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Evolving Self-Rated Health in Middle and Old Age: How Does It Differ Across Black, Hispanic, and White Americans?

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Abstract

Objective—This research focuses on ethnic variations in the intra-individual changes in self-rated health.

Methods—Data came from the Health and Retirement Study involving up to 6 repeated observations between 1995 and 2006 of a national sample of 18,486 Americans over 50 years of age. Hierarchical linear models were employed in depicting variations in self-rated health across white, black, and Hispanic Americans.

Results—Subjective health worsened over time albeit moderately. Relative to younger persons, older individuals rated their health poorer with a greater rate of deteriorating health. With reference to ethnic variations in the intercept and slope of perceived health, white Americans rated their health most positively, followed by black Americans, with Hispanics rating their health least positively. This pattern held even when socioeconomic status, social networks, and prior health were adjusted.

Discussion—Significant ethnic differences exist in the evolvement of self-rated health in middle and late life. Further inquiries may include analyzing ethnic heterogeneities from a person-centered perspective, health disparities across subgroups of Hispanics, effects of neighborhood attributes, and implications of left truncation.

Keywords

Self-rated health; trajectory; ethnic differences

Introduction

As a powerful predictor of mortality, disability, and health care utilization, self-rated health has been regarded as a key indicator of health status. It differs from a biomedical definition of health in that individuals evaluate health by using more inclusive criteria including not only diseases and physical functioning but also social comparison, role activities, and even emotional and spiritual well-being (Idler & Benyamini, 1997; Idler, Hudson, & Leventhal, 1999). A growing body of research has suggested that African and Hispanic Americans

consistently report poorer health than white Americans, and these differences often persist even with socioeconomic status (SES) and other health indicators adjusted (Bzostek, Goldman, & Pebley, 2007; Cagney, Browning & Wen, 2005; McGee, Liao, Cao, & Cooper, 1999).

However, there is very limited understanding of ethnic variations in how health evolves over time within individuals. Because the vast majority of studies are cross-sectional, intrapersonal changes are confounded with interpersonal differences. Although blacks and Hispanics are known to have poorer perceived health than whites, we do not know whether over time changes in self-rated health are at the same or different rates across these groups. In this regard, a life course perspective (Elder & Johnson, 2002) would be useful as it calls for an examination of the shape of intrapersonal changes or trajectories over an extended period of time. In addition, one needs to ascertain the increasing heterogeneity in health changes in old age (Nelson & Dannefer, 1992).

A more complete understanding of ethnic differences in health requires an analysis of health trajectory in terms of both the level as well as rate of change across these groups. Some investigators have examined transitions in self-rated health between two points in time (e.g., Idler, 1993) which do not fully reflect the dynamic nature of health, as they provide no basis for distinguishing among alternative growth curves or trajectories (Rogosa, 1988). Connected by health transitions across successive years, a health trajectory imparts a form and meaning distinct from those of health transitions (Clipp, Pavalko, & Elder, 1992).

Furthermore, current research on ethnic differences in trajectories of self-rated health has generally been confined to a contrast between two groups involving white Americans versus non-white, black or Hispanic Americans (Lynch, 2003; McDonough & Berglund, 2003; Shuey & Willson, 2008; Yao & Robert, 2008). There is little knowledge regarding the similarities and differences between blacks and Hispanics, and how Hispanics stand in relation to the black and white differentials in health. This is a serious gap in light of the fact that Americans are becoming increasingly diverse leading to a profound transformation of the cultural landscape of the United States. By 2050, Hispanics are projected to account for 16% of the elderly population, whereas non-Hispanic blacks will constitute another 12%. The proportion of non-Hispanic whites will decline to 64% (Angel & Angel 2006).

This research aims to contribute to current knowledge on aging and health in two respects. We first offer quantitative estimates of intrapersonal changes in self-rated health over time and examine how they vary by age. Second, we examine how the intercept and rate of change associated with self-rated health differ among black, Hispanic, and white middle age and older adults.

Hypotheses

In the present research, ethnic differences in self-rated health will be evaluated in the conceptual framework of social stratification of aging and health (Crimmins & Seeman, 2001; House, Lantz, & Herd, 2005). In particular, SES (e.g., education and income) is viewed as a function of age, gender, and ethnicity as they have profound implications for the distribution of wealth, prestige, and power. Building upon the concept of disablement (Verbrugge & Jette, 1994), we regard self-rated health as a core component of health status which is a function of diseases, functional disability, and psychological distress (Angel & Guarnaccia, 1989; Liang, 1986; Stump, Clark, Johnson & Wolinsky, 1997). As a fundamental cause, SES shapes people's exposure to all risk factors for health outcomes (Link & Phelan, 1995). Chief among them are social relations, health behaviors, and personality dispositions. More importantly, age, gender, and ethnic differences on health and well-being often cannot be fully explained by SES. Examples of these perspectives include the sociology of age stratification (Riley, 1987), gender stratification (Huber, 1990), and race stratification (Williams, 1997). Ethnicity may influence

the exposure to adverse socioeconomic circumstances and transform the way that these circumstances affect health. Extrapolating from the framework of social stratification of aging and health, we hypothesize that ethnicity may affect self-rated health directly and indirectly via SES, marital status, and prior health (i.e., diseases, disability, and mental distress). To address our research questions, we pose the following hypotheses.

