

## Invited Article

# Diverse Aging and Health Inequality by Race and Ethnicity

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## Abstract

Although gerontologists have long embraced the concept of heterogeneity in theories and models of aging, recent research reveals the importance of racial and ethnic diversity on life course processes leading to health inequality. This article examines research on health inequality by race and ethnicity and identifies theoretical and methodological innovations that are transforming the study of health disparities. Drawing from cumulative inequality theory, we propose greater use of life course analysis, more attention to variability within racial and ethnic groups, and better integration of environmental context into the study of accumulation processes leading to health disparities.

**Translational Significance:** To better understand the causes and consequences of health disparities, we should consider more sophisticated assessments of individuals' cumulative biological, social, and environmental risks and assess exposures throughout the life course.

**Keywords:** Cumulative inequality, Health disparities, Racial and ethnic heterogeneity, Theory

Health is an invaluable resource for optimal aging, so much so that some scholars use terms such as “healthy aging” to draw attention to the advantageous position of growing older unencumbered by disease or disability. Some individuals and human collectivities, however, are noticeably challenged to age well because they face a host of threats to health. Within gerontology, research on minority health—comparing the health of historically underrepresented minority groups to the majority population—has revealed how structural disadvantages challenge individuals to age well. The disadvantage is nontrivial, as illustrated by one study showing that survival to age 65 was greater for men in Bangladesh than in Harlem, NY (McCord & Freeman, 1990).

Despite public health efforts to reduce and eliminate racial and ethnic disparities in health, the gap remains. The

purpose of this essay, therefore, is to provide an overview of recent research on health inequality by race and ethnicity and outline promising approaches to make significant progress in addressing the inequality.

To begin, we note that although the word *inequality* has become part of the public lexicon in recent years, inequality is more than just a difference between individuals or human collectivities. *Health inequality*, also referred to as health disparity, *implies an inequity or injustice because the difference in a health outcome is considered preventable* (Hebert, Sisk, & Howell, 2008). During the past 50 years, as evidence has accumulated regarding the myriad ways that social and environmental contexts influence health, the scope of preventable health problems has widened. Racial and ethnic differences in health that were once considered inevitable have become redefined as remediable.

## Evolving Views of Health Inequality by Race and Ethnicity

Racial health inequality was manifest early in U.S. history, reflecting immigration streams as well as public health in the United States and the countries of origin. Unfortunately, many laypersons and scholars alike attributed these differences to innate biological factors (Krieger, 1987). Research during the past half-century, however, has documented that although some diseases and conditions have a genetic component that may contribute to health differences among Black, White, Hispanic, and Asian adults, these biological *differences* play a fairly small part in health *disparities* (Adler & Rehkopf, 2008; Hummer, 1996; Phelan & Link, 2005; Williams, Priest, & Anderson, 2016). Instead, scholars showed that many health disparities are due to exposure to environmental hazards, poverty, behaviors known to harm health (e.g., smoking), and limited access to medical care, especially high-quality medical care (Bach, Pham, Schrag, Tate, & Hargraves, 2004). Any of these factors is sufficient to accelerate health decline. When combined, however, the health consequences are predictably grave, underscoring the influence of institutionalized discrimination (Williams & Mohammed, 2009).

For decades, researchers reported that Black Americans rate their health worse (Farmer & Ferraro, 2005), have shorter life expectancies (Hummer, 1996), live a greater proportion of life with a disability (Hayward & Heron, 1999), and have higher rates of many of the leading causes of death such as cancer and heart disease (National Center for Health Statistics, 2016; Siegel, Miller, & Jemal, 2016; Sorlie, Backlund, & Keller, 1995). The stark reality of racial health inequality led scholars to advance hypotheses such as weathering (Geronimus, Hicken, Keene, & Bound, 2006), scarring (Preston, Hill, & Drevenstedt, 1998), and double jeopardy/intersectionality (Ferraro & Farmer, 1996) or perspectives such as the ecosocial approach to discrimination and health (Krieger, 2012) and chains of risk (Ferraro & Shippee, 2008).

