Health-Related Quality of Life in Older Adults: Testing the Double Jeopardy Hypothesis

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ABSTRACT

The double jeopardy hypothesis posits that racial minority elderly suffer a double disadvantage to health due to the interactive effects of age and race. Empirical examinations have found mixed support for the proposition that the aging process heightens the health disadvantage for racial minorities compared to whites. Race-by-age differences are tested using a health-related quality of life measure that has been largely overlooked in previous double jeopardy analyses. The outcome, number of days in poor physical health during the past month, quantifies day-to-day physical well-being in a way not available to standard measures of morbidity and mortality. Cross-sectional data from the 2003 California Health Interview Survey (CHIS) were analyzed using negative binomial regression. Results show that the magnitude of differences in the number of physically unhealthy days for African Americans and Hispanics compared to their white counterparts is much larger in the elderly strata than that observed between younger groups. Additionally, social characteristics do not fully explain why racial differences in poor physical health days become greater at older ages. A life course perspective is proposed as one possible explanation for the double jeopardy finding. The results indicate a need to consider health-related quality of life outcomes when examining racial/ethnic health disparities among the elderly population. The appendix presents cross-validation of the 2003 CHIS results with the 2005 CHIS and the findings are replicated.

Keywords: Health-related quality of life; racial/ethnic disparities; double jeopardy hypothesis

INTRODUCTION

The aging of the U.S. population, as well as its growing cultural diversity, highlights the need for racially and ethnically sensitive theories in the area of gerontology. California, in particular, has the largest number of elderly in the nation and has one of the fastest growing Hispanic and Asian immigrant populations. This study uses data from the California Health Interview Survey (CHIS), a cross-sectional telephone survey representative of the state's ethnic diversity, to investigate the double jeopardy hypothesis, one of the better-known theories in minority aging. The hypothesis states that minority elderly suffer a double disadvantage to health due to the interactive effects of age and race (Dowd & Bengtson, 1978). Minority elderly may suffer not only from prejudices, stereotypes, and discrimination associated with old age, but are also burdened by their racial minority group status (Markides, 1983). Thus, racial minority elderly may bear more health problems than their non-Hispanic white counterparts.

This study extends existing research on the double jeopardy theory by focusing on five major racial/ethnic groups: African Americans, Asians and Pacific Islanders (API), American Indians and Alaskan Natives (AIAN), the Hispanic origin population, and non-Hispanic whites. We also use a much broader age range (18-85 years) than used in earlier studies. Additionally, we use a health-related quality of life measure that accounts for the number of days in which poor physical health was experienced during a given month. Although this outcome is significantly associated with cause-specific mortality and hospitalization among the elderly (Tsai et al., 2007; Dominick et al., 2002), it has not been systematically studied in previous double jeopardy analyses. In general, there are limited empirical data about health-related quality of life among the elderly

population and particularly, regarding racial/ethnic differences beyond black-white comparisons (Skarupski et al., 2007). Moreover, the measure we use is an especially relevant outcome when investigating racial health differences because it indicates unmet health needs and assesses a person's well-being rather than merely the absence of disease (Chowdhury et al., 2008).

Literature Review

Racial/ethnic health disparities are well documented in the literature. Blacks have higher mortality rates than whites for most causes of death, including heart disease and stroke, cancer, diabetes, homicide, accidents, and drug abuse (Rogers, 1992), and there are few signs of impending convergence (Hummer, 1996; Read & Emerson, 2005). Studies of the Hispanic and Asian and Pacific Islander populations suggest health that is equal to or better than whites, although research has shown that while Hispanics have lower death rates than whites for the two leading causes of death (i.e., heart disease and cancer), they have higher death rates for other causes, such as tuberculosis, diabetes, homicide, and chronic liver disease (Williams & Collins, 1995). Survey-based health data for American Indian and Alaskan Natives continue to be limited.

Far less is known about racial/ethnic differences in the health of older adults compared to younger populations. Although it is well established that the aging process is accompanied by a steady and progressive deterioration in physical health, the effects of racial minority group status on the health of the elderly are less agreed upon. A recent report commissioned by the National Institute on Aging showed that morbidity

and mortality outcomes are worse for elderly blacks, AIAN, and to a lesser degree, Hispanics, while white and API elders display more favorable patterns (Hummer et al., 2004). The report also stated that socio-demographic and economic differences, such as sex, education, income, and nativity continue to play an important part in racial/ethnic health disparities for the aged.

The double jeopardy hypothesis grew from concerns regarding the disadvantage of older black-Americans (Dowd & Bengtson, 1978). Some researchers argue that the combined effects of old age and minority group membership, i.e., occupying two or more stigmatized statuses, brings with it greater negative consequences than occupying one status alone (Chappell & Havens, 1980). This disparity is often explained by differences in socioeconomic status (SES). Socioeconomic differences across racial and ethnic groups account for much of the observed racial health disparities, although not all (Read & Gorman, 2006; House & Williams, 2000). Additionally, adverse socioeconomic conditions experienced during early life strongly influence one's biological pathway and health behaviors into adulthood (Ben-Shlomo & Kuh, 2002). Individuals acquire varying levels of resources (i.e., education, income, health insurance) over the life course that allows them to achieve health (Warner & Hayward, 2006; House & Williams, 2000; Williams & Collins, 1995). Thus, health status is not only a function of current levels of socioeconomic status but also of other conditions experienced throughout the life course. For example, exposures to infectious agents in childhood are associated with impaired immune function, increasing the likelihood of infectious diseases, conditional on exposure to pathogens (Ben-Shlomo & Kuh, 2002).Therefore, it is reasonable to conclude that disadvantages accrued throughout life

amplify in old age, when one faces physical limitations such as chronic conditions and functional disability.

