Alternative Measures of Self-Rated Health for Predicting Mortality Among Older People: Is Past or Future Orientation More Important?

Kenneth F. Ferraro, PhD, Lindsay R. Wilkinson, PhD
Alternative Measures of Self-Rated Health for Predicting Mortality Among Older People: Is Past or Future Orientation More Important?

Kenneth F. Ferraro, PhD, *1,2 and Lindsay R. Wilkinson, PhD3

1Center on Aging and the Life Course, Purdue University, West Lafayette, Indiana. 2Department of Sociology, Purdue University, West Lafayette, Indiana. 3Department of Sociology, Baylor University, Waco, Texas.

*Address correspondence to Kenneth F. Ferraro, PhD, Center on Aging and the Life Course, Purdue University, 1202 West State Street, West Lafayette, IN 47907-2180. E-mail: ferraro@purdue.edu

Received June 5, 2013; Accepted July 22, 2013

Decision Editor: Rachel Pruchno, PhD

Abstract

Purpose: The purpose of this study was to compare the prognostic validity of alternative measures of health ratings, including those that tap temporal reflections, on adult mortality.

Design and Methods: The study uses a national sample of 1,266 Americans 50–74 years old in 1995, with vital status tracked through 2005, to compare the effect of 3 types of health ratings on mortality: conventional indicator of self-rated health (SRH), age comparison form of SRH, and health ratings that incorporate temporal dimensions. Logistic regression was used to estimate the odds of mortality associated with alternative health ratings while adjusting for health conditions, lifestyle factors, and status characteristics and resources.

Results: Self-rated health was a consistent predictor of mortality, but the respondent’s expected health rating—10 years in the future—was an independent predictor. Future health expectations were more important than past (recalled change) in predicting mortality risk: People with more negative expectations of future health were less likely to survive.

Implications: The findings reveal the importance of future time perspective for older people and suggest that it is more useful to query older people about their future health expectations than about how their health has changed.

Key Words: Self-assessed health, Survival, Time orientation

Empirical generalizations are critical to scientific progress, and one of gerontology’s most consistent findings from the past two decades is that self-rated health (SRH) is associated with mortality risk among older people, even after adjusting for medical conditions, social status, and psychosocial resources. Mossey and Shapiro’s (1982) report of this relationship based on data from the Manitoba Longitudinal stimulated a host of studies, and Idler and Benyamini’s
(1997) review fanned the flames of interest in the topic. Scores, perhaps hundreds of studies, have been published on the subject—and most but not all report the same finding: SRH is an independent predictor of mortality among older people. The consistency across studies is remarkable given that these studies arise from around the world; pick a continent or a country, and one is likely to find a study on the topic. The empirical generalization also holds for many specific populations such as persons who have diabetes mellitus or have undergone kidney transplantation.

As one surveys this expansive literature, it is apparent that most studies make use of ratings of current health based on some variant of the question: In general, would you say your health is poor, fair, good, very good, or excellent? There have been modifications that tap age comparisons by adding a phrase such as “for your age” (Mossey & Shapiro, 1982) or that use different or fewer response categories (cf., Idler & Kasl, 1991; Kaplan & Camacho, 1983). In their review of 27 community studies, however, Idler and Benyamini (1997) conclude that these semantic variations have little effect on the basic finding that SRH is related to mortality.

Although less plentiful, there are also studies that ask residents to assess change in their health ratings. Based on the premise that change in health may be just as important as current health, the Short-Form 36 (SF-36) Health Survey included a question to provide some biographic context for current health: “Compared to one year ago, how would you rate your health in general now?” (Ware & Sherbourne, 1992, p. 482). Other studies probe future health: “Next year, would you predict that your overall health will be better, about the same, worse, or don’t know?” (Wang & Satariano, 2007, p. 1429). Although several studies examine either past or future change in SRH, we are unaware of any study that systematically compares the effects of past, current, and future health ratings on mortality among older people. The purpose of this article is to give explicit attention to whether these temporal formulations of SRH are consequential to mortality risk among older people.

