ We tested for and found evidence of violations of the proportional odds assumption in our ordered regression models. In supplementary analyses, we analyzed the NHANES measure of food insecurity with multinomial regression and created two dichotomous versions of the original four category food insecurity variable (full food security vs. the other categories; full/marginal food security vs. low/very low food security) that we analyzed with logistic regression. Results from these models provided evidence of the same pattern of results that we identified with the ordered logistic regression; therefore, we chose to continue with our original modeling strategy.

⁶ Practically, we used SAS Proc Surveylogistic for our analytical analyses. To properly adjust the data, we used the cluster (sdmvpsu), strata (sdmvstra), and weight (wtint4yr, wtint2yr) options (the appropriate NHANES variables are in parentheses). We used the formula in Table E in Johnson et al. (2013) to combine weights across survey cycles.

⁷ In supplemental analysis, we compared results generated both with and without multiple imputation and found similar results.

Table 1 Weighted descriptive statistics for food security, explanatory variables and control variables in the USA. Data are from the National Health and Nutrition Examination Survey (NHANES), 1999–2010, $N = 32,464$

	Black		Latino		Other race		White	
	Full sample	Foreign-born	Native-born	Foreign-born	Native-born	Foreign-born	Native-born	Native-born
Outcome variable - food insecurity								
Ordinal measure (0–3)	0.31 (0.01)	0.58 (0.05)	0.54 (0.02)	0.76 (0.03)	0.56 (0.04)	0.22 (0.04)	0.44 (0.05)	0.21 (0.01)
Proportions of ordinal measure categories								
Full food security (ordinal measure = 0)	0.83	0.69	0.70	0.57	0.69	0.87	0.79	0.89
Marginal food security (ordinal measure = 1)	0.07	0.12	0.13	0.18	0.14	0.06	0.06	0.05
Low food security (ordinal measure = 2)	0.06	0.10	0.10	0.17	0.10	0.05	0.07	0.04
Very low food security (ordinal measure = 3)	0.04	0.09	0.07	0.08	0.07	0.02	0.08	0.03
Explanatory variables								
Race/ethnicity and immigrant status								
Black - foreign-born	0.01	–	–	–	–	–	–	–
Black - native-born	0.10	–	–	–	–	–	–	–
Latino - foreign-born	0.08	–	–	–	–	–	–	–
Latino - native-born	0.05	–	–	–	–	–	–	–
Other race - foreign-born	0.03	–	–	–	–	–	–	–
Other race - native-born	0.02	–	–	–	–	–	–	–
White - foreign-born	0.04	–	–	–	–	–	–	–
White - native-born	0.67	–	–	–	–	–	–	–
Socioeconomic status								
Ratio of income to poverty	3.00 (0.03)	2.46 (0.10)	2.34 (0.05)	1.76 (0.04)	2.43 (0.08)	2.97 (0.11)	2.71 (0.15)	3.29 (0.04)
Education								
Less than high school	0.20	0.26	0.30	0.58	0.27	0.19	0.17	0.14
High school	0.25	0.19	0.26	0.17	0.26	0.15	0.24	0.27
Some college	0.30	0.30	0.32	0.16	0.34	0.21	0.37	0.31
Bachelor's degree or higher	0.25	0.25	0.13	0.08	0.13	0.46	0.22	0.28
Control variables								
Time in the U.S. (Immigrants only)	18.99 (0.36)	16.81 (0.89)	–	17.24 (0.52)	–	17.54 (0.72)	–	–
Age	46.21 (0.21)	42.21 (0.92)	43.78 (0.29)	40.53 (0.49)	39.15 (0.75)	44.65 (0.60)	40.61 (0.78)	48.00 (0.25)
Marital status								
Married	0.56	0.46	0.33	0.58	0.45	0.69	0.44	0.59
Never married	0.17	0.26	0.31	0.18	0.26	0.16	0.29	0.14
Cohabiting	0.07	0.06	0.09	0.09	0.09	0.03	0.09	0.06
Separated or divorced	0.12	0.16	0.18	0.11	0.15	0.06	0.13	0.12
Widowed	0.06	0.04	0.07	0.04	0.04	0.05	0.04	0.07
Female	0.52	0.48	0.56	0.47	0.55	0.53	0.54	0.52
Household size	3.02 (0.02)	3.42 (0.13)	3.15 (0.04)	4.34 (0.07)	3.50 (0.07)	3.52 (0.10)	3.14 (0.14)	2.77 (0.02)
N (unweighted)	32,464	625	5762	5469	3231	825	540	15,107