Although considerable research demonstrated the idea that Black Americans were faring worse than White or Asian Americans on many health outcomes, studies of Hispanic Americans yielded more equivocal, and some argued paradoxical, results (Markides & Coreil, 1986). Despite higher health risk profiles than their non-Hispanic counterparts, Hispanic Americans displayed better mental health outcomes, lower prevalence of many chronic diseases, and even lower mortality rates (Ruiz, Hamann, Mehl, & O'Connor, 2016). Building on an extensive literature describing racial and ethnic health disparities, investigators began to question whether gaps in Black and White health outcomes are closing or persisting, and whether the so-called "Hispanic Paradox" indeed exists (Crimmins, Kim, Alley, Karlamangla, & Seeman, 2007).

## Evidence of Changes in Health Inequality by Race and Ethnicity

Over the last two decades, rich data and innovative analytic methods have been used to examine health trends by race and ethnicity, enabling investigators to explicate historical

trends as a whole and for given cohorts. The accumulated research shows that health disparities by race have fluctuated—some gaps have shrunk, whereas others have expanded (Bleich, Jarlenski, Bell, & LaVeist, 2012; National Center for Health Statistics, 2016; Olshansky et al., 2012). According to the Center for Disease Control's most recent annual report, health trends for the U.S. population were "generally positive" between 1999 and 2014, including a narrowing of some racial and ethnic gaps in health (e.g., life expectancy and infant mortality). However, racial and ethnic gaps are still manifest for all ten measures considered in the report (e.g., hypertension, infant mortality), confirming that health inequality by race and ethnicity remains substantial (National Center for Health Statistics, 2016).

In addition to investigating population trends in racial and ethnic health inequality over the past few decades, attention has been given to how the aging process shapes inequality. Researchers have examined three potential relationships between age and racial/ethnic health inequality: (a) minority *older* adults are at even greater risk of poor health (i.e., double jeopardy hypothesis; Dowd & Bengtson, 1978), (b) racial/ethnic health disparities shrink with age (i.e., age as a leveler; Kim & Miech, 2009), and (c) racial/ethnic differences emerge early and remain relatively stable in adulthood (i.e., stability of racial differences; Kelley-Moore & Ferraro, 2004). Evidence exists to support all three patterns, but caution is warranted regarding the purported leveling effect because failure to account for mortality selection "may give the appearance of decreasing inequality in later life" (Ferraro & Shippee, 2009, p. 337).

## Why Racial Health Inequality?

Beyond documenting trends in racial/ethnic health over historical and biographical time, researchers have sought to explain why racial and ethnic differences in health are so substantial, complex, and perhaps paradoxical. For instance, why is it that, despite being economically disadvantaged, Hispanic adults appear to have similar or better health outcomes than their non-Hispanic counterparts? The fact that foreign-born Hispanics are healthier than their U.S.-born counterparts suggests the viability of a healthy immigrant effect (Salazar et al. 2016). However, studies show that not only does the health advantage of Hispanic Americans over non-Hispanic White Americans decline with longer tenure in the United States (Hamilton, Palermo, & Green, 2015) but also that this advantage shrinks over generations—so much so that by the third generation, these health advantages effectively disappear (Padilla, Hamilton, & Hummer, 2009). Many scholars argue this relationship is, in large part, due to acculturation, or "the process by which individuals adapt to a new living environment and potentially adopt the norms, values, and practices of their new host society" (Abraído-Lanza, Echeverría, & Flórez, 2016). For many Hispanic immigrants, this process leads to a departure from largely healthy lifestyles and the adoption of many negative health behaviors such as smoking, alcohol abuse, and poor nutrition (Lara, Gamboa, Kahramanian,

Morales, & Bautista, 2005). As such, though age and nativity are critical elements for assessing racial and ethnic health inequality, it behooves scholars of minority aging to use a life course perspective that considers exposures, resources, and behaviors over time. Failure to consider immigration and ethnic cultures may result in an oversimplified, and perhaps misleading, picture of racial/ethnic health inequality.

