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Self-rated health and interviewer-rated health: differentials in predictive power for mortality among subgroups of Chinese elders

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Abstract: Interviewer-rated health (IRH) and self-rated health (SRH) have strong and independent predictive power for mortality, but their relative predictive power has not been examined among subpopulations. Because individuals from different subpopulations havedifferent characteristics have distinct views, understandings, and judgments about health that influence their criteria and referents for SRH, we examine whether IRH is a valid predictor of mortality within subpopulations, which may provide added value for understanding its association with mortality. Using data from the 2005 and 2008 waves of the Chinese Longitudinal Healthy Longevity Survey, this study modeled associations of SRH and IRH with mortality in various subgroups among 12,583 older adults in China. We found that IRH is a robust predictor of mortality, independent of SRH, across major demographic and socioeconomic subpopulations after adjusting for a wide range of covariates. The predictive power of IRH for mortality was generally more robust than that of SRH in most subpopulations. Our findings suggest that IRH could be a good complement to SRH among subgroups of the Chinese older population.

Keywords: interviewer-rated health, self-rated health, mortality, older adults, China

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1. Introduction

Self-rated health (SRH) is usually measured by a single question that asks respondents to rate their global health status as excellent, good, fair, or poor (Krause and Jay, 1994; McFadden *et al*., 2009). In comparison with other health measures, the major advantage of SRH is its inclusiveness; it indicates a comprehensive self-image of health status beyond a narrow biomedical perspective (Feng, Zhu, Zhen *et al*., 2016). Previous studies have suggested that the process of self-assessing overall health involves multiple domains, including physical functioning, psychological well-being, health history, and health-related behaviors (e.g., Benyamini, Idler, and Leventhal, 2000; Idler and Benya-

mini, 1997; Idler, Hudson, and Leventhal, 1999). SRH is widely used in health and mortality studies due to its simplicity in collecting data and its effectiveness in evaluating overall health status and predicting health outcomes, health care utilization, and subsequent mortality (e.g., Anson, Shteingrad, and Paran, 2011; Chen and Wu, 2008; Ferraro, Farmer, and Wybraniec, 1997; Idler and Benyamini, 1997). However, issues remain despite SRH's widespread use (Smith and Goldman, 2011). Because the complex process of self-rating is inherently subjective, sometimes the self-rating may be biased (Huisman and Deeg, 2010; Jylhä, 2009). Accordingly, the subjective nature of SRH may affect the accuracy of the overall health assessment and the ability of that assessment to predict mortality.

In contrast, another line of literature has long highlighted the advantages of external health ratings. Most studies in this field focused on medical ratings by a professional (e.g., Glare, Virik, Jones *et al*., 2003; Rocker, Cook, Sjokvist *et al*., 2004). Beyond the professional assessment, an early study by van Doorn (1998) suggested that a health report from a spouse could also predict mortality of his/her partner, independent of SRH and many other objective health measures. This finding on spouse's health report gained confirmation from some subsequent studies (Daugherty, 2009; Peek, Stimpson, Townsend *et al*., 2006). Meanwhile, a new line of research started to emerge with a focus on health evaluation by survey interviewers (Chen and Wu, 2008; Feng, Zhu, Zhen *et al*., 2016; Smith and Goldman, 2011; Todd and Goldman, 2013). According to these studies, the use of interviewer-rated health (IRH) may have some advantages over SRH in capturing health situations and may complement the routine use of SRH. For example, unlike SRH, IRH avoids person-specific biases from the respondent, applies a sound comparative framework for judgment based on multiple respondents, incorporates good on-site observations about living conditions and environment, and often takes advantage of the evaluation of SRH from the respondent (Brissette, Leventhal, and Leventhal, 2003; Feng, Zhu, Zhen *et al*., 2016).

Among the pioneering studies investigating SRH and IRH as tools for mortality prediction, there have been few efforts to examine their relative predictive power across different subpopulations. For example, in a recent study, Feng *et al*. (2016) examined the potential of IRH as a complementary measure to SRH by comparing their components and predictive powers for mortality in the Chinese elderly population. Analyzing data from a nationwide survey, they found that SRH and IRH captured similar health information, but SRH placed more weight on health perceptions and experiences while IRH emphasized more objective health conditions such as IADL (instrumental activities of daily living) and ADL (activities of daily living) disabilities. Importantly, this study showed that IRH was a strong predictor of mortality, independent of SRH, and thus IRH could be used as a good measure to complement SRH among Chinese elders. However, this study did not examine the predictive powers of SRH and IRH in mortality among different subpopulations of Chinese elders, so it is unknown whether these established findings would hold across specific population groups, such as different demographic and socioeconomic groups.

SRH may predict mortality differently across subpopulations. Due to the subjective nature of SRH, individual characteristics including age, gender, and education can affect the understanding and judgment of one's health status and the referents and criteria used to assess overall health (Dowad and Zajacova, 2007; 2010; McFadden, Luben, Bingham *et al*., 2009). Individuals with different backgrounds may therefore weigh and value the SRH domains differently and may also use different referents when evaluating their global health. For example, SRH and its predictive power for mortality may vary by socioeconomic status (SES). Research has shown that individuals with lower levels of educational attainment likely place more weight on health behaviors (Krause and Jay, 1994); SRH could be a more accurate predictor of mortality for people with higher socioeconomic status because they may have a better understanding of their personal health due to the better health resources compared to those with lower educational attainment and income (Franks, Gold, and Fiscella, 2003; Quesnel-Vallee, 2007). In addition, rural/urban residence, which is often considered as an indicator of SES (Zhu and Xie, 2007), may also matter, especially for countries such as China

where rural/urban socioeconomic inequality is substantial. Some studies reported substantial differences between rural and urban residents in China in terms of cognitive procedure behind self-reported disability and the measure's power to predict mortality (Purser, Feng, Zeng *et al*., 2012; Feng, Hoenig, Gu *et al*., 2010).

Gender differentials have long been found as one major source of health and mortality disparity in old age (e.g., Arber and Cooper, 1999; Case and Paxson, 2005; Kaneda, Zimmer, Fang *et al*., 2009; Verbrugge, 1985). According to the review by Deeg and Bath (2003), gender differences in elderly health have multiple manifestations: women and men suffer different health problems in later life; given a particular health problem, women tend to develop functional limitations while men are more likely to die; elderly women and men do not perceive health in the same manner due to the different social conditions such as marital status and SES; and women and men may differ in their sensitivity to physical symptoms of illness, and thus they may rate their health differently even if they have the same illnesses. Health behaviors between women and men are also distinctive. Women are more willing and have a greater motivation to engage with health-related information (Stefan, 2013). Women also tend to have a different mortality trajectory and different trend in disability over time than men do (Kaneda, Zimmer, Fang *et al*., 2009; Zimmer, Hidajat, and Saito, 2015). In self-reporting health, studies show that men emphasize health-oriented domains while women tend to emphasize family and social relationship domains, and men often choose healthy age peers as a referent while the age peers of women are more likely to be in poor health (Benyamini, 2008; Deeg and Kriegsman, 2003). Thus, it is important to examine gender differences in SRH and how they affect the association between SRH and mortality.