While the double jeopardy hypothesis seems conceptually sound, empirical evidence for it has been mixed (Markides, 1983, 1984). Using cross-sectional data collected in Los Angeles, Dowd and Bengston (1978) provided one of the first empirical tests for double jeopardy to health. They compared mean scores for self-rated health status based on a 5-point Likert scale among blacks, whites, and Mexican Americans for age groups ranging from 45-74 years. Similarly, Jackson, Kolody, and Wood (1982) examined perceptions of health as a serious problem for blacks and whites using cross-sectional data. However, both studies could only claim partial support for the double jeopardy hypothesis because they did not explicitly test for race-by-age interaction (Ferraro, 1989). Soon after, Ward (1983), and Ferraro and Farmer (1996) performed race-age interaction tests using cross-sectional survey data and similar subjective health outcomes between white and black respondents but found no support for double jeopardy.

Since the double jeopardy perspective is contingent on the aging process, longitudinal data with detail on life experiences is preferable. However, while longitudinal research may appear to provide a more appropriate analytical approach, large sample longitudinal datasets of minority elderly are virtually non-existent, particularly for immigrant elderly groups. Further, panel data is subject to attrition, i.e., mortality selection. The loss of subjects becomes even more relevant in a health study, as those who suffer a health decline during the study or die are ultimately not included in the analysis. For example, a double jeopardy study by Markides and colleagues

(1984) on Mexican Americans and whites had a substantial loss in subjects. They utilized longitudinal data collected during 1976 to 1980 on Mexican Americans and whites living in San Antonio, Texas. Out of a total of 510 participants, 172 subjects were not followed-up due to death, illness, refusal, or relocation. Interestingly, it was only after the researchers included subjects who died during the study by assigning them the lowest score on health, that the analysis supported the double jeopardy hypothesis. Conversely, leaving out the deceased subjects showed a negative relationship between age and poor health for Mexican Americans. Ferraro and Farmer (1996) also examined the double disadvantage to health among blacks and whites using subjects age 25-74 at baseline from a 15-year panel study of the National Health and Nutrition Examination Survey. However, instead of finding double jeopardy, their results showed that health inequality for blacks exists throughout adulthood and does not necessarily amplify in later life.

Contrary to the double jeopardy hypothesis, some researchers assert that the aging process acts instead as a leveler of racial differences in health (Markides et al., 1984; Ferraro & Farmer, 1996). The age-as-a-leveler hypothesis can be explained by selective mortality, implying that disadvantaged people who “survive” to old age have overcome significant barriers in the life course and will consequently show fewer health problems in their later life, in comparison to their white counterparts. In other words, these people may be “biologically more robust” than others who did not survive to advanced ages. Leveling may also occur because biological, psychological, and social factors that pose a challenge to health are present in all old persons, and are no longer unequally distributed according to race or ethnicity. Another counterargument to the

double jeopardy hypothesis is the notion that health problems are present at all ages, not just among older adults. This is often referred to as persistent health inequality, which states that the health disparity exists throughout adulthood and does not amplify in later life (Ferraro & Farmer, 1996).

In sum, previous findings for tests of the double jeopardy hypothesis are not uniform, thus warranting further examination. Past studies on the double jeopardy hypothesis also do not compare across more than three racial groups. Also missing from this literature is a focus on health-related quality of life. Previous research (Dowd & Bengtson, 1978; Markides et al., 1984; Ward, 1983; Ferraro & Farmer, 1996) has relied heavily on self-rated general health, which typically asks respondents to rate their general health on a five-point scale from excellent to poor. Although this is a powerful measure of health, some aging scholars have found it to be too subjective (Markides et al., 1984). In particular, for the elderly population, global assessments of health based on a Likert-scale may be a biased measure of health because the elderly tend to assess their health relative to other people of similar age. Prior studies have also used other traditional measures, such as previous diagnosis of a chronic disease (Ferraro & Farmer, 1996); or created disability indexes (Markides et al., 1984; Ferraro & Farmer, 1996), which sum separate scores accounting for the presence of a “serious” health condition, bed disability days, or hospital stays. These studies have dichotomized or trichotomized their outcome measures.

This study employs a measure of health status by asking respondents how many physically unhealthy days the respondent experienced during the past month. This outcome considers day-to-day well-being in a way that is not captured by standard

measures of morbidity and mortality. Health-related quality of life dimensions such as physical health limitations are important predictors of both short- and long-term adverse health events and are useful for assessing health care utilization and mortality among older adults (Dominick et al., 2002). Few studies have empirically examined racial differences in the number of physically unhealthy days among the elderly. One notable exception is Skarupski et al. (2007) who investigated black and white differences in overall health-related quality of life among older adults and found that socioeconomic status, medical conditions, and cognitive function accounted for the overall racial differences. Additionally, Skarupski and colleagues showed that, for blacks, racial differences in health-related quality of life become greater at older ages.

Methodological suggestions for how to test for a double disadvantage are noted in the literature (Dowd & Bengtson, 1978; Ferraro & Farmer, 1996). When using cross-sectional data, significant main effects of race and age and a multiplicative race-by-age interaction term must be found to conclude double jeopardy. In other words, (1) significant differences in health that favor whites must exist between the elderly racial minority group and their white counterparts; and (2) there must be greater declines in health with aging for racial minority groups compared to whites. Thus, double jeopardy posits that racism and ageism interact to make the health status of elderly minority more problematic than that of either the aged or racial minorities considered separately, or interacting in a linearly additive way (Dowd & Bengtson, 1978). Therefore, if health differences exist between young minority groups and their white counterparts that favor whites, those differences cannot be the same or larger than the differences observed among the elderly groups. Two hypotheses were generated:

(1)Elderly blacks, Hispanics, and AIANs will experience more physically unhealthy days than elderly whites and APIs; and

(2)Health differences between Blacks, Hispanics, and AIANs compared to their white counterparts will be substantially larger among elderly adults than between younger adults.

METHODS

Data

Data for this study are from the 2003 California Health Interview Survey (CHIS), a collaborative project of the UCLA Center for Health Policy Research, the California Department of Health Services and the Public Health Institute. The survey is conducted every other year and is the largest state health survey in the United States. It is a population-based random-digit dial telephone survey and is an especially appropriate data source for the study because the sample was designed to produce results representative of California's ethnically diverse population, as well as reliable estimates of various health parameters for all California counties. Additionally, to capture California's diversity, interviews were conducted in five languages: English, Spanish, Chinese, Vietnamese, and Korean. Detailed methods appear elsewhere (CHIS, 2005). The 2003 sample included adult respondents age 18-85 years (n=40,939).

