Archives of Gerontology and Geriatrics 81 (2019) 182–191

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Objective and subjective financial status and mortality among older adults in China☆

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ARTICLE INFO

Keywords:
China
Mortality
Objective financial status
Subjective financial status
Oldest-old
CLHLS

ABSTRACT

The association between financial status and mortality in older adults is well documented. However, it is unclear whether the association may vary by objective and subjective indicators of financial status. To examine this issue, we used the latest four waves (2005, 2008/2009, 2011/2012, and 2014) of the Chinese Longitudinal Healthy Longevity Survey (CLHLS) of community-residing adults aged 65 and older (n = 25,954). Financial status was assessed using eight objective, subjective, and culturally-oriented measures to capture various dimensions of financial resources at older ages. Multivariate hazard models were used to examine how different indicators of financial status were associated with subsequent mortality in all older adults and by age, gender, and urban-rural residence. Results showed that higher financial status—either objective or subjective—was associated with lower risks of mortality. Subjective assessments of financial status had stronger associations with mortality than objective assessments. The patterns were generally similar between young-old (aged 65–79) and the oldest-old (aged 80 +), between women and men, and between rural and urban areas. Together, the findings offer new evidence to help improve the socioeconomic gradient in mortality among older adults in China.

1. Introduction

Adequate financial status is an important condition for healthy longevity in later life (Marmot, 2002). Studies have consistently shown that having higher levels of financial status at older ages promotes greater psychological well-being, quality of life, self-rated health, and cognitive function; and in turn, lowers disability, morbidity, and mortality (Angel, Frisco, Angel, & Chiriboga, 2003; Arber, Fenn, & Meadows, 2014; Cheng, Chi, Boey, Ko, & Chou, 2002; Gasiorowska, 2014; Hirai, Kondo, & Kawachi, 2012; House, Lantz, & Herd, 2005; Kahn & Fazio 2005; Khang, Bahk, Yi, & Yun, 2015; Kim, Kim, Lee, Ju, & Park, 2017; Momtaz, Ibrahim, Hamid, & Yahaya, 2010; Nummela, Sulander, Heinonen, & Uutela, 2007; Xiang, Hao, Qiu, Zhao, & Gu, 2018; Zimmerman & Katon, 2005).

Income, a major component of one's financial status, is among the most widely used indicators in studies on the social gradient and social stratification of health and mortality—largely due to its variability and simplicity in measurement (House et al., 1994, 2005). However, there is a debate about the social gradient in health at older ages, particularly at advanced ages. Cumulative disadvantage theory emphasizes the accumulation of risks over the life course and thus predicts widening social inequalities in health with increasing age (Dannefer, 2003; Dupre, 2007; O'Rand & Hamil-Luker, 2005; Ross & Wu, 1996). Conversely, the age-as-leveler hypothesis proposes a weakening association between socioeconomic status and health at older ages. The explanations for leveling social inequalities in health have been attributed to biological

Abbreviations: ADL, activities of daily living; CLHLS, Chinese Longitudinal Healthy Longevity Survey; HR, hazard ratio; MMSE, mini-mental status examination

☆ Views expressed in the paper are solely of authors and do not reflect those of Nanjing Normal University, National University of Singapore, Duke University, and the United Nations.

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https://doi.org/10.1016/j.archger.2018.12.006
Received 11 May 2018; Received in revised form 4 November 2018; Accepted 21 December 2018
Available online 24 December 2018
0167-4943/

processes, the redistribution of “equalizing" resources in society (e.g., Medicare), the disengagement of older adults from socioeconomic activities, the lower frequency of unhealthy behaviors in later life, and mortality selection (House et al., 1994, 2005; Luo, Zhang, & Gu, 2015; Muennig, 2008; Singh-Manous, Marmot, & Adler, 2005).

Income, however, is just one of multiple dimensions (measures) of an individual’s financial resources and status. To date, few studies have simultaneously considered multiple measures of financial resources when examining the link between financial status and health. Indeed, although objective and subjective assessments of financial status have been investigated, rarely have they been examined simultaneously or compared systematically (for exceptions, see Arber et al., 2014; Kim et al., 2017; Nummela et al., 2007; Xiang et al., 2018).

Objective and subjective measures of financial status, though interrelated, capture distinct dimensions of economic well-being in the lives of older adults (Kim et al., 2017; Nummela et al., 2007). Objective measures of financial status often include information on an individual’s income, pension, retirement wages, assets/properties, and bank savings. Subjective measures of financial status often include the perceptions of financial adequacy and satisfaction, economic/financial strains or distresses, economic status in comparison with others, and decision-making abilities or power (Gasiorowska, 2014; Kim et al., 2017; Lichtenberg et al., 2018; Litwin & Sapir, 2009; Nummela et al., 2007; Xiang et al., 2018).