The cognitive procedure of self-rating health and the predictive power of SRH for mortality may also vary by age and marital status. Previous studies have shown age differences in SRH because physical health domains such as functional limitation and chronic disease are more important for SRH assessment of older people, whereas young people tend to highlight health behaviors (Krause and Jay, 1994; Shadbolt, 1997). Unlike objective dimensions of health such as physical and cognitive functioning, self-reported health may not decline sharply with age (Zeng, Feng, Gu *et al*., 2016). Frail elderly individuals may report relatively good self-rated health status because they have adapted to chronic conditions (Groot, 2000). As a result, the predictive power of SRH for mortality may decline with age (Zajacova and Woo, 2016). The self-rating of health also varies by marital status. Studies have repeatedly shown that married people report better health compared to the unmarried (e.g., Waite and Gallagher, 2000; Zhu and Gu, 2010; Verbrugge, 1979) and the predictive power of SRH for mortality is greater among the married than among the unmarried (Zheng and Thomas, 2013).

The rating procedure and predictive power of IRH may also differ across these subgroups, though the current literature is relatively limited in this regard. This is because interviewers may incorporate respondents' reported health information into evaluation when such an assessment is performed at the end of interview (Feng, Zhu, Zhen *et al*., 2016), and because interviewers' assessments are also susceptible to subjectivity (Brissette, Leventhal, and Leventhal, 2003; Feng, Zhu, Zhen *et al*., 2016). Some research has indeed shown that factors such as respondents' socioeconomic status affect not only SRH, but also affect physicians' and interviewers' reporting of health outcomes (Smith and Goldman, 2011). It is therefore valuable to examine the predictive power of IRH for mortality by gender, age, and other socioeconomic factors, especially given the recent interest in this important measure.

To better understand global assessments of health and their ability to predict mortality, it is necessary to examine IRH relative to SRH in different subgroups. This study examines the predictive power of IRH and SRH for three-year mortality in different subpopulations among Chinese elders. China is an aging giant, holding the largest elderly population in the world now and for a foreseeable future. Based on UNPD statistics (2015), in the year 2010 8.2% of China's 1.34 billion population

was 65 years or older, with a life expectancy of 75.43 (2010–2015); projections to the year 2050 estimate that the elderly proportion will increase to 27.6% with a life expectancy of 83.45 (2050–2055). Chronic diseases are becoming more prevalent among the Chinese elderly population, though the disability prevalence declined in recent years (Gu, Dupre, Warner *et al*., 2009; Martin, Feng, Schoeni *et al*., 2014). As such, understanding the predictive power of global health measurement such as SRH and IRH for mortality is particularly important in China. The goal of this paper is to test whether IRH is an effective complementary measure to SRH to predict mortality across different subgroups in this important population, specifically gender, age, marital status, rural/urban status, and socioeconomic status. To ensure statistical power for subgroup analyses, we analyzed a national survey data with a large sample size.

2. Data and Measures

2.1 Data

The data used for this analysis are from two waves of the Chinese Longitudinal Healthy Longevity Survey (CLHLS) in 2005 (the fourth wave) and 2008 (the fifth wave). The CLHLS was conducted in 1998 as a baseline for a longitudinal project on health and longevity among the oldest-old population aged 80+ in China. A multistage, stratified cluster survey design was conducted in 631 randomly selected counties and cities in 22 out of 31 provinces. In the year 2002 (the third wave), young-old respondents aged 65–79 were added to the survey sample. The CLHLS attempted to interview all centenarians in the selected counties/cities. In order to ensure comparable numbers of octogenarians and nonagenarians at each age from 80 to 99, for each centenarian interviewed, one nearby octogenarian and one nearby nonagenarian with pre-designated age and sex were randomly chosen and interviewed based on a random code assigned to the centenarian. Informed consent was obtained from each of the respondents. All information was obtained through in-home interviews with professionally trained and well-educated interviewers. A couple of studies have evaluated the CLHLS data quality as high, including the accuracy of age-reporting and the validity, reliability, and consistency of various measures (Gu, 2008; Zeng and Gu, 2008).

In the longitudinal dataset, the 2005 wave interviewed 15,638 individuals aged 65+, with 5,047 young-old respondents aged 65–79 and 10,591 oldest-old respondents aged 80+. Among the respondents aged 80+, there were 3,870 octogenarians, 3,927 nonagenarians, and 2,794 centenarians. Out of these 15,638 respondents, 5,111 older adults died before the 2008 survey, accounting for about 33% of the 2005 sample. About 19.5% of the 2005 sample, or 3,055 respondents, were lost to follow-up and 7,472 respondents (47.8%) were re-interviewed in 2008. Those lost to follow-up were excluded from analysis because we did not have the information on their survival status and health conditions in 2008. Therefore, we analyze data from 12,583 respondents who were interviewed in 2005 and had known survival status in 2008.

2.2 Measures

2.2.1 Mortality

The dependent variable is mortality due to all causes, which was estimated by the length of exposure and survival status during the survey interval from 2005 to 2008. The mortality exposure was measured in number of days from the interview date in 2005 to either the date of interview in 2008 or the date of death. For those who died before the 2008 interview, the date of death was collected from officially issued death certificates whenever available; next-of-kin and local Residential Committees were consulted in the cases when death certificates were not available (Zhu and Gu, 2010).

2.2.2 Self-Rated Health (SRH)

SRH was measured by the question “How do you rate your overall health?” with five response cate-

gories: very good, good, fair, poor, and very poor. Following previous research (e.g. Feng, Zhu, Zhen *et al*., 2016), we combined both very poor and poor into one category, "poor/very poor", due to the very low prevalence of the very poor category. In addition, there was a response category "unable to answer" that accounted for about 8% of the sample. We performed a number of analyses to evaluate how this group affected our study under different scenarios, such as excluding these cases, including these cases with the assumption that they were in very poor health, or imputing these cases. Since all of the methods showed similar results, we chose to impute these cases in the analysis. We assumed that those who were not able to answer the question had the same answer as those who answered the question if the attributes of the former group were the same as the latter group in terms of demographics, socioeconomic status, family/social connections, health behaviors, and health.

2.2.3 Interviewer-Rated Health (IRH)

IRH was measured by the question "How do you rate the respondent's overall health?" with four response categories: "healthy," "fairly healthy," "slightly ill," or "moderately or severely ill." This question was answered by the interviewer after the interview was completed.

2.2.4 Stratifying Variables

The sample was stratified into different subgroups for analysis based on demographics and socioeconomic status (SES). Demographic variables included chronological age group (65–79 vs. 80+), sex (men vs. women), marital status (married vs. single), and residence (urban vs. rural). SES was measured by years of schooling (1+ years of schooling vs. none) and family economic condition compared to others (good vs. not good). These variables are the basic factors significantly associated with health and mortality at late ages (Feng, Zhu, Zhen, *et al*., 2016; McFadden, Luben, Bingham *et al*., 2009; Zimmer, Hidajat, and Saito, 2015).