Although many people attribute health inequality to lifestyle behaviors, some have urged caution for multiple reasons, not the least of which is blaming the victim. Most studies show that health behaviors do *not* adequately explain the health gap—and it may downplay the role of social and environmental forces (Hayward, Miles, Crimmins, & Yang, 2000; Hummer, 1996). Moreover, some health risks such as obesity are more prevalent among Black adults (Jackson et al., 2013), whereas others such as smoking and alcohol consumption are more prevalent among White adults (Keyes et al., 2015). Lifestyle and health behaviors are important, but they also are influenced by socioeconomic status (SES). Indeed, some scholars assert that SES is the driving force of racial health disparities (Phelan & Link, 2005). People in lower socioeconomic groups are more likely to experience chronic ill-health and die earlier than those who are more advantaged. Even though SES often explains some racial differences in health, it is not by itself an adequate explanation (Adler & Rehkopf, 2008; Farmer & Ferraro, 2005; Williams et al., 2016); racial disparities often persist after accounting for health behaviors, risk factors, and adult resources such as SES (Shippee, Ferraro, & Thorpe, 2011).

## Weathering?

The weathering hypothesis attracted considerable scholarly interest and has helped advance research on health inequality by race. Originally developed in the context of Black/White differences in fertility timing and infant mortality, Geronimus (1992) argued that weathering represents “a theoretical view of aging ... reflective of the life circumstances that promote or undermine women’s health” (p. 210). Conceptualized as a “heuristic model,” weathering prioritizes how socioeconomically disadvantaged persons “may be subjected to many sets of health risks, the consequences of which may accumulate with age” (p. 210). In short, the myriad insults faced by social disadvantage result in premature aging—an accelerated deterioration in health. The hypothesis also has been described as a “cumulative stress perspective” (Geronimus, 2013) and empirically supported on other outcomes during adulthood such as allostatic load (Geronimus et al., 2006) and telomere length (Geronimus et al., 2010, 2015).

Although the weathering hypothesis remains useful, we offer three observations about applying it. First, the evidence to support weathering as a process of premature aging may be limited to certain periods of the life course. Accelerated aging may not be linear, nor extend to later life. In multiple studies, the evidence points to greater midlife inequality by race (Geronimus et al., 2006) and education (House et al.

1994)—not during later life as one would anticipate based on the double jeopardy hypothesis. Thus, there is an important research question for gerontology to address: Does racial health inequality increase at certain points of the life course and perhaps contract (level) at other phases of human life? And what role does mortality selection play when interpreting observed differences by race/ethnicity and age? Viewing weathering as a theory of aging may be premature until we better understand the age dynamics of racial inequality.

Second, the evidence is inconsistent that weathering operates for other historically underrepresented minority groups. Whether studying birth outcomes (Collins, Rankin, & Hedstrom, 2012) or allostatic load in later life (Peek et al., 2010), there is no compelling evidence that weathering operates in a comparable way for Hispanic Americans. Results from Peek and colleagues for Black Americans are consistent with the weathering hypothesis but not for Mexican Americans. Moreover, their support for *healthy immigrant* and *acculturation* hypotheses point to the importance of behavioral responses to misfortune, both at the individual and community level.

Third, the metaphor of weathering can unintentionally lead to a fairly passive view of the consequences of insults. Unlike inanimate materials on a house or vehicle, which show the effects of weathering (e.g., oxidation-reduction), humans can respond to insults. Some of these responses may themselves lead to health decline whereas others may compensate for or nullify the likely consequence of the insult (e.g., substance abuse and aerobic exercise, respectively). Thus, the same insult may lead to divergent health consequences (or none at all) because the response to the insult may vary. Human agency merits more attention when testing the weathering hypothesis (Elder, 1998; Ferraro & Shippee, 2009). We acknowledge that recent articles on weathering hypothesis give more attention to “access to coping resources” (Geronimus, 2013; Geronimus et al., 2015), but access is a first step in how one engages with resources. Drawing from cumulative inequality theory, greater attention should be given to *selecting* and *mobilizing* resources (Ferraro & Shippee, 2009). Access is a necessary condition for resource mobilization, but it is not sufficient.

