**Race, Immigration, Aging, and Health Inequality**

# Racial Stratification, Immigration, and Health Inequality: A Life Course-Intersectional Approach

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While health inequalities related to race/ethnicity, nativity, and age are well documented, it remains unclear how these axes of stratification combine to shape health trajectories, especially in middle and late life. This study addresses gaps in the literature by drawing on both life course and intersectionality perspectives to understand inequalities in morbidity trajectories. Using growth curve models applied to data from the Health and Retirement Study, I examine the life course patterning of health inequalities among US- and foreign-born non-Hispanic whites, non-Hispanic blacks, and Mexican Americans between the ages of 51 and 80 ($N = 16{,}265$). Findings are consistent with premature aging and cumulative disadvantage processes: US- and foreign-born blacks and Mexican Americans experience earlier health deterioration than US-born whites, and they also tend to exhibit steeper health declines with age. Moreover, contrary to the common assumption of monolithic healthy immigrant and erosion processes, results show that these processes are contingent on both race/ethnicity and age: compared with US-born whites, white immigrants have a persistent health advantage, while black and Mexican American immigrants experience a health disadvantage that increases with age. These results suggest that among nonwhite immigrants, the immigrant health advantage may be offset by cumulative exposure to racialized immigrant incorporation processes. A wide array of health-related factors including socioeconomic resources, health behaviors, and medical care account for some, but not all, group differences in morbidity trajectories. Findings highlight the utility of life course and intersectionality perspectives for understanding health inequalities.

Health inequality in America is stark. Understanding how social inequalities lead to unequal health outcomes in later life is particularly important given that the older population in the United States is growing and diversifying with respect to race/ethnicity and nativity (Hummer and Hayward 2015). Because of population aging and shifting migration patterns over the past half century, more than one in five people in the United States will be over the age of 65 in 2030, and racial/ethnic minority groups and immigrants will comprise increasing shares of older adult

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cohorts (Ortman, Velkoff, and Hogan 2014). These complex changes in population composition are likely to have far-reaching consequences throughout US society, especially for the health care system and overall population health.

A plethora of studies have documented health inequalities along racial/ethnic or nativity lines. US-born black and Mexican American adults, for example, experience worse health relative to US-born whites, owing to systemic racism and the ensuing unequal life chances across myriad domains (Reskin 2012; Williams and Mohammed 2013). Immigrants, on the other hand, tend to have better health relative to their US-born counterparts (Elo, Mehta, and Huang 2011). This is due in part to migration selection processes and immigrants' salutary sociocultural resources (Riosmena, Wong, and Palloni 2013). The immigrant health advantage, however, appears to erode over time, as immigrants experience negative forms of acculturation and distress stemming from discrimination as they are incorporated into US society (Antecol and Bedard 2006; Waters and Pineau 2015).

Prior research, however, has typically examined these health differences separately for racial/ethnic or nativity groups rather than using an intersectional lens to examine the contingent health consequences of race/ethnicity *and* nativity. Furthermore, the previous dependence on cross-sectional or retrospective data has obscured the life course patterning of health inequalities, including increasing disparities with age and the putative health erosion processes experienced by nonnative groups. Thus, it still remains unclear how racial/ethnic stratification and immigration intersect to shape health trajectories across life stages, especially in middle and late life. Several important questions persist: 1) Do US- and foreign-born blacks and Mexican Americans experience higher levels of morbidity earlier in life, compared to US-born whites? 2) Do health inequalities at the intersection of race/ethnicity and nativity increase or decrease with age? 3) Are healthy immigrant effects and erosion processes contingent on race/ethnicity and age?

This study draws on life course and intersectionality perspectives to address these questions by examining how racial/ethnic inequality, nativity, and age intersect to influence morbidity trajectories—defined by the timing and rate of accumulation of chronic conditions and functional limitations—among native- and foreign-born whites, blacks, and Mexican Americans during middle and late life. Importantly, the present study extends prior research in several ways. First, this study explicitly tests the intersecting consequences of race/ethnicity, nativity, and age, rather than examining them separately. Second, health is conceptualized and modeled as a dynamic process, using longitudinal data and methods to estimate group differences in age trajectories of health. Third, retrospective measures of duration of US residency in tandem with analyses of *prospective* health trajectories are used to provide a more complete picture of 1) post-immigration health changes, and 2) racial/ethnic and age variations in healthy immigrant and erosion processes. Fourth, the present study investigates group differences in trajectories of multiple (rather than single) health outcomes including composite measures of life-threatening chronic conditions and functional limitations—both of which increase in prevalence and severity in middle and later life. Finally, this study provides a better understanding of the extent to which differential socioeconomic resources, health behaviors, and medical care account for racial/ethnic and nativity inequalities in age patterns of health.

## Background

### Racial/Ethnic Inequalities in Health

In addition to having shorter life expectancies, US-born non-Hispanic blacks (hereafter referred to as blacks) experience worse health than US-born non-Hispanic whites (hereafter referred to as whites) across an array of chronic conditions including diabetes, arthritis, hypertension, stroke, and heart disease, as well as functional limitations (Farmer and Ferraro 2005). Health inequalities are typically defined as avoidable health gaps between marginalized racial/ethnic groups and native-born whites, as the latter are the largest and most economically, socially, and politically advantaged subgroup in the United States (see Hummer and Hayward 2015). Health inequalities between Mexican Americans and whites also exist, but are less uniform across health conditions. Relative to whites, US-born Mexican Americans have lower rates of cancer and heart disease (Pleis, Ward, and Lucas 2010) and slightly longer or comparable life expectancies (Lariscy, Hummer, and Hayward 2015), but they have higher rates of diabetes and kidney and liver disease (Pleis, Ward, and Lucas 2010) and poorer functional health (Hummer and Hayward 2015; Markides et al. 2007).

Importantly, within racialized societies such as the United States (Bonilla-Silva 2017), racism is a fundamental cause of racial/ethnic inequalities in health because it leads to unequal access to health-related resources as well as differential exposure to health risks across the life course (Phelan and Link 2015; Reskin 2012). Given that socioeconomic resources have salutary effects on health (Elo 2009) and that blacks and Mexican Americans are disadvantaged relative to whites across an array of socioeconomic factors (e.g., education, income, wealth, and occupation; Brown 2016; Massey 2007), research on mechanisms underlying racial/ethnic inequalities in health has largely focused on the role of socioeconomic status (SES). Studies have also examined whether differential health behaviors (e.g., smoking, high alcohol consumption, and obesity) and access to medical care contribute to these health gaps (Warner and Brown 2011). However, findings suggest that group differences in SES, health behaviors, and medical care do not fully account for racial/ethnic inequalities in health (Boen 2016; Haas and Rohlfsen 2010; Hayward et al. 2000). Mounting empirical evidence indicates that other factors such as residential segregation, incarceration, racist ideology, and exposure to discrimination and other stressors across the life course also contribute to racial/ethnic inequalities in health (Williams and Mohammed 2013).

### Immigrant Health

Health inequalities along nativity lines are also evident, with immigrants exhibiting lower rates of chronic conditions such as cancer, diabetes, heart disease, hypertension, and stroke (Dey and Lucas 2006; Gorman, Read, and Krueger 2010), better functional health (Markides et al. 2007), and lower mortality rates than their US-born counterparts (Dupre, Gu, and Vaupel 2012). Several explanations have been proposed to explain immigrants' better health vis-à-vis native-born populations. The "healthy migrant" explanation states that migration is selective on numerous

characteristics, and consequently, those who migrate to the United States are healthier than their native-born counterparts (Riosmena, Wong, and Palloni 2013). Alternatively, the "salmon bias" explanation asserts that the relatively good health and low rates of adult mortality among immigrants in the United States are statistical artifacts, owing to the return migration of migrants in poor health (Palloni and Arias 2004). However, this bias is likely too small to fully account for the healthy immigrant pattern observed among Hispanics (Riosmena, Wong, and Palloni 2013). A third explanation focuses on the roles of immigrant health behaviors and social ties that provide sociocultural buffers against poor health (Abraido-Lanza, Chao, and Florez 2005). Specifically, relative to their US-born counterparts, immigrants are less likely to smoke, drink alcohol excessively, or be obese (Dey and Lucas 2006), and they have higher levels of social support (Jasso et al. 2004). Indeed, Mexican American immigrants' favorable health profiles are attributable, in large part, to low prevalence rates of smoking (Fenelon 2013). Furthermore, they would have even better health relative to their US-born counterparts if not for their lower levels of socioeconomic resources (Lariscy, Hummer, and Hayward 2015) and disproportionate concentration in physically demanding and low-autonomy occupations—which negatively affect health (Hayward et al. 2014).