Standard errors are in parentheses. Proportions may not total 1 due to rounding

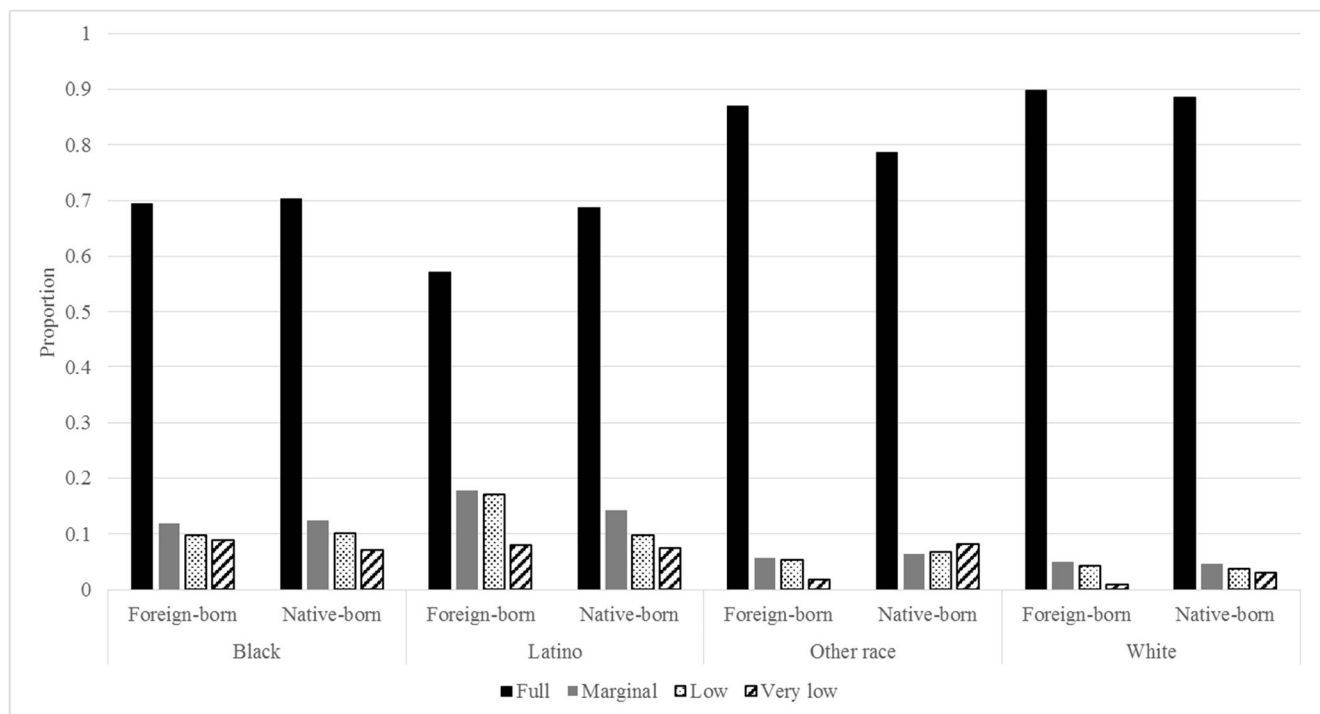


Fig. 1 Proportions of the human population in the USA that are food secure, by food security category (full, marginal, low, very low), race/ethnicity, and nativity. Data are from the National Health and Nutrition Examination Survey (NHANES), 1999–2010, N = 32,464

Model 3 added education. Here, in comparison to adults with less than a high school education, completing some college or at least a bachelor's degree reduced food insecurity, though attaining a bachelor's degree or higher was a stronger barrier against food insecurity. When education was added, the coefficients for the race/ethnicity and immigrant variables were relatively unchanged.