## Lived Experience as an Underrepresented Minority

If not due to weathering, health behaviors, or adult resources, what is it about skin color and ethnic heritage that might explain health inequality? By themselves, the variables of race and ethnicity are useful but ultimately fairly crude indicators of the concepts implied by their use. Just as gerontologists realize that age is a fairly crude and limited explanatory variable, so are race and ethnicity. We contend that we need more information about the *lived experience* of persons from diverse ethnic or racial heritages because race and ethnicity describe general categories of humanity, each of which is replete with diversity. For instance, Asian Americans are not generally considered

an underrepresented minority because their educational attainment and health are better than White Americans, but the opposite is true for selected categories of Asian Americans (e.g., Cambodian, Hmong).

To give more attention to lived experiences, investigators have examined two primary potential influences on health inequality by race and ethnicity: perceived discrimination and neighborhood concentration/segregation. First, although racism is prevalent in many complex societies, not all people in racial and ethnic minorities feel the brunt of it. Thus, the logic of this line of investigation is to tap the *experience* of racism as reported by persons who feel that they have been treated unfairly. There are health consequences to “the institutional structures, processes, and policies that undergird societal racism” (Williams & Mohammed, 2009, p. 40). The experience of discrimination is a notable stressor that harms the health of both Black and Hispanic adults (Everson-Rose et al., 2015; Pascoe & Smart Richman, 2009) as well as immigrants more generally (Schunck, Reiss, & Razum, 2015). Moreover, past research on stress and health has been criticized for failing to include measures of perceived discrimination, thus downplaying stress experienced by Black Americans and other minority groups (Krieger, 2012; Turner & Avison, 2003). We need more research on who experiences stressors due to racism and who is most affected by such stressors.

Second, investigators have studied the health effect of residing in racially or ethnically homogenous neighborhoods. Research shows that the health effects associated with racial/ethnic segregation vary by minority group. The literature generally reveals deleterious effects of residential segregation on health behaviors and lifestyles of Black adults (Kershaw, Albrecht, & Carnethon, 2013; Williams & Collins, 2001), but not for Hispanic adults. For example, research has shown that for older Hispanic adults, particularly Mexican Americans, living in neighborhoods with high Hispanic density reap a health-protective benefit—a phenomenon known as the *barrio advantage* (Aranda, Ray, Snih, Ottenbacher, & Markides, 2011; Lee & Ferraro, 2007).

There are many useful approaches to the study of aging and health inequality by race/ethnicity, but the most promising ones give attention to context. The core concepts of race and ethnicity are so crude that using them exclusively tends to result in fairly descriptive findings. With developmental and demographic context, however, the concepts of race and ethnicity become more useful for explicating why health inequality is so prevalent and resistant to amelioration. We contend that core concepts and propositions from life course epidemiology (Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003) and cumulative inequality theory (Ferraro & Shippee, 2009) hold great promise for explicating why racial and ethnic disparities in health persist. We illustrate a few recent applications of these concepts for research frontiers on the topic.

## Advancing Research Frontiers on Health Inequality by Race and Ethnicity

Despite the efforts of scholars to explain racial and ethnic gaps in health, many unresolved issues remain. In order to advance research on the topic and reduce racial/ethnic health inequality in complex societies, we offer several recommendations and an integrated conceptual framework. We begin by outlining six main areas of research that we identify as auspicious avenues of study for gerontology.

### Life Course Epidemiology

An evolving literature has emerged that focuses on the potential of early-life events and experiences to set the stage for later life health, but relatively little attention has been given to racial and ethnic differences in the processes linking early-life exposures to later-life health outcomes. Given that various exposures to risk—and available resources to manage risk—are likely to vary by race and ethnicity, it is imperative to investigate the cumulative effect of insults at different points in the life (e.g., childhood) and accumulation across the life course by race and ethnicity. Early-life misfortune may lead to discrepant health outcomes directly or indirectly (Ferraro, Schafer, & Wilkinson, 2016). For instance, in comparison to White men, Black men’s poorer health was due partially to childhood adversity but also because the adversity heightened relationship strain in adulthood (Umberson, Williams, Thomas, Liu, & Thomeer, 2014). We need parallel studies related to the processes leading to racial and ethnic health inequality, whether direct or indirect. This includes the study of risk accumulation and subsequent resource activation to determine whether these processes differ by race/ethnicity.