The healthy immigrant effect appears to erode the longer immigrants reside in the United States (Antecol and Bedard 2006; Elo, Mehta, and Huang 2011). Several studies suggest that among middle-aged and older Mexican immigrants, those who have resided in the United States for longer periods of time have worse biological risk profiles than immigrants with shorter tenures in the United States (Crimmins et al. 2007). This erosion process is typically attributed to *acculturation*, or the process by which individuals acquire the "behaviors, attitudes, and values prevalent within American society" (Lopez-Class, Castro, and Ramirez 2011, 1558). However, research suggests that although length of residence in the United States is positively associated with risk factors (e.g., smoking, heavy drinking, and obesity) and higher rates of chronic conditions (Gorman, Read, and Krueger 2010), it is also associated with higher levels of physical activity (Abraido-Lanza, Chao, and Florez 2005). Thus, evidence for the health behavior and acculturation explanations is mixed (Jasso et al. 2004). It is important to note that many prior studies are based on cross-sectional data—which cannot account for the confounding effects of age, cohort, mortality selection, and return migration—and may underestimate the pathogenic consequences of acculturative stress. Furthermore, much of the literature on immigrant-native disparities in health has focused on Mexican Americans, paying little attention to the morbidity patterns among black and white immigrants (see Elo et al. 2011; Melvin et al. 2014 for exceptions) and the roles that anti-black racism and anti-immigrant sentiments both play in the erosion of healthy immigrant effects.

## Intersectionality and Life Course Lenses on Race/Ethnicity, Nativity, Age, and Health

While considerable research documents the unequal distribution of health by race/ethnicity and nativity, few studies have examined how these statuses intersect to

shape health. Intersectionality perspectives on health highlight how intersecting social statuses result in unique social contexts that differentiate the lived experiences and health pathways among broadly defined social groups (Ailshire and House 2011; Brown et al. 2016).[1] A key premise of intersectionality is that social statuses are interlocking and have simultaneous effects (Collins and Bilge 2016; Choo and Ferree 2010). Thus, within racialized societies, the health effects of nativity may be contingent on race/ethnicity (Viruell-Fuentes, Miranda, and Abdulrahim 2012). This is consistent with the notion that as immigrants become incorporated into US society, they are positioned within the racial/ethnic stratification system, most often based on their phenotypic characteristics (Bonilla-Silva 2017; Waters and Pineau 2015). To the extent that white immigrants reap health benefits associated with the privileges of whiteness (Malat, Mayorga-Gallo, and Williams 2017) as well as favorable health selection processes and health-protective behaviors, they are likely to exhibit better overall health profiles than their US-born counterparts. Several studies suggest that foreign-born whites have lower rates of chronic conditions and functional limitations than US-born whites (Melvin et al. 2014; Sing and Siahpush 2002). The process of incorporation into the United States for black and Mexican American immigrants, however, more likely entails deleterious health consequences. In addition to their exposure to general acculturative stressors (e.g., adapting to a new country, language barriers, and legal status stressors), black and Mexican American immigrants are marginalized and stigmatized as a result of being exposed to nativism and "othering" experiences based on beliefs that they are "un-American" and exposed to institutional, cultural, and interpersonal racism (Angel, Buckley, and Sakamoto 2001; Bonilla-Silva 2017; Waters 2014). These experiences undermine their health (Philbin et al. 2018; Viruell-Fuentes 2007). If the healthy immigrant effect is offset by the harmful effects of exposure to racism and nativism, black and Mexican American immigrants may have comparable or even worse health than US-born whites (see Hamilton and Hummer 2011; Hummer and Hayward 2015; Melvin et al. 2014). Such patterns are especially likely in later life given that healthy immigrant effects appear to be strongest in early and midlife (Gubernskaya 2015; Melvin et al. 2014), and that many older black and Mexican immigrants have endured considerable cumulative exposure to racialized incorporation processes over the life course. Thus, intersectional perspectives call into question the uniformity of the existence and the patterns of change in healthy immigrant effects across racial/ethnic groups and age.

The heterogeneous age patterning of health inequalities at the intersection of race/ethnicity and nativity is not well understood. Few studies have examined how healthy immigrant and erosion processes are contingent on race/ethnicity, and virtually none have done so using longitudinal data and life course perspectives (Jasso et al. 2004). Life course perspectives on population health processes underscore how a constellation of social factors shape health trajectories—that is, long-term patterns of stability and change in health with age—and lead us to expect that race/ethnicity and nativity combine in different ways to shape the *timing* and *rate of accumulation* of health problems. For example, life course research on race/ethnicity indicates that middle-aged US-born blacks and Mexican Americans experience

"premature aging" (earlier physiological "wear and tear"), as evidenced by findings that their health profiles are comparable to US-born whites that are much older (Brown, O'Rand, and Adkins 2012; Geronimus et al. 2006; Taylor 2008). It remains unclear exactly how race/ethnicity and nativity jointly shape the timing of health decline. However, a healthy immigrant effect would imply *earlier* health problems for US natives, while the many racialized disadvantages faced by black and Mexican American immigrants may lead to earlier health problems than would otherwise be expected given their potential immigrant health advantage (see Viruell-Fuentes, Miranda, and Abdulrahim 2012; Waters and Pineau 2015).

In addition to the question of whether certain racial/ethnic-nativity groups experience health problems earlier in life than others, it is also unclear whether health inequalities at the intersection of race/ethnicity and nativity persist, increase, or decrease with age. The literature on intra-cohort inequality dynamics across the life course has examined several hypotheses—persistent inequality, cumulative disadvantage, and aging as leveler—regarding how health inequalities along racial/ethnic or nativity lines unfold over time. The *persistent inequality* hypothesis predicts that health gaps between social groups are stable with age (Henretta and Campbell 1976). While several longitudinal studies have found that racial inequalities in health persist in later life (Kelley-Moore and Ferraro 2004; Warner and Brown 2011), the relatively scarce attention to whether and how age moderates the joint impacts of race/ethnicity and nativity on morbidity reflects an implicit assumption (rather than evidence) that health disparities along these lines are constant over time. Instead, more support continues to build for the *cumulative disadvantage* hypothesis that predicts that structural disadvantages early in life lead to further disadvantages and increased risk exposures, and ultimately widening inequalities with age (Dannefer 2003; O'Rand 2009; Willson, Shuey, and Elder 2007). The accumulation of advantages for some and cascading disadvantages for others results in increasing intra-cohort inequality over the life course (Ferraro, Shippee, and Schafer 2009). For example, if blacks and Mexican Americans (US- and foreign-born) experience accelerated health declines relative to US-born whites, inequalities in health would be expected to increase as individuals age.

Finally, the *aging-as-leveler* hypothesis predicts that inequalities in health appear to dissipate in later life. However, the key mechanism responsible for apparent leveling in later life—mortality selection—is likely to result from cumulative disadvantage processes prior to later life (Taylor 2008). Mortality selection reflects the process by which those with the worst health are the least likely to survive to older ages, leaving the impression of reduced inequalities in health (and a possible black-white mortality crossover) among surviving adults (Dupre et al. 2012). Declining health inequalities in later life may also stem from another mechanism—the ability of advantaged groups to delay the onset and/or progression of health problems. This would effectively compress their morbidity to later life, when they experience more accelerated frailty than disadvantaged groups and are disproportionately impacted by the deleterious consequences of aging (House et al. 2005; Willson, Shuey, and Elder 2007). Furthermore, several studies have shown weak/no effects of nativity and duration in the United States on health among older adults (Choi 2012; Ro and Gee 2012; Wakabayashi 2010), suggesting these effects are more important earlier in adulthood, while the force of mortality may have a leveling

effect at advanced ages. It is important to note that these alternative life course hypotheses (i.e., persistent inequality, cumulative disadvantage, and aging as leveler) *may not* be mutually exclusive (Willson, Shuey, and Elder 2007). A handful of longitudinal studies have found that racial/ethnic inequalities in health increase through midlife and subsequently decrease in later life, though these studies have often excluded immigrants or ignored the role of nativity (Brown, O'Rand, and Adkins 2012; Shuey and Willson 2008) or relied on pooled cross-sectional data (Melvin et al. 2014). Only prospective longitudinal data taking mortality selection into account can adjudicate among these hypotheses.

This study aims to test several interrelated hypotheses drawn from a life course-intersectional framework. The first several hypotheses involve how race/ethnicity and nativity intersect to shape health trajectories of blacks and Mexican Americans *relative to US-born whites*. Because earlier and more rapid health deterioration with age results from differential exposure to disadvantage and may result in mortality selection at advanced ages, I hypothesize that:

> H1a: Compared to US-born whites, US-born blacks and Mexican Americans will experience premature aging, characterized by higher levels of morbidity at younger ages.
>
> H1b: Health inequalities between US-born whites and US-born blacks and Mexican Americans will increase with age, with some leveling at advanced ages.

Informed by research on racial inequalities in health trajectories, healthy immigrant effects, and race-based and acculturative stressors, I hypothesize that:

> H2a: Compared to US-born whites, foreign-born blacks and Mexican Americans will not exhibit a healthy immigrant effect, and will instead experience premature aging, characterized by higher levels of morbidity at younger ages.
>
> H2b: Health inequalities between US-born whites and foreign-born blacks and Mexican Americans will increase with age, with some leveling at advanced ages.

These patterns would reflect racialized immigrant incorporation and cumulative disadvantage processes. Hypotheses 3a and 3b pertain to *within-race* healthy immigrant effects. Based on prior research identifying immigrant health advantages, I hypothesize that:

> H3a: Relative to their same-race US-born counterparts, foreign-born individuals will exhibit health problems *later* in life.