Although subjective assessments of financial status are often based on actual resources, the association between objective and subjective measures is often not strong (Chan, Ofstedal, & Hermalin, 2002; Tang, Luna-Arocas, Sutarso, & Tang, 2004). In part, this is because the subjective assessment of financial status can be affected by a myriad of psychological and/or cognitive factors (Gasiorowska, 2014; Shaked, Williams, Evans, & Zonderman, 2016). In addition, subjective financial conditions also reflect the current needs and life expectations of older adults in different contexts. Moreover, individual needs, expectations, and contexts may change with advancing age due to health deterioration or other important life events (Arber et al., 2014). Therefore, subjective assessments of financial status may capture individual dynamics and “realities” that are beyond the objective metrics. Indeed, among the few studies that have examined both objective and subjective financial resources, subjective measures were found to have more robust associations with health and well-being (Arber et al., 2014; Balabanova & McKee, 2002; Xiang et al., 2018). Furthermore, the subjective assessment of financial status at older ages is multifactorial. For example, the perceived decision-making power in utilizing financial resources—i.e., the ability to make financial decisions—is an often overlooked dimension for older adults in the mobilization of resources to meet their needs in later life (Chou & Chi, 2002; Xiang et al., 2018; Arber et al., 2014; Nummela et al., 2007; Sun, Hilgeman, Durkin, Allen, & Burgio, 2009). Indeed, failing to account for such a decision-making power has been shown to influence the association between financial recourses and health outcomes (Lichtenberg et al., 2018). Thus, it has been argued that studies should account for objective and subjective measures of financial status simultaneously to provide a more comprehensive and multi-dimensional assessment for actual and perceived resources (Chan et al., 2002; Sun et al., 2009).

In addition, in some familialism societies, such as in China, the role of intergenerational transfers of wealth has been highlighted as an important dimension of financial status that can influence health outcomes (Silverstein, Cong, & Li, 2006). In China, the intergenerational transfer of wealth is highly related to the financial status of older adults (Zhu, 2016). In Confucian societies, individual financial resources are normally tied to families through a strong culture of familism and filial piety (Silverstein et al., 2006)—whereby giving or receiving financial resources is common among older adults and their offspring. Cultural factors such as these are thus additionally important to the financial status and health outcomes of older adults in China.

Several studies focusing on the overall subjective socioeconomic status showed its more robustness in linking with various health outcomes among middle-aged (e.g., Demakakos, Nazroo, Breeze, & Marmot, 2008) or older adults (Singh-Manous et al., 2005) than objectively measured socioeconomic status. However, it remains largely unknown (1) whether the association between financial status and health/mortality differ for objective and subjective measures, (2) whether the associations persist or weaken with advancing age, (3) whether the association is consistent among population subgroups, and (4) whether cultural-related measures of financial resources also relate to mortality in later life. The purpose of this study is to provide the first investigation about these research questions among adults aged 65 and older in mainland China (hereafter China). Using a large national longitudinal dataset, multiple indicators of financial status, and a wide range of covariates, we aim to examine how individual and combined indicators of financial status are associated with subsequent mortality in older adults overall and by age, gender, and urban-rural residence.

2. Data and methods

2.1. Study sample

We use data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), the largest ongoing nationally-representative longitudinal survey of older adults in China. The CLHLS is conducted throughout 22 provinces in mainland China where age-reporting at very old ages was shown to be relatively accurate (Zeng, Poston, Vlosky, & Gu, 2008). The CLHLS was designed to interview all centenarians in the sampled counties/cities and to collect a roughly equal number of respondents by sex in each year of age from 65 to 99. Study participants were followed/re-interviewed over time and new respondents were replenished in subsequent waves to maintain sufficient and representative sample sizes. One Han-dominated county from Hainan Province was added in the 2008 wave and beyond, resulting in a total of 23 provinces in the CLHLS. A detailed description of the sampling design and the data quality assessment of the CLHLS have been documented elsewhere (see Chen et al., 2018; Gu, Yang, & Sautter, 2016; Zeng et al., 2008).

The latest four waves of CLHLS data were used for analysis and included the years 2005, 2008/2009 (hereafter as 2008), 2011/2012 (hereafter as 2011), and 2014. The first three waves of the CLHLS (1998, 2000, and 2002) were not included in the analyses because key variables on economic conditions were not available. Excluding those with no information on survival status at follow-up (the total number of the loss was 5669 individuals from 2005 to 2014, accounting for 21.8% of all individuals interviewed in 2005–2011), the total analytic sample for the present study included 20,285 community-residing adults who contributing 33,965 observations from 2005 to 2014.