Our rationale for comparing these temporal formulations of health ratings for predicting mortality is twofold. First, diachronic thinking provides the context for rating one’s current health. Whereas current evaluations are anchored in one’s view of past and future health, it makes sense to consider the past and future evaluations (Baars, 2007). Indeed, in attempting to explicate why SRH predicts mortality, Idler and Benyamini (1997, p. 29) suggested that it may be precisely because SRH reflects “a dynamic, rather than static, perspective on health; people may be judging decline (or improvement) in various aspects of health.” Second, perhaps adding a question that taps these temporal elements would improve our prediction of mortality risk. Researchers and clinicians have found SRH to be an exceptionally useful variable for predicting mortality risk, but one wonders if adding a question that probes past or future health might help further identify persons at risk of death. Moreover, if past or future ratings of health are predictive of mortality, this becomes a much less costly way to tap health dynamics in a cross-sectional study than repeated measures, which require a longitudinal follow-up.

**Self-Rated Health in Temporal Context**

There are two bodies of empirical research relevant to exploring whether the temporal formulations of SRH add value to the widespread practice of using current health ratings to predict mortality. First, there are several studies that have prospectively examined change in SRH over time. For example, Ferraro and Kelley-Moore (2001) examined the “dynamic evaluation thesis” and found that treating SRH as a time-dependent variable in survival analyses was superior to using a baseline measure only. Indeed, if one used baseline SRH only, mortality risk was underestimated. Others have reported similar findings over a long time frame (e.g., 10 years: Nery Guimarães et al., 2012), whereas those using a shorter time frame report that changing SRH does not improve mortality prediction (e.g., 3 years: Galenkamp, Deeg, Braam, & Huisman, 2013). Based on the literature, perhaps the utility of changing SRH is greater when the observation period is longer.

Beyond observed changes in SRH, there are also studies that examine the subjective evaluations of changing health. As noted earlier, the most frequently asked question is the retrospective one focusing on the past by probing how one’s health has changed compared to 1 year ago. This question is part of the SF-36 and has also been incorporated in the Supplement on Aging of the National Health Interview Survey and the Australian Longitudinal Study of Ageing (Sargent-Cox, Antsey, & Luszcz, 2010). It was also included in the Original Cohorts from the National Longitudinal Surveys and the Nottingham Longitudinal Study of Activity and Ageing (Bath, 2003) using a 5-year time frame as well as in the Longitudinal Aging Study of Amsterdam (Deeg & Kriegsman, 2003) using a 10-year time frame. To date, most studies show that this question does not add much explanatory power to the prediction of mortality risk (Deeg & Kriegsman, 2003; Galenkamp et al., 2013; Sargent-Cox et al., 2010).

Although many studies ask respondents to compare current health to past health, we identified one mortality study that framed the comparison with a future orientation. Respondents in a large sample of Sonoma, CA, residents 53 years or older were asked: Next year, would you predict your overall health will be better, about the same, worse, or don’t know? Wang and Satariano (2007, p. 1433) reported that “a simple assessment of one’s own future health (1 year in the future) is independently predictive of mortality over a 10-year period.” Respondents who felt that their health would be worse next year—or replied “don’t know”—had elevated mortality risk even when current SRH was simultaneously considered. We were unable to locate any studies...
of mortality risk that considered SRH using past, current, and future time frames.

In addition to the empirical research, there is a theoretical justification for incorporating temporal elements of health ratings into studies of mortality risk. Indeed, multiple theories of aging hold that time horizons are essential to the study of aging. First, socioemotional selectivity theory prioritizes future time orientation for understanding the aging process (Carstensen, 2006). The theory specifies that a shorter time horizon leads to change in emotion regulation, which may be consequential to health (Carstensen, Isaacowitz, & Charles, 1999). Awareness of finitude has long been considered important to life review and behavioral adaptation (Marshall, 1975), but recent empirical studies reveal that older adults are realistic about the future (Lachman, Röcke, Rosnick, & Ryff, 2008) and that future time orientation influences their health behavior (Stahl & Patrick, 2012).