H₁: Self-rated health worsens over time in middle and old age (H_{1a}). In addition, members of older age groups experience poorer health on average and more accelerated rates of deterioration than their younger counterparts (H_{1b}).

Given that physical health declines in middle and old age, one would expect that self-rated health would follow the same pattern. This implies a statistically significant and positive rate of change in the perceived health decline (McDonough & Berglund, 2003). However, relevant empirical findings are mixed. For instance, Idler (1993) observed that self-assessed health exhibited considerable stability over periods ranging from 2 to 15 years, whereas Yao and Robert (2008) reported that perceived health improved slightly before long-term decline. We hypothesize that among those over 50 years of age, self-rated health becomes worse over time albeit moderately.

Meanwhile, there may be significant age differences in how self-rated health changes with time. Nonetheless, research in this regard is inconclusive. Idler (1993) found that members of older cohorts reported a greater improvement of subjective health, whereas several other investigators reported the reverse (Lynch, 2003; Shuey & Willson, 2008; Yao & Robert, 2008). McDonough and Berglund (2003) observed no significant age differences in the rate of change, although they found significant age variations in the level of self-rated health. To resolve these inconsistencies, further research is clearly required. We hypothesize that the worsening of subjective health is greater in older age groups than younger groups, because health decline accelerates in late life.

H₂: Relative to white Americans, blacks and Hispanics experience a poorer level of self-rated health as well as a greater rate of health deterioration (H_{2a}). In comparison with blacks, Hispanics have worse health and a greater rate of health decline (H_{2b}).

A key factor leading to ethnic difference in health is racial/ethnic stratification, a system involving ethnic groups interacting in patterns of dominance and subordination (Jackson, Antonucci, & Gibson, 1990; Williams, 1997). Racial stratification may influence health through several mechanisms, including (a) less advantaged socioeconomic circumstances, (b) constraints placed on life style choices, (c) stress as a result of perceptions of discrimination, and (d) acculturation and language (Angel & Guarnaccia, 1989; Crimmins, Hayward & Seeman, 2004; Robert & House, 2000).

African Americans (Cagney et al. 2005) and Hispanics (Ren & Amick 1996; Shetterly, Baxter, Mason, & Hamman 1996) have been shown to rate their health poorer than whites. This can be partially attributed to the fact that black and Hispanic Americans are more disadvantaged than white Americans in SES and health. Although Hispanics on average have lower education than blacks, the phenomenon of the Hispanic paradox suggests that Hispanics fare better than blacks in terms of life expectancy (Markides & Black, 1996; Palloni & Arias, 2004). Nevertheless, there is some evidence that even after adjusting for SES and functional limitations, Hispanics have worse self-rated health than blacks (Browning, Cagney & Wen, 2003; Ren & Amick, 1996).

Several broad hypotheses could be derived concerning ethnic disparities in how health changes over time (Markides & Black, 1996). For instance, the perspective of cumulative disadvantage would suggest that ethnic variations in health would become greater in middle and older age (Dannefer, 1987; Ross & Wu, 1996). In contrast, proponents of the social stratification of aging

and health would suggest the opposite (House et al., 2005). Similarly, Williams and Lawler (2001) have proposed the hardiness hypothesis suggesting that minorities may become better off in old age because of surviving a highly selective process. Still, there are others who suggest the gap in health between blacks and whites would remain the same and persist in later life (Kelley-Moore & Ferraro, 2004).

Empirical findings regarding ethnic differences in changes in perceived health are inconclusive. While some observed that subjective health declined more rapidly among blacks than whites (Ferraro, Farmer & Wybraniec, 1997; Yao & Robert, 2008), others found no such differences (McDonough & Berglund, 2003). In fact, we are not aware of any published research examining changes in subjective health across black, Hispanic, and white Americans simultaneously. Based on the predominant findings from prior studies, we hypothesize that minorities including blacks and Hispanic Americans experience a higher rate of health decline than whites. In addition, extrapolating from the observations that Hispanics rate their health poorer than blacks (Browning et al., 2003; Ren & Amick, 1996), we hypothesize a greater rate of worsening health for Hispanics than blacks.

Methods

Design and data

Data came from the Health and Retirement Study (HRS) which began in 1992 by surveying a national sample of over 12,600 persons born in 1931–1941. In 1993, the “Asset and Health Dynamics among the Oldest Old” (AHEAD) study was launched with a national sample of individuals aged 70 and over (i.e., born before 1924). Biennial follow-ups have been made of the HRS and AHEAD respondents thereafter. Starting from 1998, HRS and AHEAD surveys were fully integrated and two new sub-samples were added in 1998: Children of the Depression (CODA)--persons born in 1924–1930 and War Baby (WB)--persons born in 1942–1947. As of 2006, these four components of HRS yielded a total of 26,988 respondents, representing all individuals over 50 years of age in the United States. Extensive documentation of HRS, including response rates and mortality, is available at its website (<http://hrsonline.isr.umich.edu>).