2.2.5 Covariates

Covariates included health conditions, health practices, health care coverage, social connection, self-rated life satisfaction, and geographic area. Previous studies have shown that these variables are either components of SRH or factors associated with the process of self-rating health (e.g., Feng, Zhu, Zhen *et al*., 2016; Anson, Shteingrad, and Paran, 2011). By controlling for these variables in models, we clarified how SRH and IRH could contribute differently to mortality prediction beyond these established predictors. Health conditions included instrumental activities of daily living (IADL) limitations, activities of daily living (ADL) limitations, cognitive impairment, and chronic conditions. IADL was measured by whether a respondent needed assistance with the following eight activities: visiting neighbors/friends, shopping, cooking, washing clothes, walking 1 km, lifting 5 kg, crouching and standing up three times, and taking public transportation. For each of the eight items, no need for assistance was coded as 0, and 1 otherwise. We summed these items to create an IADL index ranging from 0 (no limitations) to 8 (limitations in all activities). ADL was measured by six items: eating, dressing, indoor transferring, using the toilet, bathing, and continence. Scoring was similar to that for IADL, producing a summed index ranging from 0 (no disability) to 6 (most severe disability). Cognitive impairment was measured by the Chinese version of the mini-mental state examination (MMSE), which tested respondents' orientation, registration, copy and design, calculation, recall, naming, and language. A score of 23 or less out of 30 was considered as cognitively impaired. Alternative criteria for cognitive impairment were tested and the results were similar (not shown). Chronic conditions were measured by the self-reported number of chronic diseases in a given list, ranging from 0 to 11.

Health practices included whether the respondent smoked (yes vs. no), consumed alcohol (yes vs. no), and regularly exercised (yes vs. no) at the time of survey. Healthcare coverage was measured by whether the respondent was covered by public medical service (yes vs. no). Family/social connection was measured by two proxies: whether the participant has family members, neighbors or friends to talk with when in need (yes vs. no) and whether the participant has family members, neighbors or friends to ask for help when in need (yes vs. no). If a respondent gave a positive answer to either of

these two questions, we coded his/her family/social relation as good (vs. poor). Self-rated life satisfaction was a dummy variable, with 'satisfied' coded as 1 and 'unsatisfied' coded as 0. Due to great regional differences in economic development in China, we additionally included the geographic area of the respondent as a control variable with five categories: northern, northeastern, eastern/southeastern, central, and northwestern.

2.3 Analytic Strategy

We chose gender as the leading stratifying variable to examine relative hazard risks of mortality based on SRH and IRH. For each gender, we further separated the subpopulation by age, marital status, urban/rural residence, years of schooling, and family economic condition. We used this strategy because gender differentials are one of the major sources of health and mortality disparity in old age, as discussed in the Introduction. Another reason that we stratified our analyses by these subgroups is that there were statistically significant differences in the associations between SRH/IRH and mortality for each set of the subgroups (results not shown). To compare the predictive powers of SRH and IRH for mortality, we calculated relative hazards of mortality risk based on three parametric Weibull hazard models for each of the subgroups: SRH only, IRH only, and both SRH and IRH. This model design tests whether SRH and IRH have independent associations with mortality and shows how those associations change in the presence of the other. All stratifying variables and covariates are from the baseline 2005 wave of the CLHLS, while mortality status and exposure incorporate data from the 2008 wave. Since the proportion of missing data was only about 2%, it was not considered to be a serious source of bias.

3. Results

Table 1 describes the sample characteristics by gender. The majority of respondents were in the 80+ age group, more than half lived in rural areas, and most of the elders had poor family economic conditions. There was a significant gender disparity for education and martial status. About 64.2% of men received 1+ years of schooling, while the rate was only 7.8% for women. In terms of marital status, women were more likely to be unmarried (widowed) in old age than men (81.4% vs. 49.2%). Among covariates, it is noteworthy that women had worse health conditions than men with higher scores of IADL, ADL, MMSE, and number of chronic diseases; men were more likely to smoke and drink alcohol than women.

The sex-specific distributions of SRH and IRH in the baseline 2005 wave and deaths from 2005 to 2008 are shown in Table 2. Among older men, 11.7% of the sample reported their health as very good, 37.8% as good, 34.6% as fair, and 15.9% as poor/very poor. In comparison, older women tended to report poorer health status with 8.1% reporting health as very good, 36.1% as good, 36.1% as fair, and 19.7% as poor/very poor. In terms of IRH, the proportions of reporting healthy, fairly healthy, slightly ill, and moderately/severely ill were 32.1%, 54.0%, 12.2%, and 1.7%, respectively for men; the corresponding rates among women were 22.3%, 57.4%, 17.6%, and 2.7%, respectively. Overall, IRH tended to be better than SRH for both women and men, and IRH was rated lower for women than for men. Table 2 also shows that the death rate was generally higher for women than for men across the SRH and IRH categories, except within the healthy and fairly healthy categories of IRH.

Figure 1 shows Kaplan-Meier survival curves for SRH and IRH for men and women. It reveals that respondents in very good or good categories of SRH had a better survival trajectory than those in fair and poor/very poor categories of SRH. The same pattern applied to survival curves of IRH. In other words, respondents with better ratings of SRH or IRH had a lower mortality risk.

Table 3 presents three-year mortality risks for men and women predicted by three parametric Weibull hazard regression models: SRH only, IRH only, and both. SRH was not a significant predictor of mortality in any models. In contrast, the differentiation of mortality risks by IRH was robust with a good gradient for both men and women, regardless of inclusion of SRH and controlling for

Table 1. Sample Characteristics, CLHLS 2005, n=12,583

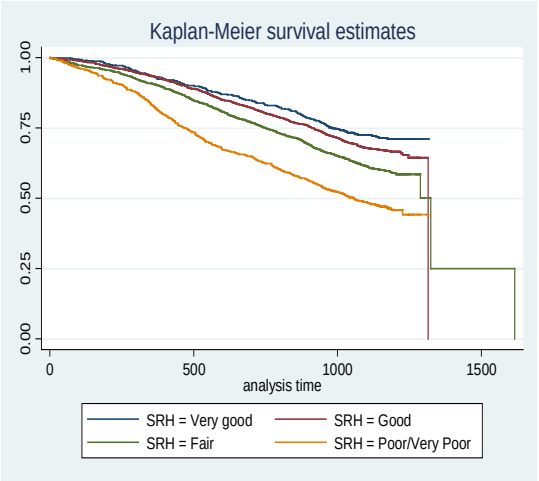
	Men	Women
Stratifying Variables		
Age (%)		
65-79	38.4	27.3
80+	61.6	72.7
Residency (%)		
Rural	57.9	59.2
Urban	42.1	40.8
Years of Schooling (%)		
0	35.8	82.2
1+	64.2	7.8
Family Economic Condition (%)		
Poor	82.6	86.0
Good	7.4	4.0
Marital status (%)		
No	49.2	81.4
Yes	50.8	18.6
Control Variables		
Average IADL disability score (range 0–8)	2.6	4.2
Average ADL disability score (range 0–6)	0.46	0.88
Average No. of chronic diseases (range 0–11)	0.76	0.69
Cognitively impaired (%)	27	49
Covered by public medical service (%)		
Yes	89.4	86.9
No	10.6	13.1
Family/social connection (%)		
Poor	9.8	10.9
Good	90.2	89.1
Current smoker (%)		
No	63.8	92.9
Yes	36.2	7.1
Current alcohol consumer (%)		
No	67.4	88.7
Yes	32.6	11.3
Currently doing regular exercise (%)		
No	63.1	76.3
Yes	36.9	23.7
Good life satisfaction (%)		
No	41.6	41.1
Yes	58.4	58.9
Geographic area (%)		
Northern	5.7	5.5
Northeastern	9.8	7.6
Eastern/Southeastern	37.1	36.4
Central	32.0	34.8
Northwestern	15.4	15.7

Note: estimates are unweighted.