Second, cumulative inequality theory calls for more attention to perceived life trajectories as influential for the aging process (Ferraro & Shippee, 2009). The use of longitudinal data to track the life course has led to important breakthrough discoveries for gerontology. At the same time, however, there is value in integrating the perspective of the respondent (i.e., definition of the situation). People are continually reevaluating their life circumstances, so recent change in health or one’s environment may precipitate a new view of current and future health status. The theory recognizes that “individuals’ interpretations of their lives are rooted in structural systems of advantage and disadvantage, but the interpretations also shape the future through goals, expectations, and/or self-fulfilling prophecies” (Schafer, Ferraro, & Mustillo, 2011, pp. 1054–1055).

Diachronic thinking is essential to the interpretation of one’s life. Thus, for the present research, the subjective evaluation of changing health may be more important than the actual change in bodily symptoms or functioning. In short, both socioemotional selectivity and cumulative inequality theories call for greater attention to temporal evaluations because they are related to behavior and psychosomatic processes. Drawing from both theoretical and empirical research on aging, we specify two main research questions to guide the analysis.

1. **Is the prediction of mortality improved by including diachronic evaluations with current SRH?** Although there are strong theoretical grounds for expecting diachronic evaluations to be consequential, there is mixed evidence regarding whether these temporal formulations of SRH are consequential to mortality.

2. **If diachronic formulations of SRH are significant in predicting mortality, does the past or future time frame manifest greater prognostic validity?** Prior studies test either past or future specifications of SRH, but this study considers both time frames. On the basis of theory and Wang and Satariano’s (2007) research, we hypothesize that future orientation is more consequential than past to mortality among older people.

In answering these questions, the present analysis seeks to build upon prior research to better understand why SRH is related to mortality among older people. The analysis is noteworthy in at least four ways. First, this is the first study of which we are aware to simultaneously consider the effect of past, present, and future health ratings on mortality risk among older people. Second, although most studies use a relatively short time frame (1 or 3 years) for measuring diachronic health ratings, we use a longer time horizon, which may be more consequential to mortality risk. Third, we also take advantage of the age comparison form of current SRH as a follow-up from findings to prior studies incorporating this measure. Finally, we examine our research questions with a nationally representative sample of older Americans.

### Design and Methods

The data used were collected for the National Survey of Midlife Development in the United States (MIDUS; Brim et al., 2000). Baseline data were collected during 1995–1996 with random-digit-dialing to obtain a sampling frame of all English-speaking noninstitutionalized adults aged 25–74 in the continental United States as well as an oversample of men between 65 and 74 years of age (response rate = 70%). Additional questions were probed in a mail survey of those who responded to the telephone interview (response rate = 86.6%). Thus, the overall response rate was 61% (0.70 × 0.87 = 0.61). With our focus on older adults, we make use of data from 1,266 respondents 50 years or older at the baseline survey. A follow-up survey was completed approximately 10 years later, and this time period serves as the window of mortality observation. The MIDUS is an exceptional data source for this research because it contains multiple measures of SRH, including those tapping temporal dimensions.

### Measures

#### Mortality

Deaths from all causes were identified at the 10-year follow-up with the National Death Index for those persons who were reported as deceased by a proxy respondent or could not be contacted for reinterview. Surviving respondents were 60–84 years old at the follow-up. The range and descriptive statistics for all variables used in the analyses are presented in Table 1. About 16% of the analytic sample died during the follow-up period (n = 207).

#### Self-Rated Health (Multiple Formulations)

The widely used measure of SRH was posed in the telephone interview as follows (with coding in parentheses): In general, would you say your physical health is poor (1), fair (2), good (3), very good (4), or excellent (5)?
Table 1. Means and SDs of Variables in the MIDUS
(N = 1,266)