Studying accumulation processes across the life course also implies greater attention to human agency. According to cumulative inequality theory, individual “trajectories are shaped by the accumulation of risk, available resources, and human agency” (Ferraro & Shippee, 2009, p. 337). All too often humans are treated not as actors but as the objects of exposures. We need the complementarity of the structure-agency debate to sort out which behaviors and lifestyles are due to racism and which are due to responses to racism. Doing so will open up evidence-based consideration of how to mobilize resources that may be effective in reducing health inequality. Differences abound in human experience, but our focus is *preventable inequality in health*.

Whether tracing early origins from in utero, childhood, or early adulthood, we need high-quality data, perhaps via biomarkers or medical records, on the health of populations by ethnic heritage. Although some countries do not maintain official data on racial and ethnic categories, researchers need such information to identify the extent of inequality across the life course and offer recommendations for ameliorating it.

## Intergenerational Transmission of Health

Both life course epidemiology and cumulative inequality theory call for greater attention to family lineage, which is helpful not only for assessing family/genetic predispositions to disease, but also for how lifestyles shape health. The study of the early origins of adult health implies consideration of intergenerational transmission of health. Data that link generations may open up new vistas for explicating why health inequality is so highly related to race and ethnicity.

Sparked by [Barker and Osmond's \(1986\)](#) pioneering research on the health consequences of fetal nutrition, [Fox and colleagues \(2015\)](#) propose "fetal programming" as an underlying cause of the observed generational decline in health among Hispanic Americans. This interdisciplinary framework posits that the acculturation processes of first-generation, pregnant women may alter the development of their unborn children and can lead, through fetal programming, to phenotypic changes that increase the likelihood of developing chronic disease later in life. Although this perspective emphasizes the importance of intrauterine development in predicting later-life health outcomes, intergenerational transmission of health does not end at birth. Such influence may endure via lifestyles and resources. Moreover, for those who become parents, the influence typically becomes reciprocal: parents influence their children's health, but children also influence their parent's health. We need studies of both processes.

## Environmental Context

We have witnessed notable scientific achievements from research integrating environmental context into the study of health. Whereas the residence of many ethnic groups is clustered, it is logical to advance research on health inequality by giving renewed attention to race and ethnicity. By environment, we refer to both the physical and social environments. Dating back to Hippocrates, the effect of physical environment on health and health behaviors has been clear. Exposure to toxins, whether naturally occurring or due to pollution, may lead to or exacerbate health problems, but social environments can be equally detrimental to health. Crowding, social disorganization, poverty, and war can similarly wreak havoc on health, and persons who are underrepresented minorities are more likely to be exposed to such elements of the social structure.

Racial and ethnic residential patterns are often shaped by two forces. *Homophily*, the tendency for people to associate with others who have similar characteristics, *draws* ethnic and racial groups into neighborhoods or areas, sometimes resulting in ethnic enclaves (including goods, services, and cultural practices desired by those groups). By contrast, *racism limits* opportunities for residence outside of ethnically homogeneous communities. Racial and ethnic segregation exists because of both forces, and [Williams and Collins \(2001\)](#) argued that racial segregation

is a fundamental cause of disparities in health; residence in disadvantaged and segregated neighborhoods often limits opportunity and quality of life for Black Americans.

As noted earlier, however, past research found that segregation is often protective of Hispanic health, even in poor neighborhoods, probably because the segregation is accompanied by greater social capital and economic interdependency. Even here, however, research reveals that this relationship varies by country of origin of the Hispanic Americans ([Nelson, 2013](#); [Palloni & Arias, 2004](#)).

Given the importance of physical context in shaping health, researchers now have the opportunity explore or at least account for geographic location via data linkages. Geocoded data make it possible for investigators to contextualize their models by incorporating multiple levels of geographic information as well as the ability to examine between- and within-level variation.