In the present study, baseline data were obtained from respondents in 1995 for AHEAD, 1996 for HRS, and 1998 for CODA and WB. Follow-up data were gathered in 1998 (for AHEAD and HRS cohorts), 2000, 2002, 2004, and 2006. Hence, up to 5 or 6 repeated observations were obtained for each admission cohort over 8 to 11 years. HRS data collected in 1992 and 1994 and AHEAD data in 1993 were excluded because of incomparable measures of functional status.

To overcome language barriers, Spanish version of the questionnaires were administered by bilingual interviewers to Spanish-speaking respondents. Respondents who were unable to communicate adequately in either English or Spanish, and for whom interviews with proxy informants could not be obtained, were excluded from the HRS.

Measures

Self-rated health was a single item rating of the respondent's present health (1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor). Evidence from Andersen, Mullner, and Cornelius (1987) and other psychometric investigations have concluded that differences in self-rated health detected between ethnic groups are real rather than an artifact of the measurement method (Cunningham, Hays, Burton, & Kington, 2000).

Ethnicity included three categories: non-Hispanic black, Hispanic, and non-Hispanic white. Non-Hispanic black and non-Hispanic white are referred to interchangeably as black and white.

734 respondents did not belong to these groups and were excluded. In addition, several measures of social stratification were included. Age differences were measured by age in 1995. Dummy variables for gender and ethnicity were created. Education was indexed by the number of years of schooling, whereas household income was measured in thousands of 2006 dollars adjusted for inflation.

The model also adjusted for several time-varying covariates such as marital status and health conditions, which were measured at each wave of the survey. Marital status was used as an indicator for social networks and was constructed as a dummy variable (1 = married or living with a partner, and 0 = otherwise). Diseases were a count of health conditions (i.e., heart disease, cancer, stroke, diabetes, hypertension, lung disease, and arthritis; range = 0 – 7). Functional status was assessed by a count of having at least some difficulties with six activities of daily living (ADL) (i.e., dressing, walking, bathing or showering, eating, getting in or out of bed, and using the toilet) and five instrumental activities of daily living (IADL) (i.e., preparing hot meals, grocery shopping, making phone calls, taking medications, and managing own money and expenses). With a range from 0 to 11, a higher score represents a greater functional impairment.

Depressive symptoms entailed a count of nine dichotomous items drawn from the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). These include: (a) felt depressed, (b) everything was an effort, (c) restless sleep, (d) felt happy, (e) felt lonely, (f) enjoy life, (g) felt sad, (h) couldn't get going, and (i) had a lot of energy during the week prior to the interview. Items were recoded so that a higher score reflected higher reported depressive symptoms. Finally, in each wave of the survey, whether the observation was obtained through a proxy interview was coded as a dummy variable.

To ensure that a clear time sequence is defined between the time-varying covariates and the outcome measure, our model involved a lagged measure (i.e., observation from the last interview) and a change term (i.e., difference between current observation and the previous observation, $X_t - X_{t-1}$) for each of the time-varying covariates. Table 1 presents the descriptive statistics of all the measures by ethnic groups.

Data analysis

Hierarchical Linear Modeling (HLM) was used to describe how self-rated health changes over time (Raudenbush & Bryk, 2002) in a level 1 or repeated-observation model:

$$Y_{it} = \pi_{0i} + \pi_{1i}Time + \sum \gamma_k X_{kit} + \varepsilon_{it} \quad (1)$$

where Y_{it} is self-rated health for individual i at time T (e.g., 1998). π_{0i} is the intercept of self-rated health for individual i ; $Time$ refers to the timing of assessment from the baseline in years; π_{1i} is the rate of change (slope) in self-rated health for individual i over time since the baseline; X_{kit} are the time-varying covariates such as lagged marital status, lagged health status, and their corresponding change terms associated with individual i at time T ; γ_k represents the effect of X_k on individual i 's self-rated health; and ε_{it} represents random error in self-rated health for individual i at time T .

For the sample as a whole, both linear and non-linear changes in health were considered. Time was centered at its mean in order to minimize the possibility of multicollinearity when non-linear functions of changes with time were evaluated. Hence the intercept represents the level of self-rated health at the mean time of follow-up.

To examine ethnic differences in the changes of self-rated health, we included them as predictors in the level 2 (or person-level) equation in the multi-level analysis:

$$\pi_{pi} = \beta_{p0} + \sum \beta_{pq} X_{qi} + r_{pi} \quad (2)$$

Here X_{qi} is the q th time constant covariate (e.g., age in 1995 and measures of ethnic groups) associated with individual i , and β_{pq} represents the effect of X_q on the p th growth parameter (π_p). Representing the order of the time function, p ranges from 0 to 1 for a linear model. r_{pi} is a random effect with a mean of 0.