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>0–1</td>
<td>0.164</td>
<td></td>
</tr>
<tr>
<td>SRH (conventional)</td>
<td>1–5</td>
<td>3.307</td>
<td>1.044</td>
</tr>
<tr>
<td>Age comparison SRH</td>
<td>1–5</td>
<td>3.801</td>
<td>0.971</td>
</tr>
<tr>
<td>Diachronic SRH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past</td>
<td>0–10</td>
<td>8.079</td>
<td>1.822</td>
</tr>
<tr>
<td>Present</td>
<td>0–10</td>
<td>7.316</td>
<td>1.767</td>
</tr>
<tr>
<td>Future</td>
<td>0–10</td>
<td>6.500</td>
<td>2.253</td>
</tr>
<tr>
<td>Slope of SRH (future–past)</td>
<td>−10–10</td>
<td>−1.577</td>
<td>2.551</td>
</tr>
<tr>
<td>Serious health conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>0–1</td>
<td>0.307</td>
<td></td>
</tr>
<tr>
<td>Heart problems</td>
<td>0–1</td>
<td>0.197</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>0–1</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>0–1</td>
<td>0.093</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>0–1</td>
<td>0.117</td>
<td></td>
</tr>
<tr>
<td>Count of chronic illnesses</td>
<td>0–25</td>
<td>2.691</td>
<td>2.680</td>
</tr>
<tr>
<td>Somatic symptoms</td>
<td>1–6</td>
<td>2.089</td>
<td>0.884</td>
</tr>
<tr>
<td>Psychological symptoms</td>
<td>1–5</td>
<td>1.496</td>
<td>0.595</td>
</tr>
<tr>
<td>Smoking status*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past smoker</td>
<td>0–1</td>
<td>0.596</td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>0–1</td>
<td>0.186</td>
<td></td>
</tr>
<tr>
<td>Heavy drinker</td>
<td>0–1</td>
<td>0.231</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>0–1</td>
<td>0.230</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>50–74</td>
<td>60.137</td>
<td>6.922</td>
</tr>
<tr>
<td>Female</td>
<td>0–1</td>
<td>0.536</td>
<td></td>
</tr>
<tr>
<td>Non-white</td>
<td>0–1</td>
<td>0.092</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>0–1</td>
<td>0.656</td>
<td></td>
</tr>
<tr>
<td>Education*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>0–1</td>
<td>0.586</td>
<td></td>
</tr>
<tr>
<td>College</td>
<td>0–1</td>
<td>0.257</td>
<td></td>
</tr>
<tr>
<td>Household income</td>
<td>0–300</td>
<td>61.535</td>
<td>59.401</td>
</tr>
</tbody>
</table>

Notes: MIDUS = National Survey of Midlife Development in the United States; SRH = self-rated health. All dichotomous variables are scored 0 and 1 (0 = no or otherwise). The SD of a dichotomous variable is omitted because it is a function of the mean.

*aReference group = never smoked.

*bReference group = less than high school.

The age comparison of SRH, technically an age and sex comparison, was also asked in the telephone interview: In general, compared to most (men/women) your age, would you say your health is much better (5), somewhat better (4), about the same (3), somewhat worse (2), or much worse (1)?

Additional formulations of SRH were presented in the mail questionnaire and used 11 response categories. Present SRH was asked again with the following question: Using a scale from 0 to 10 where 0 means the worst possible health and 10 means the best possible health, how would you rate your health these days? We explored the potential consequence of the different range of scores (5 vs 11 categories) and discovered that the two measures are highly correlated ($r = .616$). Nevertheless, as shown below, each communicates unique information in models of mortality.

To tap past SRH, respondents were next asked: Looking back ten years ago, how would you rate your health at that time using the same 0 to 10 scale? For future SRH, respondents were asked: Looking ahead ten years into the future, what do you expect your health will be like at that time? Of note, because the follow-up period is approximately 10 years, the question probing future health fits well with the observed mortality follow-up period of a decade.

After examining several alternative ways of using the diachronic measures with 11 response categories, we completed the analyses with two approaches: (a) the observed scores for past, present, and future SRH and (b) a slope of future minus past SRH.

Physical Health
Studies of the relationship between health ratings and mortality need to account for morbidity; failure to do so would likely lead to overestimating the effect of the health ratings on mortality. We take advantage of a rich inventory of health problems in the MIDUS and isolate the influence of serious or life-threatening conditions as dummy variables: hypertension, heart problems, stroke, diabetes, and cancer.

We also create sum of the remaining conditions for a count of chronic illnesses (Ferraro & Wilmoth, 2000). Although these measures are self-reported, prior studies of the SRH–mortality relationship reach similar conclusions by using physician-evaluated morbidity (Idler & Angel, 1990).