Dependent Measure

The outcome variable measuring health status is self-reported number of days in poor physical health during the past month. This measure asks respondents to think

about their physical health, including physical illness and injury, and provide the number of days during the past 30 days their physical health was not good. The poor physical health days question is a common health-related quality of life measure and was found to be useful for identifying health disparities among different subgroups (Chowdhury et al., 2008). Very little information currently exists on the health-related quality of life among elderly racial minorities, particularly beyond black and white comparisons (Skarupski et al., 2007).

Independent Measures

The independent variables were entered in three stages. Since the main variables of interest are race and age, the baseline model allowed for comparison between 5 racial categories: African American, Hispanic, API, AIAN, and Whites (referent category), linear effects of age (range: 18-85 years). The baseline model also includes an adjustment for the sex of the respondent (0=male, 1=female), which is an important control given that women report poorer health than men on a variety of outcomes (Gorman & Read, 2006). Following the baseline model, in keeping with the hypothesis that the effect of age on health is different for certain racial groups, a series of interaction terms for the combined effects of race and age were added.

In the final model, we introduced three different sets of control measures designed to examine whether any of the observed race, age, or race-by-age interactions can be attributed to social characteristics. Socioeconomic variables included marital status, education, and income. Marital status is a dichotomous variable, comparing married (0) to not married (1) individuals. The not married category includes

those who are divorced, separated, widowed, living with a partner, and have never been married. Research has consistently shown the health benefits of being married. Past research has also shown positive relationships between health and both income and educational attainment. Income (range: $1 to $300,000) was logged. Educational attainment is a categorical variable measuring highest grade completed, ranging from less than high school (1) to post-baccalaureate education (4). Additionally, we examined immigration variables: duration of residence in the U.S. (1=native born, 2=less than 5 years, 3=5-9 years, 4=10-14 years, 5=15+ years), and English language proficiency (1= English proficient, 2=speaks English not well or not at all). Immigration differences are important in explaining racial and ethnic differences in health, with immigrants experiencing lower mortality than their U.S.-born counterparts (Singh & Siahpush, 2002). Lastly,we controlled for a series of health-related characteristics. Health care utilization was measured with two variables: (1) health insurance (dichotomous: 0=currently insured, 1=not insured), and (2) usual source for medical care (trichotomous: 1=doctor office/ HMO care, 2=community/ government clinic or hospital, 3=no usual source). Three proxies for health lifestyles are included: smoking status, consumption of alcohol, and obesity. Smoking is a categorical variable, comparing those who currently smoke, have quit smoking, and never smoked. Alcohol consumption is a measure that combines information asked about whether the respondents had any alcohol in the past month, and, if so, how much alcohol they consumed per occasion: 1=had no alcohol in the past month, 2=light drinkers (1-2 drinks per occasion), 3=moderate drinkers (3-4 drinks per occasion) , 4=heavy drinkers (5 or more drinks per occasion). Obesity is a dichotomous variable (0=no, 1=yes).

Analysis

CHIS employs a two-stage geographically stratified sample design. In order to ensure that estimates from the sample are unbiased and representative of the California population, application of weights was necessary before any calculations are performed (Lee et al. 2007). The CHIS Public Use Files provide weight variables to account for sample selection probabilities and corrects for undercoverage and nonresponse biases.

The mean (SD) number of days in poor health for the full sample was 4.11 (8.24). Most observations are zero days, i.e.,59.41% of respondents reported no days in poor physical health during the past month). The count data are right skewed and the variance (67.90) is much larger than the mean. Thus, the negative binomial model provides an improved fit to the data, over the Poisson regression model, by accounting for the overdispersion. All analyses were conducted using STATA survey jackknife procedures, developed to analyze complex survey data. Relative rate ratios (RR) were calculated; rate ratios less than one show a negative association, while values greater than one suggests a positive relationship between the independent and dependent variables, when compared with the referent category.

FINDINGS

Descriptive Analyses

Table 1 presents weighted means for the number of physically unhealthy days during the past month by race and age groups. Looking down the columns, we see that not surprisingly, the aging process is accompanied by worsening health for all racial

groups. Moreover, when comparing the full sample, blacks and AIANs have experience more days in poor health in contrast to their white counterparts; while Asians and Hispanics report lower mean number of days than whites. However, when we start to compare across the groups and at different age categories, a more complicated picture emerges. Blacks age 18-29 years have significantly fewer poor heath days than their white counterparts (1.88 and 2.67 days, respectively). In contrast, older blacks ages 30-64 years and 65 years and older, have significantly more poor health days in comparison to whites. Thus, the data show that blacks become more disadvantaged in health with age relative to whites.

A similar pattern is observed for Hispanics. Hispanics and whites, age 18-29 years, are not significantly different in the number of poor health days (2.47 and 2.67 days, respectively). However, Hispanics age 30 years and older have significantly more physically unhealthy days compared to whites. Therefore, health differences between blacks and Hispanics compared to whites are larger in the older strata than in the younger age categories. This argues against the persistent health inequality and leveling hypotheses and suggests that race and age are interacting to produce larger health disadvantages for older blacks and Hispanics in comparison to whites.

----INSERT TABLE 1 HERE----

Multivariate Analyses

Table 2 shows the results of regressing number of days in poor health on various predictors tested in conceptually cohesive blocks. The estimated rate ratios (RR) describe the change in days associated with a one-unit increment in an explanatory variable relative to the reference group. The baseline model (Model 1) shows that for a one unit increase in age, we expect to see an increase of poor health days per month by a factor of 1.02. Blacks, Hispanics, and AIANs, when compared to whites, are predicted to have 13%, 14%, and 15% more physically unhealthy days per month, respectively. On the contrary, APIs are expected to have 18% fewer days in poor health per month, in comparison to whites. Therefore, the baseline model shows that all minority groups, with the exception of API, experience substantially worse health-related quality of life compared to whites when adjusting for age and sex.