Data linkages can add great value to research on health by race and ethnicity. One potential drawback, however, is that many data linkages are considered sensitive and/or rely on access to restricted data (often requiring the investigator to have a major grant). Wider access to geocoded data would enable scholars to better contextualize their research, which would be helpful for studies of social factors and health. We also need better measurement of why people live in their respective neighborhoods. Would they like to live elsewhere? If yes, what are the attractive attributes of the alternative location? Answers to these questions will help sort out the countervailing influences of residential homophily and racial segregation.

## Racism and Perceived Discrimination

Racism is prevalent in many societies and manifest on multiple levels, from national and regional policies to interpersonal relations. Given the variability in exposure to racism, investigators have turned to measuring its health impact via reported or perceived discrimination ([Williams & Mohammed, 2009](#)). This is a logical approach, but reports of perceived discrimination do not always map onto structural disadvantage. For instance, perceived discrimination is often positively correlated with educational attainment. This is not to infer that persons with limited education do not experience discrimination, but that higher education leads to greater awareness of discrimination as well as to attempts to traverse into occupational groups with few racial and ethnic minorities (hence, underrepresented).

We need more research on the experience of discrimination and strategies used to deal with it ([Shippee, Schafer, & Ferraro, 2012](#)). Given that early-life events and experiences shape life perceptions and health trajectories ([Ferraro & Shippee, 2009](#)), it would be ideal to know about perceived discrimination at multiple periods of the life course; doing so would enable one to differentiate recurring experiences from one or two episodes only ([Landrine, Klonoff, Corral, Fernandez, & Roesch, 2006](#);

Williams, Neighbors, & Jackson, 2003). Measurement is also important because some studies tap perceived discrimination with a dichotomous indicator, whereas others use multi-item scales, relying on specific experiences to be reported. In addition, many measurement batteries ask for an attribution for the unequal treatment, but this may be difficult for respondents to answer because race and ethnicity overlap with other statuses.

Another thesis that has garnered attention is that lighter-skinned Black people are advantaged compared to their darker-skinned counterparts on a host of social and economic outcomes (Keith & Herring, 1991) and perhaps on health (Klonoff & Landrine, 2000). Skin tone stratification, sometimes referred to as colorism, is a type of discrimination that may be perpetrated by both Black and/or non-Black persons (Hunter, 2007). Although considerable research reveals that skin tones are related to socioeconomic stratification, the link to health remains unclear. Some studies show no relationship between skin tone and health (Borrell, Kiefe, Williams, Diez-Roux, & Gordon-Larsen, 2006), whereas one study revealed an interaction effect: greater income was protective against high blood pressure for light-skinned Black people but not for those with darker skin (Sweet, McDade, Kiefe, & Liu, 2007). Others find that skin tone is associated with both lifetime and recent racial discrimination, suggesting that its effect on health is probably indirect via racial discrimination (Klonoff & Landrine, 2000).

Many questions also remain regarding the pathways by which perceived discrimination influences health. Perceived discrimination has been proposed as a stressor and likely affects health via stress response processes and health behaviors (Kessler, Mickelson, & Williams, 1999; Pascoe & Smart Richman, 2009), but evidence is needed on specific pathways. For instance, does it lead to chronic inflammation (as measured by C-reactive protein)? And what resources such as religion, or actions such as protest or avoidance, might help people cope with the unfair treatment?

### Ethnic Heritage and Identity

Integrating the first four recommendations also means that we need attention to changing environmental contexts and the evolution of ethnic identity. To begin, we need more attention to variation *within* general categories of race and ethnicity. Research has begun to do so with intra-group variability of Hispanic or Latino Americans (e.g., Mexican, Cuban) and Black Americans (e.g., African, Afro-Caribbean), but this merits sustained investigation to capture the diversity of complex societies.

A focus on ethnic heritage and identity also implies greater attention to international immigration (moving to a new country) as well as internal migration (relocation within a nation). Some underrepresented minority groups are recent immigrants, and others are descents of immigrants three or more generations ago. At a minimum,

we need to collect data on nativity status. Ideally, we need more information to integrate information on family lineage, immigration streams, and intergenerational status attainment.