To examine preclinical morbidity, we also included a measure of somatic symptoms. This measure is especially relevant for studying the influence of future SRH because it taps physical health problems that may not have yet been reported to or diagnosed by a physician. During the course of the self-administered questionnaire, respondents were asked how often they experienced the following during the past 30 days: (1) headaches, (2) back aches, (3) frequent sweating, (4) irritability, (5) hot flashes or flushes, (6) aches or stiffness in the joints, (7) troubling getting to or staying asleep, (8) incontinence, and (9) pain during sex. The response categories for each item ranged from not at all (coded 1) to almost every day (6). We created an average score for all persons who completed seven of the nine questions (Acock, 2010); the nine-item index manifests good reliability ($\alpha = .75$).

Psychological Health
To assure that temporal formulations of SRH are not simply reflecting psychological status, we adjust for psychological symptoms, which were assessed with six items referring to symptoms experienced during the past 30 days. Indicators include feeling (1) so sad nothing could cheer you up, (2) nervous, (3) restless or fidgety, (4) hopeless, (5) that everything was an effort, and (6) worthless. Response options ranged from none of the time (coded 1) to all the time (5). We created an average score for all persons who...
completed five of the six questions, and the index manifests high reliability ($\alpha = .85$).

**Lifestyle Risks to Mortality**
Consistent with many previous studies, we also adjust for lifestyle factors that are related to health and survival. *Current smokers, former smokers, heavy drinkers,* and *obese persons* are each designated with a binary variable (0, 1). In preliminary analyses, we examined the influence of alternative coding of these variables (e.g., ordinal drinking measure), but the conclusions were unchanged by the alternative coding algorithms.

**Status Characteristics and Resources**
The analyses adjust for a number of demographic factors including age (coded in years). Binary variables for gender (female = 1), marital status (married = 1), and race (non-white = 1), were also included (non-white is comprised of Black and/or African American, Native American or Aleutian Islander/Eskimo, Asian or Pacific Islander, and other). To measure socioeconomic status, we used both education and income. *Education* was measured in three categories (< high school graduate [reference group], high school graduate, and attended college), and *income* was coded in thousands (top coded at ≥300).

**Analytic Plan**
We estimated the influence of various forms of SRH on mortality with logistic regression. For ease of interpretation, odds ratios (ORs) and confidence intervals are shown in the tabular presentation of results. The first set of mortality analyses compares three different forms of *current SRH*: conventional SRH (five response categories), age comparison SRH, and the 11-point version. Second, we examine the temporal formulations of SRH along with the conventional measures of SRH to determine if past or future ratings add anything beyond current ratings. Given the number of very similar models, we forego the presentation of all of the covariates but they are available upon request. Instead, we focus on how the formulations of SRH are related to mortality. Finally, we examine variability within each of the five categories of SRH by the temporal measures. Predicted probabilities of the differences are plotted.

All multivariate models were estimated with Stata 12 and apply the poststratification sample weights to adjust for unequal probabilities of selection and to make valid population estimates.

**Results**
As shown in Table 1, mean SRH, the conventional measures for current health, is 3.307, somewhere between good and very good on the 5-point scale. The mean for the age comparison SRH is slightly higher (3.801). As one examines the three diachronic measures with 11 response categories, the means for past, present, and future are 8.079, 7.316, and 6.500, respectively. Thus, it is clear that most respondents rate their health 10 years ago as the best of the three, and this value falls in successive measurements. The slope of SRH (future minus past) reflects this pattern with a mean of −1.577; most people reduced their SRH from the past to the future by nearly 1.6 units on the 11-point scale, but there is substantial heterogeneity in how these ratings varied ($SD = 2.551$).

