Race/Ethnic and Nativity Disparities in Later Life Physical Performance: The Role of Health and Socioeconomic Status Over the Life Course

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Objectives. We examine race/ethnic and nativity differences in objective measures of physical performance (i.e., peak expiratory flow, grip strength, and gait speed) in a nationally representative sample of older Whites, Blacks, and Hispanics. We also examine whether detailed measures of childhood and adult health and socioeconomic status (SES) mediate race/ethnic differences in physical performance.

Method. We use data from the Health and Retirement Study, a population-based sample of older Americans born before 1947, and 3 measures of physical performance. Nested ordinary least squares models examine whether childhood and adult health and SES mediate race/ethnic differences in performance.

Results. We find large and significant race/ethnic and nativity differences in lung function, grip strength, and gait speed. Adjusting for childhood and current adult health and SES reduces race/ethnic differences in physical performance but does not eliminate them entirely. Childhood health and SES as well as more proximal levels of SES are important determinants of race/ethnic disparities in later life physical performance.

Discussion. The analysis highlights that a large proportion of race/ethnic and nativity disparities result from health and socioeconomic disadvantages in both early life and adulthood and thus suggests multiple intervention points at which disparities can be reduced.

Key Words: Early origins of health—Functional health status—Health disparities—Life course analysis—Minority aging (race/ethnicity)—Socioeconomic status.

Race/Ethnic disparities in health in the United States begin in early life and persist well into middle and old age. Compared with Whites, Blacks have shorter life expectancies, and both Blacks and Hispanics have increased levels of disability (Warner & Brown, 2011; Xu, Kochanek, Murphy, & Tejada-Vera, 2010). Foreign-born individuals typically have lower mortality than their US-born counterparts, although immigrants in some race/ethnic groups have elevated risks for some mental and physical conditions (Argesenau, Ruben, & Venkat Narayan, 2008; Gorman, Read, & Krueger, 2010). We advance on prior work by focusing on disparities in physical performance measures (i.e., peak expiratory flow, grip strength, and gait speed) across race/ethnicity and nativity. Physical performance measures provide objective measurement of health disparities in various domains (e.g., lung function, and upper and lower body strength and coordination) that predict future health and mortality outcomes (Cooper, Kuh, Hardy, & Mortality Review Group, 2010; Cooper et al., 2011).

Differences in health by race/ethnicity and nativity are particularly vexing because they represent the severe consequences of inequitable access to social opportunity. In the United States, race/ethnicity and nativity indicate social positions that confer unequal access to social institutions and resources that promote health (Williams, 1997), including salubrious childhood circumstances, socioeconomic opportunity, access to marriageable partners, and social conditions that encourage healthy behaviors. Two aims guide our analyses. First, we examine disparities in physical performance across race, ethnicity, and nativity in a nationally representative sample of older US adults. Second, we examine whether early life and adult health, demographic, and socioeconomic conditions mediate disparities in the physical performance measures.

Physical Performance

Some research has examined race/ethnic disparities in physical performance. Seeman and colleagues (1994) find that Blacks have lower scores than Whites on a physical performance index and have greater volatility in their physical performance over time. Among Hispanics, measures of lower body performance and grip strength are associated with subsequent disability and mortality (Markides et al., 2001; Ostir, Markides, Black, & Goodwin, 1998; Snih, Markides, Ottenbacher, & Raji, 2004). Yet, we are unaware of research...
that compares Hispanics with Blacks or Whites, or foreign-
born adults from various race/ethnic groups to their US-born
counterparts. The limited amount of research on race/ethnic
and nativity disparities in physical performance may result
from the reliance on studies that include a small number of
communities that have few Blacks and Hispanics, include only
Hispanics, or use British or European data where race/ethnic
may take on different meanings than in the United
States (Guralnik, Butterworth, Wadsworth, & Kuh, 2006;
Hari, Mackenbach, Andersen-Ranberg, & Avendano, 2010;
Jylhä, Guralnik, Balfour, & Fried, 2001; Kuh, Bassey,
Butterworth, Hardy, & Wadsworth, 2005; Kuh et al., 2002;
Markides et al., 2001; Ostir et al., 1998; Seeman et al., 1994).