Moreover, given that aging and assimilation processes occur simultaneously and both tend to have deleterious effects on health, I hypothesize that:

> H3b: Relative to their same-race US-born counterparts, immigrants—especially nonwhite immigrants—will experience accelerated health declines with age, resulting in dissipating intra-racial inequalities between native and immigrant groups.

Hypothesis 4 relates to the duration of residence in the United States by immigrants. Based on findings from several recent studies, I hypothesize that:

> H4: Immigrants with longer durations in the United States will have diminished levels of health and steeper health declines than those with shorter durations in the United States, though the magnitude of these erosion effects on immigrant health are likely to be modest. Consequently, the health gaps between those with longer and shorter durations are expected to increase with age.

Deleterious health consequences of duration of residence are particularly likely among blacks and Mexican Americans, as they are more likely than white immigrants to experience the harmful effects of racism and nativism. The final hypothesis relates to the mediators of the identified health inequalities. In light of unequal life chances across myriad domains and differential exposures to an array of health risks, I hypothesize that:

> H5: Accounting for differences in SES, health behaviors, and medical care will partially explain racial/ethnic-nativity inequalities in health levels and rates of change, though the extent to which these factors account for inequalities will vary across different groups given their heterogeneous experiences.

## Data and Methods

### *Sample*

Data from waves 1 through 11 of the Health and Retirement Study (HRS) are used. The target population for the HRS includes all English- or Spanish-speaking adults in the contiguous United States over the age of 50 (spouses of respondents were interviewed regardless of age eligibility). Respondents were interviewed biennially between 1992 (wave 1) and 2012 (wave 11). Response rates ranged from 81 to 91 percent. The first interviews for the 1931–1941, 1942–1947, 1948–1953, and 1954–1959 birth cohorts were in 1992, 1998, 2004, and 2010, respectively. Blacks and Hispanics were oversampled, and the institutionalized were excluded, with the exception of a small number of respondents who were institutionalized after their baseline interview. Thus, levels of morbidity may be somewhat understated given the exclusion of institutionalized populations at baseline. Analyses are based on 16,265 respondents (11,131 US-born whites, 471 foreign-born whites, 3,181 US-born blacks, 227 foreign-born blacks, 611 US-born Mexican Americans, and 644 foreign-born Mexican Americans).

### *Dependent Variables*

#### Chronic Conditions

Respondents were asked, "Has a doctor ever told you that you have (had a) [condition]?" Chronic conditions examined in this study included cancer, diabetes, heart disease, hypertension, and stroke, which are unified by their life-threatening

nature. As is conventional in previous research, I used a summary measure of the total number of chronic conditions ever diagnosed, ranging between 0 and 5 (Gorman, Read, and Krueger 2010; Kahn and Fazio 2005). An index was used for several reasons: 1) it better captures the multifaceted nature of health and the broad health consequences of social statuses (Aneshensel 2005) than an indicator of a single disease; 2) an index provides a more parsimonious approach than analyzing single items (Farmer and Ferraro 2005); and 3) it is less likely than binary measures to lead to insufficient statistical power (Ferraro and Wilmoth 2000). Ancillary analyses indicated that results of this study were robust to the exclusion of each life-threatening condition, suggesting that the results were not being driven by a single condition. Analyses controlled for whether respondents had private health insurance to partially account for measurement error in the evaluation of serious illnesses among respondents with limited access to care. Prior research indicates that there is a high level of agreement between self-reported and physician-evaluated morbidity for life-threatening conditions among older adults (Skinner et al. 2005).

#### Functional Limitations

In waves 2 through 11, respondents were asked whether they had difficulty performing a set of tasks, including walking several blocks, walking one block, walking across the room, sitting for two hours, getting up from a chair after having sat for a while, climbing several flights of stairs, climbing a single flight of stairs, stooping, kneeling, or crouching, lifting or carrying 10 pounds, picking up a dime off a table, raising one's arms above one's shoulders, and pushing or pulling large objects such as furniture. Consistent with prior research, I used a summary measure of the total number of limitations ranging from 0 to 12 (Cronbach's alpha = 0.84). The functional limitation measure in wave 1 is not included because it is not comparable to measures in subsequent waves (see Haas and Rohlfsen 2010).

### *Demographic Variables*

Six dummy variables index *racial/ethnic/nativity groups*: 1) non-Hispanic white, native-born; 2) non-Hispanic white, foreign-born; 3) non-Hispanic black, native-born; 4) non-Hispanic black, foreign-born; 5) Mexican American, native-born; and 6) Mexican American, foreign-born. Consistent with prior research, native-born whites are the primary reference group (e.g., Hummer and Hayward 2015), though supplemental analyses also estimate immigrant-native inequalities within racial/ethnic groups. Respondents are classified as white or black if they indicated that they considered themselves, respectively, as primarily "White or Caucasian" or "Black or African American" and did not report any Hispanic/Latino ethnicity. Individuals are classified as Mexican American if they reported that they considered themselves to be "Hispanic or Latino" and that they were "Mexican American" or "Chicano." Other racial/ethnic groups are excluded due to small sample sizes. *Sex* is measured by a dummy variable (1 = female; 0 = male). Both *age* (measured in years) and $age^2$ are included in the analysis to capture different patterns of health changes over the life course. *Duration of residence in the United*

*States* (years) is measured at baseline for immigrants, using a conditionally relevant variable approach, which interacts duration with nativity status (see Ro and Gee 2012 for details on this method). The duration measure is centered at the mean in order to facilitate interpretation and avoid multicollinearity with other temporal measures; ancillary analyses using non-linear and categorical measures of duration in the United States yielded similar results. To account for potential birth cohort effects, analyses control for (approximately) five-year *birth cohorts*: 1931–1934; 1935–1939; 1940–1944 (reference); 1945–1949; 1950–1953.[2] Analyses also use dummy variables to control for *geographic region* (Northeast [reference]; South; Midwest; West). *Marital status* (unmarried = 1; 0 = otherwise) is also included because it is known to be predictive of health and to vary by race/ethnicity/nativity. Finally, indicators of *number of waves missing* and *death* during the observation period are included in all models to adjust for differential rates of attrition.

## Social and Economic Resources

Given the robust SES-health relationship and well-documented racial/ethnic and nativity difference in SES, multivariate analyses include several SES measures, including respondent's *educational attainment* (in years), *occupation type for longest-held job*, *logged household income* (total income from all sources), and *logged household net worth* (total assets – total liabilities). Occupation type for longest-held job is captured by dummy variables indicating whether the job was upper white collar, lower white collar, blue collar (reference), or never worked for pay (see Carr 2012). Income and wealth measures were logged to reduce the skewness of their distributions. They were transformed into 2012 dollars using the Consumer Price Index (CPI), and include personal resources for unmarried respondents and resources from both spouses (partners) for married (cohabiting) respondents. In addition, income and wealth equivalencies across households were created by dividing income and wealth by the square-root of household member size (Brady 2009).

## Health Behaviors

Analyses included several measures of health behaviors because they are proximate determinants of health. Weight variables indicate whether respondents are underweight (BMI < 18.5), normal weight (BMI of 18.5–25; reference group), overweight ($25 < \text{BMI} \leq 30$), or obese (BMI > 30). Three dummy variables for smoking history indicate whether the respondent is a current smoker, former smoker, or never smoked (reference group). *Heavy drinking* is measured by a dummy variable (1 = 3+ drinks/day; 0 = otherwise).

## Medical Care

Because health care access and utilization vary by race/ethnicity and nativity and are related to health and knowledge of health conditions, dummy variables

indicate whether respondents have private health insurance (1 = yes), and whether they have been to the doctor (1 = yes) or hospital (1 = yes) in the past year.

## Analytic Strategy

Random coefficient growth curves were modeled within a mixed model (i.e., hierarchical linear model) framework to investigate racial/ethnic/nativity differences in health trajectories between the ages of 51 to 80. These models are well suited for assessing individual change with age, where repeated observations (Level 1) are nested within respondents (Level 2) (Raudenbush and Bryk 2002). Growth curve models generate individual trajectories determined by person-specific intercepts (initial values) and slopes (rate of changes across age). These models describe intra-individual patterns of change in health as a function of age. Comparisons of nested likelihood ratio tests (LRTs) of various shapes of health trajectories (e.g., linear, quadratic, or cubic models) suggested that a quadratic growth curve with random intercepts and random linear and quadratic age slopes provided the best fit to the data. Sets of independent variables are added to the model to examine the extent to which they account for observed racial/ethnic-nativity inequalities in health intercepts and slopes (see Raudenbush and Bryk 2002). All variables are time-varying except measures of race/ethnicity/nativity, gender, cohort, length of residence in the United States at baseline, and smoking history. Time-varying measures are lagged ($t - 1$). Continuous covariates are mean-centered to facilitate model interpretation.