Model 4 was the full model, with control variables. In this model, the same race/ethnicity and nativity pattern evident in Model 1 was present here. Equality-of-coefficients Wald tests indicated that all of the statistically significant race/ethnicity and nativity status coefficients in Model 4 were statistically equivalent to each other. That is, there was no statistically unique variation between racial/ethnic minority groups or by nativity, suggesting a white/nonwhite divide (the white foreign-born were statistically equivalent to the white native-born) in food security. For the measures of socioeconomic status, higher income and educational attainment continued to decrease food insecurity. Unique to Model 4 was that all levels of educational attainment reduced food insecurity.

In terms of the hypotheses, we found mixed evidence. For race/ethnicity, we found support for our hypotheses as both blacks (Hypothesis 1) and Latinos (Hypothesis 2) had a higher likelihood of food insecurity than whites. Instead of a Latino vs. black/white divide that was evident in the study by Alaimo and her colleagues (1998), we observed a white/nonwhite contrast in food insecurity similar to that descriptively reported in the 2016 USDA report (Coleman-Jensen et al. 2016).

For Hypothesis 3, we found no evidence as immigrants were similarly food insecure as their native-born same-race/co-ethnic counterparts. In fact, the only evidence in support of a nativity divide was among the “other race” category, a category that is a catch-all due to NHANES public data restrictions. We did, however, observe the same racial/ethnic divide among foreign born blacks and Latinos (Hypotheses 4 and 5) that we observed among the native-born. As such, our results suggested that race/ethnicity is more influential than nativity status for food insecurity in the United States.

5 Discussion

Using over 10 years of data from the National Health and Nutrition Examination Survey, this is the first study to analyze the relationship between race/ethnicity, nativity status, and food insecurity in the United States. The central contribution of our study is the simultaneous attention on both race/ethnicity and nativity using nationally representative data. Beginning with race/ethnicity, we hypothesized that blacks and Latinos would be more food insecure than whites. For nativity, we used new assimilation theory to hypothesize that immigrants likely encounter similar barriers and obstacles (for racial/ethnic minorities) or advantages (for whites) as their same-race/co-ethnic native-born counterparts. As such, we expected the racial/ethnic divide present in the literature on race/ethnicity and food insecurity to be applicable to – and observable among – immigrants.

Table 2 Ordered logistic regression estimates of adult food insecurity on race/ethnicity and nativity status in the USA. Data are from the National Health and Nutrition Examination Survey (NHANES), 1999–2010, N = 32,464

	Model 1	Model 2	Model 3	Model 4
Explanatory variables				
Race/ethnicity and immigrant status ^a				
Black - foreign-born	1.232** (0.129)	0.827** (0.143)	0.883** (0.142)	0.662** (0.173)
Black - native-born	1.176** (0.072)	0.682** (0.066)	0.632** (0.067)	0.464** (0.065)
Latino - foreign-born	1.688** (0.077)	0.888** (0.072)	0.797** (0.072)	0.541** (0.093)
Latino - native-born	1.239** (0.112)	0.801** (0.089)	0.755** (0.094)	0.574** (0.111)
Other race - foreign-born	0.138 (0.201)	−0.136 (0.198)	−0.004 (0.187)	−0.181 (0.188)
Other race - native-born	0.793** (0.130)	0.506** (0.169)	0.524** (0.166)	0.374* (0.153)
White - foreign-born	−0.137 (0.161)	−0.296 (0.179)	−0.247 (0.180)	−0.248 (0.213)
Ratio of income to poverty	—	−0.733** (0.023)	−0.702** (0.025)	−0.701** (0.025)
Education ^b				
High school	—	—	−0.095 (0.055)	−0.239** (0.056)
Some college	—	—	−0.139* (0.061)	−0.348** (0.063)
Bachelor's degree or higher	—	—	−0.796** (0.086)	−1.034** (0.093)
Controls				
Time in the U.S.	—	—	—	0.001 (0.004)
Age	—	—	—	0.066** (0.009)
Age, squared	—	—	—	−0.001** (0.000)
Marital status ^c				
Never married	—	—	—	0.095 (0.069)
Cohabiting	—	—	—	0.270** (0.100)
Separated or divorced	—	—	—	0.474** (0.067)
Widowed	—	—	—	0.366** (0.091)
Female ^d				
Household size	—	—	—	−0.036 (0.032)
Wave	—	—	—	0.010 (0.020)
Wave	—	—	—	0.136** (0.017)
Intercept 1	−2.050**	−0.113*	0.003	−1.201**