We focus on measures of physical performance including
handgrip strength, peak expiratory flow, and gait speed.
Handgrip strength measures the presence of arthritis in the
hand and the overall strength of skeletal muscle (Giampoli et
al., 1999; Rantanen et al., 1999; Snih et al., 2004). Peak expira-
tory flow is a measure of lung function and an indicator of
obstructive lung diseases such as asthma, chronic bronchitis,
and emphysema (Cook et al., 1991). Gait speed is an indicator
of lower body mobility, balance, coordination, and muscle
tone (Guralnik et al., 2000; Jylhä et al., 2001; Ostir et al.,
1998). Physical performance is useful for our study of race/
ethnic and nativity disparities because it allows the objective
measurement of health disparities in large community-based
samples; measures physiological decline before it manifests
in disability, morbidity, or mortality; and taps into diverse
areas of physiological functioning that are predictive of
future disability and mortality (Cooper et al., 2010, 2011;
Guralnik et al., 2000; Markides et al., 2001; Ostir et al.,
1998).

Physical performance measures offer additional advantages
over more commonly used health measures. Self-rated health
or self-reported of medical conditions may be problematic
if individuals have limited insight into their own health or if
they seldom have their health evaluated by doctors. In partic-
ular, immigrants may face barriers to accessing health care,
leaving them with optimistically biased assessments of their
own health (Gorman et al., 2010). Similarly, self-reported
activity limitations may be inaccurate if adults do not routinely
undertake the queried activities (e.g., balance a checkbook,
walk a flight of stairs). Mortality can also be problematic;
when Hispanic immigrants fall ill, they may return to country
of origin where their subsequent deaths are not recorded in
the National Death Index (Palloni & Arias, 2004). Although
the measures that are used in prior work are valuable, an
important advance of our article is our reliance on several
objective measures of physical performance.

**Race/Ethnicity and Nativity Disparities**

We examine whether a wide array of childhood and
adult health, demographic, and socioeconomic characteristics
mediate race/ethnic and nativity disparities in physical
performance. Scant research has investigated the role of both
childhood and adult factors in driving race/ethnic and nativity
disparities in health at older ages, and we are aware of none
that examines physical performance.

Racial, ethnic, and nativity disparities in health and
socioeconomic status (SES) begin in early life and persist
throughout the life course (Conley, Strully, & Bennett,
Geronimus, Bound, Waidmann, Colen, and Steffick (2001)
argue that prolonged exposure to structural and material
disadvantages over the life course by racial and ethnic
minorities leads to the premature onset of chronic disease
and more rapid deterioration of functional health. Thus, it is
important to examine both childhood and adult conditions
that shape health outcomes. Recent theoretical and empirical
work has demonstrated the importance of early life processes
in determining later life health (Montez & Hayward, 2011).
For example, childhood SES and early life health and devel-
opment are associated with physical performance at midlife
(Guralnik et al., 2006; Kuh et al., 2002, 2005), functional
health trajectories (Haas, 2008), and race/ethnic disparities
in functional health trajectories (Haas & Rohlfsen, 2010).

Early life health and SES may also drive adult health
and SES—factors that may shape race/ethnic and nativity
disparities in physical performance in later life. Some
studies have found that SES accounts for 5%–90% of
Black/White differences in health, depending on the
measures of SES, the health outcomes examined, and the
particular study population (Bond Huie, Krueger, Rogers,
& Hummer, 2003; Hayward, Crimmins, Miles, & Yang,
2000; Kahn & Fazio, 2005). Education is often established
in early adulthood, before the onset of age-related poor
health, and it sets individuals on lifelong employment and
earning trajectories. Education is associated with improved
knowledge about healthy behaviors and provides individ-
uals with cognitive and psychosocial skills and material
resources that allow them to effectively pursue better health
(Link & Phelan, 1995; Pampel, Krueger, & Denney, 2010).
Race/ethnic differences in education are substantial. Blacks
and Hispanics have less education than Whites, although
the Black-White gap narrows among the foreign born,
whereas the Hispanic-White gap is widest among the foreign
born (Everett, Rogers, Hummer, & Krueger, 2011).

Wealth is a key component of material well-being that
typically peaks in individuals’ final years in the labor force
and then provides a long-term and relatively stable resource
in the remaining decades of life (Ghez & Becker, 1975).
Similarly, receipt of numerous sources of income—such as
earnings, investments, interest, and retirement accounts—
indicates a secure position in the middle or upper classes of
society. Diverse income portfolios suggest long-term financial
security and are associated with longer lives because individ-
uals can prosper even if any single income source should fail
(Krueger & Burgard, 2011). Blacks (and potentially
Hispanics and foreign-born adults) have greater difficulty
than Whites in accruing and maintaining wealth over the
life course and across generations due to social forces including segregation and institutionalized discrimination in the housing market (a key source of wealth for most individuals), and higher levels of debt for the same level of earnings (Conley, 1999).