----INSERT TABLE 2 HERE ----

In the next model (Model 2), several race-by-age interactions terms are added. Interaction terms allow the slopes describing age on number of days to be non-parallel for the different groups. Significant interaction terms for blacks and Hispanics indicate that the number of poor health days increases more steeply for aging blacks and Hispanics compared to whites. Thus, in support of hypothesis 2, race and age appear to be interacting to produce larger health disadvantages for older blacks and Hispanics in comparison to their white counterparts. Rate ratios of 1.01 indicate a 1% compounded increase for number of poor health days for each additional year of age. Over a span of

many years, these are not small differences but rather very meaningful to a person's physical well-being.

Interpreting interaction terms in a negative binomial regression often involves the examination of predicted outcomes at specific values of the independent variables. The negative binomial coefficients allow us to calculate predicted probabilities for each of the 5 racial groups. In Figures 1 and 2, we graph the race-by-age interaction from Model 2 to illustrate racial differences in number of sick days as a function of age. Both graphs show that the effect of race-ethnicity on number of days in poor health is modified by age, such that the association is stronger for blacks and Hispanics. At younger adult ages, blacks and Hispanics have lower unhealthy days than all other groups, except APIs. However, as they age, the predicted values for blacks and Hispanics increase much steeper relative to whites and APIs. Therefore, race and age are interacting to affect health-related quality of life, which argues for the double jeopardy hypothesis. Moreover, predicted values for females are considerably higher, suggesting "multiple jeopardy" for female minority elders. Females compared to males are predicted to have a rate of 1.33 times greater sick days.

----INSERT FIGURES 1 AND 2 ABOUT HERE----

In model 3, we examine whether socioeconomic status, immigration factors and health-related characteristics can explain the observed racial differences. The API advantage is eliminated with the addition of these variables suggesting that some of these variables help to mediate the association between race and health for the Asian

American and Pacific Islander population. This is consistent with previous findings which demonstrate that the addition of socioeconomic controls reduces the racial/ethnic gap in mortality between Asians and whites. Socioeconomic stratification in the United States is racially based so that racial minorities have less access to resources that protect health, such as education and income (Warner & Hayward, 2006). However, none of the socioeconomic variables reduces the interaction effect between race-and-age to non-significance – in support of the double jeopardy hypothesis. Therefore, although significant differences do not exist between younger racial minority and white respondents, elderly blacks and Hispanics are at a greater disadvantage than their elderly white counterparts. However, the race-by-age interaction terms remain relatively unchanged from model 2 – in support of the double jeopardy hypothesis. Despite adjusting for various social characteristics, racial differences continue to be modified by age for blacks and Hispanics. Thus, racial and ethnic group membership is significantly related to greater declines with increasing age among blacks and Hispanics. Most of other explanatory measures in the model have a significant effect on the number of unhealthy days reported, and in the expected directions. Interestingly, having no insurance or usual source of health care did not have a significant effect on health-related quality of life for the elderly.

For the American Indian and Alaska Native (AIAN) category, the double jeopardy interaction coefficient does not achieve statistical significance, due to the small sample size of this group in the CHIS. The appendix presents cross-validation of the 2003 CHIS results with the 2005 CHIS. Rather than combine samples, the cross-validation shows that the findings are not unique to the 2003 data.

DISCUSSION

Using cross-sectional data, we examined the double jeopardy hypothesis by testing for main effects of race and age, and a race-by-age interaction (Ferraro & Farmer, 1996). Since all these effects were statistically significant, we conclude that double jeopardy is operating, but only for blacks and Hispanics. Data from Table 1 supports hypothesis 1 in that elderly blacks and Hispanics experience poor physical health days more frequently than do elderly whites and APIs. Sequential negative binomial regression models shown in Table 2 were designed to examine whether any observed race, age, and race-by-age differences in health can be attributed to a combination of social characteristics. Risk ratios confirm that elderly blacks and Hispanics are significantly more likely to report greater physically unhealthy days and consequently, are at a greater disadvantage than their elderly white counterparts. The life course perspective offers one possible explanation for why racial differences are modified by age for blacks and Hispanics. Life course studies have shown that physical and social conditions experienced throughout childhood and adulthood strongly influence the development of diseases in later life (Ben-Shlomo & Kuh, 2002). These studies suggest that social and economic disadvantages, for example, have consequences on health which accumulate with age (Warner and Hayward 2006). Adopting a life course approach suggests recognizing the importance of early influences on health (e.g. biological, behavioral, social, and psychological) without negating later-life interventions (Lynch & Smith, 2005). The framework has been previously used to understand the race gap in morbidity and mortality, contending that early life circumstances initiate “chains of risk” that can undermine future health status. Heart

diseases, diabetes and some cancers seem to be influenced by factors acting across the entire life course. Since early life resources are allocated based on racial and class-based stratification systems in the United States, racial minority group status and increasing age act interactively to produce greater health differentials in later age. Lifetime exposure to adverse socioeconomic conditions over the life course creates a unique experience for elderly blacks and Hispanics. Experiencing poverty during critical or sensitive periods, for example, may represent accumulation of risk for certain health problems (Lynch & Smith, 2005).

Self-rated health assessments can be powerful predictors of morbidity and mortality compared to some objective health measures (Tsai et al., 2007). However, past studies have largely focused on categorical or ordinal versions of health status as opposed to count data, perhaps reducing the observed magnitude of race-by-age inequalities. Future research is needed to determine whether count data, such as number of days in poor physical health during the past month, more closely match a person's day-to-day well being. Previous double jeopardy analyses relying on either self-rated global assessments of health based on a Likert-scale, prior medical diagnosis of chronic or serious condition, or other mortality measures may not adequately consider perceptions of disability as captured here. Although racial minorities are more likely to get sick at a higher rate than whites across the life course, they are also more likely to conceal their illness by missing less work and school and utilizing less healthcare (Fiscella & Franks, 2002). To the authors' knowledge, the outcome variable used in this study has not been used in prior double jeopardy analyses.

The findings presented here reflect the situation for California, so we cannot generalize the results to any other population. However, California is an especially large and diverse state that we believe is an ecological unit worthy of study.