Self-rated health is frequently operationalized as an interval variable as in the vast majority of studies of mortality and self-rated health (Idler & Benyamini, 1997). However, some investigators have treated self-rated health as an ordinal measure (Browning et al., 2003; Bzostek et al., 2007). In addition to analyzing self-rated health as a continuous variable, we treated it as a categorical variable by using an ordered logit linking function within the context of HLM. Whereas an ordered logit model is more complex than a linear model, results from both models concerning ethnic variations were very similar. As a result, we opted to operationalize self-rated health as a continuous variable for readability and ease of understanding of our results.

The HRS involves a national sample of households, augmented by oversamples of African Americans, Hispanics, and Floridians. Many of the attributes (e.g., ethnicity, age, marital status) upon which unequal selection probabilities were based were explicitly controlled in the multivariate analyses. When sampling weights are solely a function of independent variables included in the model, unweighted ordinary least squares (OLS) estimates are preferred because they are unbiased, consistent, and have smaller standard errors than weighted estimates (Winship and Radbill 1994). In addition, we undertook separate analyses with and without weighting (i.e., level 1 weights from the corresponding wave of interview and level 2 weights from the 1998 interview) and obtained very similar results. Hence we chose not to weight the data.

To minimize the loss of subjects due to item missing, multiple imputation (MI) was undertaken (Schafer, 1997). In addition, we included measures of mortality and attrition in our model to control for selection bias associated with these factors. In our analysis, mortality and attrition were treated as confounding variables. This is similar to the approaches used by other investigators in dealing with selection bias (Mroczek & Spiro, 2005). Hence, mortality and attrition are not meant to be causal variables or interpreted as such.

Whereas subjective health was obtained from the proxy informants, certain measures such as CES-D were not ascertained. There were two options for handling this issue. First, multiple imputation could be applied to impute the missing values (e.g., CES-D) so that the proxy interviews could be included in the analysis. However, imputation of subjective measures might not be justified. Second, we could delete all proxy interviews, which accounted for 7% of level-1 observations, from multivariate analysis. This, however, could lead to selection bias. Neither option was fully satisfactory. Nonetheless, we analyzed data by including as well as excluding proxy interviews. The results were remarkably similar. Consequently, we chose not to include proxy interviews in our analysis. Nonetheless, according to our analysis including proxy interviews, both the lagged measure of proxy interview and change in the status of proxy interview were significantly associated with poor self-rated health. Their effects were partially explained by prior health status.

Finally, due to the massive sample (18,486 respondents with over 71,000 observations), there is a concern about the over-abundance of significant results. To offset this, only estimates with a p value less than 0.01 were considered as being statistically significant.

Findings

Change in self-rated health

We charted the trajectory of subjective health by using linear and non-linear functions. Although the linear slope was statistically significant, quadratic and cubic slopes were not. Thus, we used the linear function as the basis for our analysis of ethnic differences in self-rated health. At the mean time of follow-up, perceived health was 2.94 out of 5 points (M_1 in Table 2). Consistent with H_{1a} , self-rated health worsened linearly but moderately with time ($b = .037$, $p < .001$, M_1 in Table 2). Even with the adjustment of demographic characteristics and education, the rate of change over time remained virtually unchanged (M_3 in Table 2). When time-varying covariates were controlled, the rate of change remained significant but diminished from .037 to .014, suggesting that a significant part of the change was due to health changes (M_4 in Table 2).

Our findings also lend support to H_{1b} in that members of an older age group have poorer perceived health at the mean time of follow-up ($b = .010$, $p < .001$) and a greater rate of worsening health ($b = .001$, $p < .001$) (M_2 in Table 2). These age differences were substantially reduced when various covariates were controlled (M_2 to M_4 in Table 2). Hence, heterogeneity in ethnicity, education, and health conditions accounts for much of the observed age variations.

Ethnic differences in self-rated health

In support of H_{2a} , both blacks ($b = .442$, $p < .001$) and Hispanics ($b = .589$, $p < .001$) exhibited significantly worse levels of self-rated health than whites (M_2 in Table 2). However, there were no significant differences in the rate of change across blacks, Hispanics, and whites. As shown in Figure 1, self-rated health trajectories across Hispanics, blacks, and whites were largely parallel, with Hispanics and blacks consistently viewing their health to be poorer than whites.

How much of the ethnic differences can be explained by heterogeneity in SES, marital status and prior health status? Based on our analyses of data derived from HRS, ethnicity is significantly associated with diseases, functional status, and CES-D (e.g., Liang et al., 2008). In addition, there were significant ethnic variations in education and marital status (Table 1). When these factors were taken into account, ethnic differences in the level of perceived health diminished quite substantially (i.e., from .442 to .092 for blacks and from .589 to .156 for Hispanics) (M_2 through M_4 in Table 2). According to the approach outlined by Baron and Kenny (1986), these findings suggest that SES, marital status, and changing health status mediate the effects of ethnicity on the levels of self-rated health, although ethnic variations remain significant.