Income, unlike education or wealth, suggests a flow of resources that are immediately available for individuals to use without, say, mortgaging their homes or liquidating their financial assets. However, the relationship between income and health often weakens with age (Krueger & Burgard, 2011) because earnings may underestimate the actual differences in material well-being that adults have experienced throughout their lives, especially by race (Bond Huie et al., 2003). Nevertheless, there are persistent race/ethnic differences in income even at the older ages. Small race/ethnic disparities in earnings in early life grow larger with age due to the cumulative effects of discrimination (Conley, 1999).

Occupational status implies both status and working conditions, wherein higher status workers typically have more prestigious yet sedentary jobs, and lower status workers more often work in dirty, dangerous, and sometimes physically demanding jobs (Krueger & Burgard, 2011). In turn, lower status manual and unskilled laborers typically have worse health and increased risks for mortality (Rogers, Hummer, & Nam, 2000). Indeed, some low-status occupations may cause wear and tear on joints that reduce strength and flexibility, or increase exposure to dust, particulates, and pesticides that can adversely impact lung function (Krueger & Burgard, 2011). Blacks and other race/ethnic minorities continue to be disproportionately overrepresented in low-status, low-wage occupations (Grotsky & Pager, 2001).

Marriage entails a series of formal and informal social commitments that support couples in promoting each others’ health by encouraging healthy behaviors and preventive health care, and providing social support (Carr & Springer, 2010). In turn, marriage is associated with better health and longer lives (Rogers et al., 2000). Marriage is more common among Whites than among Blacks or Hispanics because Whites have greater economic security to help ensure stable marriages and because Blacks and Hispanic women have fewer potential spouses in old age due to higher rates of death and incarceration among minority men (Cherlin, 2010).

Overweight or obese body masses and smoking are differentially distributed by race and ethnicity (US Department of Health and Human Services, 2010), and may result from childhood and adult SES and health (Pampel et al., 2010). In the cohorts we examine, Blacks and Whites have similar rates of smoking, although Hispanics are less likely to be current or former smokers (US Department of Health and Human Services, 2010). Furthermore, Blacks and Hispanics are much more likely than Whites to be overweight or obese (Denney, Krueger, Rogers, & Boardman, 2004). Some chronic medical conditions are also more prevalent among Blacks and Hispanics than among Whites (Ferraro, Farmer, & Wybraniec, 1997), and this higher burden of disease may impede physical performance.

**Data and Methods**

This study uses data from the Health and Retirement Study (HRS), an ongoing panel study of Americans born before 1947 designed to investigate economic and health transitions associated with retirement (Juster & Suzman, 1995). Respondents were selected from a sample of housing units generated using a multistage, clustered area probability sample. The HRS oversamples Blacks and Hispanics, and conducts face-to-face, in-home interviews in English and Spanish at baseline, with follow-up interviews every second year and interviews with knowledgeable others if respondents die. Response rates for the HRS are high, with more than 81% responding at study onset and 88% of respondents being interviewed in each wave of follow-up.

In 2004, the HRS began to collect physical performance measures on a random subsample of respondents, excluding those who were living in nursing homes, proxy interviews, or those who were interviewed by telephone. The sample was representative of all ages covered by the original sample of the HRS and included approximately 100 individuals in each age between 51 and 80 years and declining numbers for ages 81+ to yield 3,339 respondents in 2004. In 2006, one half of the HRS sample was randomly selected to receive face-to-face interviews including physical performance assessments. In 2008, the other half of the sample received face-to-face interviews including physical performance assessments.

There are 14,561 respondents who have peak flow data, with 2,416 having two assessments. A total of 14,493 individuals have grip strength data, with 2,286 having two assessments. A total of 8,490 respondents have gait speed data, with 1,281 having two assessments. Gait speed is assessed only for those aged 65 years and older. Seventeen respondents who did not report information on their racial or ethnic background were dropped from the analysis. Most covariates had no or very little missing data (<5%). However, longest tenured occupation (22%) and paternal (15%) and maternal (10%) education had a greater amount of missing data. These data are not likely to be missing completely at random, the assumption made by list-wise deletion. We use multiple imputation to provide multiple sets of plausible values for each piece of missing data, which allows us to relax the assumption that data are missing completely at random, while preserving our sample size (Rubin, 1987).