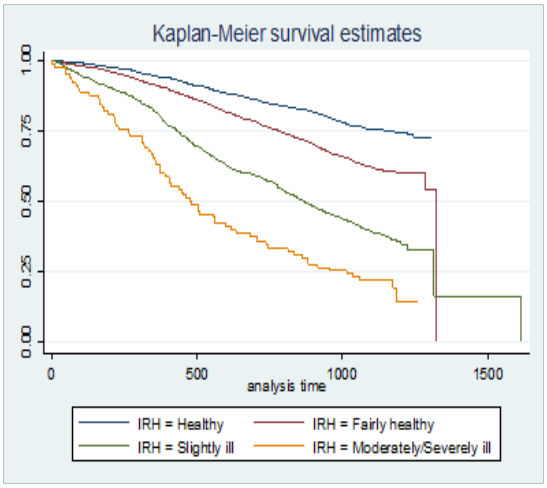
Table 2. Sex-specific distributions of self-rated health, interviewer-rated health, and deaths, CLHLS 2005–2008

	Men			Women		
	Sample in 2005	Sample %	# (%) of deaths from 2005 to 2008	Sample in 2005	Sample %	# (%) of deaths from 2005 to 2008
Self-rated health (SRH) among the respondents						
Very good	629	11.7	176 (28.0)	586	8.1	180 (30.7)
Good	2,034	37.8	662 (32.6)	2,595	36.1	955 (36.8)
Fair	1,863	34.6	740 (39.7)	2,600	36.1	1,184 (45.5)
Poor/Very poor	857	15.9	452 (52.7)	1,419	19.7	762 (53.7)
Total	5,383	100.0	2,030(37.7)	7,200	100.0	3,081 (42.8)
Interviewer-rated health (IRH) for the respondents						
Healthy	1,727	32.1	426 (24.7)	1,607	22.3	431 (26.8)
Fairly healthy	2,910	54.0	1,122 (38.6)	4,131	57.4	1,678 (40.6)
Slightly ill	656	12.2	410 (62.5)	1,269	17.6	835 (65.8)
Moderately/Severely ill	90	1.7	72 (80.0)	193	2.7	137 (80.0)
Total	5,383	100.0	2,030 (37.7)	7,200	100.0	3,081 (42.8)

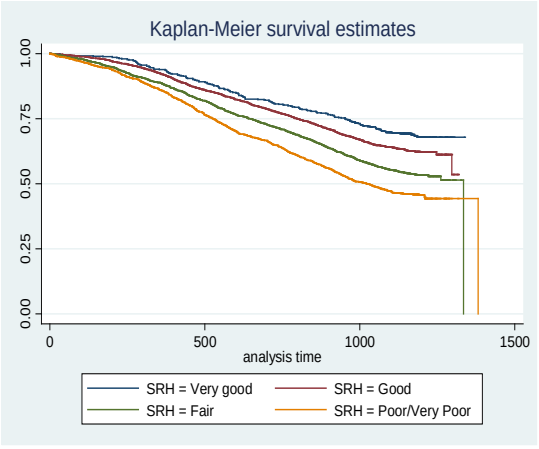
Note: unweighted.



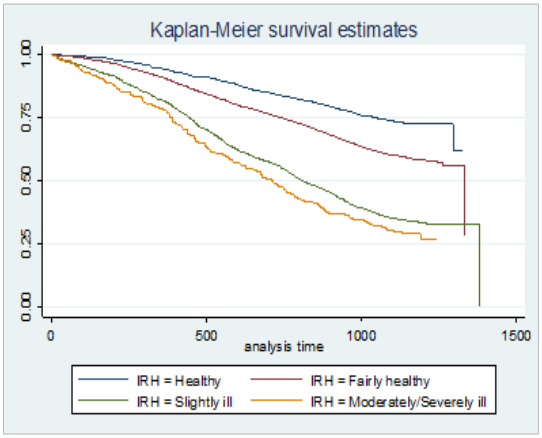
(a) SRH for Men



(b) IRH for Men



(c) SRH for Women



(d) IRH for Women

Figure 1. Kaplan-Meier curves for self-rated health (SRH) and interviewer-rated health (IRH) by sex, CLHLS 2005–2008

Table 3. Relative hazards of mortality risk for self-rated health (SRH) and interviewer-rated health (IRH), CLHLS 2005–2008

	Men			Women		
	I	II	III	I	II	III
Total						
SRH, good (very good)	1.04		1.03	1.04		1.03
SRH, fair (very good)	1.15		1.11	1.05		0.96
SRH, poor/very poor (very good)	1.31		1.17	1.17		1.06
IRH, fairly healthy (healthy)		1.14**	1.11		1.11	1.11
IRH, slightly ill (healthy)		1.47***	1.40***		1.40**	1.39***
IRH, moderately/severely ill (healthy)		2.28***	2.16***		1.05***	1.37**
N	5,383	5,383	5,383	7,200	7,200	7,200
Chi-square	1656.9***	1680.9***	1684.3***	2493.6***	2517.9***	2519.4***

Note: (1) Model I includes SRH only, Model II includes IRH only, and Model III includes both SRH and IRH. (2) Relative hazards are obtained from models adjusted for other stratifying variables and all covariates. (3), *p < 0.05, **p < 0.01, ***p < 0.001.

various covariates (Model II and III). For both men and women, there was about 40% additional risk of mortality for those in the slightly ill IRH category compared with healthy IRH (Model II and III). Moderately/severely ill IRH was associated with 116%–128% additional risk of mortality compared with healthy IRH for men (Model II and III), but with only 5%–37% additional risk for women.

Results in Tables 4 and 5 show further models of SRH and IRH as predictors of mortality stratified by various subpopulations, controlling for a number of covariates including health conditions and health behavior. Among all subgroups except unmarried men, SRH was not significantly associated with mortality; in contrast, the association of IRH with mortality was significant in all subpopulations, regardless of whether SRH was present or not in the models. For example, among rural men, compared with healthy IRH, fairly healthy IRH was associated with 17% additional risk of mortality in the three-year period, slightly ill IRH with 66% increased risk, and moderately/severely ill IRH with 176% increased risk (Model II). When SRH was further included in Model III, these additional mortality risks were only slightly attenuated to 55% for slightly ill IRH and 157% for moderately/severely healthy IRH, respectively. This pattern was generally replicated in other subgroups in Table 4, except for married women, for whom both SRH and IRH did not have significant predictive power for mortality. Table 5 shows that IRH proved to be a strong predictor across all socioeconomic subgroups except for women with higher SES (i.e., 1+ years of schooling or good family economic conditions). For those high SES women, both SRH and IRH were not significantly associated with mortality risk.