The multivariate analysis began by comparing models of three ratings of *current* physical health: conventional SRH and age comparison SRH (both on a 5-point scale) and present SRH (11-point scale). Models 1, 2, and 4 of Table 2 display the OR for each of these as the only measure of SRH, whereas Models 3 and 5 are specified with the conventional measure of SRH along with each of the other two forms. As described in the Table 2 note, all five models adjust for the full vector of independent variables described in Table 1 (but not shown). For each equation, we present both Akaike’s Information Criterion (AIC) and Schwarz’s

### Table 2. Binary Logistic Regression of Mortality on Alternative Current Health Ratings

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRH (5-point)</td>
<td>0.581*** (0.455,</td>
<td>0.740)*</td>
<td>0.625** (0.468,</td>
<td>0.756* (0.572,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.740)</td>
<td></td>
<td>0.835)</td>
<td>0.999)</td>
<td></td>
</tr>
<tr>
<td>Age comparison SRH</td>
<td>0.718* (0.553,</td>
<td></td>
<td>0.882 (0.655,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.931)</td>
<td></td>
<td>1.189)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present SRH (11-point)</td>
<td>0.684*** (0.593,</td>
<td></td>
<td>0.735*** (0.621,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.790)</td>
<td></td>
<td>0.871)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIC</td>
<td>723.220</td>
<td>731.296</td>
<td>720.221</td>
<td>705.650</td>
<td>703.149</td>
</tr>
<tr>
<td>BIC</td>
<td>828.284</td>
<td>836.227</td>
<td>830.148</td>
<td>810.599</td>
<td>813.096</td>
</tr>
<tr>
<td>Observations</td>
<td>1,100</td>
<td>1,093</td>
<td>1,093</td>
<td>1,094</td>
<td></td>
</tr>
</tbody>
</table>

Notes: AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; SRH = self-rated health. Each equation adjusts for the health conditions, lifestyle factors, and status characteristics listed in Table 1.

*Odds ratio.

1Confidence interval.

*p < .05. **p < .01. ***p < .001.
Bayesian Information Criterion (BIC) for assessing model fit. Both adjust for the number of parameters estimated, but BIC also adjusts for N of cases. Models with low values on both criteria are generally favored (Kuha, 2004).

When each measure of current SRH is isolated, conventional SRH manifests a strong relationship with mortality (OR = 0.581, p < .001). Because the variable is measured on a 5-point scale, it means that for each higher category of SRH, the probability of death decreases by a factor of 0.581. Stated differently, the odds of death decrease 41.9% (1 – .581) for each higher level of SRH while holding all other variables constant. The OR for the age comparison version is not as strong (p < .05), but present SRH on an 11-point scale demonstrates a substantial effect (OR = 0.684, p < .001). In other words, each additional rung on the Cantril ladder reduces the odds of death by 31.6%.

In Model 3, the effect of the conventional SRH attenuates somewhat, but the age comparison SRH is no longer significant. In Model 5, both the conventional measure of SRH and the 11-point version are significant. Recalling that the latter is measured on an 11-point scale, however, its effect is actually more substantial (i.e., 26.5% increase in survival for each additional rung on the ladder; p < .001).

Together, these Table 2 results confirm Idler and Benyamini’s (1997, p. 22) conclusion that the effect of SRH on mortality is robust regardless of “semantic variations in the questions soliciting it” (emphasis added) but suggest that variation in the response categories may be useful to consider in future research. Asking a respondent to rate his or her current health on an 11-point scale brings unique information to the prediction of mortality, even when adjusting for the conventional measure of SRH. By contrast, there seems little utility in further tests of the age comparison form of SRH; there is no added value from contrast, there seems little utility in further tests of the age when adjusting for the conventional measure of SRH. Whereas the slope (future minus past) and past SRH have no influence on mortality risk, Model 4 is more parsimonious and isolates the only temporal formulation that is consequential to mortality alongside the conventional SRH. When considering both past and future, only future has prognostic validity for mortality risk.

Finally, we graphically illustrate the variability within each level of SRH by displaying the predicted probabilities of death for three values of future SRH (derived from Model 4 of Table 3). The middle bar in each of the five sets represents the mean of future SRH when all other variables are held at their means. The darker bar represents the most favorable SRH, whereas the lighter bar represents the worst future SRH.