**Measures**

We analyze three measures of physical performance. First, peak expiratory flow was measured using the Mini-Wright peak flow meter. We use the best of three assessments that were taken 30 s apart. Second, two measures of handgrip strength (kilogram/square inch) were taken for each hand
using a Smedley spring-type hand dynamometer. We use the best measure from the dominant hand. Finally, gait speed is measured using a timed walk of a 98.5-inch span. We use the best of two times recorded. See Crimmins and colleagues (2008) for detailed protocols and other documentation concerning the fielding of the physical performance assessments.

Our key independent variables are race/ethnicity, nativity, and childhood and adult health and SES. Race/ethnicity and nativity are combined using six categories: US-born non-Hispanic White, foreign-born non-Hispanic White, US-born non-Hispanic Black, foreign-born non-Hispanic Black, US-born Hispanic, and foreign-born Hispanic. Unfortunately, sample size does not permit disaggregating Hispanics by country of origin. Childhood health is measured using a retrospective subjective report that asks respondents to rate their health from birth to age 16, and ranges from excellent to poor on a 5-point scale. Previous analyses have shown this measure to be a reliable and valid measure of overall childhood health in aging populations (Haas, 2007; Haas & Bishop, 2010; Smith, 2009). Following Haas (2007), this measure is dichotomized as good/fair/poor versus excellent/very good. Childhood SES is measured using continuous years of schooling completed by mothers and fathers (range: 0–17).

Education is a continuous measure of the number of years of schooling completed (range: 0–17). Measures of total household income and total household assets are logged. Income diversification is a count (range: 0–10) of the number of non-employment and nonpoverty income sources including pensions, real estate, IRAs, annuities, stocks, bonds, interest, and dividends. Occupational status is categorical and classifies the longest held occupation as managerial/professional, unskilled nonmanual, unskilled manual, skilled manual, farming, or military.

We also adjust for age in years, gender (1 = male), and current marital status (1 = married). Current health status is measured with body mass index (BMI; underweight, normal weight, overweight, obese), smoking (current, former, never smoker), and the number of comorbid chronic conditions. In the models of peak expiratory flow, we also adjust for height because it is correlated with the total lung volume.

Statistical Analyses

The results are based on ordinary least squares (OLS) regression models that use the pooled data from 2004, 2006, and 2008. We cluster on individual-specific identifiers to account for the correlated errors among the individuals who are measured in multiple years. Although peak respiratory flow and grip strength are normally distributed, walking time is slightly right-skewed. However, analysis of a log-transformed variable found substantively similar results. We did not find evidence of nonlinear relationships between our continuous predictor variables and any of the physical performance items.

In order to assess the role of our covariates in mediating race/ethnic disparities in physical functioning, we estimate four nested models for each outcome. Model 1 examines race/ethnic and nativity differences in physical performance when adjusting for demographic variables (age, sex). Model 2 adds parental education and childhood health status to examine whether early life conditions mediate race/ethnic differences in physical performance. Model 3 further adds adult SES measures that might mediate childhood conditions and later life physical performance, and explain race/ethnic and nativity differences in physical performance. Finally, Model 4 includes chronic diseases and lifestyle risk factors to examine whether they mediate the link between childhood conditions and later life physical performance, and further close race/ethnic and nativity differences in physical performance.

Results

Table 1 presents descriptive statistics for our covariates, by race/ethnicity and nativity. Before adjusting for other covariates, Whites have higher peak flow and grip strength values than Blacks or Hispanics, and faster gait speeds than Blacks and Hispanics. Foreign-born adults typically have equal or worse physical performance measures than their US-born counterparts.

Table 2 presents the unstandardized OLS regression coefficients and standard errors from models predicting peak expiratory flow. Model 1 shows that US- and foreign-born Whites do not have significantly different respiratory function. Compared with US-born Whites, US-born Blacks average peak expiratory flow rates that are 37.3 L/min lower, and foreign-born Blacks average rates that are 63.5 L/min lower. Peak expiratory flow rates of US-born Hispanics are not statistically significantly different from those of the US-born Whites, but foreign-born Hispanics have significantly lower rates.