To assess the extent to which age-based trajectories across subgroups are consistent with premature aging processes, this study utilizes age-equivalent profiles, which provide comparisons of the average ages when different race/ethnicity/nativity subgroups experience comparable levels of morbidity (Zajacova, Karas-Montez, and Herd 2014). Evidence of premature aging processes is found if, relative to US-born whites, racial/ethnic minorities (US- or foreign-born) exhibit higher levels of morbidity at younger ages. In addition, to address the question of whether health inequality is stable, increasing, or decreasing with age, I test whether and how race/ethnicity/nativity interact with age to impact health (Willson, Shuey, and Elder 2007). Whereas a lack of statistical significance of race/ethnicity/nativity × age (and age-squared) interaction terms is considered support for the persistent inequality hypothesis, support for the cumulative disadvantage hypothesis would be found if race/ethnicity/nativity × age-slope interaction terms are significant and result in increasing health inequality with age, and significant age-slope interactions leading to converging health disparities would be consistent with the aging-as-leveler hypothesis. Notably, previous studies have found that interactions between race/ethnicity and both age and age-squared were simultaneously significant but in opposite directions, providing support for both the cumulative disadvantage and leveling hypotheses (Shuey and Willson 2008).

Given racial/ethnic/nativity differences in missing waves and mortality rates (see table 1), and the selective nature of attrition, conventional methods that exclude respondents with incomplete data yield biased estimates of inequalities in health trajectories. To minimize prospective selection biases, this study incorporates

respondents who were observed at least once, including those who attrited, during the observation period (Raudenbush and Bryk 2002). Furthermore, to adjust for racial/ethnic/nativity differences in mortality and dropout attrition, indicators of death and number of waves missing are included in all multivariate models. In addition, Stata's Multiple Imputation by Chained Equations (MICE) procedures are implemented to adjust for incomplete data (10 multiply imputed datasets). Analyses are performed using Stata 14.2 and weighted using sampling weights.

## Results

Table 1 presents descriptive statistics by race/ethnicity and nativity. As expected, results reveal that whites have better health than blacks and Mexican Americans, and there is clear evidence of an immigrant health advantage within racial/ethnic groups. Findings also show that racial/ethnic minorities are disadvantaged on an array of factors. For example, compared to US-born whites, US-born blacks and Mexican Americans have less education, income, and wealth, and are more likely to work in a blue-collar occupation and be unmarried, obese, and uninsured.

Interestingly, whereas foreign-born blacks and whites have greater socioeconomic resources than their native-born counterparts, the reverse is true with regard to Mexican Americans. Consistent with the health behaviors hypothesis, foreign-born respondents are less likely than their same-race US-born counterparts to exhibit risky health behaviors. Importantly, foreign-born Mexican Americans are much less likely than US-born whites or Mexican Americans to have health insurance or have visited the doctor recently.

Table 2 provides estimates from growth curve models of chronic conditions and functional limitations. All models control for birth cohort, gender, health insurance, region, marital status, and death and dropout attrition. Results in table 2 show that health intercepts and age slopes vary by both race/ethnicity and nativity. Figures 1–4 summarize key results by illustrating the magnitude and shape of model-implied morbidity inequalities, based on estimates from base models in table 2. The horizontal lines provide visual representations of the ages at which subgroups experience comparable morbidity levels (Zajacova, Karas-Montez, and Herd 2014). Collectively, results from table 2 and figures 1 and 2 provide evidence that blacks and Mexican Americans (US- and foreign-born) experience higher levels of morbidity at younger ages than US-born whites, and that the healthy immigrant and erosion effects are shaped by the intersection of race/ethnicity and age.

Figure 1 shows the patterns of racial/ethnic inequalities among individuals born in the United States. There is strong support for Hypothesis 1a, which predicted premature aging among US-born racial/ethnic minorities relative to US-born whites. The chronic condition levels of US-born whites are reached as many as six years earlier by US-born blacks and Mexican Americans (figures 1a and c). Further, US-born blacks and Mexican Americans experience higher levels of functional limitations as many as 11 and 12 years earlier than native-born whites, respectively (figures 1b and d).

**Table 1. Weighted Descriptive Statistics, by Race/Ethnicity and Nativity[ab]**

| | Whites | | Blacks | | Mex. Americans | |
|---|---|---|---|---|---|---|
| | (USB) | (FB) | (USB) | (FB) | (USB) | (FB) |
| **Outcomes** | | | | | | |
| Chronic Conditions | .58 | .49* | .95*† | .74* | .71*† | .55 |
| Functional Limitations | 1.85 | 1.46* | 2.87*† | 1.55* | 2.74* | 2.20* |
| **Socioeconomic Resources** | | | | | | |
| Years of Education | 13.14 | 13.32 | 12.04*† | 12.65* | 10.69*† | 6.47* |
| Income (Ln) | 10.52 | 10.66 | 9.67* | 9.75* | 9.67*† | 8.45* |
| Net Worth (Ln) | 10.60 | 11.89* | 6.35* | 6.52* | 8.58*† | 6.77* |
| Occupation Type | | | | | | |
| Upper White Collar | .33 | .39* | .18*† | .23* | .17*† | .04* |
| Lower White Collar | .26 | .21* | .20* | .25 | .20*† | .11* |
| Blue Collar (ref) | .35 | .31 | .51* | .44* | .50*† | .65* |
| Never Worked in job 5+ years | .06 | .09* | .11* | .07 | .13*† | .20* |
| **Health-Related Behaviors** | | | | | | |
| Weight | | | | | | |
| Underweight | .02 | .02 | .02 | .02 | .01 | .09 |
| Normal weight (ref) | .34 | .36 | .22* | .21* | .21* | .19* |
| Overweight | .40 | .44 | .36† | .43* | .43 | .40 |
| Obese | .24 | .18* | .40*† | .34* | .35* | .32* |

(*Continued*)

**Table 1.** ***continued***

| | Whites | | Blacks | | Mex. Americans | |
|---|---|---|---|---|---|---|
| | (USB) | (FB) | (USB) | (FB) | (USB) | (FB) |
| Smoking Status | | | | | | |
| Never Smoked (ref) | .37 | .39 | .36† | .66* | .39† | .51* |
| Former Smoker | .37 | .40 | .31*† | .23* | .37† | .31* |
| Currently Smokes | .26 | .21* | .33*† | .11* | .24 | .18* |
| Drinker (3+Drinks/Day) | .10 | .08 | .10 | .06 | .15 | .13 |
| **Medical Care** | | | | | | |
| Doctor Visit | .84 | .82 | .86 | .89 | .77*† | .62* |
| Hospital Visit | .13 | .12 | .20* | .15 | .15 | .12 |
| **Demographics & Controls** | | | | | | |
| Age | 54.71 | 54.90 | 54.48† | 53.85* | 54.27* | 54.01 |
| Years in the U.S. | | 31.94 | | 23.06 | | 27.22 |
| Unmarried | .25 | .21 | .55*† | .42* | .32* | .25* |
| Female | .49 | .54 | .58* | .48 | .49 | .48 |
| Birth Cohort | 1942 | 1942 | 1945 | 1948* | 1945 | 1948* |
| Private Health Insurance | .81 | .79 | .58*† | .71* | .57*† | .30* |
| No. of Missing Waves | 2.14 | 2.26 | 2.12† | 1.69* | 1.83*† | 1.46* |
| Died | .19 | .14 | .24*† | .07* | .18† | .09* |
| N | 11,131 | 471 | 3,181 | 227 | 611 | 644 |

[a]Based on information from respondents' first interview.
[b]USB and FB refer to respondents who are US-born and foreign-born, respectively.
†$p < .05$ for comparison between the U.S.- and foreign-born within racial/ethnic groups.
*$p < .05$ for comparison of racial/ethnic/nativity group to U.S.-born Whites.

**Table 2. Race/Ethnicity, Nativity and Age-Trajectories of Morbidity Among Adults Ages 51-80: Random Coefficient Growth Curve Models**

| | Chronic Conditions | | | Functional Limitations | | |
|---|---|---|---|---|---|---|
| *Fixed Effects* [abcd] | 1 | 2 | 3 | 1 | 2 | 3 |
| **Intercept** | .630*** | .646*** | .542*** | 1.655*** | 2.076*** | 1.923*** |
| | (.021) | (.022) | (.025) | (.078) | (.075) | (.082) |
| White (FB) | −.137** | −.134* | −.140** | −.472** | −.476** | −.435** |
| | (.059) | (.058) | (.057) | (.171) | (.172) | (.172) |
| Black (USB) | .287*** | .260*** | .248*** | .661*** | .386*** | .322*** |
| | (.019) | (.019) | (.019) | (.097) | (.095) | (.093) |
| Black (FB) | .035 | .010 | .008 | −.312 | −.619** | −.561* |
| | (.064) | (.065) | (.063) | (.245) | (.238) | (.237) |
| Mexican American (USB) | .151** | .102** | .099** | .757*** | .184 | .164 |
| | (.039) | (.039) | (.038) | (.193) | (.183) | (.180) |
| Mexican American (FB) | −.112** | −.255*** | −.240*** | −.060 | −1.694*** | −1.520*** |
| | (.044) | (.048) | (.047) | (.177) | (.187) | (.184) |
| Years in U.S. (White) | .008* | .008* | .008* | .013 | .015 | .012 |
| | (.003) | (.003) | (.003) | (.012) | (.011) | (.011) |
| Years in U.S. (Black) | .016** | .017* | .018** | .018 | .034 | .029 |
| | (.005) | (.006) | (.006) | (.026) | (.025) | (.024) |
| Years in U.S. (Mex. Amer.) | .003 | .004 | .004 | .020 | .035* | .030* |
| | (.003) | (.003) | (.003) | (.015) | (.015) | (.014) |
| **Linear Slope (Age)** | .037*** | .037*** | .039*** | .042*** | .049*** | .044*** |
| | (.001) | (.001) | (.001) | (.006) | (.006) | (.006) |
| White (FB) | .005 | .004 | .005 | −.002 | −.001 | −.012 |
| | (.007) | (.008) | (.007) | (.032) | (.001) | (.030) |