Regardless whether SES, marital status, and prior health were controlled, there were no statistically significant differences in the rate of change in self-rated health between blacks and whites (M_2 and M_4 in Table 2). On the other hand, the initially non-significant Hispanic/white difference in the rate of change for self-rated health became significant, only when all covariates were included in the regression equations ($b = .019$, $p < .001$, M_4 in Table 2). These findings point to the possibility that the Hispanic/white difference in the rate of change may be suppressed if population heterogeneity is not controlled.

How do black and Hispanic Americans differ in the trajectory of self-rated health? Hispanics ($b = .153$) appeared to have worse health than blacks ($b = .092$) and suffered from a greater rate of deterioration ($b = .019$ for Hispanics versus $b = .003$ for blacks) (M_4 in Table 2). Further

evaluations (not shown) demonstrated statistically significant differences between these two groups in terms of the intercept and rate of change associated with self-rated health, thus providing some evidence in support of Hypothesis H_{2b}.

Ethnic differences in subjective health net of population heterogeneity are illustrated in Figure 2. For white Americans, perceived ill health increased from 2.81 to 2.95 over 11 years. Blacks showed a higher level of perceived ill health than whites, but the rate of change was the same for both black and white Americans. On the other hand, Hispanics experienced not only a higher level of ill health than white Americans but also a faster deterioration of self-rated health. Contrasting Figures 1 and 2, variations in the trajectories in Hispanics, blacks, and whites became significantly reduced when SES, social networks, and prior health were taken into account. Nonetheless, Hispanics and blacks remained less positive concerning their health. More importantly, Hispanics exhibited a greater rate of worsening health than blacks and whites.

Other covariates

Changes in subjective health were correlated with a number of other covariates as well. For instance, women appeared to rate their health less negatively than men ($b = -.041$, $p < .001$) but experienced the same rate of decrement (M_4 in Table 2). In contrast, higher education was associated with a better level of health ($b = -.078$, $p < .001$) and a slightly higher rate of worsening health ($b = .001$, $p < .01$) (M_3 in Table 2). On the other hand, higher household income and increased income were both associated with lower self-rated ill health. These differences appeared to be partially due to changes in health status over time (M_4 in Table 2).

Changes in marital status also had interesting effects on reported self-health for individuals. Being married was associated with an increase in ill-health ($b = .034$, $p < .001$), whereas changing marital relations between times $t-1$ and t (i.e., -1 = becoming unmarried, 0 = no change in marital status, and 1 = becoming married) were also correlated with worse self-rated health ($b = .085$, $p < .001$) (M_4 in Table 2). These results are somewhat counterintuitive. Nevertheless, additional analyses of HRS data (not shown here) suggested that being married and becoming married were associated with less functional impairment and fewer depressive symptoms. These differential effects of marital status on these health outcome measures remain to be examined.

Poor prior health conditions and/or recent decline in health (in terms of diseases, disability, and depressive symptoms) were significantly associated with worse self-rated health (M_4 in Table 2). Furthermore, self-rated health at the baseline was associated with poorer perceived health at the mean time of follow-up ($b = .384$, $p < .001$) but a slower rate of worsening health ($b = -.015$, $p < .001$). Difference in the variance components of the intercept between M_1 and M_2 $[(.765 - .715)/.752 = .065]$ suggests that at most 6.5% of the variation of the intercept is associated with ethnicity. Comparing M_2 with M_4 in which health status measures were controlled, the residual variance is reduced by almost 68%.

Mortality and attrition

Mortality is significantly associated with the intercept and slope of change in perceived health. In particular, those deceased during the period of follow-up had poorer health ($b = .786$, $p < .001$) and a greater rate of worsening health ($b = .024$, $p < .001$) (M_1 in Table 2). A substantial portion of these linkages seemed to be explained by socio-demographic attributes and health changes over time (M_4 in Table 2). Finally, attrition during the period of follow-up was associated with poorer health but did not affect the rate of change (M_4 in Table 2). In short, parameter estimates associated with the trajectory of self-rated health would likely be biased if mortality and attrition were not controlled.

Discussion

To the best of our knowledge, this research is the first to analyze the variations in the trajectory of subjective health in middle and old age across black, Hispanic, and white Americans. A key contribution of this research lies in its dynamic focus on the level as well as rate of change in self-rated health. Among those over 50 years of age, self-rated health worsens over time in a linear fashion although moderately. This adds to a growing body of research documenting that like objective measures of health, subjective health deteriorates over time in adulthood (Lynch, 2003; McDonough & Berglund, 2003). Yao and Robert (2008) reported that self-rated health improved slightly before an accelerated deterioration. Nonetheless, over a long period of time, their overall trajectory is not very different from our observation of a course of moderately worsening health in old age.

Consistent with prior research (Lynch, 2003; Pinquart, 2001), those in an older age group had poorer perceived health and a greater rate of worsening health. This could be due to a combination of cohort and aging effects. Because education, income, health, and medical care have improved significantly for members of the younger cohorts (Crimmins, Saito, & Reynolds, 1997; Lynch, 2003), they may have a stronger expectation for a healthy life and a greater concern for mild illness conditions (Schnittker, 2005). On the other hand, worsening self-rated health in older age groups may be a reflection that declines in physical and mental health status accelerate with age (Liang et al. 2005).