Model 2 finds that parental education and childhood health partially mediate race/ethnic and nativity differences in lung function. For example, after adjusting for parental education and childhood health, the gap between US-born Whites and Blacks narrowed by 18% [= (37.3 – 30.4)/37.3 × 100], and the gap between US-born Whites and foreign-born Hispanics is reduced by 55% [= (32.4 – 14.6)/32.4 × 100]. Maternal and paternal education are each associated with improved respiratory function. Those who reported poor childhood health average peak expiratory flow rates that are 17.2 L/min lower than those of their peers who had very good or excellent childhood health.

Model 3 shows that adjusting for adult SES further reduces the Black–White difference in peak expiratory flow. The coefficients for US- and foreign-born Blacks are markedly smaller in Model 3 than in Model 1 or 2. Furthermore, after accounting for adult SES, both US- and foreign-born Hispanics have significantly better lung function than US-born.
Whites. Individuals with less education, wealth, or income; with fewer sources of income; and who worked in unskilled manual occupations had worse lung function than their higher SES peers. Adjusting for adult SES also diminished the relationship between parental education and lung function to nonsignificance and substantially reduced the impact of poor childhood health.

Model 4 shows that after further adjusting for current health status, race/ethnic and nativity disparities persist. Foreign-born Whites have significantly lower peak expiratory flow compared with their US-born peers. Furthermore, adjusting for current health in Model 4 increases the gap in lung function between US-born Whites and US- and foreign-born Blacks. Conversely, net of current adult health status, US-born Hispanics have better lung function than US-born Whites. Lung function for foreign-born Hispanics was not significantly different from that of US-born Whites. Being underweight, being a current or former smoker, and having more chronic medical conditions were associated with reduced lung function. After adjusting for current health, the slope for childhood health status is no longer significant.

Table 3 presents the unstandardized OLS regression coefficients and standard errors from models predicting grip strength. Model 1 shows that US-born Hispanics average 2.88 kg/in² and foreign-born Hispanics average 3.28 kg/in² lower grip strength compared with US-born Whites. There are no significant differences in grip strength between US-born Whites and foreign-born Whites, US-born Blacks, or foreign-born Blacks. Model 2 shows that mother’s education and childhood health are significantly associated with grip strength. Adjusting for childhood conditions reduces the gap between US-born Whites and US-born and foreign-born Hispanics.

After adjusting for adult SES (Model 3), US-born Blacks have significantly higher grip strength than their White counterparts, and the gap in grip strength between US-born Whites and US- and foreign-born Hispanics narrows. Those with greater income and wealth have better grip strength. Relative to those from professional/managerial
occupations, those from nonmanual occupations have significantly reduced grip strength, and those from military and skilled manual occupations have significantly better grip strength. Adjusting for current health (Model 4) slightly narrows the disparity in grip strength between US-born Blacks and Whites, whereas the gap between US-born Whites and US- and foreign-born Hispanics widens. Those who are overweight or obese have increased grip strength, and those who are underweight or have more chronic medical conditions have worse grip strength. After adjusting for all adult health and SES, the slopes for childhood health and parental education are no longer significant.

Table 4 presents unstandardized OLS regression coefficients and standard errors from models predicting walk time. Higher values indicate greater times to walk the same distance and, thus, slower gait speed. Model 1 shows that US-born Blacks, foreign-born Blacks, US-born Hispanics, and foreign-born Hispanics have longer walk times than US-born Whites. Model 2 shows that childhood health and socioeconomic position are not significantly associated with walking time, although race/ethnic and nativity disparities close slightly. Adjusting for adult SES in Model 3 reduces the gap in the timed walk between US-born Blacks and Whites, and closes the gap between US-born Whites and foreign-born Blacks, US-born Hispanics, and foreign-born Hispanics. More education, household assets, and income diversity are associated with shorter walk times. Finally, Model 4 finds that adjusting for current health, US-born Blacks and foreign-born Hispanics have significantly longer walk times than their US-born White counterparts. Being underweight or obese rather than normal weight, or having more chronic conditions, is associated with longer times for the timed walk.
We test for race/ethnic and nativity disparities in peak expiratory flow, grip strength, and gait speed, and examine whether those disparities result from health and socioeconomic factors over the life course. We rely on nationally representative data of older adults, with oversamples of Blacks and Hispanics and detailed health and socioeconomic measures.

We find consistent evidence of race/ethnic and nativity disparities in physical performance in later life. In our baseline models, compared with US-born Whites, US-born Blacks and Hispanics have longer walk times (i.e., slower gait speeds), US-born Blacks have worse lung function, and US-born Hispanics have worse grip strength. Although foreign- and US-born Whites had similar performance outcomes, foreign-born Blacks and Hispanics typically had worse outcomes than their US-born counterparts.