(*Continued*)

**Table 2.** ***continued***

| *Fixed Effects* [abcd] | Chronic Conditions | | | Functional Limitations | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 |
| Black (USB) | .010*** (.003) | .010*** (.003) | .010*** (.003) | .012 (.016) | .010 (.015) | .014 (.015) |
| Black (FB) | .033*** (.009) | .034*** (.009) | .033*** (.009) | .058 (.042) | .059 (.040) | .060 (.040) |
| Mexican American (USB) | −.007 (.005) | −.008 (.005) | −.009 (.005) | −.006 (.033) | −.019 (.032) | −.014 (.031) |
| Mexican American (FB) | .020** (.006) | .020** (.006) | .018** (.006) | .136*** (.038) | .112** (.037) | .113** (.038) |
| Years in U.S. (White) | −.001* (5.0E-4) | −.001* (5.0E-4) | −.001* (5.0E-4) | 3.8E-4 (.002) | 1.2E-4 (.001) | 2.2E-4 (.002) |
| Years in U.S. (Black) | −.003** (.001) | −.003** (.001) | −.003** (.001) | −.001 (.004) | −.001 (.003) | −.002 (.003) |
| Years in U.S. (Mex. Amer.) | −.001 (.001) | −.001 (.001) | −.001 (.001) | −.004 (.003) | −.004 (.003) | −.004 (.003) |
| **Quadratic Slope ($Age^2$)** | .001*** (5.0E-5) | .001*** (5.0E-5) | .001*** (5.0E-5) | .002*** (2.2E-4) | .002*** (2.2E-4) | .002*** (2.2E-4) |
| White (FB) | −4.9E-4 (3.3E-4) | 4.8E-4 (3.2E-4) | −4.6E-4 (3.2E-4) | −.001 (.001) | −.001 (.001) | −4.1E-4 (.001) |
| Black (USB) | −1.5E-4 (1.1E-4) | 1.4E-4 (1.1E-4) | −1.3E-4 (1.1E-4) | 3.4E-5 (.001) | 6.9E-5 (.001) | 2.4E-5 (.001) |
| Black (FB) | −.002*** (4.2E-4) | −.002*** (4.3E-4) | −.002*** (4.2E-4) | −.003 (.002) | −.003 (.002) | −.003 (.002) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mexican American (USB) | .001*** | .001*** | .001*** | .001 | .001 | .001 |
| | (2.3E-4) | (2.3E-4) | (2.3E-4) | (.001) | (.001) | (.001) |
| Mexican American (FB) | −.001* | −.001* | −.001* | −.005*** | −.004* | −.004* |
| | (2.9E-4) | (2.9E-4) | (2.8E-4) | (.002) | (.002) | (.002) |
| Years in U.S. (White) | 4.0E-5* | 4.0E-5* | 4.0E-5* | 6.7E-6 | 1.5E-5 | 2.2E-5 |
| | (2.0E-5) | (2.0E-5) | (2.0E-5) | (8.4E-5) | (7.5E-5) | (7.5E-5 |
| Years in U.S. (Black) | 1.3E-4** | 1.3E-4** | 1.3E-4** | 5.3E-5 | 6.9E-5 | 9.0E-5 |
| | (4.0E-5) | (4.0E-5) | (4.0E-5) | (1.5E-4) | (1.3E-4) | (1.3E-4) |
| Years in U.S. (Mex. Amer.) | 1.3E-5 | 1.3E-5 | 9.6E-6 | 4.0E-5 | 3.2E-5 | 3.9E-5 |
| | (2.3E-5) | (2.3E-5) | (2.2E-5) | (1.2E-4) | (1.2E-4) | (1.2E-4) |
| **Socioeconomic Resources** | | | | | | |
| Years of Education | | −.016*** | −.017*** | | −.185*** | −.175*** |
| | | (.003) | (.003) | | (.009) | (.009) |
| Income | | −.002* | −.001 | | −.031*** | −.028** |
| | | (.001) | (.001) | | (.005) | (.005) |
| Net Worth | | −.001** | −.001** | | −.018*** | −.018*** |
| | | (3.7E-4) | (3.7E-4) | | (.002) | (.002) |
| Occupation (ref. Blue Collar) | | | | | | |
| Upper White Collar | | −.009 | −.010 | | −.148** | −.140** |
| | | (.011) | (.011) | | (.051) | (.050) |
| Lower White Collar | | .014 | .011 | | −.095 | −.089 |
| | | (.012) | (.012) | | (.055) | (.054) |
| Never Worked 5+yrs | | .063** | .075*** | | .607*** | .651*** |
| | | (.018) | (.019) | | (.105) | (.105) |

(*Continued*)

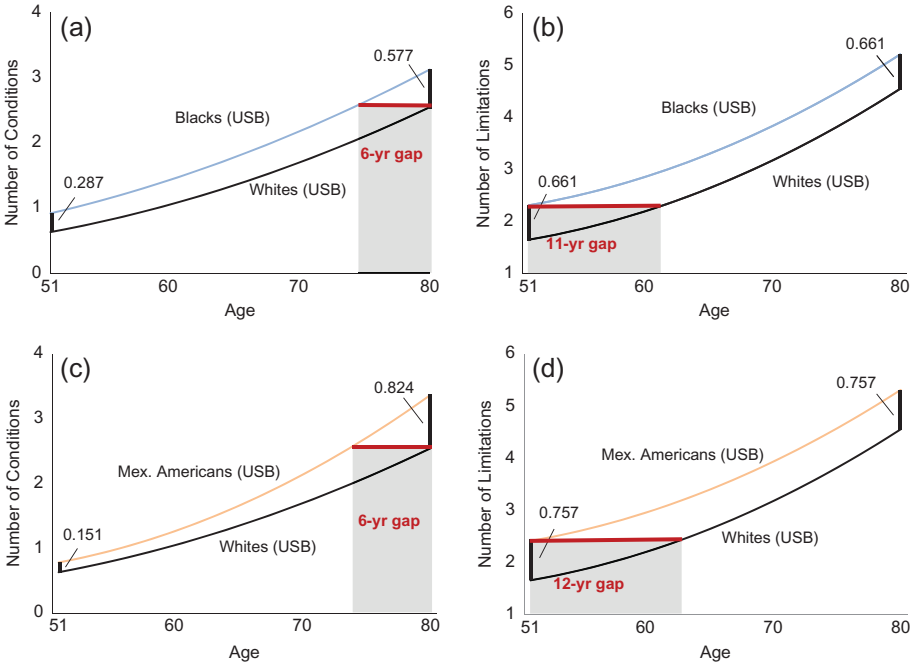
**Table 2.** ***continued***

| *Fixed Effects* [abcd] | Chronic Conditions | | | Functional Limitations | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 |
| **Health-Related Behaviors** | | | | | | |
| Weight (ref. normal weight) | | | | | | |
| Underweight | | | .041** (.012) | | | .267*** (.070) |
| Overweight | | | .017*** (.005) | | | .048* (.024) |
| Obese | | | .063*** (.006) | | | .294*** (.031) |
| Smoking Status (ref. never) Smoked | | | | | | |
| Former Smoker | | | .047*** (.013) | | | .373*** (.041) |
| Currently Smokes | | | −.038** (.014) | | | .386*** (.048) |
| Heavy Drinker | | | .017** (.006) | | | −.127*** (.032) |
| **Medical Care** | | | | | | |
| Doctor Visit | | | .069*** (.005) | | | .202*** (.024) |
| Hospital Visit | | | .103*** (.003) | | | .282*** (.021) |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Random Effects* | | | | | | |
| Level 1 Residual | .311***<br>(.001) | .311***<br>(.001) | .311***<br>(.001) | 1.361***<br>(.010) | 1.369***<br>(.010) | 1.370***<br>(.010) |
| Level 2 Age | .056***<br>(.001) | .056***<br>(.001) | .054***<br>(.001) | .118***<br>(.004) | .113***<br>(.003) | .110***<br>(.003) |
| Level 2 Age$^2$ | .002***<br>(3.3E-5) | .002***<br>(3.3E-5) | .002***<br>(3.2E-5) | .004***<br>(1.6E-4) | .004***<br>(1.4E-4) | .004***<br>(1.5E-4) |
| Level 2 Intercept | .759***<br>(.005) | .756***<br>(.005) | .737***<br>(.005) | 2.291***<br>(.022) | 2.178***<br>(.021) | 2.109***<br>(.021) |