Because CHIS is a cross-sectional survey, our findings may reflect cohort differences. Some researchers have suggested that double jeopardy must be studied with longitudinal data (Ferraro & Farmer, 1996). Utilizing panel data, Markides, Timbers, and Osberg (1984) and Ferraro and Farmer (1996) found little support for the double jeopardy using traditional subjective and objective health measures and instead observed persistent health disparities. They found that racial minorities of all ages suffer from health problems, not just the elderly. However, in panel studies, the unhealthiest people are often left out of the second and/or subsequent survey waves, due to illness or mortality. Longitudinal data suffers from mortality selection, namely that health is only a trait of the living. Consequently, analyses do not include subjects who declined in health with aging, concealing inequalities and unmet health needs that may really exist among elderly subgroups. Further, the outcome variable, number of unhealthy days, is a measure that benefits greatly from having a large sample size because of the distributional issues. A large sample, particularly one allowing comparisons between racial/ethnic minority populations, was needed in order to have non-sparse cells to complete the analyses. CHIS is a large state health survey and we are not aware of any longitudinal surveys with comparable sample size that asks the unhealthy days question.

Another limitation concerns the race groupings used in the analysis. Asians and Latinos are heterogeneous with respect to several characteristics including income,

education, and family structure. As indicated above, the API sample used here includes ethnic subgroups such as Chinese, Japanese, Korean and Filipino, etc. Similarly, the Latino sample is comprised of several ethnicities: Mexicans, Salvadorans, Guatemalans, and Puerto Ricans, etc. Future analyses should consider how the relationship between age and health varies across the Asian and Latino ethnic subgroups. Moreover, all self-reported measures of health, including the one used here, are subjective assessments and it is unclear whether different racial and ethnic groups interpret these questions in the same manner. One intriguing way to get better data would be diary studies, where respondents would be given month-long forms to fill out, including specific symptoms. This would have its own difficulties, but would be a step in the right direction. This study presents results which are representative of reported sick days for California and if there are latent differences among the subgroups in reporting practices, then our results will surely be affected by them.

Lastly, quality of life is a concept that encompasses dimensions of physical, emotional, and social health (Skarupski et al., 2007). The current study accounted for physical well-being; future studies are needed to examine the other two dimensions in order to fully appreciate racial differences in quality of life among older adults. We hope our analysis of existing days-sick data will intrigue other researchers and spur more work on the double jeopardy hypothesis, including the point raised about reporting issues across sub-communities.

The U.S. Department of Health and Human Services and other federal agencies have provided decades of funding and support for public health and social programs designed to eliminate health disparities among different segments of the population. For

example, *Healthy People 2020*, a set of national health objectives, challenges and enables individuals, communities, and professionals to eliminate health disparities (DHHS, 2009). Furthermore, *Healthy People* objectives and the World Health Organization strongly support improving health-related quality of life, not merely the absence of disease. Racial differences in health remain, however, and may actually be widening. Reconsidering theoretical approaches, such as the double jeopardy argument, holds promise in understanding how the varying demographic, socioeconomic, and social experience of today's growing minority elderly impact health.

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Table 1. Weighted means for number of days in poor physical health during the past month, by race and age

	Whites	Blacks	APIs	Hispanics	AIANs
18-29 years old (*N)*	2.67 (2680)	1.88** (450)	2.00** (768)	2.47 (2020)	2.71 (99)
30-64 years old (*N)*	3.75 (16980)	4.91*** (1805)	3.08*** (2649)	4.19* (4614)	6.11** (383)
65+ years and older (*N)*	5.42 (6846)	6.77* (436)	4.47 (610)	6.18* (501)	7.46 (98)
Full sample (*N)*	3.91 (26506)	4.40* (2691)	3.01*** (4027)	3.73 (7135)	5.30** (580)

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Significance tests are based on two-tailed *t*-tests comparing whites with each of the other racial groups in the same age category.

Table 2. Rate Ratios from the negative binomial regression models for number of days in poor physical health during the past month

	Model 1	Model 2	Model 3	Jknife Std Err
	RR†	RR†	RR†	
Demographic Variables				
Age	1.018***	1.015***	1.012***	0.001
Race-ethnicity				
Whites (ref)	---	---	---	---
Blacks	1.130*	0.656*	0.607**	0.113
APIs	0.822***	0.686***	0.821	0.109
Hispanics	1.136***	0.782*	0.709**	0.080
AIANs	1.469***	1.087	0.957	0.273
Female	1.337***	1.329***	1.374***	0.045
Race × Age Interactions				
Race × Age				
White × Age (ref)		---	---	---
Black × Age		1.012***	1.009*	0.004
API × Age		1.004	1.003	0.003
Hispanic × Age		1.009***	1.006*	0.003
AIAN × Age		1.007	1.003	0.006
Socioeconomic Variables				
Not married			1.173***	0.035
Educational Attainment				
Less than H.S. (ref)			---	---
H.S. degree			0.866**	0.046
Some college-College grad			0.868**	0.045
Post-baccalaureate			0.719***	0.043
Household's total annual income (log)			0.933***	0.011
Immigration Variables				
Duration of Residence in U.S.				
Native born (ref)			---	---
15 years or more			0.941	0.047
10-14 years			0.800*	0.076
5-9 years			0.856	0.081
Less than 5 years			0.686**	0.055

	*	
Speaks English not well/ not at all		
Health Lifestyle and Behavioral Variables		
No Insurance	1.034	0.042
Usual source of health care		
Doctor office or HMO hospital (ref)	---	---
Community clinic or government hospital	1.150**	0.052
No usual source	0.958	0.051
Smoking status		
Never smoked (ref)	---	---
Current smoker	1.496***	0.062
Former smoker	1.265***	0.046
Alcohol consumption in the past month		
Abstainer (ref)	---	---
Light drinker	0.781***	0.025
Moderate drinker	0.798***	0.045
Heavy drinker	0.953	0.066
Overweight/ obese	1.188***	0.037

† RR is the rate ratio defined as e^{β}, where β is the coefficient estimate.
* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Figure 1. Predicted values for number of days in poor physical health during the past month (males)