To further examine why SRH and IRH were not significantly associated with mortality risk among married women, educated women, and women in good economic conditions, we performed additional analyses (see Appendix Table A). In these analyses, we estimated the relative hazards for these specific subpopulations without controlling for health conditions (i.e., IADL, ADL, chronic diseases, and cognitive function). Our results showed that when health conditions were not controlled for, SRH and IRH were significantly associated with mortality risk. For example, among women with 1+ years of schooling, having poor/very poor SRH increased mortality risk by 79% compared to having very good SRH; having slightly ill and moderately/severely ill IRH increased mortality risk by 112% and 133%, respectively, compared to being in the healthy group. When both SRH and IRH were included in the model, both predictors were still significant although the strengths were decreased. These analyses suggest that SRH and IRH were not significantly associated with mortality in Tables 4 and 5 because health conditions had explained a substantial part of variations in mortality risks for these specific subpopulations.

Table 4. Relative hazards of mortality risk for self-rated health (SRH) and interviewer-rated health (IRH) by residency, age, and marital status, CLHLS 2005–2008

	Men			Women		
	I	II	III	I	II	III
Rural						
SRH, good (very good)	1.02		1.01	0.99		0.98
SRH, fair (very good)	1.16		1.10	0.99		0.95
SRH poor/very poor (very good)	1.39		1.19	1.13		1.03
IRH, fairly healthy (healthy)		1.17*	1.14		1.10	1.11
IRH, slightly ill (healthy)		1.66***	1.55***		1.37**	1.36**
IRH, moderately/severely ill (healthy)		2.76***	2.57***		1.38*	1.35*
N	3,114	3,114	3,114	4,264	4,264	4,264
Chi-square	950.6***	973.5***	976.4***	1474.3***	1485.5***	1486.9***
Urban						
SRH, good (very good)	1.08		1.08	1.11		1.09
SRH, fair (very good)	1.15		1.13	1.13		1.06
SRH poor/very poor (very good)	1.23		1.15	1.22		1.10
IRH, fairly healthy (healthy)		1.09	1.07		1.12	1.11
IRH, slightly ill (healthy)		1.25	1.20		1.42**	1.41**
IRH, moderately/severely ill (healthy)		1.79*	1.73*		1.42*	1.40
N	2,269	2,269	2,269	2,936	2,936	2,936
Chi-square	735.6***	739.4***	740.4***	1050.5***	1061.5***	1062.1***
Ages 65-79						
SRH, good (very good)	0.95		0.87	1.19		1.32
SRH, fair (very good)	0.81		0.68	1.15		1.30
SRH, poor/very poor (very good)	1.29		1.01	1.76		1.64
IRH, fairly healthy (healthy)		1.53**	1.63***		0.80	0.76
IRH, slightly ill (healthy)		1.72*	1.71**		1.99**	1.78*
IRH, moderately/severely ill (healthy)		3.04**	2.67**		2.55*	2.27*
N	2,077	2,077	2,077	1,973	1,973	1,973
Chi-square	132.32***	137.1***	143.5***	94.7***	109.8***	112.1***
Ages 80+						
SRH, good (very good)	1.02		1.02	1.06		1.05
SRH, fair (very good)	1.11		1.10	1.06		1.02
SRH poor/very poor (very good)	1.09		1.02	1.03		0.95
IRH, fairly healthy (healthy)		1.02	1.01		1.10	1.11
IRH, slightly ill (healthy)		1.24*	1.23*		1.27	1.30**
IRH, moderately/severely ill (healthy)		1.70**	1.70**		1.21	1.25
N	3,306	3,306	3,306	5,227	5,227	5,227
Chi-square	530.9***	542.4***	544.8***	870.3***	881.1***	883.8***

Table 4 continued

	Men			Women		
	I	II	III	I	II	III
Not currently married						
SRH, good (very good)	1.01		1.01	1.06		1.04
SRH, fair (very good)	1.26*		1.22	1.06		0.99
SRH, poor/very poor (very good)	1.33*		1.20	1.16		1.05
IRH, fairly healthy (healthy)		1.11	1.07		1.14*	1.14*
IRH, slightly ill (healthy)		1.49***	1.39**		1.42***	1.42***
IRH, moderately/severely ill (healthy)		2.17***	2.03**		1.35*	1.34*
N	2,639	2,639	2,639	5,850	5,850	5,850
Chi-square	697.1***	706.3***	713.8***	1765.3***	1786.1***	1789.6***
Currently married						
SRH, good (very good)	1.08		1.06	0.87		0.93
SRH, fair (very good)	0.95		0.91	1.04		1.11
SRH, poor/very poor (very good)	1.23		1.09	1.08		1.04
IRH, fairly healthy (healthy)		1.16	1.18		0.88	0.85
IRH, slightly ill (healthy)		1.34*	1.33		1.37	1.30
IRH, moderately/severely ill (healthy)		2.14**	2.91**		1.79	1.72
N	2,744	2,744	2,744	1,350	1,350	1,350
Chi-square	649.4***	653.8***	657.6***	223.3***	228.4***	229.4***

Note: (1) Model I includes SRH only, Model II includes IRH only, and Model III includes both SRH and IRH. (2) Relative hazards are obtained from models adjusted for other stratifying variables and all covariates. (3), *p < 0.05, **p < 0.01, ***p < 0.001.

4. Discussion

IRH has been proven to have a strong predictive power for mortality independent of SRH, but its predictive power relative to SRH has not been examined among subpopulations in previous studies. Due to the subjective nature of SRH, individuals may have different understandings and judgments about health and thus use different criteria and referents to rate their health status. Consequently, SRH may vary across individuals with different characteristics. Meanwhile, IRH may also vary across individuals, because interviewer's assessment of a respondent's health may incorporate the respondent's self-reported health information into his/her observation. Given these two issues, IRH's predictive power relative to SRH needs to be examined in different subgroups. Using data from the 2005 and 2008 waves of the CLHLS, this study examined predictive powers of SRH and IRH on mortality in various subgroups of the Chinese older population.

