Why Self-Rated Health Predicts Mortality Less Well at Older Ages: Physical and Mental Health Correlates of Self-Rated Health

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ABSTRACT

Research on population subgroup differences in the predictive power of self-rated health (SRH) on mortality has largely neglected age-related patterns. This is a critical omission given the systematic age-related changes in underlying health and the need to correctly measure the health of the aging U.S. population with simple measures like SRH. We address two issues. 1) Using the NHIS-Linked Mortality Files 1989-2004, we examine how age modifies the SRH-mortality links. Age-related changes may occur if older respondents weigh the health dimensions differently. 2) To test this possibility, we use 1999-2010 National Health and Nutrition Examination Surveys and examine how age modifies links between biomarker profiles, health conditions, limitations, health behaviors, and mental health. Preliminary results indicate that the predictive power of SRH declines significantly from middle to old age; we also find that SRH is more closely determined by mental health for older respondents, while physical health becomes less critical.

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Self-rated health (SRH) is a widely used measure of population health status, trends, and inequalities. One reason for its pervasive use is the understanding that SRH has high construct validity, as typically assessed by its association with subsequent mortality (1-4). The SRH-mortality association typically persists beyond a host of important physical health indicators and socioeconomic factors, suggesting that the health rating carries unique information about individual's own health status which specific measures or assessment by health professionals does not include.

Interesting variations in the SRH-mortality link arise, however, with respect to subgroups of population: the association between SRH and mortality is stronger in some groups than others. Specifically, individuals with higher socioeconomic status, men, and white adults seem to report their health more precisely, as indicated by a stronger power of their ratings to predict mortality compared to those with lower SES, women, and minority adults (5-9). These variations are problematic because they point to different validity of the SRH across groups. If we use SRH to measure health disparities between groups, but there are systematic differences between groups in how they 'operationalize' their health status, i.e., how they construct the health judgment, then we may obtain biased results about the underlying health differences between the groups.

A critical gap in the literature pertains to potential differences in the SRH-mortality association by age. Surprisingly, only a few studies addressed the question of whether SRH predicts mortality equally well in the older respondents as among younger or middle-aged ones, and the findings are inconsistent. A recent study reported equal or stronger predictive power of SRH on mortality, although the age effects were not tested for statistical significance (10). Two older studies found the opposite pattern, with stronger predictive power of SRH among younger adults (11-12). Interestingly, both reported no statistically significant association between SRH and mortality in their older groups, defined as age 65-74 (12) and 78 or more (11). This contradicts other studies focusing on older adults or elderly found that their health ratings remained predictive of mortality (1, 12-14). The studies differed, however, in the target populations' socioeconomic and demographic composition, which may introduce additional reporting heterogeneity, as well as in the covariates the models adjusted for. Overall, a gap remains in our understanding of how age influences the SRH-mortality association. **The first part of our analysis is therefore to establish how age modifies the predictive power of SRH in a nationally-representative sample of American adults 50 years and older.**

If there is a modifying effect of age, we may want to examine age differences in the SRH evaluation process, more specifically age differences in how the various dimensions of health are incorporated into the SRH judgment. Younger adults may consider the absence of medical

conditions as a baseline, while older adults whose peers have often numerous diagnoses may not weigh this factor as likely. Instead, older adults may consider a range of social, psychological, and spiritual resources that moderate the impact of the conditions (15-16) as more important than younger ones. Additionally, studies reported that health behaviors, which have become increasingly understood as critical determinants of health status, are weighed more heavily by younger respondents than their older peers (15, 17). Several reasons for such age patterns have been suggested. One reason may be that the with increasing age respondents gradually decrease the 'weight' they put on their physical health and increase the 'weight' they put on their mental health as they evaluate their overall health status. While mental health and well-being are linked to future health changes and mortality (18-20), the association is likely weaker than for physical health that captures conditions directly causing death like cardiovascular disease, cancer, or overall frailty as captured by physical limitations.

We are aware of only two previous studies that directly assessed the correlates of self-rated health by age. A study using the American Changing Lives respondents found patterns corresponding to the conceptualization discussed above: the oldest respondents had the weakest association of chronic conditions and functional limitations with their health judgment, and strongest association of mental health (21). Similarly, a recent study based on Australian population found a weaker association of medical conditions, and even non-significant link of select IADL measures with SRH, while the association of depression increased with age (22). Neither of these studies included objectively-measured physical health. An objective measure would isolate the actual level of health, or at least of the specific dimension of health, from reporting tendencies that may also impact the general health rating.