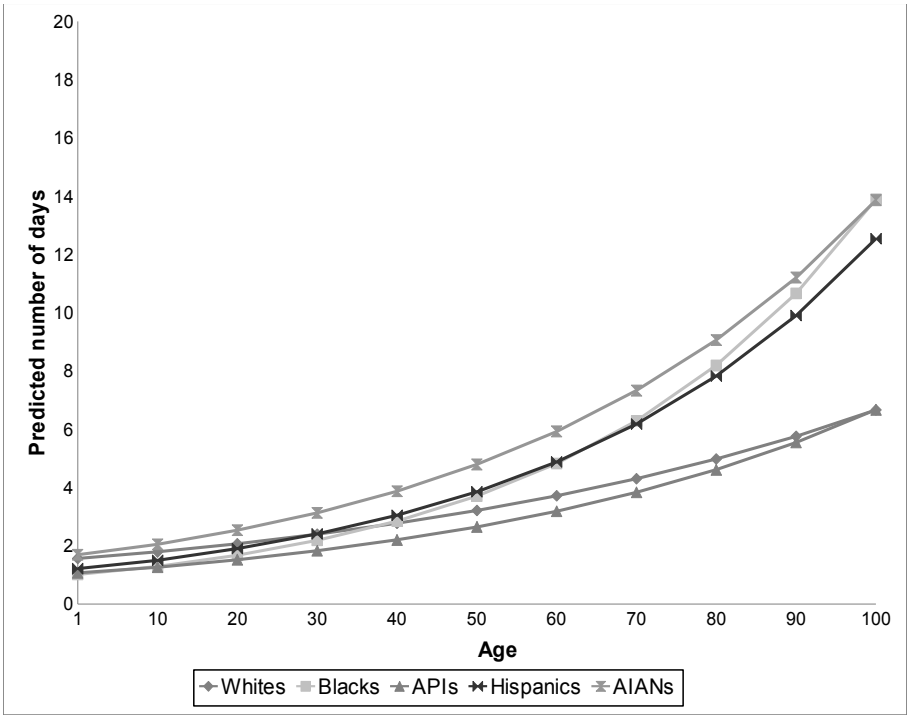
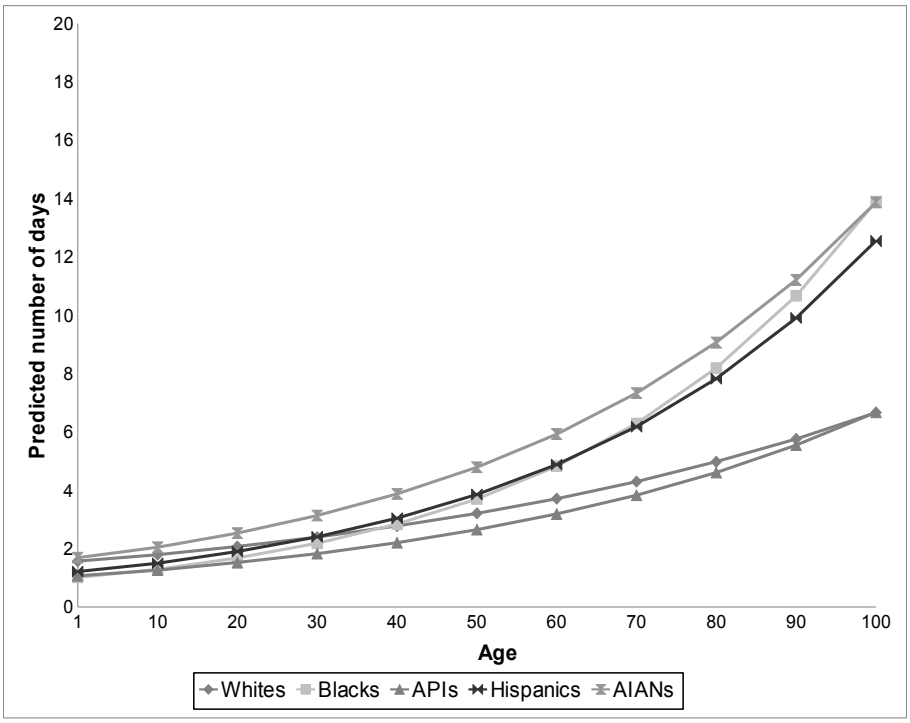


Figure 2. Predicted values for number of days in poor physical health during the past month (females)



Note: Graphs are based on the negative binomial regression, model 2.

Appendix

In this appendix, we present cross-validation tables. These tables are a re-estimation of the models from the main body of the paper, using the 2005 instead of the 2003 CHIS. The 2005 sample included adult respondents age 18-85 years (n=41,917). The mean (SD) number of days in poor health for the full sample was 4.47 (8.70). Most observations are zero days, i.e., 58.45% of respondents no days in poor physical health during the past month).

The results from the 2003 CHIS data established support for the double jeopardy hypothesis and the 2005 data provide a quasi-independent verification. Similar to the 2003 findings, the tables and graphs presented here suggest that race and age are interacting to produce larger health disadvantages for older African Americans and Hispanics compared to whites. Table 1 compares means for the number of physically unhealthy days during the past month and shows that although significant differences do not exist between younger racial minority and white respondents, older blacks and Hispanics are significantly more likely to report greater days relative to their elderly white counterparts. The fully adjusted regression model in Table 2 shows race-by-age interaction terms for blacks and Hispanics remain significant, despite controlling for various demographic and socioeconomic characteristics.

Table 1. Weighted means for number of days in poor physical health during the past month, by race and age

	Whites	Blacks	APIs	Hispanics	AIANs
18-29 years old	2.93	1.92*	2.51	2.41	4.42
(*N)*	(2328)	(286)	(544)	(1691)	(81)
30-64 years old	3.92	4.76	2.99	4.02	6.82
(*N)*	(18586)	(1297)	(2892)	(4196)	(377)
65+ years and	6.15	7.20*	5.27	8.41**	9.27
older (*N)*	(8065)	(371)	(625)	(482)	(96)
Full sample (*N)*	4.19	4.36	3.19***	3.73**	6.67**
	(28979)	(1954)	(4061)	(6369)	(554)

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Significance tests are based on two-tailed *t*-tests comparing whites with each of the other racial groups in the same age category.