Our analyses reveal that, across various demographic and SES subpopulations, IRH is generally an independent and robust predictor of mortality that often performs better than SRH in mortality prediction. This is not a surprise. Compared to SRH, evaluation by interviewer could be less affected by subjective factors (Todd and Goldman, 2013) and thus may have some advantages over SRH (Brissette, Leventhal, and Leventhal, 2003). Because interviewers usually rate respondents' health at the end of the interview, which is the practice in the CLHLS, interviewers can incorporate information on a respondent's reported health and health-related conditions and information from their own observations while communicating with respondents. Furthermore, during the process of interviewing multiple respondents, interviewers may develop a relatively objective standard for rating the respondent in reference to other age peers (Feng, Zhu, Zhen *et al*., 2016). Therefore, IRH could be more valid and less affected by respondents' self-rating bias. Our study confirms such

Table 5. Relative hazards of mortality risk for self-rated health (SRH) and interviewer-rated health (IRH) by years of schooling and family economic conditions, CLHLS 2005–2008

	Men			Women		
	I	II	III	I	II	III
No. years of schooling						
SRH, good (very good)	1.03		1.03	1.02		1.01
SRH, fair (very good)	1.13		1.11	1.04		0.99
SRH, poor/very poor (very good)	1.14		1.03	1.17		1.06
IRH, fairly healthy (healthy)		1.07	1.05		1.13	1.12
IRH, slightly ill (healthy)		1.33*	1.32*		1.43**	1.42**
IRH, moderately/severely ill (healthy)		1.99**	1.99**		1.44***	1.42***
N	1,921	1,921	1,921	5,909	5,909	5,909
Chi-square	544.0***	553.9***	554.8***	1903.7***	1926.1***	1927.7***
1+ years of schooling						
SRH, good (very good)	1.04		1.02	1.13		1.16
SRH, fair (very good)	1.16		1.10	1.09		1.12
SRH, poor/very poor (very good)	1.47**		1.28	1.14		1.09
IRH, fairly healthy (healthy)		1.18*	1.14		0.93	0.92
IRH, slightly ill (healthy)		1.59***	1.47**		1.29	1.28
IRH, moderately/severely ill (healthy)		2.80***	2.52***		1.09	1.09
N	3,462	3,462	3,462	1,291	1,291	1,291
Chi-square	1085.7***	1100.4***	1105.7***	489.3***	493.9***	494.4***
Poor family economic condition at present						
SRH, good (very good)	0.99		0.98	1.14		1.14
SRH, fair (very good)	1.08		1.03	1.12		1.07
SRH, poor/very poor (very good)	1.16		1.03	1.26*		1.14
IRH, fairly healthy (healthy)		1.12	1.11		1.09	1.09
IRH, slightly ill (healthy)		1.43***	1.41***		1.40***	1.39***
IRH, moderately/severely ill (healthy)		2.10***	2.07***		1.41**	1.39**
N	4,441	4,441	4,441	6,189	6,189	6,189
Chi-square	1416.8***	1440.1***	1440.8***	2166.6***	2188.3***	2191.7***
Good family economic condition at present						
SRH, good (very good)	1.17		1.14	0.78		0.74
SRH, fair (very good)	1.50**		1.46*	0.88		0.82
SRH, poor/very poor (very good)	2.83***		2.38**	0.91		0.83
IRH, fairly healthy (healthy)		1.25	1.13		1.19	1.23
IRH, slightly ill (healthy)		1.81**	1.36		1.35	1.37
IRH, moderately/severely ill (healthy)		19.66***	11.21***		1.15	1.17
N	942	942	942	1,011	1,011	1,011
Chi-square	257.9***	255.2***	267.9***	345.3***	344.8***	348.3***

Note: (1) Model I includes SRH only, Model II includes IRH only, and Model III includes both SRH and IRH. (2) Relative hazards are obtained from models adjusted for other stratifying variables and all covariates. (3), *p<0.05, **p<0.01, ***p<0.001.

merit of IRH across most of the demographic and SES subgroups, and therefore further expands the previous literature by concluding that IRH can be a good complementary measure of SRH and should be used in health and mortality studies (Feng, Zhu, Zhen *et al*., 2016; Smith and Goldman, 2011; Todd and Smith, 2013).

We also found that neither SRH nor IRH was associated with mortality in a few subgroups of women, including those who were married, educated for at least one year, or had good family economic conditions. The literature on how SES affects SRH's predictive power is less than consistent. Although some literature found that the associations between SRH and mortality were stronger among higher SES groups of older Americans (Dowad and Zajacova, 2007; 2010), other research has shown that the association between SRH and mortality was weaker among high-SES groups than among low-SES groups (Singh-Manoux, Dugravot, Shipley *et al*., 2007). It is possible that the low-SES women may not report serious illnesses because they cannot afford medical services, while the high-SES groups may tend to over-report less serious health problems (Singh-Manoux, Dugravot, Shipley *et al*., 2007). This pattern may be because the low-SES groups cannot afford medical services but the high-SES groups have better health literacy and make more frequent visits to doctors (Blackwell, Martinez, Gentleman *et al*., 2009). There is also evidence that women are more likely to exaggerate minor health problems or report health problems at an earlier stage (Singh-Manoux, Guéguen, Ferrie *et al*., 2008). As the SES of women in old Chinese cohorts is much lower than that of men, it is possible that the higher SES women in our sample were more likely to overreport their health problems than their low-status counterparts. Our additional analysis further revealed that associations between SRH/IRH and mortality were indeed explained away by physical and psychological health conditions. A few reasons seem plausible here. Firstly, it is likely that women who are married or have a high SES tend to assess their own overall health mainly based on ADL, IADL, cognitive function, and chronic disease conditions. As a result, the significance of SRH would be explained by these health conditions. Secondly, when they provided health information to the interviewer during interview, these higher SES women may have stressed these health conditions, and the interviewers may thus have largely relied on these conditions, so that IRH also loses additional predictive power in the presence of these health conditions. Thirdly, the relatively small sample size and lower mortality among married or higher position women compared to other subgroups may also contribute to non-significant results. We call for more research to examine these issues.

There are some limitations to the study's measurement of variables. Firstly, IRH is also a subjective measure because it depends on interviewers' judgments (Feng, Zhu, Zhen *et al*., 2016). Therefore, interviewers' own characteristics could possibly affect how they rate respondents' health status. We call for future studies to measure and analyze interviewers' characteristics, such as demographic characteristics, education, occupation, and health literacy, which could help improve the understanding of IRH. Secondly, the Chinese wording of the SRH and IRH categories is not exactly the same, which may introduce some bias to respondents' responses. However, since they largely represent the same meanings in Chinese, the inconsistency of wording should not seriously affect our findings. In spite of these limitations, based on a national survey with a large sample size, we were able to examine the predictive power of IRH relative to SRH for mortality in various subgroups of the elderly Chinese population and found that, overall, IRH is an independent and robust predictor of mortality and even performs better than SRH in mortality prediction among most of the subgroups.

5. Conclusions

Our study found that, in general, IRH is a robust predictor of mortality, independent of SRH across most major demographic and socioeconomic subpopulations among Chinese older adults. Thus, IRH could be a good complementary measurement for SRH. Among the subgroups of women in which neither SRH nor IRH was significantly associated with mortality, we found that SRH's and IRH's predictive power for mortality were explained away by respondents' self-reported physical,

mental, and chronic disease conditions. More importantly, the predictive power of IRH on mortality generally performs better than that of SRH. Our findings suggest that it would be a good strategy for surveys to include IRH at the end of the interview and also collect information on interviewers' characteristics to help improve our understanding of IRH and disentangle its predictive power independent of SRH.