As shown in Figure 1, there is substantial variability within each level of conventional SRH: Persons who have unfavorable future SRH have higher mortality risk than those who are more positive within each level of conventional SRH. For instance, respondents who rated their

<table>
<thead>
<tr>
<th>Table 3. Binary Logistic Regression of Mortality on Measures of SRH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
</tr>
<tr>
<td>SRH</td>
</tr>
<tr>
<td>Slope (future–past)</td>
</tr>
<tr>
<td>Present SRH</td>
</tr>
<tr>
<td>Past SRH</td>
</tr>
<tr>
<td>Future SRH</td>
</tr>
<tr>
<td>AIC</td>
</tr>
<tr>
<td>BIC</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Notes: AIC = Akaike’s Information Criterion; BIC = Bayesian Information Criterion; SRH = self-rated health. Each equation adjusts for the health conditions, lifestyle factors, and status characteristics listed in Table 1.

*aOdds ratio.
|bConfidence interval.
**p < .01. ***p < .001.
current health as excellent but project their future health as worst manifest mortality risk comparable with respondents in the fair SRH category with an average future SRH. To be clear, we tested but did not find an interaction between these two measures on mortality. Rather, the Figure 1 highlights the independent contribution of each and the considerable variability due to future SRH within each level of conventional SRH.

Supplementary Analyses

To further examine how these two measures—conventional SRH and future SRH—are related, we also estimated a series of logistic regression models in which variables were added in blocks. Sequentially, we introduced demographic variables, health variables, lifestyle factors, conventional SRH, and future SRH. Next, we performed a Sobel–Goodman mediation test and discovered that the proportion of the total effect of conventional SRH on mortality that is mediated by future SRH is 35.48 (Sobel, 1986). In short, the mediation test clarifies that future SRH substantially adds to the prediction of mortality, above and beyond what one is able to do with conventional SRH.

We also conducted supplementary analyses to determine if the findings presented herein were affected by other factors shown to be consequential in previous studies. Although the findings are mixed with regard to gender differences in the relationship between SRH and mortality (cf., Bath, 2003; Benyamini, Blumstein, Lusky, & Modan, 2003; Deeg & Kriegsman, 2003), we reestimated the models presented earlier by sex and also tested multiple interaction effects. We found no evidence that the relationships differed for men and women nor even that the key variables were correlated with sex (i.e., correlations between sex and SRH, present SRH, and future SRH were −.019, −.001, and .024, respectively). Instead, we found that men and women did not differ in their current or future health ratings and that interaction terms between female and both current and future SRH were nonsignificant. It is possible that the relationships between diachronic health ratings and mortality differ by other individual characteristics, but we examined several factors in detail (e.g., sex, age) and did not detect interaction effects.

Discussion

Scores of studies report that SRH is an independent risk factor for mortality, but few studies have considered temporal formulations of the widely used question. Of those that consider temporal forms of the question, all except one focused on change from past health to current health. The present investigation was the first study of which we are aware that systematically considered past, present, and future health ratings to predict mortality among older people. By doing so, we confirm the findings of Wang and Satariano (2007) that future health ratings are an independent predictor of mortality. Our findings also show that even within levels of the conventional measure of SRH, there is considerable variability in future health expectations. Regardless of how people rated their health on the conventional measure, those who have unfavorable expectations for their health in 10 years showed higher than average mortality. Those with more favorable health expectations were more likely to survive the 10-year period.

There is no evidence or inference from these analyses that the conventional measure of SRH should be replaced by asking the question about future health expectations. Despite many alternative measures of SRH and analytic specifications testing their effects, SRH remained a robust predictor of mortality (Mossey & Shapiro, 1982). Rather, the findings presented herein show that future health ratings add value to mortality predictions that use the conventional measure of SRH. By contrast, asking about past health change is of little value when SRH is also used as a predictor. Although there are reasonable grounds for looking backward in time to capture change in health ratings,
the current study shows that looking forward in time is much more useful. It is somewhat ironic, therefore, that many studies have included a question assessing how one’s health has changed in recent years when future health would have been much more useful. We, therefore, recommend that surveys that want another simple question to measure health ratings consider future ratings for that sentinel indicator.