**Notes**: N = 16,265 for chronic condition models and 15,806 for functional limitation models;
[a]All models control for cohort, gender, region, marital status, number of waves missing and whether respondents died (chronic condition models also control for health insurance);
[b]White U.S.-born serves as the racial/ethnic reference group;
[c]Robust standard errors are shown in parentheses;
[d]USB and FB refer to respondents who are US-born and foreign-born, respectively;
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

**Figure 1. Health trajectories for US-born blacks and Mexican Americans relative to US-born whites**

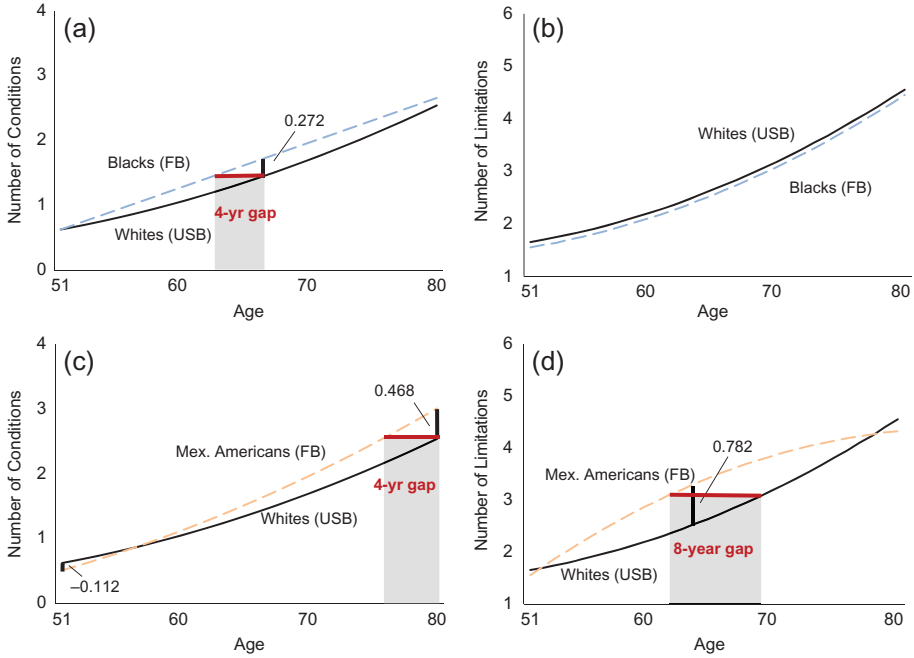



**Note**: Predicted health trajectories are based on estimates from model 1 of table 2.

Regarding Hypothesis 1b, evidence of increasing inequality between US-born whites and their black and Mexican American counterparts with advancing age is mixed. Compared to native-born whites, both native-born blacks and Mexican Americans have more chronic conditions at age 51 and more rapid accumulation of chronic conditions with age (figures 1a and c). Consequently, between ages 51 and 80, chronic disease inequalities between US-born whites and blacks double (from 0.287 to 0.577), and the magnitude of the chronic disease gap between US-born Mexican Americans and US-born whites increases nearly five-fold (from 0.151 to 0.824), in line with cumulative disadvantage processes. However, inequalities in functional limitations remain stable across age, a pattern consistent with persistent inequality. Compared to native-born whites, native-born blacks and Mexican Americans have 0.661 and 0.757 more functional limitations, respectively, and the sizes of these functional health gaps are persistent between the early 50s and 80 (figures 1b and d).

Figure 2 shows the health trajectories of black and Mexican American immigrants relative to US-born whites. Findings are largely consistent with Hypothesis 2a, which predicted premature aging, rather than healthy immigrant effects, among non-white immigrant groups. US-born whites' chronic condition burdens are reached as many as four years earlier for black and Mexican American immigrants (figures 2a and c). Compared to US-born whites, black immigrants have

**Figure 2. Health trajectories for foreign-born blacks and Mexican Americans relative to US-born whites**

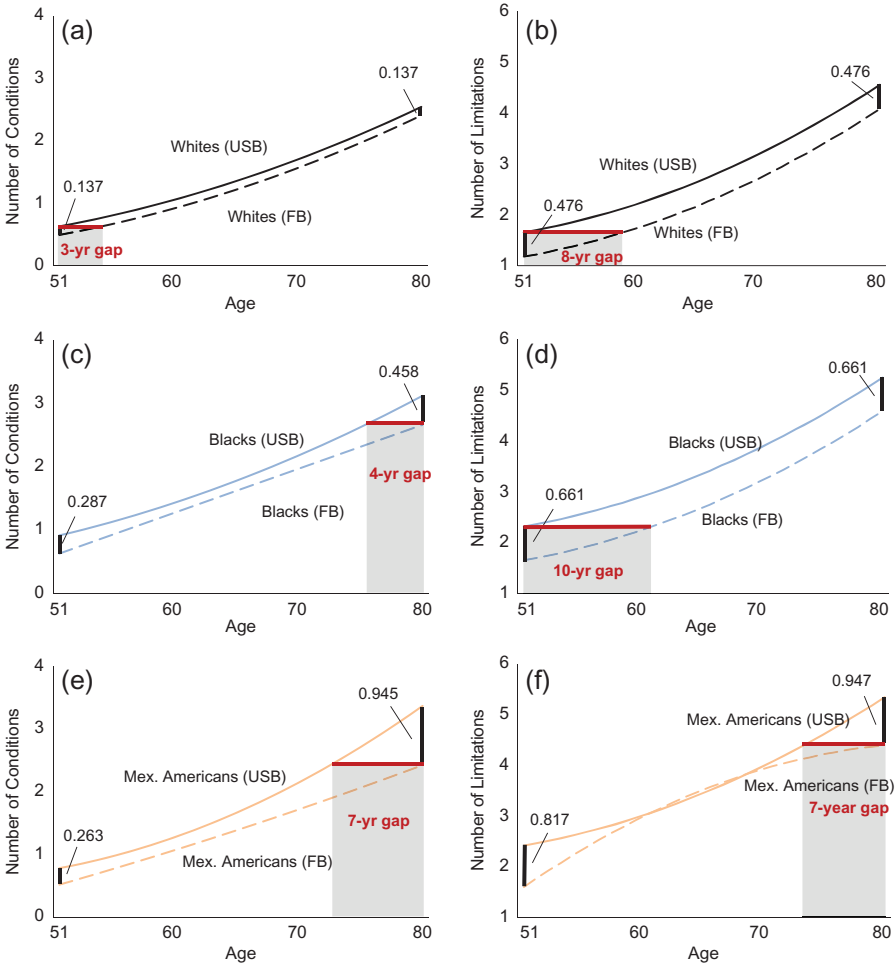



**Note**: Predicted health trajectories are based on estimates from model 1 of table 2.

similar age trajectories of functional limitations, and Mexican American immigrants exhibit higher levels of functional limitations as many as eight years earlier (figures 2b and d). Results also lend partial support to Hypothesis 2b regarding increasing health inequalities across age (with some leveling at advanced ages) between US-born whites and black and Mexican American immigrants. With the exception of functional limitations among black immigrants—which are comparable to US-born whites (figure 2b)—the age patterns observed are largely consistent with this hypothesis. For example, foreign-born blacks are at parity with native-born whites in terms of baseline levels of chronic conditions, though a foreign-born black disadvantage emerges during the 50s and peaks at age 67 (cumulative disadvantage process) before receding (aging as leveler; figure 2a). Compared to native-born whites, foreign-born Mexican Americans have fewer chronic conditions at age 51, and experience steeper increases in chronic conditions with age. This leads to a crossover at age 60 and to foreign-born Mexican Americans having 0.468 more chronic conditions at age 80 (figure 2c). This erosion and reversal of their prior immigrant health advantage is consistent with cumulative disadvantage processes. Compared to US-born whites, Mexican American immigrants experience more rapid accumulation of functional limitations in late middle life, though the gap narrows in later life (figure 2d).