The second part of our analysis is therefore to determine how specific components of mental and physical health vary their relationship with SRH across age, using a nationally-representative sample of U.S. adults. We hypothesize that older respondents will exhibit a stronger association of SRH with the mental health dimension and a weaker association of SRH with physical health. The key contribution is a systematic exploration of a broader set of physical health status components including health conditions, physical limitations, but also biomarkers. The biomarkers are a particularly important addition in that they are objectively measures rather than self-reported, and they reflect health issues that respondents may be unaware of. This study moves forward the literature on group differences in SRH by aiming to provide an explanation for the age differences that has been repeatedly proposed but rarely directly tested.

METHOD

Data

First part: SRH-mortality across age. The analyses use data from the National Health Interview Surveys Linked Mortality Files (NHIS-LMF). The NHIS is an annual cross-sectional survey that collects a wide range of information about health, demographics and socio-economic attainment among non-institutionalized population in the United States. The NHIS-LMF links adult respondents in the 1986-2004 NHIS to death records in the National Death Index through December 31, 2006. We include matched NHIS surveys from 1989 to 2004 and focus on respondents age 50 to 84 years old at the time of the interview (N=375,338).

Second part: SRH-specific health measures across age. These analyses are based on data from the National Health and Nutrition Examination Surveys (NHANES), 1999-2010 (23). The continuous survey collects an extensive range of socio-demographic, lifestyle, and health-related information from a nationally representative sample of the non-institutionalized civilian U.S. population, using a complex probability sampling design with an oversample of African Americans and Mexican Americans. Detailed information about response rates by sex and age are available in the NHANES documentation (24). We define the analytic sample as respondents 50-85. This age range captures the middle to old age; the NHANES top-coded individuals at 85 (N=14,762 although it is less in some models).

Measures

First part: SRH-mortality across age (NHIS-LMF). The dependent variable is all-cause mortality. Self-rated health and age are key predictors. SRH is used with the original 5 response categories: excellent (reference), very good, good, fair, and poor. Age is grouped in 5-year increments and centered around 70 in order to obtain more meaningfully interpretable estimates of the SRH by age interaction terms. Other covariates include sex, race/ethnicity, marital status, educational attainment, and poverty status.

Second part: SRH-specific health measures across age (NHANES). Self-rated health was assessed on a 5-point scale from excellent, very good, good, fair, and poor. We use for measures of specific health dimensions: biomarker profile, medical conditions, physical limitations, and depressive symptoms. The biomarker profile is the summation index of elevated values of the following: C-reactive protein, blood pressure, total cholesterol, pulse, (low) HDL cholesterol, and glycosylated hemoglobin. We used standard thresholds (25-26) to define elevated values; the detailed description will be provided in the manuscript. The medical conditions are a summation index of the following doctor-diagnosed conditions: arthritis, congestive heart failure, coronary heart disease, angina, heart attack, stroke, emphysema, chronic bronchitis, liver condition, or cancer. The functional or activity limitation index captures the level of difficulty in 18 activities from walking a quarter mile to attending social events and leisure activities. The complete list of the items is available elsewhere (27). Obesity is measured as BMI of 30 or above. Obesity can be understood equally as a health behavior, a risk

factor for future health problems, or a health condition in its own right. Regardless of the interpretation, obesity captures another physical-health dimension that can be expected to become less salient to older respondents. Finally, the depressive score is an index comprising nine items from a screening questionnaire that asked about the frequency of depressive symptoms over the past 2 weeks (28).

We also adjust models for age, gender (some analyses will be stratified by gender), race/ethnicity, marital status dichotomizing married and not-married groups, and socioeconomic status as captured by educational attainment.

Analysis

Cox proportional hazard models of all-cause mortality are estimated for the first set of analyses. For the second part, we use ordered logistic models of self-rated health on each of the five specific health measures. We include an interaction of each measure with age to test whether its effect on the SRH judgment varied across age.

PRELIMINARY RESULTS

Preliminary findings are summarized in Tables 1 and 2 below. We find that there is a strong significant moderating effect of age on the SRH-mortality association: older respondents' health ratings are less predictive of mortality, compared to younger respondents. Between ages 60 and 80, the effect of SRH on mortality attenuates by about half.