In our fully adjusted models, race/ethnic and nativity disparities narrow and sometimes reverse. Compared with US-born Whites, US- and foreign-born Hispanics have worse grip strength, and foreign-born Hispanics have longer walk times after adjusting for our full set of covariates. But, consistent with the Hispanic paradox, both US- and foreign-born Hispanics have better lung function than US-born Whites after adjusting for adult SES. Hispanics may have better physical performance than Whites on some health outcomes if they are positively selected for health when they, their parents, or their grandparents migrated to the United States, or if they have stronger prosocial ties than similar Whites (Elo, Turra, Kestenbaum, & Ferguson, 2004; Markides & Eschbach, 2005).

Although Hispanic immigrants may return to their countries of origin if they fall into poor health (Palloni & Arias, 2004), the advantage in lung function among US-born Hispanics persists after adjusting for current health conditions that may inform migration decisions.

Table 3. Linear Regression Assessing Grip Strength

<table>
<thead>
<tr>
<th>Race–ethnic/nativity group</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>SE</td>
<td>b</td>
<td>SE</td>
</tr>
<tr>
<td>Foreign-born White</td>
<td>-0.62</td>
<td>0.49</td>
<td>-0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>US-born Black</td>
<td>0.11</td>
<td>0.35</td>
<td>0.25</td>
<td>0.34</td>
</tr>
<tr>
<td>Foreign-born Black</td>
<td>-1.84</td>
<td>1.37</td>
<td>-1.65</td>
<td>1.38</td>
</tr>
<tr>
<td>US-born Hispanic</td>
<td>-2.88***</td>
<td>0.70</td>
<td>-2.47***</td>
<td>0.67</td>
</tr>
<tr>
<td>Foreign-born Hispanic</td>
<td>-3.28***</td>
<td>0.53</td>
<td>-2.77***</td>
<td>0.58</td>
</tr>
<tr>
<td>Age</td>
<td>-0.30***</td>
<td>0.01</td>
<td>-0.38***</td>
<td>0.01</td>
</tr>
<tr>
<td>Male</td>
<td>16.13***</td>
<td>0.20</td>
<td>16.10***</td>
<td>0.16</td>
</tr>
<tr>
<td>Mother’s education (years)</td>
<td>0.10*</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Father’s education (years)</td>
<td>-0.02</td>
<td>0.03</td>
<td>-0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Poor childhood health</td>
<td>-1.17**</td>
<td>0.39</td>
<td>-0.90*</td>
<td>0.39</td>
</tr>
<tr>
<td>Married</td>
<td>-0.43*</td>
<td>0.17</td>
<td>-0.46**</td>
<td>0.17</td>
</tr>
<tr>
<td>Education (years)</td>
<td></td>
<td></td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Household income (log $)</td>
<td>0.28*</td>
<td>0.11</td>
<td>0.22*</td>
<td>0.11</td>
</tr>
<tr>
<td>No. of income sources</td>
<td>0.07</td>
<td>0.09</td>
<td>0.11</td>
<td>0.08</td>
</tr>
<tr>
<td>Household wealth (log $)</td>
<td>0.23***</td>
<td>0.04</td>
<td>0.19**</td>
<td>0.05</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
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<tr>
<td>Nonmanual</td>
<td>-0.99**</td>
<td>0.28</td>
<td>-1.04**</td>
<td>0.27</td>
</tr>
<tr>
<td>Unskilled manual</td>
<td>-0.23</td>
<td>0.33</td>
<td>0.21</td>
<td>0.31</td>
</tr>
<tr>
<td>Farming</td>
<td>1.48*</td>
<td>0.74</td>
<td>1.27</td>
<td>0.75</td>
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<tr>
<td>Skilled manual</td>
<td>0.56</td>
<td>0.35</td>
<td>0.67*</td>
<td>0.33</td>
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<tr>
<td>Military</td>
<td>2.32*</td>
<td>1.06</td>
<td>2.23*</td>
<td>1.06</td>
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<tr>
<td>Body mass index</td>
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<tr>
<td>Underweight</td>
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<tr>
<td>Overweight</td>
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<tr>
<td>Obese</td>
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<tr>
<td>Current smoker</td>
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<tr>
<td>Former smoker</td>
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<td></td>
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<td></td>
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<tr>
<td>No. of chronic conditions</td>
<td></td>
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</tbody>
</table>

Notes. aReference group is US-born non-Hispanic White.
bReference group is female.
cReference group is excellent/very good.
dReference group is single/divorced/separated.
eReference group is professional/managerial.
fReference group is normal weight.
gReference group is never smoker.
*p < .05. **p < .01. ***p < .001.
have lower grip strength than US-born Whites. But our results show that unskilled manual occupations are not generally associated with improved physical performance. Given that the White–Hispanic gap in grip strength increases with adjustment for current adult health status, it appears that any musculoskeletal benefit gained by working in a manual occupation may be offset by greater risks for chronic disease such as osteoarthritis and poorer management of medical conditions.