Black, Hispanic, and white Americans differ substantially in SES, social networks, and health status. Therefore, ethnic differences in self-rated health should be analyzed before and after population heterogeneity is taken into account. Before adjusting for SES, marital status, and prior health, trajectories of self-rated health were essentially parallel, with Hispanics and blacks consistently rating their health to be poorer than whites. Ethnic differences diminished significantly, when SES, social networks, and prior health were taken into account. Whereas both black and Hispanic Americans had a poorer level of health than white Americans, these differences were substantially smaller. Although blacks and whites did not differ in the rate of change, Hispanics had a higher rate of worsening health than whites. Finally, relative to blacks, Hispanics appear to have poorer perceived health both in terms of the intercept and linear rate of change.

Moving beyond a comparison involving only two ethnic groups, we were able to depict quantitatively how the dynamics of subjective health varies across black, Hispanic, and white Americans. Our findings complement recent observations that black older adults experienced greater declines in self-rated health over time than white older persons (Yao & Robert, 2008) by contrasting these two groups with older Hispanics. It is interesting to note that in comparison with blacks and whites, Hispanics rated their health least positively.

Our observations are contrary to what one would extrapolate from the notion of the Hispanic paradox which suggests Hispanics have similar or better health outcomes than whites, despite their socioeconomic disadvantages (Markides & Black, 1996). Existing research related to the Hispanic Paradox is largely based on mortality, with very limited data on other health outcomes (Morales, Lara, Kington, Valdez, & Escarce, 2002; Palloni & Arias, 2004). Complementing results from several recent studies (Cho, Frisbie, Hummer & Rogers, 2004; Franzini & Fernandez-Esquer, 2004), our findings suggest that ethnic variations in the trajectory of self-rated health could manifest themselves differently from those of physical and mental health. Nevertheless further replication of our findings is warranted.

Ethnicity influences the intrapersonal changes in perceived health directly and indirectly through SES, social networks, and changing health status. Prior investigators have generally viewed these variables as mediating factors (e.g., Mutchler & Burr, 1991; Yao & Robert,

2008). Their roles as suppressor variables are less explored. According to our research, education, income, marital status, and changing health status serve as mediating variables only with reference to ethnic differences in the level of subjective health, whereas they act as suppressor variables for variations in the rate of change between Hispanics and whites.

Evidence is mixed regarding variations in the meaning of self-rated health across ethnic groups. According to some investigators, blacks and whites may evaluate their health differently (Ferraro & Kelley-Moore, 2001; Johnson & Wolinsky, 1994). In contrast, there is strong evidence that differences detected between groups are real rather than an artifact of the measurement method (Andersen, Mullner, & Cornelius, 1987; Chandola & Jenkinson, 2000; Cunningham et al., 2000). Furthermore, Finch, Hummer, Reindl, & Vega (2002) questioned the validity of self-rated health in predicting mortality among Latinos. They made the case for using birth and duration in the US as controls for acculturative factors when examining self-rated health. We also undertook sensitivity analyses including language of interview as well as nativity status to determine if these account for some of the observed ethnic differences (Appendix A, Table A1). Language of interview was not significantly correlated with self-rated health. Nor were place of birth and age at immigration significantly associated with the intercept and linear slope of self-rated health. More importantly, the inclusion of these variables did not alter our key findings concerning ethnic variations.

Our analysis was based on time-based models (i.e., intrapersonal changes over the period of observation) (Alwin, Hofer, & McCammon, 2006), whereas interpersonal age differences were controlled in the prediction of the intercept and slope of self-rated health. In an age-based analysis, age is used as the metric in estimating the growth parameters. Other metrics of time (i.e., time since a significant event such as the onset of a disease, disability, or widowhood) can also be employed. Alternative time specifications may lead to differences in parameter estimates and their interpretations. Nonetheless, from a statistical point of view, models involving different time metrics are all equally correct, and the choice of a given metric should be dictated by one's research questions and substantive considerations (Kreft, de Leeuw, & Aiken, 1995; Mehta & West, 2000; Bollen & Curran, 2006).

In the present study, we did not pursue an age-based analysis because data from HRS are currently not suitable for the correct estimation of the intrapersonal age effects on self-rated health. An age-based analysis only makes sense, if an adequate number of repeated observations exist to capture the proper form of the within-individual growth (Mehta & West, 2000). It requires that age-outcome trajectories either do not vary by cohorts or cohort differences can be adjusted appropriately (McArdle & Hamagami, 1992). Most longitudinal studies including HRS yield only data collected from members of different birth cohorts at different ages over a period of less than 20 years (e.g., Willson, Shuey, & Elder, 2007; Yang, 2007). Hence, age and cohort effects are highly confounded. Furthermore, age-based analysis often results in the introduction of missing data (Bollen & Curran, 2006). Attempts to identify cohort effects by using age-based models with such data require extrapolations of intrapersonal changes to unobserved age ranges, which could lead to serious bias. We chose to undertake time-based analysis which involved no such extrapolations.