Immigrant-native inequalities in trajectories of health within racial/ethnic groups are illustrated in figure 3. This figure provides broad support for Hypothesis 3a,

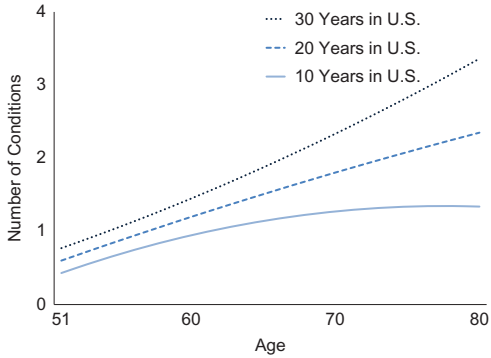
**Figure 3. Immigrant-native inequalities in health trajectories within racial/ethnic groups**




**Note**: Predicted health trajectories are based on estimates from model 1 of table 2. Ancillary analyses with alternate reference groups reveal that health trajectories also vary along nativity lines among blacks and Mexican Americans.

which predicted within-race healthy immigrant effects. Specifically, relative to their same-race US-born counterparts, foreign-born individuals exhibit comparable health problems between three and 10 years later. Results from figures 3a–f also suggest that the age patterning of immigrant-native inequalities is heterogeneous. Whereas immigrant-native inequalities in chronic conditions and functional limitations among whites are stable with age (figures 3a and b), the health gaps between immigrants and natives among blacks and Mexican Americans tend to increase with age.[3] Such patterns are evident for trajectories of chronic conditions among both blacks and Mexican Americans (figures 3c and e). For example, at age 51, black immigrants have 0.287 fewer chronic conditions than native-born blacks,

**Figure 4. Duration effects on chronic condition trajectories among foreign-born blacks**




**Note**: Predicted health trajectories are based on estimates from model 1 of table 2.

and the gap is substantially larger at age 80 (0.458 fewer conditions; figure 3c). Similarly, Mexican American immigrants have fewer chronic conditions than native-born Mexican Americans, and this nativity gap more than triples (from 0.263 to 0.945) between ages 51 and 80 (figure 3e). Black immigrants have 0.661 fewer functional limitations than US-born blacks, and this advantage is stable with age (figure 3d). In addition, Mexican American immigrants experience a health advantage of 0.817 fewer functional limitations than US-born Mexican American at age 51, and this advantage erodes through the mid-60s before increasing in later life (figure 3f). Thus, findings do not support the expectation (Hypothesis 3b) of dissipating intra-racial inequalities between US-born and immigrant groups.

Estimates from table 2 show mixed results for the effects of duration in the United States on health trajectories. As hypothesized, duration effects vary by race/ethnicity and age. Length of residence in the United States is not predictive of older Mexican Americans' chronic condition or functional limitations trajectories, nor is it predictive of functional limitations among black or white immigrants. Furthermore, while statistically significant and in the hypothesized direction, the magnitude of the effect of duration on chronic conditions trajectories among foreign-born whites is very small. Among foreign-born blacks, however, longer durations in the United States are predictive of more chronic conditions in midlife and more rapid accumulation of chronic conditions at advanced ages. Figure 4 shows the predicted chronic condition trajectories for black immigrants with varying durations in the United States. Among foreign-born blacks, 10 additional years spent in the United States is associated with 0.160 more chronic conditions at age 51, and this gap widens to 1.011 more chronic conditions at age 80. Overall, findings that the effects of duration on health trajectories are modest and contingent on race/ethnicity provide partial support for Hypothesis 4.

To examine the extent to which observed social and behavioral factors explain group differences in health trajectories, model 2 of table 2 adds socioeconomic status measures to the base model, and model 3 includes measures of socioeconomic factors as well as health behaviors and medical care utilization. While these measures are predictive of both chronic conditions and functional limitations in largely

expected ways, they only partially account for racial/ethnic/nativity inequalities in health trajectories—consistent with Hypothesis 5. For example, a comparison of coefficients in models 1 and 2 indicates that adjusting for SES measures slightly attenuates US-born blacks' and US-born Mexican Americans' elevated chronic condition intercepts relative to US-born whites. Furthermore, accounting for group differences in SES substantially reduces US-born blacks' excess functional limitation levels relative to whites (0.661 to 0.386), and it completely attenuates US-born Mexican Americans' elevated levels of functional limitations. Estimates of health inequalities between US-born whites and US-born blacks and Mexican Americans are similar across models 2 and 3, suggesting that health behaviors and medical care are not the primary mechanisms underlying these inequalities.

Results from models 1 and 2 also indicate that foreign-born Mexican Americans' health advantage in terms of chronic condition intercepts vis-à-vis US-born whites would be twice as large (−0.112 to −0.255) if they had equivalent socioeconomic resources. Moreover, after controlling for SES, both black and Mexican American immigrants have fewer functional limitations at age 51 than US-born whites, and a statistically significant positive association between duration in the United States and functional limitation intercept emerges for Mexican American immigrants (model 2). This suggests that black and Mexican American immigrants would have better functional health at age 51 if they had equivalent socioeconomic resources to whites, though Mexican American immigrants' functional health advantage would be partially offset by the deleterious consequences of duration in the United States. Ancillary analyses indicated that the emergence of a functional health intercept advantage among Mexican American immigrants is largely driven by adjusting for their low levels of education and overrepresentation in blue-collar jobs. Furthermore, estimates from models 2 and 3 show that health behaviors and medical care play a modest role in shaping inequalities between US-born whites and blacks and Mexican American immigrants, though supplemental analyses suggest that Mexican American immigrants' low prevalence rates of smoking contribute to their favorable chronic condition intercepts. Overall, these findings lend strong support to Hypothesis 5—that accounting for differences in SES, health behaviors, and medical care partially explains racial/ethnic-nativity inequalities in health.

## Discussion

Health inequalities by race/ethnicity and nativity are well established, but far less is known about how these inequalities intersect and unfold in midlife and old age. This study explicitly examines how race/ethnicity, nativity, and age jointly shape health trajectories and advances prior research in several ways. Importantly, this study is among the first to conceptualize and model post-immigration morbidity changes and racial/ethnic/nativity inequalities in health trajectories among older adults using both retrospective and prospective data. Additionally, two measures of population health are assessed to provide a more complete understanding of the joint health consequences of race/ethnicity, nativity, and aging. Moreover, this study examines the extent to which several factors (SES, health behaviors, and medical care) explain group differences in morbidity trajectories. Overall, findings

reveal that racial/ethnic minorities and immigrants have very different aging and health experiences than their white and native-born counterparts.

This study provides strong evidence to support the premature aging hypothesis: relative to US-born whites, US- and foreign-born blacks and Mexican Americans experience earlier health deterioration. For example, in seven of the eight comparisons between native-born whites and racial/ethnic minorities (across both health outcomes), blacks and Mexican Americans (US- and foreign-born) experience higher levels of morbidity at younger ages, ranging from four to 12 years earlier in the life course. This early health deterioration is particularly pronounced among US-born blacks and Mexican Americans. Collectively, these results are consistent with the prediction that racial/ethnic minorities experience accelerated physiological "wear and tear" due to systemic racism, and the ensuing unequal access to health-promoting resources and differential exposure to health risks over the life course.

A second key contribution of this study is the finding that the life course patterning of inequalities in health is more dynamic and complex than previously suggested. Scant attention in previous studies to how age moderates the relationships among race/ethnicity, nativity, and health has often reflected an implicit assumption that health inequalities are stable across the life course. The present findings, however, challenge such an assumption. Although some of the findings support persistent inequality, it is not the norm; rather, cumulative disadvantage is the most prevalent pattern (especially from the 50s into the mid-60s), followed by persistent inequality and aging-as-leveling processes. Given that inequalities between a few subgroups appear to decline at advanced ages, leveling explanations cannot be dismissed, though these patterns could be due to unmeasured selection prior to inclusion in the study. Altogether, results reveal that the heterogeneous life course patterning of health inequalities at the intersection of race/ethnicity, nativity, and age are not fully captured by any one of the life course hypotheses on intra-cohort inequality dynamics, although cumulative disadvantage processes are dominant.

The findings that racial/ethnic/nativity inequalities in health vary by age suggest that other approaches that do not account for their intersecting consequences may obscure the complex patterns of health inequalities across the life course. Because life course processes are likely to vary across age, contradictory findings from prior research may stem, in part, from collapsing age ranges in cross-sectional studies, and from comparisons of different age ranges across longitudinal studies. Results from this study suggest that all processes may operate at any given age across groups or within groups across age. Furthermore, a fuller picture of the diverse and nuanced age-stratifying forces is observable when comparing numerous subgroups and using longitudinal data spanning a large age range. These findings suggest that life course and intersectionality approaches that contextualize experiences along racial/ethnic, nativity, and aging lines have considerable utility for understanding diverse health trajectories.

A third central finding of this study is that, in contrast with the common assumption of monolithic healthy immigrant and erosion processes, these processes appear to be contingent on both race/ethnicity and age. For example, whereas vis-à-vis native-born whites, white immigrants have a persistent health advantage, black and Mexican American immigrants tend to have comparable or worse health profiles.

Importantly, these results suggest that for nonwhite immigrants, the immigrant health advantage may be offset by cumulative exposure to racialized incorporation processes. White immigrants have a persistent health advantage relative to native-born whites and exhibit only a very slight erosion effect with longer durations of residence in the United States. On the other hand, compared to US-born whites, black and Mexican American immigrants exhibit worsening health over time. For example, longer durations in the United States lead to higher chronic condition intercepts and more rapid accumulation of chronic conditions with age among black immigrants. Moreover, relative to US-born whites, Mexican American immigrants experience steeper increases in chronic conditions with age, resulting in an erosion and reversal of initial health advantage. Similarly, Mexican American immigrants exhibit accelerated increases in functional limitations relative to whites during their 50s and 60s, leading to a growing health disadvantage, though the gap narrows at advanced ages. These results are consistent with the notion that the process of immigrant incorporation into the United States is shaped by racial and ethnic stratification (Bonilla-Silva 2017; Waters and Pineau 2015). In addition to experiencing the typical deleterious effects of aging and acculturation, black and Mexican immigrants are burdened with the pathogenic consequences of their cumulative exposure to racism and nativism (Viruell-Fuentes, Miranda, and Abdulrahim 2012; Waters 2014). Importantly, these findings highlight the utility of using both retrospective and prospective information to study the health trajectories of immigrants.