Could this attenuation be explained by a shift across age in how physical versus mental components of health are incorporated into the health judgment? Results in Table 2 suggest this may be the case. Each of the five specific health measures changes significantly across age in how well they predict self-rated health. Specifically, the interaction of depression with age is positive; meaning that depression becomes more strongly predictive of SRH among older respondents. For the remaining four health measures, including the objectively-measured biomarkers, the effect is in the opposite direction: the effects of physical limitations, medical conditions, and obesity become significantly less strong among older respondents.

IMPLICATIONS

The findings suggest that as people age, their health rating changes in a systematic way. The changes make their health judgment a poorer predictor of mortality, perhaps suggesting that the health rating is less closely tied to critical aspects of physical health. In particular, older adults may put a greater weight on their mental health when forming their SRH judgment; correspondingly lesser weight is given to physical health dimensions. This shift in emphasis may explain at least some of the age variation in the construct validity of SRH.

Table 1. Hazard Ratios for All-Cause Mortality, NHIS-LMF 1989-2006

	Model 1	Model 2
Very good	1.21***	1.20***
Good	1.71***	1.66***
Fair	2.79***	2.67***
Poor	5.07***	4.80***
Very good * age	0.97***	0.97***
Good * age	0.93***	0.93***
Fair * age	0.87***	0.87***
Poor * age	0.83***	0.83***
Age	1.65***	1.64***
Race (white)		
Black	0.99	0.97**
Hispanic	0.71***	0.69***
Other	0.68***	0.68***
Male	1.68***	1.70***
Not married	1.30***	1.29***
Education (College degree)		
Less than HS		1.25***
High School		1.20***
Some college		1.18***
Family income (above poverty)		
Below poverty threshold		1.06***
N/A		0.92***

* p<.05, ** p<.01, *** p<.001
N=289,432.

Table 2. Ordered logistic regression of SRH.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Depressive score	1.85***					1.12***
Depressive * age	0.08*					0.13*
Physical limitations		2.22***				1.59***
Physical lim. * age		-0.32***				-0.18*
Elevated biomarkers			1.34***			0.76***
Elevated bio. * age			-0.16**			-0.02
Medical conditions				5.56***		3.35***
Medical cond. * age				-0.36***		0.13
Obesity (BMI>30)					0.49***	0.23**
Obesity * age					-0.06**	-0.04
Age	0.08***	0.07**	0.08***	0.01	0.09***	0.02
Female	-0.22***	-0.21***	-0.07*	-0.05	-0.10**	-0.20**
Race (white)						
Black	0.84***	0.56***	0.58***	0.78***	0.59***	0.89***
Hispanic	0.85***	0.69***	0.63***	0.95***	0.67***	1.09***
Other	1.02***	0.56***	0.69***	0.82***	0.78***	0.84***
Education (HS)						
Less than HS	0.43***	0.36***	0.54***	0.51***	0.59***	0.30**
Some college	-0.35***	-0.40***	-0.43***	-0.44***	-0.42***	-0.37***
BA or more	-0.92***	-0.80***	-0.92***	-0.98***	-0.96***	-0.78***
N/A	0.34	-0.63	0.12	0.47	0.27	0.44
Not married	-0.06	-0.06	-0.16**	-0.15***	-0.20***	-0.05
N	7,212	10,511	14,658	14,761	14,762	4,951

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

N=Models are adjusted for the complex sampling design of the NHANES 1999-2010.

SRH=self-rated health; HS=high school; BA= Bachelor's degree.

Age is centered on 71 and added in 5-year increments.

The sample size varies across models because the age range is 50-85 for models with depression, biomarkers, and medical conditions and 60-85 for physical limitations; models with depression use only information from waves 4-6.