Although many race/ethnic and nativity disparities narrowed (or even reversed), US-born Blacks remain worse than US-born Whites on all the physical performance measures, even after adjusting for childhood and adult health and SES. Blacks in the United States have experienced persistent disadvantage across generations that culminates in segregation and discrimination in contemporary society (Conley, 1999; Iceland & Wilkes, 2006; Williams, 1997). Unfortunately, the HRS data offer little insight into segregation, discrimination, or other community characteristics that may drive health disparities.

Our results also show that both childhood and adult health and SES are significant predictors of physical performance and play an important role in the genesis of race/ethnic and nativity disparities. Although childhood SES and health status were significant predictors of physical performance, their impact was almost completely explained by adult health and SES. Thus, early life health and material disadvantages seem to matter largely to the extent that they shape later life health and socioeconomic attainment. This is consistent with prior research on the biological and psychosocial pathways that link both childhood and later life factors to socioeconomic and race/ethnic disparities in health (Glymour, Avendaño, Haas, & Berkman, 2008; Haas & Rohlfsen, 2010). Early life is marked by developmental

### Table 4. Linear Regression Assessing Timed Walk

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race–ethnic/nativity group</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Foreign-born White</td>
<td>−0.04</td>
<td>0.12</td>
<td>−0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>US-born Black</td>
<td>1.05***</td>
<td>0.09</td>
<td>0.97***</td>
<td>0.09</td>
</tr>
<tr>
<td>Foreign-born Black</td>
<td>1.16*</td>
<td>0.46</td>
<td>1.12*</td>
<td>0.46</td>
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<tr>
<td>US-born Hispanic</td>
<td>0.44***</td>
<td>0.11</td>
<td>0.25*</td>
<td>0.11</td>
</tr>
<tr>
<td>Foreign-born Hispanic</td>
<td>0.86***</td>
<td>0.12</td>
<td>0.67***</td>
<td>0.13</td>
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<tr>
<td>Age</td>
<td>0.07***</td>
<td>0.00</td>
<td>0.07***</td>
<td>0.00</td>
</tr>
<tr>
<td>Male&lt;sup&gt;b&lt;/sup&gt;</td>
<td>−0.40***</td>
<td>0.04</td>
<td>−0.39***</td>
<td>0.04</td>
</tr>
<tr>
<td>Mother’s education (years)</td>
<td>−0.03</td>
<td>0.01</td>
<td>−0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Father’s education (years)</td>
<td>−0.02</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Poor childhood health&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.09</td>
<td>0.09</td>
<td>0.02</td>
<td>0.10</td>
</tr>
<tr>
<td>Married&lt;sup&gt;d&lt;/sup&gt;</td>
<td>−0.05</td>
<td>0.05</td>
<td>−0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Education (years)</td>
<td></td>
<td></td>
<td>−0.5***</td>
<td>0.01</td>
</tr>
<tr>
<td>Household income (log $)</td>
<td>−0.02</td>
<td>0.03</td>
<td>−0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>No. of income sources</td>
<td>−0.08***</td>
<td>0.02</td>
<td>−0.09***</td>
<td>0.02</td>
</tr>
<tr>
<td>Household wealth (log $)</td>
<td>−0.06***</td>
<td>0.01</td>
<td>−0.05***</td>
<td>0.01</td>
</tr>
<tr>
<td>Occupation&lt;sup&gt;e&lt;/sup&gt;</td>
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<tr>
<td>Nonmanual</td>
<td>0.01</td>
<td>0.06</td>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Unskilled manual</td>
<td>0.06</td>
<td>0.07</td>
<td>0.04</td>
<td>0.07</td>
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<tr>
<td>Farming</td>
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<td>−0.17</td>
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<tr>
<td>Skilled manual</td>
<td>−0.03</td>
<td>0.08</td>
<td>−0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Military</td>
<td>−0.15</td>
<td>0.15</td>
<td>−0.16</td>
<td>0.14</td>
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<tr>
<td>Body mass index&lt;sup&gt;f&lt;/sup&gt;</td>
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<td></td>
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<tr>
<td>Underweight</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Overweight</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker&lt;sup&gt;g&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Former smoker&lt;sup&gt;g&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of chronic conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes.**