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Authors' Contributions

HZ designed the study and performed the analysis. HZ drafted and revised the text. FQ drafted and revised the text. DG co-designed the study and co-performed the analysis. DG also revised the text.

Conflict of Interest and Funding

The authors declare that there is no conflict of interest and they have no financial support for this study.

Ethics Approval and Consent to Participate

No ethics approval was required for this study because the datasets used are obtained from a publicly accessible database of the Chinese Longitudinal Healthy Longevity Survey (http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/36179) with a signed data user agreement.

Availability of Data and Materials

The CLHLS datasets are publicly available at http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/36179.

Disclaimer

Views expressed in this paper are solely those of the authors and do not necessarily reflect the views of Virginia Tech, National University of Singapore, or the United Nations.

References

Anson O, Shteingrad J and Paran E. (2011). Self-rated health and survival: a seven-years follow-up. *Psychology*, 2(9): 987–991.
http://dx.doi.org/10.4236/psych.2011.29148.

Arber S and Cooper H. (1999). Gender differences in health in later life: the new paradox? *Social Science & Medicine*, 48(1): 61-76.
http://dx.doi.org/10.1016/S0277-9536(98)00289-5

Benyamini Y. (2008). Self-ratings of health and longevity: a health psychologist's viewpoint on epidemiological findings. *The European Health Psychologist*, 10: 10–3.

Benyamini Y, Idler E L, Leventhal H, *et al*. (2000). Positive affect and function as influences on self-assessments of health: expanding our view beyond illness and disability. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 55: 107–116.
http://dx.doi.org/10.1093/geronb/55.2.P107.

Blackwell D L, Martinez M E, Gentleman J F, *et al*. (2009). Socioeconomic status and utilization of health care services in Canada and the United States: findings from a binational health survey. *Medical Care*, 47(11): 1136–1146.
http://dx.doi.org/10.1097/MLR.0b013e3181adcbe9.

Brissette I, Leventhal H and Leventhal E A. (2003). Observer ratings of health and sickness: can other people tell us anything about our health that we don't already know? *Health & Psychology*, 22(5): 471–478.

http://dx.doi.org/10.1037/0278-6133.22.5.471.

Case A and Paxson. (2005). Sex differences in morbidity and mortality. *Demography*, 42(2): 189-214. http://dx.doi.org/10.1353/dem.2005.0011

Chen J and Wu Z. (2008) Gender differences in the effects of self-rated health status on mortality among the oldest-old in China, in: Zeng Y, Poston D L, Vlosky D A, *et al*. (Eds.), *Healthy Longevity in China: Demographic, Socioeconomic, and Psychological Dimensions*. Dordrecht, The Netherlands: Springer Publisher, pp. 397–418.

Daugherty K E. (2009). *Dyadic influences on self-rated health among older adults*. Master degree thesis, Iowa State University, Ames, Iowa.

Deeg D and Bath P A. (2003). Self-rated health, gender, and mortality in older persons: introduction to a special section. *The Gerontologist*, 43(3): 369–371. http://dx.doi.org/10.1093/geront/43.3.369.

Deeg D and Kriegsman D. (2003). Concepts of self-rated health: specifying the gender difference in mortality risk. *The Gerontologist*, 43(3): 376–386. http://dx.doi.org/10.1093/geront/43.3.376.

Dowad J B and Zajacova A. (2007). Does the predictive power of self-rated health for subsequent mortality risk vary by socioeconomic status in the US? *International Journal of Epidemiology*, 36 (6): 1214–1221. http://dx.doi.org/10.1093/ije/dym214.

Dowad J B and Zajacova A. (2010). Does self-rated health mean the same thing across socioeconomic groups? Evidence from biomarker data. *Annual Epidemiology*, 20(10): 743–749. http://dx.doi.org/10.1016/j.annepidem. 2010.06.007.

Ferraro K F, Farmer M M and Wybraniec J A. (1997). Health trajectories: long-term dynamics among black and white adults. *Journal of Health and Social Behavior*, 38(1): 38–54.

Feng Q, Hoenig H M, Gu D, *et al*. (2010). Impact of new disability subtypes on three-year mortality in Chinese older adults. *Journal of the American Geriatrics Society*, 58(10): 1952–1958. http://dx.doi.org/10.1111/j.1532-5415. 2010.03013.x.

Feng Q, Zhu H, Zhen Z, *et al*. (2016). Self-rated health, interviewer-rated health, and their predictive powers on mortality in old age. *Journal of Gerontology: Social Sciences*, 71(3): 538–550. http://dx.doi.org/10.1093/geronb/gbu186.

Franks P, Gold M R and Fiscella K. (2003). Sociodemographics, self-rated health, and mortality in the U.S. *Social Science & Medicine*, 56(12): 2505–2514.

Glare P, Virik K, Jones M *et al*. (2003). A systematic review of physicians' survival predictions in terminally ill cancer patients. *British Medical Journal*, 327(7408): 195–198. http://dx.doi.org/10.1136/bmj.327.7408.195.

Gu D. (2008). General data assessment of the Chinese longitudinal healthy longevity survey in 2002, in: Zeng Y, Poston D L, Vlosky D A, *et al*. (Eds.), *Healthy Longevity in China: Demographic, Socioeconomic, and Psychological Dimensions*. Dordrecht, The Netherlands: Springer Publisher, pp.61–78.

Gu, D, Dupre M E, Warner D F, *et al*. (2009). Changing health status and health expectancies among older adults in China: gender differences from 1992 to 2002. *Social Science & Medicine*, 68: 2170–2179. http://dx.doi.org/10.1016/j.socscimed.2009.03.031.

Groot W. (2000). Adaption and scale of reference bias in self-assessments of quality of life. *Journal of Health Economics*, 19(3): 403–420.

Huisman M and Deeg D J. (2010). A commentary on Marija Jylhä's "What is self-rated health and why does it predict mortality? Toward a unified conceptual model" (69:3, 2009, 307–316). *Social Science & Medicine*, 70(5): 652–654. http://dx.doi.org/10.1016/j.socscimed.2009.11.003.

Idler E L and Benyamini Y. (1997). Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior*, 38(1): 21–37.

Idler E L, Hudson S V and Leventhal H. (1999). The meanings of self-ratings of health: a qualitative and quantitative approach. *Research on Aging*, 21(3): 458–476. http://dx.doi.org/10.1177/0164027599213006.

Jylhä M. (2009). What is self-rated health and why does it predict mortality? Toward a unified conceptual model. *Social Science and Medicine*, 69(3): 307–316. http://dx.doi.org/10.1016/j.socscimed.2009.05.013.

Kaneda T, Zimmer Z, Fang X, *et al.* (2009). Gender differences in functional health and mortality among the Chinese elderly: testing an exposure versus vulnerability hypothesis. *Research on Aging*, 31(3): 361–388. http://dx.doi.org/10.1177/0164027508330725.

Krause N L and Jay G M. (1994). What do global self-rated health items measure? *Medical Care*, 32 (9): 930–942.