REFERENCES

1. Mossey JM, Shapiro E. Self-Rated Health: A Predictor of Mortality among the Elderly. *American Journal of Public Health* 1982;72(8):800-8.
2. Idler EL, Benyamini Y. Self-Rated Health and Mortality: a Review of Twenty-Seven Community Studies. *Journal of Health and Social Behavior* 1997;38(1):21-37.
3. Idler EL, Russell LB, Davis D. Survival, Functional Limitations, and Self-Rated Health in the NHANES I Epidemiologic Follow-up Study, 1992. First National Health and Nutrition Examination Survey. *American Journal of Epidemiology* 2000;152(9):874-83.
4. Finch BK, Hummer RA, Reindl M, et al. Validity of Self-Rated Health among Latino(a)s. *American Journal of Epidemiology* 2002;155(8):755-9.
5. Dowd JB, Zajacova A. Does the predictive power of self-rated health for subsequent mortality risk vary by socioeconomic status in the US? *International Journal of Epidemiology* 2007;36(6):1214-21.
6. Zajacova A, Dowd JB. Reliability of Self-Rated Health in US Adults. *American Journal of Epidemiology* 2011;174(8): 977-83.
7. Bago d'Uva T, Doorslaer EV, Lindeboom M, et al. Does Reporting Heterogeneity Bias the Measurement of Health Disparities? *Health Economics* 2008;17(3):351-75.
8. van Doorslaer E, Gerdtham U-G. Does Inequality in Self-Assessed Health Predict Inequality in Survival by Income? Evidence from Swedish Data. *Social Science and Medicine* 2003;57(8):1621-29.
9. Lee SJ, Moody-Ayers SY, Landefeld CS, et al. The Relationship Between Self-Rated Health and Mortality in Older Black and White Americans. *Journal of the American Geriatrics Society* 2007;55(10):1624-9.
10. Khang Y-H, Kim H. Self-rated health and mortality: gender- and age-specific contributions of explanatory factors in South Korea. *International Journal of Public Health* 2010;55(4):279-89.
11. Helweg-Larsen M, Kjøller M, Thoning H. Do age and social relations moderate the relationship between self-rated health and mortality among adult Danes? *Social Science & Medicine* 2003;57(7):1237-47.
12. Idler EL, Kasl SV, Lemke JH. Self-evaluated health and mortality among the elderly in New Haven, Connecticut, and Iowa and Washington counties, Iowa, 1982–1986. *American Journal of Epidemiology* 1990;131(1):91-103.
13. Kaplan GA, Camacho T. Perceived health and mortality: a nine-year follow-up of the human population laboratory cohort. *American Journal of Epidemiology* 1983;117(3):292-304.
14. Wolinsky FD, Tierney WM. Self-Rated Health and Adverse Health Outcomes: An Exploration and Refinement of the Trajectory Hypothesis. *Journal of Gerontology: Social Sciences* 1998;53(6):S336-40.

15. Jylhä M. What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine* 2009;69(3):307-16.
16. Idler EL, Hudson SV, Leventhal H. The Meanings of Self-Ratings of Health - A Qualitative and Quantitative Approach. *Research on Aging* 1999;21(3):458-76.
17. Krause NM, Jay GM. What Do Global Self-Rated Health Items Measure? *Medical Care* 1994;32(9):930-42.
18. Zhang J-P, Kahana B, Kahana E, et al. Joint Modeling of Longitudinal Changes in Depressive Symptoms and Mortality in a Sample of Community-Dwelling Elderly People. *Psychosomatic Medicine* 2009;71(7):704-14.
19. Marmot MG, Fuhrer R, Ettner SL, et al. Contribution of Psychosocial Factors to Socioeconomic Differences in Health. *The Milbank Quarterly* 1998;76(3):403-48.
20. Xu J, Roberts RE. The power of positive emotions: It's a matter of life or death—Subjective well-being and longevity over 28 years in a general population. *Health Psychology* 2010;29(1):9-19.
21. Schnittker J. When Mental Health Becomes Health: Age and the Shifting Meaning of Self-Evaluations of General Health. *The Milbank Quarterly* 2005;83(3):397-423.
22. French DJ, Sargent-Cox K, Luszcz MA. Correlates of Subjective Health Across the Aging Lifespan: Understanding Self-Rated Health in the Oldest Old. *J Aging Health* 2012;24(8):1449-69.
23. CDC. National Health and Nutrition Examination Survey Data 2007-2008. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, 2010.
24. NCHS. Unweighted Response Rates for NHANES 2005-2006 and 2007-2008 by Age and Gender. Hyattville, MD: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2010. (http://www.cdc.gov/nchs/nhanes/response_rates_cps.htm). (Accessed April 7, 2011).
25. Crimmins EM, Alley D, Reynolds SL, et al. Changes in biological markers of health: Older Americans in the 1990s. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 2005;60(11):1409.
26. Seeman T, Merkin SS, Crimmins E, et al. Education, Income and Ethnic Differences in Cumulative Biological Risk Profiles in a National Sample of US Adults: NHANES III (1988–1994). *Social Science & Medicine* 2008;66(1):72-87.
27. Centers for Disease Control. 2009 - 2010 Data Documentation, Codebook, and Frequencies: Physical Functioning.; 2011. (http://www.cdc.gov/nchs/nhanes/nhanes2009-2010/PFQ_F.htm). (Accessed September 17, 2013 2013).
28. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a Brief Depression Severity Measure. *Journal of General Internal Medicine* 2001;16(9):606-13.