Table 2. Rate Ratios from the negative binomial regression models for number of days in poor physical health during the past month

	Model 1	Model 2	Model 3	Jknife Std Err
	RR†	RR†	RR†	
Demographic Variables				
Age	1.019***	1.016***	1.013***	0.00106
Race-ethnicity				
Whites (ref)	---	---	---	---
Blacks	1.076	0.669*	0.602*	0.118
APIs	0.826***	0.866	1.179	0.164
Hispanics	1.044	0.610***	0.584***	0.0721
AIANs	1.777***	2.151*	1.582	0.650
Female	1.340***	1.342***	1.375***	0.0424
Race × Age Interactions				
Race × Age				
White × Age (ref)		---	---	---
Black × Age		1.010**	1.009*	0.00360
API × Age		0.999	0.995	0.00292
Hispanic × Age		1.013***	1.011***	0.00244
AIAN × Age		0.995	0.997	0.00946
Socioeconomic Variables				
Not married			1.113**	0.0427
Educational Attainment				
Less than H.S. (ref)			---	---
H.S. degree			0.911	0.0544
Some college-College grad			0.910	0.0537
Post-baccalaureate			0.789***	0.0509
Household's total annual income (log)			0.893***	0.0124
Immigration Variables				
Duration of Residence in U.S.				
Native born (ref)			---	---
15 years or more			0.809***	0.0363
10-14 years			0.772**	0.0591
5-9 years			0.801**	0.0670
Less than 5 years			0.511**	0.0554

	*	
Speaks English not well/ not at all	1.242***	0.0764
Health Lifestyle and Behavioral Variables		
No Insurance	0.956	0.0483
Usual source of health care		
Doctor office or HMO hospital (ref)	---	---
Community clinic or government hospital	1.060	0.0370
No usual source	0.985	0.0615
Smoking status		
Never smoked (ref)	---	---
Current smoker	1.392***	0.0608
Former smoker	1.221***	0.0513
Alcohol consumption in the past month		
Abstainer (ref)	---	---
Light drinker	0.787***	0.0264
Moderate drinker	0.714***	0.0441
Heavy drinker	0.951	0.0941
Overweight/ obese	1.232***	0.0342

† RR is the rate ratio defined as e^{β}, where β is the coefficient estimate.
* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Figure 1. Predicted values for number of days in poor physical health during the past month (males)

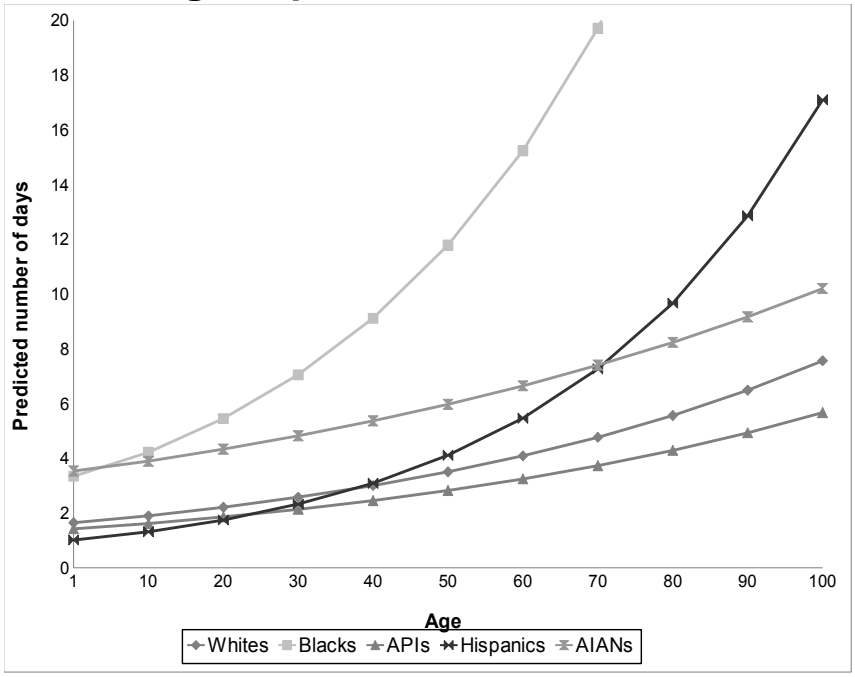
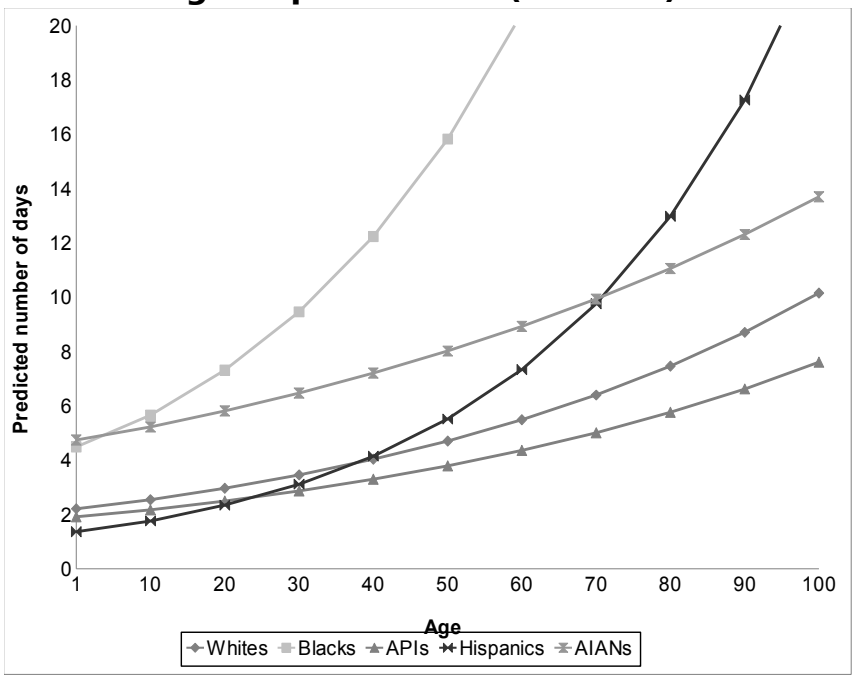


Figure 2. Predicted values for number of days in poor physical health during the past month (females)



Note: Graphs are based on the negative binomial regression, model 2.