The finding that duration of residency in the United States has a small impact on health among whites and is largely unrelated to health trajectories among Mexican Americans in this sample is at odds with some studies showing that longer durations are associated with poorer health outcomes (Antecol and Bedard 2006). However, it is consistent with others showing mixed evidence or no relationship between years in the United States and health (e.g., Jasso et al. 2004; Hamilton and Hummer 2011; Read and Reynolds 2012), especially among older adults (Choi 2012; Ro and Gee 2012). Duration of residence may not be predictive of morbidity trajectories among older immigrants for several reasons. First, the countervailing effects of negative forms of acculturation (e.g., declines in healthy behaviors, loss of protective social relationships and cultural traditions) and positive ones such as increasing SES and exercise with years spent in the United States (Jasso et al. 2004) may offset one another. Second, given the relatively few recent immigrants included in this sample, as well as the considerable time elapsed since their arrival (average duration of residency is nearly three decades), any potential erosion of the immigrant health advantage may have occurred long ago. Third, the modest sample sizes of immigrants may contribute to some of the null results related to duration in the United States.

Fourth, immigrants that come to the United States with family preference visas are less positively selected in terms of health than those who enter the country with employment visas (Akresh and Frank 2008). When coupled with the fact that older immigrants who recently arrived in the United States are more likely to immigrate for family reasons rather than for employment (Choi 2012), they may be less likely to experience positive health selection than older adults who immigrated at younger ages. Moreover, compared to those who migrate at younger ages, middle-aged

and older immigrants are less likely to accumulate health-protective socioeconomic resources (Gubernskaya 2015). Thus, potentially deleterious effects of duration in the United States may be masked by the poor health profiles of older adults who recently immigrated (Angel, Buckley, and Sakamoto 2001).

Finally, selective return migration prior to the study may lead to downwardly biased estimates of the negative impact of time in the United States on health. This is especially likely if the least healthy immigrants of earlier arriving cohorts were more likely to return to their countries of origin (Palloni and Arias 2004), though recent research suggests that biases due to return migration are modest (Riosmena, Wong, and Palloni 2013). Panel studies that follow multiple birth and immigrant cohorts prior to migration, as well as their counterparts who stay in the sending countries, are necessary to disentangle the effects of these factors and to better understand the post-immigration health dynamics of older adults (Riosmena, Wong, and Palloni 2013).

Results of this study show that a wide array of factors including SES, health behaviors, and medical care account for some, but not all, group differences in morbidity trajectories. For example, inequalities in socioeconomic resources partially explain elevated numbers of chronic conditions among US-born blacks and Mexican Americans. Adjusting for SES, however, actually increases foreign-born Mexican Americans' health advantage in terms of the chronic conditions intercept vis-à-vis US-born whites. Consistent with prior research, inequalities in health behaviors and medical care utilization do not fully explain group differences in morbidity (Haas and Rohlfsen 2010; Warner and Brown 2011). Supplemental analyses did not find evidence of systematic differences in the effects of the covariates across subgroups, though this topic warrants future research.

As expected, findings indicate that even after controlling for SES, health behaviors, and medical care, US-born blacks have worse chronic condition and functional limitation trajectories than US-born whites. Myriad manifestations of structural and interpersonal racism underlie racial inequalities in health (Phelan and Link 2015). For example, racial residential segregation leads to differential exposure to health-related societal risks and resources, and perceived discrimination increases levels of stress, resulting in elevated risks for stress-related diseases and increasing health inequalities across the life course (Williams and Mohammed 2013). Given the unique historical and social circumstances of blacks and Mexican Americans, it is not surprising that the black-white and Mexican American–white patterns of health inequality differ, or that controlling for socioeconomic resources attenuates the Mexican American–white health gap but not the black-white gap. Despite some progress, blacks continue to experience unparalleled levels of social isolation due to residential segregation (Lichter, Parisi, and Taquino 2015), and they perceive the greatest racial/ethnic alienation and least fairness, followed by Hispanics, and then whites (Bobo 2001; Waters 2014). Unfortunately, the data used for this study do not include information on neighborhood conditions or perceived discrimination. Further research is needed on the roles that structural and interpersonal racism play in generating inequalities in health trajectories.

The patterns across the two different health outcomes—chronic conditions and functional limitations—paint a fairly consistent picture of the morbidity

disadvantage and premature health problems of blacks and Mexican Americans (both US- and foreign-born) relative to whites. However, the race/ethnicity-nativity inequalities in functional limitations tend to be somewhat larger and more stable across age for all groups except foreign-born Mexican Americans. Foreign-born Mexican Americans experience a dramatic increase in functional limitations in late middle life, which may reflect wear and tear associated with greater exposure to physically demanding jobs (Hayward et al. 2014; Melvin et al. 2014). Given that functional limitations can develop as a consequence of either strenuous physical labor or the progressive disablement following a chronic condition (Verbrugge and Jette 1994), the larger inequalities observed on this outcome are not surprising.

This study has several limitations. For example, sample sizes in the HRS preclude analysis of health inequalities among Asians, Native Americans, and Hispanics other than those of Mexican descent. Furthermore, given the relatively small sample sizes of immigrants, estimates of differences among and between these subgroups are likely conservative; thus, statistically non-significant differences between foreign-born subgroups and US-born whites should be considered provisional and interpreted with caution. Moreover, it is important to examine heterogeneity among immigrants by gender (Gorman, Read, and Krueger 2010), country of origin (Dodoo 1997; Read and Emerson 2005), skin color (López et al. 2017), religion, citizenship, and documented/undocumented status (Philbin et al. 2018; Waters 2014), though the samples of immigrants in this study are too small to investigate how the immigrant health advantage and its erosion varies across these categories.[4] Future analyses and additional data collection efforts are needed to investigate health inequality between and within racially and ethnically diverse samples of US- and foreign-born older adults (Hamilton and Hummer 2011). Another potential limitation of this study is the reliance on self-reported health measures. Although measures of chronic conditions and functional limitations are predictive of subsequent morbidity and mortality, and are key components of the disablement process (Brown, O'Rand, and Adkins 2012), they may be limited due to respondents' lack of information about their health, as well as present-state and recall biases. Thus, future research using more objective, clinical health measures and biomarker data is needed.

In addition, a drawback of many longitudinal datasets such as the HRS is the limited age range of respondents, which precludes the examination of health trajectories across the entire life span. On a related note, although the analyses account for right-censoring by controlling for prospective death and dropout attrition, left-censoring may be an issue. Accordingly, findings should be interpreted as conditional on survival to midlife. Furthermore, the HRS does not include direct measures of acculturation such as language preferences and proficiency, naturalization, and adoption of culturally specific behaviors and values.

Overall, findings from this study highlight the utility of viewing health inequalities with an integrated life course intersectionality framework. Health inequalities in middle and late life reflect the cumulative impact of social factors across the life course. Results reveal that race/ethnicity, nativity, duration in the United States, and age intersect to shape health, and that health inequalities are dynamic. As a result, racial/ethnic minorities (US- and foreign-born) experience higher levels of

morbidity at younger ages, and the healthy immigrant and erosion effects are contingent on race/ethnicity and age.

In light of findings that US- and foreign-born blacks and Mexican Americans have worse health than US-born whites in later life, the rapidly growing and diversifying older population is likely to have a serious impact on the health care system and overall population health (Melvin et al. 2014). That said, it is important to recognize that demographics are not destiny; factors driving health inequalities are shaped by socio-political contexts. For example, empirical evidence indicates that structural racism and exclusionary immigration and immigrant-focused policies have deleterious spillover effects that lead to worse health for US- and foreign-born racial/ethnic minorities (Philbin et al. 2018). This suggests that policy reforms aimed at reducing structural racism and nativism are key to improving population health and achieving health equity.

## Notes

1. While intersectionality scholarship has largely focused on intersections among race, class, and gender, the concept of intersectionality is flexible and allows for the examination of an array of intersecting dimensions of inequality, including nativity and age (Collins and Bilge 2016).
2. Supplemental analyses suggested that categorical measures of age at migration and immigrant arrival cohort were not predictive of health trajectories. Given these null findings and the fact that these measures lead to multicollinearity issues with measures of age, birth cohort, and duration in the United States, they are not included in the analyses presented.
3. Ancillary analyses with alternative reference groups reveal statistically significant differences in health trajectories between immigrants and their same-race/ethnicity native-born counterparts.
4. Supplemental analyses explore potential gender differences in the effects of race/ethnicity and nativity on health trajectories. Results are presented in online supplemental table 1. Overall, there are relatively few statistically significant gender differences in the effects of race/ethnicity and nativity on morbidity trajectories. It is important to note that gender-stratified analyses are based on relatively small sample sizes for subgroups of immigrants, especially black immigrants. In light of these small sample sizes, supplemental analyses of gender-specific effects of race/ethnicity and nativity should be considered provisional.

## Supplementary Material

Supplementary material is available at *Social Forces* online.

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