Martin L G, Feng Q, Schoeni R F, *et al*. (2014). Trends in function and activity limitations among Chinese oldest-old, 1998 to 2008. *Population and Development Review*, 40(3): 475–495. http://dx.doi.org/10.1111/j.1728-4457.2014.00694.x.

McFadden E, Luben R, Bingham S, *et al*. (2009). Does the association between self-rated health and mortality vary by social class? *Social Science and Medicine*, 68(2): 275–280. http://dx.doi.org/10.1016/j.socscimed.2008.10.012.

Peek M K, Stimpson J P, Townsend A L, *et al*. (2006). Well-being in older Mexican American spouses. *The Gerontologist*, 46: 258–265. http://dx.doi.org/10.1093/geront/46.2.258.

Purser J L, Feng Q, Zeng Y, *et al*. (2012). A new classification of function and disability in China: subtypes based on performance based and self-reported measures. *Journal of Aging and Health*, 24: 779–798. http://dx.doi.org/10.1177/0898264312444310.

Quesnel-Vallee A. (2007). Self-rated health: caught in the crossfire of the quest for 'true' health? *International Journal of Epidemiology*, 36(6): 1161–1164. http://dx.doi.org/10.1093/ije/dym236.

Rocker G, Cook D, Sjokvist P, *et al*. (2004). Clinician predictions of intensive care unit mortality. *Critical Care Medicine*, 32(5): 1149–1154.

Shadbolt B. (1997). Some correlates of self-rated health for Australian women. *American Journal of Public Health*, 87(6): 951–956.

Singh-Manoux A, Dugravot A, Shipley J M, *et al*. (2007). The association between self-rated health and mortality in different socioeconomic groups in the GAZEL cohort study. *International Journal of Epidemiology*, 36: 1222–1228. http://dx.doi.org/10.1093/ije/dym170.

Singh-Manoux A, Guéguen A, Ferrie J, *et al*. (2008) Gender differences in the association between morbidity and mortality among middle-aged men and women. *American Journal of Public Health*, 98: 2251–2257. http://dx.doi.org/10.2105/AJPH.2006.107912.

Smith K V and Goldman N. (2011). Measuring health status: self-, interviewer, and physician reports of overall health. *Journal of Aging and Health*, 23: 242–266. http://dx.doi.org/10.1177/0898264310383421.

Stefan E K. (2013). Gender differences in health information behavior: a Finnish population-based survey. *Health Promotion International*, 8: 1–10. http://dx.doi.org/10.1093/heapro/dat063.

Todd M A and Goldman N. (2013). Do interviewer and physician health ratings predict mortality? A comparison with self-rated health. *Epidemiology*, 24(6): 913–920. http://dx.doi.org/10.1097/EDE.0b013e3182a713a8.

UNPD. (2015). *The World Population Prospects, the 2015 revision*. Retrieved on September 2, 2016 from https://esa.un.org/unpd/wpp/.

van Doorn C. (1998). Spouse-rated limitations and spouse-rated life expectancy as mortality predictors. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 53: S137–S143. http://dx.doi.org/ 10.1093/geronb/53B.3.S137.

Verbrugge L M. (1979). Marital status and health. *Journal of Marriage and Family*, 41(2): 267-285.

Verbrugge L M. (1985).Gender and health: an update on hypothesis and evidence. Journal of Health and Social Behavior, 26(3): 156-182. http://dx.doi.org/10.2307/2136750.

Waite L J and Gallagher M. (2000). *The Case for Marriage: Why Married People are Happier, Healthier and Better off Financially*. New York: Doubleday.

Zajacova A and Woo H. (2016). Examination of age variations in the predictive validity of self-rated health. *Journal*

of Gerontology: Social Sciences, 71(3): 551–557. http://dx.doi.org/10.1093/geronb/gbv050.

Zeng Y and Gu D. (2008). Reliability of age reporting among the Chinese oldest-old in the CLHLS datasets, in: Zeng Y, Poston D L, Vlosky D A, *et al*. (Eds.), *Healthy Longevity in China: Demographic, Socioeconomic, and Psychological Dimensions*. Dordrecht, The Netherlands: Springer Publisher, pp.61–79.

Zeng Y, Feng Q, Gu D, *et al*. (2016). Demographic, phenotypic and genetic characteristics of centenarians in China. Under review at *Mechanisms of Ageing and Development*.

Zheng H and Thomas P A. (2013). Marital status, self-rated health, and mortality: overestimation of health or diminishing protection of marriage? *Journal of Health and Social Behavior*, 54(1): 128–143. http://dx.doi.org/10.1177/0022146512470564.

Zhu H and Gu D. (2010). The protective effect of marriage on health and survival: does it persist at oldest-old ages? *Journal of Population Ageing*, 3: 161–182. http://dx.doi.org/10.1007/s12062-0119034-8.

Zhu H and Xie Y (2007). Socioeconomic differentials in mortality among the oldest old in China. *Research on Aging*, 29(2): 125–143. http://dx.doi.org/10.1177/0164027506296758.

Zimmer Z, Hidajat M and Saito Y. (2015). Changes in total and disability-free life expectancy among older adults in China: Do they portend a compression of morbidity*? International Journal of Population Studies*, 1(1): 4–18. http://dx.doi.org/10.18063/IJPS.2015.01.001.

Appendix

Table A. Relative hazards of mortality risk for self-rated health (SRH) and interviewer-rated health (IRH) among certain subgroups without controlling for self-reported health measures, CLHLS 2005–2008

	I	II	III
Married women			
SRH, good (very good)	0.88		0.92
SRH, fair (very good)	1.17		1.14
SRH poor/very poor (very good)	1.91*		1.30
IRH, fairly healthy (healthy)		1.01	0.94
IRH, slightly ill (healthy)		2.34***	1.96*
IRH, moderately/severely ill (healthy)		4.76***	3.79***
N	1,350	1,350	1,350
Chi-square	177.5***	198.6***	200.9***
Educated women			
SRH, good (very good)	1.09		1.21
SRH, fair (very good)	1.25		1.29
SRH poor/very poor (very good)	1.79*		1.59*
IRH, fairly healthy (healthy)		1.12	1.03
IRH, slightly ill (healthy)		2.12***	1.81*
IRH, moderately/severely ill (healthy)		2.33*	1.78
N	1,291	1,291	1,291
Chi-square	458.2***	446.2***	461.9***
Women with good family economic conditions			
SRH, good (very good)	0.87		0.79
SRH, fair (very good)	1.26		1.02
SRH, poor/very poor (very good)	1.58*		1.12
IRH, fairly healthy (healthy)		1.46**	1.44*
IRH, slightly ill (healthy)		2.37***	2.08***
IRH, moderately/severely ill (healthy)		2.63**	2.21*
N	1,011	1,011	1,011
Chi-square	301.6***	311.1***	317.3***

Note: (1) Model I includes SRH only, Model II includes IRH only, and Model III includes both SRH and IRH. (2) Relative hazards are obtained from models adjusted for other stratifying variables and all covariates, except health conditions such as IADL, ADL, chronic diseases, and cognitive function. (3), *p < 0.05, **p < 0.01, ***p < 0.001.