We have shown that a future time version of SRH demonstrates good prognostic validity for mortality, but there may be several reasons why. First, future SRH may tap somatic symptoms and/or preclinical morbidity (Idler & Benyamini, 1997). People may be aware of and monitoring bodily sensations that they do not yet feel rise to the level of requiring a physician visit. Perhaps people with more positive health expectations were better at monitoring and predicting their own health and chances for survival—what one may conceptualize as being “health prescient.” Second, it is possible that positive health expectations actually extend life—and negative health expectations shorten it—presumably via psychological outlook or health behavior. To address these respective possibilities, we included relevant measures in our multivariate specifications but found no evidence that preclinical morbidity (i.e., somatic symptoms), psychological symptoms, or lifestyle factors such as smoking or heavy drinking rendered spurious the relationship between future SRH and mortality (see also Wang & Satariano, 2007, who controlled for depression in their analysis).

Another possibility, for which we have no relevant measure in the MIDUS, is that future SRH reflects or strengthens one’s will to live. Thinking that one will be in good health 10 years in the future may be salubrious by amplifying the desire to live (Karppinen, Laakkonen, Standberg, Tilvis, & Pitkala, 2012). Although we cannot definitively rule out any of these rival interpretations, there is clearly something about future time horizons that is useful in a scientific sense for understanding the aging process. We therefore join the call of others for greater integration of future time orientation in gerontological research (Carstensen, 2006; Marshall, 1975).

In the process of testing multiple versions of health ratings, we also found that the 11-point scale, even for rating current health, has good prognostic validity. Although the use of the five adjectives for SRH is widespread, the greater variance in Cantril ladder questions is useful in a prognostic sense and merits further study in health assessments.

There are several limitations of the current research that need to be recognized when interpreting the findings. First, the MIDUS is an ideal survey for studying how diachronic ratings of health may be related to mortality, but the sample is bounded by an upper age limit of 74 at baseline. Granted, the participants age to about 85 years during the follow-up period, but the findings presented herein may not apply to persons at advanced ages. Future research with older samples is needed because prior studies show that the relationship between objective and subjective measures of health is not as highly correlated in advanced ages (Ferraro, 1980; Lima-Costa, Cesar, Chor, & Proietti, 2012).

Second, it should be noted that there are differences in how some of the SRH questions were asked (i.e., conventional and the age comparison questions were asked in the telephone interview, but the diachronic questions, employing a Cantril ladder, were asked in the self-administered questionnaire). Although it seems very unlikely that the conclusions are attributable to differences in the mode of data collection, we welcome future studies using the same questions within one mode.

Third, the present study is limited to a consideration of all-cause mortality—as is most of the extant literature. Even if cause-specific mortality data were publicly available, it is unlikely that many causes of death would have occurred in numbers suitable for statistical analyses with the MIDUS sample. Nevertheless, the findings may apply to certain causes of death but not others. Given that we have isolated future health ratings as the most useful temporal frame to implement in future surveys, perhaps including the future health question would be attractive in some large existing surveys to study cause-specific mortality (e.g., National Health and Aging Trend Study).

Despite the limitations, the current study has shown that a future version of SRH has unique prognostic value in predicting mortality among older people. Wang and Satariano (2007) first demonstrated this with a 1-year future time frame, and the present analysis reaches a similar conclusion with a 10-year window. Both studies included conventional SRH, showing that a future evaluation of health conveys something related to mortality risk above and beyond the influence of the conventional SRH. More generally, we conclude that gerontology would profit from greater integration of future time orientation, including future health expectations, in our studies of health, well-being, and survival in later life.

Funding
This work was supported by grants from the National Institute on Aging (R01 AG03354) and the National Research Foundation of Korea (NRF-2011-330-B00137).

Acknowledgments
We gratefully acknowledge helpful comments from Ann Howell, Sooyoun Kim, William Satariano, and the anonymous reviewers on an earlier version of this manuscript. Paper presented at the 2013 World Congress of Gerontology and Geriatrics, International Association for Gerontology and Geriatrics, Seoul, South Korea. Data were made available by the Inter-university Consortium for Political and Social Research, Ann Arbor, MI. Neither the collector of the original data nor the Consortium bears any responsibility for the analyses or interpretations presented here.
References