This research can be improved. In the following, we focus on several issues of particular relevance. First, there might be significant heterogeneity in how self-rated health changes which is not explored in this research. For instance, recent research on older Japanese has shown that underlying the average trajectory of subjective health, there are four distinct courses of change including (a) constant good health, (b) early onset of worsening health, (c) late onset of worsening health, and (d) recovery from poor health (Liang et al., 2005). This suggests the need to examine not only the average health change with age in a given population but also its underlying heterogeneity. The distinction between the average change and its underlying

heterogeneity corresponds well with that between the variable-centered approach and the person-centered approach. The former focuses on the parameters of the average change (i.e., intercept and slopes) as the dependent variables, whereas the latter concentrates on subgroup heterogeneity that reflects qualitatively distinct trajectories as the dependent variable. As complementary perspectives, the variable-centered approach yields information on factors that apply to everyone in general, and the person-centered approach identifies effects specific to individuals experiencing a given trajectory (Magnusson, 2003).

Second, Hispanics, including Central/South American origin individuals, Cubans, Puerto Ricans, and Mexican Americans, are culturally diverse with different customs, values, migration patterns, and socioeconomic status (Cho et al., 2004; Bzostek et al., 2007). In this regard, factors such as acculturation and age at immigration may have important implications for health in middle and later life (Angel & Angel, 2006; Markides & Black, 1996). This heterogeneity is not well understood, and its linkages with self-rated health and other dimensions of health certainly require further research.

Third, because respondents of HRS were sampled in mid- and later-life, differential mortality had already altered the representativeness of the original birth cohorts before they were eligible for inclusion. This is often referred to as left truncation, which may lead to selection bias. Left truncation is a salient issue when a dependent variable is highly correlated with the risk of dying and when survival is increasingly selective. Within the context of the present study, left truncation is likely to lead to a higher proportion of healthy respondents to be included in the sample. This might underestimate the rate of increase in perceived ill health over time. On the other hand, survival may be more selective among blacks and Hispanics. If this were the case, more whites with poor health than blacks might be included in the HRS panel. This could lead to understated ethnic differences in health. Nevertheless, it is unclear how large such biases are. More research on ways of adjusting for the biases due to left truncation is clearly warranted.

Fourth, a growing body of research has suggested that neighborhood social context is linked with self-rated health. For instance, affluence, a neighborhood structural resource, contributes positively to self-rated health and attenuates the association between race and self-rated health (Cagney et al., 2005). Conceivably, our model could be further elaborated by incorporating neighborhood or community as an additional level. Thus, ethnic differences in the dynamics of self-assessed health can be ascertained across various neighborhood environments. Yao and Robert (2008) recently evaluated a model of self-rated health trajectories incorporating neighborhood SES as a level in addition to race and individual SES at the person-level. However, they did not examine racial variations in changing subjective health as a function of neighborhood attributes.

A more dynamic approach focusing on variations in health trajectories across black, Hispanic, and white Americans would lead to an improved understanding of the linkages between ethnicity and health. Our research reveals that significant ethnic variations exist in the trajectory of subjective health. Promising avenues for further inquiries include analyzing ethnic heterogeneities from a person-centered perspective, health disparities across subgroups of Hispanics, effects of neighborhood attributes, and implications of left truncation.

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Figure 1.
Changes in Self-Rated Health by Ethnicity (Model 2)

Figure 2.
Changes in Self-Rated Health by Ethnicity (Model 4)

Table 1

Descriptive Statistics for Measures at Levels 1 and 2, HRS 1995–2006

Measures	Total		White		Black		Hispanic	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Level 1	(n=64,674)		(n=51,736)		(n=8,479)		(n=4,459)	
Self-rated (ill) health	2.84	1.11	2.74	1.09	3.21	1.09	3.34	1.09
Time since baseline year	5.65	2.75	5.66	2.74	5.57	2.75	5.64	2.76
Household income (lagged) ^a	63.80	89.51	69.89	95.38	41.49	54.79	35.51	52.95
Marital status (lagged)	0.68	0.47	0.71	0.45	0.49	0.50	0.66	0.47
Functional status (lagged)	0.41	1.23	0.34	1.09	0.71	1.64	0.68	1.69
Diseases (lagged)	1.73	1.26	1.69	1.25	2.00	1.27	1.62	1.23
Depressive symptoms (lagged)	1.84	2.08	1.71	1.98	2.30	2.24	2.55	2.55
Δ Household income ^a	0.04	93.71	−0.70	99.96	2.73	65.38	3.53	57.33
Δ Marital status	−0.03	0.21	−0.03	0.21	−0.03	0.22	−0.03	0.21
Δ Functional status	0.13	1.14	0.13	1.05	0.16	1.44	0.11	1.45
Δ Diseases	0.18	0.57	0.18	0.57	0.17	0.57	0.16	0.59
Δ Depressive Symptoms	0.11	1.96	0.12	1.89	0.07	2.12	0.07	2.44
Level 2	(n=17,196)		(n=13,644)		(n=2,340)		(n=1,212)	
Died (between baseline and 2006)	0.24	0.42	0.24	0.42	0.26	0.44	0.23	0.42
Ever attrited (between baseline and 2006)	0.09	0.29	0.08	0.28	0.11	0.32	0.21	0.41
Age (in 1995)	63.97	10.02	64.32	10.06	62.80	9.93	62.28	9.44
Female	0.59	0.49	0.57	0.49	0.64	0.48	0.60	0.49
Education	12.08	3.27	12.64	2.75	10.81	3.53	8.30	4.62
Baseline self-rated health	2.67	1.14	2.56	1.11	3.06	1.14	3.15	1.17