Table 3. Weighted means for number of days in poor physical health during the past month, by race and age, 2005 CHIS.

	Whites	Blacks	APIs	Hispanics	AIANs
18-29 years old	2.93	1.92*	2.51	2.41	4.42
(*N)*	(2328)	(286)	(544)	(1691)	(81)
30-64 years old	3.92	4.76	2.99	4.02	6.82
(*N)*	(18586)	(1297)	(2892)	(4196)	(377)
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older (*N)*	(8065)	(371)	(625)	(482)	(96)
Full sample (*N)*	4.19	4.36	3.19***	3.73**	6.67**
	(28979)	(1954)	(4061)	(6369)	(554)

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Significance tests are based on two-tailed *t*-tests comparing whites with each of the other racial groups in the same age category.

Table 4. Rate Ratios from the negative binomial regression models for number of days in poor physical health during the past month, 2005 CHIS.

	Model 1	Model 2	Model 3	Jknife Std Err
	RR†	RR†	RR†	
Demographic Variables				
Age	1.019***	1.016***	1.013***	0.00106
Race-ethnicity				
Whites (ref)	---	---	---	---
Blacks	1.076	0.669*	0.602*	0.118
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Race × Age Interactions				
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Smoking status		
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Light drinker	0.787***	0.0264
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Heavy drinker	0.951	0.0941
Overweight/ obese	1.232***	0.0342

† RR is the rate ratio defined as e^{β}, where β is the coefficient estimate.
* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Figure 3. Predicted values for number of days in poor physical health during the past month (males), 2005 CHIS.

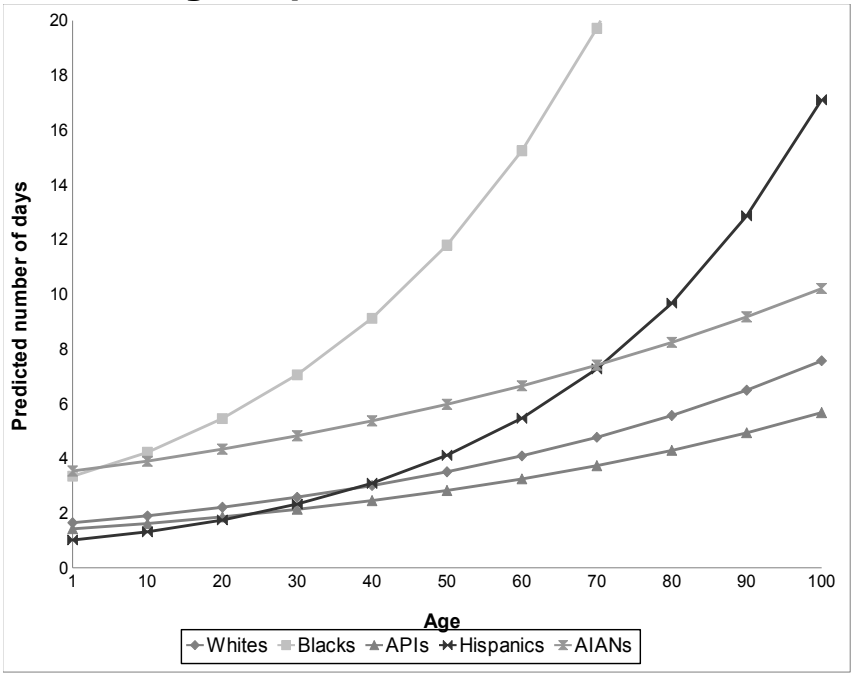
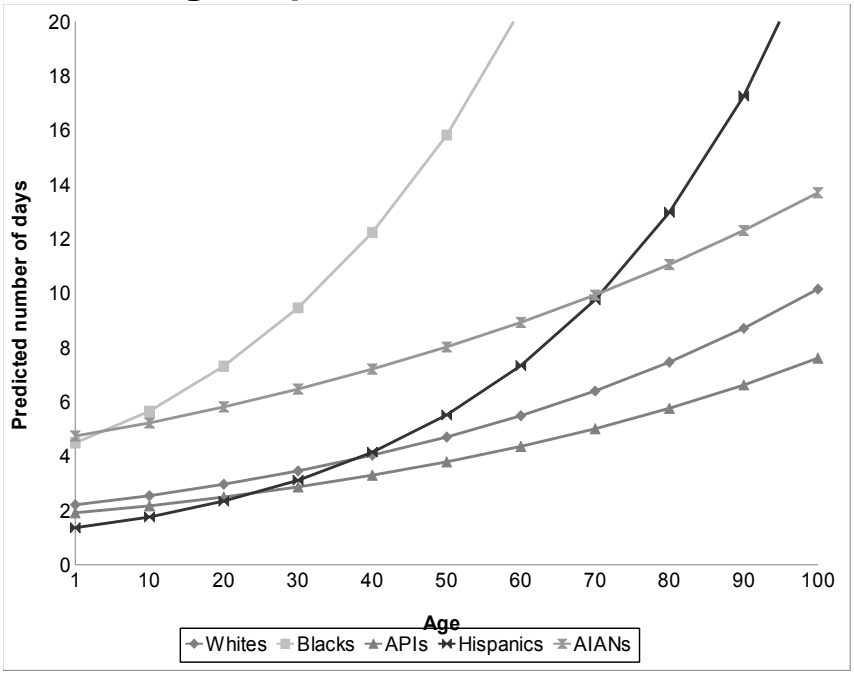


Figure 4. Predicted values for number of days in poor physical health during the past month (females), 2005 CHIS.



Note: Graphs are based on the negative binomial regression, model 2.