Table 2 (continued)

	Model 1	Model 2	Model 3	Model 4
Intercept 2	-2.707**	-0.849**	-0.739**	-1.972**
Intercept 3	-3.708**	-1.918**	-1.813**	-3.073**

Standard errors in parentheses

^a Reference is white - native-born

^b Reference is no high school

^c Reference is married

^d Reference is male

* $p < .05$; ** $p < .01$, two-tailed

In line with our expectations, we found a white/nonwhite divide in the NHANES data. Blacks and Latinos – regardless of nativity status – were equally likely to be food insecure when compared to whites. One possible mechanism that can explain this racial/ethnic health disparity, independent of socioeconomic status, is spatial inequality. Due to segregation, blacks and Latinos are more likely to have restricted access to supermarkets (both in terms of prevalence and proximity), which are an important source of affordable and nutritious food in the US. In this way, spatial inequality contributes to a lack of healthy, quality food in sufficient quantities as well as an over-population of fast food restaurants and convenience stores.

In terms of the literature, our results reflected the racial/ethnic divide identified over the past twenty years of USDA data (USDA 2015), including the 2016 report (Coleman-Jensen et al. 2016), and also provided support for the finding of Alaimo et al. (1998) that Latinos (though they had a measure of ‘Mexican American’) were more food insecure than non-Latino whites. That we observed statistically equivalent levels of food insecurity between blacks and Latinos instead of inequality is inconsistent with this earlier study. Our study, however, differed from this previous effort in that we used more recent NHANES data (1999–2010 in our study, 1988–1994 in theirs), we had a measure of Latino panethnic status instead of their measure of ‘Mexican American’, and we measured food insecurity with a four-category ordinal variable while they had a dichotomous measure of “food insufficiency.” In whole or in part, these differences likely explain why we found a black/Latino vs. white divide while they reported a black/white vs. ‘Mexican American’ discrepancy.

Counter to expectations, we observed no nativity effect for food insecurity within racial/ethnic groups. Indeed, the only nativity difference we observed was between the foreign and native-born “other race” respondents. Since this racial category is a catch-all from the NHANES data and we do not have other studies that used this category to compare with, we set aside any further discussion of this finding.

In light of the equivalence by nativity within (and even between) racial/ethnic groups, what explains this discrepancy

with our hypothesis? It could be that immigrants have characteristics that help them overcome any nativity disadvantages in food insecurity. For example, immigrants may be able to offset challenges associated with being less proficient in English by settling in coethnic neighborhoods. Greater concentrations of immigrants within certain neighborhoods may also increase access to a higher quantity and better quality of food via ethnic grocery stores. The equivalence could also be due to their status as immigrants, which suggests that they are unique from the native-born population in a variety of ways, including English language proficiency, foreign education and work experience, cultural values and behaviors. These characteristics may help to offset any disadvantages associated with a racial/ethnic minority status.

That we did not observe any nativity differences between blacks and Latinos suggests that racial/ethnic boundaries are more important than a native-immigrant divide in stratifying access to food security in the United States. Indeed, new assimilation theory predicts that race/ethnicity will remain a substantial barrier for minorities and that immigrants will encounter similar obstacles (or advantages) as their same-race/co-ethnic native-born peers. For example, West Indian immigrants strive to maintain their ethnic identity as a way of distinguishing themselves from black Americans and to help facilitate upward mobility (Waters 1999). In the end, however, “race as a master status. . . overwhelms the identities of the immigrants and their children, and they are seen as black Americans” (Waters 1999:8).