Owing to more recent immigration, there has also been interest in the influence of acculturation on Hispanic health. Scholars increasingly realize the importance of this concept in understanding health outcomes, yet often fall short in conceptualizing and measuring its complexity. Though nativity status, U.S. tenure, and language spoken at home are often used as proxy measures for acculturation, recent research has argued that researchers need to take into account the social and cultural contexts in which immigration and assimilation occur (Abraído-Lanza et al., 2016; Allen et al., 2014). Future research should account for the social environment of both the sending and receiving countries, paying special attention to country of origin and arrival-cohort. The life course is embedded in historical time, and the timing of the immigration experience is important for understanding life chances and longevity. There is evidence that ethnic neighborhoods can protect against some of the negative effects of acculturation (and discrimination) for first-generation adults, but that these neighborhoods do not confer the same benefits for their U.S.-born relatives (Abraído-Lanza et al., 2016). Better knowledge of acculturation and ethnic identity may help explain such findings.

### Performance Measures and Biomarkers

Finally, we can learn much about the sociogenesis of health problems by examining measures that are not subject to respondent reports. Physical performance measures such as hand-grip strength and expiratory volume are excellent for benchmarking preclinical health status. Especially when studying economically disadvantaged populations, asking people about diseases that a physician diagnosed is contingent on health service use. Barriers to accessing care—especially high-quality care—are related to estimated prevalence of many chronic diseases (Bach et al., 2004). Physical performance measures provide a more objective complement to self-reported health information so that one can minimize the bias introduced by limited access to quality medical care.

Biomarkers are another way to tap many of the phenomena underlying health inequality by race and ethnicity. For stress responses, many scholars have studied hormones such as cortisol, or salivary enzymes such as  $\alpha$ -amylase, because they are released in response to stressors. If perceived discrimination is a stressor, these biomarkers can tell us whether perceived discrimination is actually manifesting itself in the body. Others scholars investigate C-reactive protein, an acute-phase protein that taps chronic inflammation, because it is a robust predictor of heart disease and stroke.

Gerontologists have long been interested in telomeres, which are chromosomal end caps that shorten with age and

as cells replicate, because many regard them as a global measure of aging (Harley, 1991). Indeed, telomere length has been associated with stressors such as perceived discrimination (Chae et al., 2014), and some studies report that telomeres are shorter in Black relative to White adults (Diez Roux et al., 2009). However, evidence is equivocal and there are still many unanswered questions regarding biomarker dynamics and potential differences by race and ethnicity. For instance, some research suggests that Black newborns have longer telomeres than White newborns (Drury et al. 2015).

Cumulative stress across the life course may explain why even with longer telomeres at birth, Black adults have shorter telomeres in later life. This does not, however, explain why there may be some racial differences at birth. Drury and colleagues (2015) suggest that underlying telomere mechanics or genetic architecture may vary by race. More research is needed to determine baseline telomere lengths at birth by race and ethnicity, the rate at which they change and under varied conditions, and whether the biological structure and functions are similar across race and ethnicity. Biomarkers may enable us to be more proactive in identifying persons at risk for subsequent health decline, but we need definitive information on whether the measured racial/ethnic differences, even at the earliest ages, are in fact preventable.