- <sup>a</sup>Reference group is US-born non-Hispanic White.
- <sup>b</sup>Reference group is female.
- <sup>c</sup>Reference group is excellent/very good.
- <sup>d</sup>Reference group is single/divorced/separated.
- <sup>e</sup>Reference group is professional/managerial.
- <sup>f</sup>Reference group is normal weight.
- <sup>g</sup>Reference group is never smoker.

* p < .05. ** p < .01. *** p < .001.
plasticity, during which physical and social conditions can alter life course trajectories of socioeconomic attainment (Haas, Glymour, & Berkman, 2011) and set in motion cascading physiological processes that impact health decades later (Montez & Hayward, 2011). But our finding that early life physical and material disadvantage is mediated by subsequent circumstances suggests that interventions that target health and SES in midlife can mitigate early life disadvantages.

In addition to more commonly measured dimensions of SES such as educational and occupational attainment, income, and wealth, we also find significant positive effects of income diversity on physical performance. Adults who had more income sources had better lung function and faster gait speeds. Diverse income portfolios in later life indicate financial security (Krueger & Burgard, 2011), which may result in a greater ability to access medical services, assistive technology, and other factors that help maintain physical performance.

Prior research has suggested that adult SES may have different relationships with health and mortality across race/ethnic groups. For example, Farmer and Ferraro (2005) suggest that Blacks and Hispanics will have worse health than Whites at very low levels of SES, but that race/ethnic differences will narrow with increasing SES. Higher levels of SES may buffer Blacks and Hispanics from the health risks that are associated with their structural disadvantages. Conversely, the diminishing returns hypothesis suggests that race/ethnic differences in health will grow wider with increasing SES. Blacks and Hispanics may receive fewer health benefits from increasing SES because they have had lower quality educations, experience discrimination, and have fewer opportunities than Whites to improve their life chances (Conley, 1999; Grodsky & Pager, 2001; Kahn & Fazio, 2005). In separate analyses (not shown), we specifically tested for interactions between our adult SES variables and race/ethnicity and nativity. Consistent with previous work on race/ethnic disparities in functional health trajectories (Haas & Rohlfsen, 2010; Hayward et al., 2000), we found little evidence that the relationship between adult SES and physical performance differed across race/ethnic groups. The only significant interaction between race/ethnicity and SES was for household wealth in models of lung function, which found that Blacks and Hispanics benefited less from greater accumulated wealth than Whites.

Notably, there are large differences in the ability of life course health and socioeconomic factors to account for variation in the measures of physical performance. Our life course factors account for more than 50% of the variation in lung function and grip strength, but account for only 13% of variation in gait speed. One reason for the relatively limited ability of our variables to explain variation in gait speed may be that the timed walk measure is relatively more variable (as indicated by the ratio of the mean of each performance item to its standard deviation) than the other physical performance measures (see Table 1).

It is also somewhat counterintuitive that higher BMI is associated with increased lung function, given that prior work finds that BMI and lung function are inversely associated (Canoy et al., 2004). However, most research that focuses on lung function and BMI is based on small clinical samples, which tend to differ from the general noninstitutionalized population in ways that may mask relationships observed at the population level. The limited population-based research that accounts for an extensive set of covariates has found that the relationship between BMI and lung function can be complex. For example, the shape of the association between BMI and lung function can vary substantially between waist-to-hip ratio quartiles (Canoy et al., 2004).

Our analysis identifies large disparities in later life physical functioning across race/ethnicity and nativity in the United States. Such inequalities in physical performance may be significant contributors to disparities in the disablement process. Our analysis also highlights that a large proportion of race/ethnic and nativity disparities result from health and socioeconomic disadvantages in both early life and adulthood. This suggests multiple intervention points for addressing health disparities. Although interventions in early life may be more efficient (Heckman, 2000), the fact that the impact of early life disadvantage is largely attenuated by subsequent health and material factors suggests that policy makers could successfully intervene in adulthood. Though health disparities may have their genesis in early life, they are not immutable and appropriate policy interventions that improve subsequent physical and socioeconomic conditions can have lasting ameliorative effects.

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References