5.1 Limitations of this study and future research

Alongside the contributions of this study, a limitation is the way in which race and ethnicity are coded in the public-use NHANES data. The inability to disaggregate the panethnic Latino category into ethnic groups prevents more nuanced analyses as well as comparison to previous work using earlier NHANES data (e.g., Alaimo et al. 1998). Future research would benefit from drawing on nationally-representative data, such as the Current Population Survey Food Security Supplement (USDA 2017), that allow for investigation of

food insecurity between Latino ethnic groups. Further, all races/ethnicities other than Latino, non-Latino white and non-Latino black are grouped into a single “other race” category. This grouping does not allow for any comparisons with Asians, Native Americans or mixed-race survey participants. In particular, the inability to discern a separate Asian category in this study is unfortunate because Asians are the fastest-growing racial/ethnic group in the United States, having recently passed Latinos as the largest group of new immigrants (Pew Research Center 2012; U.S. Census Bureau 2013). Additionally, a separate category for Native Americans would also be informative. Research on food security among Native Americans in the United States is rare with only one study that found that Native Americans have higher food insecurity than non-Native Americans (Gundersen 2008).

5.2 Extensions

Given the inequalities documented in this study, what can be done to address food insecurity in the United States? There are several government assistance programs that work to combat food insecurity in the United States. One such program is SNAP, a federal aid program that distributes funds to low/no income individuals to help them purchase food. There is some disagreement in the literature regarding whether participation in SNAP reduces food insecurity; yet, the more rigorous studies find that participation substantially reduces the likelihood of being food insecure (e.g., Borjas 2004; DePolt et al. 2009; Nord 2012; Nord and Golla 2009; Ratcliffe et al. 2011; Schmidt et al. 2016; Yen et al. 2008). Notably, though SNAP participation is quite high among eligible households (83%), not all households who are eligible for SNAP participate in the program and, of those who participate, they are often the most food insecure (Gray and Cunnyham 2016; Nord 2012; Nord and Golla 2009). Indeed, in recent years only 42% of eligible elderly adults participated and 55% of eligible noncitizens use SNAP (Gray and Cunnyham 2016). Furthermore, eligibility status is particularly important for immigrants, as the ability to participate in SNAP differs by immigrant status (Koball et al. 2013). For example, undocumented immigrants have always been ineligible for SNAP and special conditions apply for legal permanent residents to participate.

Additionally, spatial inequality remains a critical barrier to food security in the United States. Poor communities and communities of color are more likely to have less access to grocery stores, independent of socioeconomic status, which affects residents’ health because large supermarkets and chain grocery stores offer a wider selection of nutritious food and more affordable prices (Chung and Myers 1999; Ver Ploeg et al. 2009). It also affects their financial well-being as the residents of poor neighborhoods pay more for food due to limited access to large discount retailers (Chung and Myers 1999; Kaufman et al. 1997).

One solution to spatial inequality is the development of local and sustainable food systems (e.g., Gottlieb and Joshi 2010). An example of a sustainable, local solution to food insecurity is The Stop in Toronto, Canada (Saul and Curtis 2013). The Stop promotes the idea that all people, regardless of economic condition, have the right to healthy food by emphasizing dignity, quality food, and accessibility and providing the local community with gardens, a greenhouse, kitchens and farmer’s markets (Saul and Curtis 2013). Thus, in addition to providing a sustainable solution to food insecurity, local food organizations, like The Stop, maintain the dignity of those in need of assistance.

5.3 Conclusion

There are many interconnected forms of inequality in the United States. We provide evidence demonstrating the continued racial/ethnic stratification in food security. While food insecurity affects approximately 13% of the overall population, blacks and Latinos are disproportionately affected. Given that the majority of immigrants to the United States today are non-white, further research on food and nutritional inequalities associated with the contemporary immigrant experience is warranted. In the meantime, there are several ways that food insecurity can be alleviated, including through reform of federal food assistance and the promotion of local, sustainable food systems, including urban and sub-urban gardening. Spatial inequality has led to segments of the U.S. population, particularly lower-income blacks and Latinos, living in places where it is difficult to easily obtain fresh, healthy food. Community-based solutions to food insecurity such as cooperative farming have proven to be successful alternatives to the current food system, providing nutritious food and fostering solidarity within disadvantaged communities. The right to food is recognized under Article 25 in the United Nation’s Universal Declaration of Human Rights (United Nations General Assembly 1948). As such, food insecurity is not simply a problem of uncertain or limited unavailability of food; it is a violation of a basic human right.

Acknowledgements For helpful comments on a previous draft, we thank Christine Porter and Anna Zajacova.

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest.

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