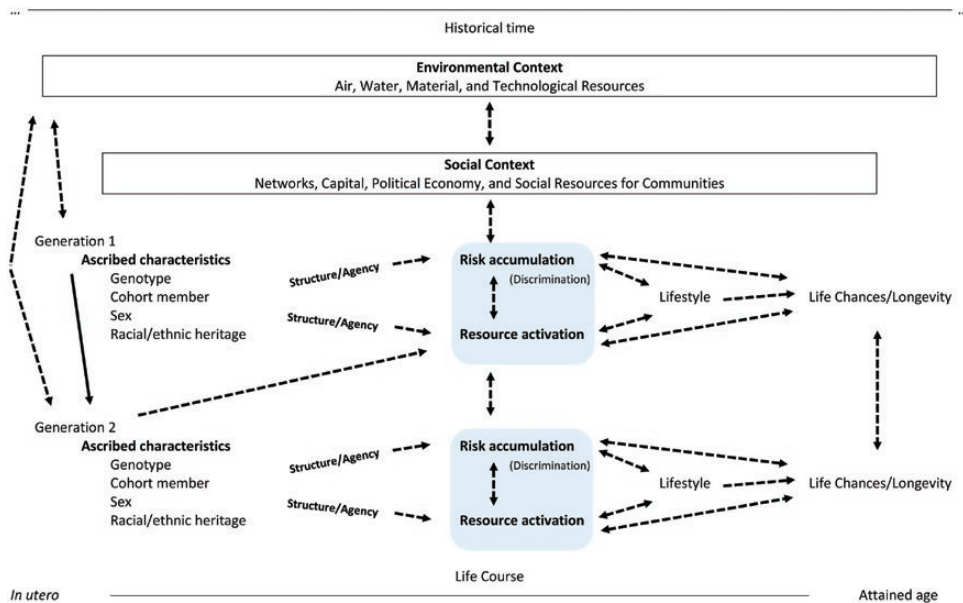
### Integration and Conclusion

Our aim was to provide an overview of a vitally important area of research in gerontology and public health and to identify promising avenues for research on health inequality by race and ethnicity. Several of the six items outlined

above focus on research design issues such as outcomes studied (e.g., biomarkers) and integration of contextual variables in analyses (e.g., use of geocoded data). Other suggestions for future research are more abstract, and we conclude by offering a heuristic model that integrates several of the theoretical ideas discussed in this article.

We present Figure 1 as a simplified model of the diversity of aging and health by race and ethnicity. The line at the top of the figure denotes historical time, and the bottom line denotes the life course in biographical time from in utero experience to attained age, representing selective longevity. Environmental context provides a broad set of influences that include natural and technological resources, and social context refers to the influence of networks, capital, and social resources in areas defined by political economy. Incorporating contextual variables draws attention to spatial and cultural elements of inequality (Hackbarth, Romley, & Goldman, 2011).

To prioritize the intergenerational transmission of health, two generations are illustrated in Figure 1. Focusing first on Generation 1, each person has ascribed characteristics such as genotype, cohort membership, sex, and racial/ethnic heritage. All humans are constrained by social structures but have some degree of independence to deal with the constraints. Navigating the dual influences of structure and agency (emphasized in dashed lines) leads to both risk accumulation and resource activation (Ferraro & Morton, 2017). Discrimination is one type of risk accumulation that merits detailed examination in studies of health because it is shaped by and acts back on environmental and social contexts. People can activate a varied portfolio of resources, including economic, social, psychological, and political assets, and some people consider



**Figure 1.** Heuristic model for studying diverse aging and health inequality by race and ethnicity. Note: Selected lines shown; dashed lines reflect the complementarity of structure and agency.

relocation a path to acquire amenities or improve their opportunities.

Drawing from Max Weber ([1922] 2001), we specify lifestyle, which includes health behavior, as shaped by actors facing risk and seeking to activate resources. Ultimately, this influences life chances (longevity and quality of life). As signified by the double-pointed arrows, lifestyle and life chances act back on risk accumulation and resource activation over time. The actions of each person also may influence environmental and social contexts.

Generation 2 reproduces the interrelationships among most variables but accentuates the role of family lineage. Although Generation 1's influence on Generation 2's ascribed characteristics are fixed, it is worth noting that Generation 2 may influence risk accumulation and resource activation of Generation 1 (e.g., adult children caring for parents) and, concomitantly, life chances and longevity. The bidirectional arrows between environmental context and Generations 1 and 2 indicate the influence of environment on each generation as well as the ability of individuals to change their physical and social environment.

Figure 1 could be elaborated with other concepts and relationships (arrows) but we present a parsimonious version to accentuate linkages between core concepts and herald the call for more attention to the processes that lead to health inequality by race and ethnicity. There are many promising ways to combine elements of this model with the aforementioned frontiers for studying health inequality.

Diversity is a core concept in gerontology, and racial and ethnic diversity greatly shapes the way we age. Some of that variability is benign but other elements of it are harmful to health, accelerating the aging process. Given the diversity of human experience, it is crucial to consider physical, social, and historical context, but also to account for the conjoint influence of structure and agency in explaining racial and ethnic gaps in health.

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