Note: At level 1, attributes are those associated with repeated observations within individuals. Level 2 measures are those associated with individuals at the baseline (i.e., 1995/1996 for AHEAD and HRS respectively, and 1998 for WB and CODA).

^aInflation-adjusted (2006 dollars) in thousands of dollars.

Table 2
Intrapersonal and Interpersonal Differences in Self-Rated Health: Results from Hierarchical Linear Models (Unweighted Data)

Covariates	Model 1 (M ₁)	Model 2 (M ₂)	Model 3 (M ₃)	Model 4 (M ₄)
Fixed Effect				
Time Variant Variables				
Household income (lagged) ^a			-0.001 ***	-0.000 ***
Married (lagged)				0.026 **
Functional status (lagged)				0.073 ***
Diseases (lagged)				0.156 ***
Depressive symptoms (lagged)				0.096 ***
Δ Household income ^a			-0.000 **	-0.000 **
Δ Married				0.085 ***
Δ Functional status				0.072 ***
Δ Diseases				0.203 ***
Δ Depressive Symptoms				0.080 ***
For Intercept, π_0				
Intercept	2.944 ***	2.942 ***	2.941 ***	2.904 ***
Death	0.786 ***	0.687 ***	0.645 ***	0.228 ***
Ever attrited	0.059 *	0.036	0.025	0.040 *
Age (in 1995)		0.010 ***	0.005 ***	0.001
Female		0.069 ***	0.033 **	-0.041 ***
Non-Hispanic black		0.442 ***	0.286 ***	0.092 ***
Hispanic		0.589 ***	0.224 ***	0.156 ***
Education			-0.078 ***	-0.023 ***
Baseline self-rated health				0.384 ***
For Time slope, π_1				
Intercept	0.037 ***	0.037 ***	0.037 ***	0.014 ***
Death	0.024 ***	0.014 **	0.015 **	0.006

Covariates	Model 1 (M ₁)	Model 2 (M ₂)	Model 3 (M ₃)	Model 4 (M ₄)
Ever attrited	0.003	0.003	0.002	0.004
Age (in 1995)		0.001 ***	0.001 ***	0.000 ***
Female		-0.002	-0.001	0.000
Non-Hispanic black		-0.007 *	-0.004	0.003
Hispanic		0.003	0.009	0.019 ***
Education			0.001 **	-0.000
Baseline self-rated health				-0.015 ***
Random Effect	Variance	Variance	Variance	Variance
Intercept 1	0.765 ***	0.715 ***	0.651 ***	0.226 ***
Time slope	0.004 ***	0.004 ***	0.004 ***	0.003 ***
Level-1, R	0.390	0.390	0.391	0.378
AIC Fit Index	161,765.57	160,855.04	159,627.77	143,077.79

Note: Reliability estimates are based on 15,140 of 17,196 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

* p<.05,
** p<.01,
*** p<.001.

^aInflation-adjusted (2006 dollars) in thousands of dollars.

Appendix Table A1
Intrapersonal and Interpersonal Differences in Self-Rated Health: Results from Hierarchical Linear Models (Unweighted Data)

Covariates	Model 4A
Fixed Effect	
Time Variant Variables	
Spanish language interview	0.047
Household income (lagged)	−0.000 ***
Married (lagged)	0.026 **
Functional status (lagged)	0.073 ***
Diseases (lagged)	0.156 ***
Depressive symptoms (lagged)	0.096 ***
Δ Household income	−0.000 *
Δ Married	0.085 ***
Δ Functional status	0.072 ***
Δ Diseases	0.203 ***
Δ Depressive Symptoms	0.080 ***
For Intercept, π_0	
Intercept	2.903 ***
Death	0.229 ***
Ever attrited	0.040 *
Age (in 1995)	0.001
Female	−0.041 ***
Non-Hispanic black	0.093 ***
Hispanic	0.105 ***
Education	−0.022 ***
Baseline self-rated health	0.384 ***
Age at immigration	0.001
Foreign-born	0.028
For Time slope, π_1	
Intercept	0.014 ***
Death	0.006

Covariates	Model 4A
Ever attrited	0.004
Age (in 1995)	0.000 ***
Female	0.000
Non-Hispanic black	0.003
Hispanic	0.015 **
Education	−0.000
Baseline self-rated health	−0.015 ***
Age at immigration	0.000
Foreign-born	−0.001
Random Effect	Variance
Intercept 1	0.225 ***
Time slope	0.003 ***
Level-1, R	0.378
AIC Fit Index	143, 107.42