Sampling weights for the CLHLS were developed to match the composition of the entire elderly population in the sampled provinces in China by age, sex, survey year, and urban-rural residence. The total elderly population in the sampled provinces were primarily obtained from linear interpolation from the two latest censuses and extrapolated to years beyond the latest census. The CLHLS sampling weights were cross-sectional; and longitudinal weights are not available to account for those lost to follow-up.

2.2. Measurement

2.2.1. Mortality risk

All-cause mortality risk of each respondent was measured by the duration of exposure (in days) from the date of his or her first interview to the date of death if he or she died before the 2014 interview, to the date of his/her latest interview if he or she was lost to follow-up in a subsequent wave, or to the date of the 2014 interview if he or she was still alive at the 2014 interview. To better map the mortality risk for study variables, we took their dynamic information across waves into

consideration. In other words, in modeling of mortality risk, the exposure of length and the survival status between each of two adjacent waves were recalibrated. An alternative approach that kept the information of study factors at the first interview produced comparable results. The dates at death were collected from official death certificates when available; otherwise, from the next-of-kin and/or the local residential committees. Previous research has shown that the quality of mortality data in the CLHLS is high (Zeng et al., 2008).

2.2.2. Measures of financial status

Following previous literature (Arber et al., 2014; Litwin & Sapir, 2009; Nummela et al., 2007; Xiang et al., 2018), we measured financial status using several objective and subjective measures. Objective financial status included three variables ascertained from the following questions: (1) "What is your main financial source for daily expenses?" with response options: own pension/retirement wage, spouse, children, grandchildren, relatives, own/spousal earnings from work, government subsides, other sources. We classified respondents as financially independent if his/her daily expenses are mainly from their own pension/earnings or their own work (yes or no); (2) "Do you or your spouse own a house/apartment?" (yes or no); and (3) "What is your total household income last year (in Chinese currency)?" We generated per capita household income by dividing by the total household size and coded as < ¥500, ¥500–1000, ¥1000–3000, ¥3000–8000, ¥8000–15,000, and > ¥15,000 (Note: 1 USD $ ˜ = 6.8 RMB¥ in 2017). The per capita household income was adjusted for the consumer price index based on the 2010 year as the radix. Consistent with previous research, the three objective measures of financial status were self-reported (e.g., Demakakos et al., 2008; House et al., 2005; Singh-Manous et al., 2005).

Subjective financial status included three variables ascertained from the following questions: (1) "Can you make a decision on the following things?" to indicate the degree and the scope of economic decision-making power within the family (coded as holding power on all major things, only holding power on own things or non-major family things, or no power); (2) "Can you make ends meet in daily expenses?" to indicate the adequacy of financial resources (yes or no); and (3) "In comparison with others in your neighborhood, how do you rate your family's financial status?" with responses categorized as very rich/rich vs. fair/poor/very poor.

In addition, we also accounted for financial status related to intergenerational exchanges by including two culturally-relevant measures (Zhu, 2016; Zimmer & Kwong, 2003) reflecting upward and downward intergenerational transfers, including (1) receiving money/food from their adult children (yes or no) and (2) giving money/food to their adult children (yes or no) – derived from two questions: "did you give money/food to your children in the past year?" and "did you receive money/food from your children in the past year?" In total, eight indicators were used to define the financial status of older adults in China.

2.2.3. Covariates

The analyses adjusted for a wide range of covariates that have been associated to either financial resources at older ages or mortality (Chan et al., 2002; House et al., 1994; Shaked et al., 2016). Sociodemographic factors included age, sex, residence (urban vs. rural), ethnicity (Han vs. non-Han), years of schooling (0, 1–6, and 7+ years), primary lifetime occupation (white collar vs. other occupations), and enrollment in any state medical insurance programs such as the new rural cooperative medical scheme, urban resident medical scheme, and urban employee medical scheme (yes or no). Family and social support resources included current marital status (currently married or not) and co-residence with children (yes or no).

Health behaviors were measured by levels of reported leisure-time activities ascertained from the sum of six items: doing housework, gardening, raising pets or domestic animals/poultry, reading books/newspapers, watching TV/listening to radio, and any other personal outdoor activities such as jogging, exercise, or *Taiji*. Each item was measured on a five-point Likert-scale from "never" to "almost daily" (scored 0–4, respectively), with a 0.66 reliability coefficient for the six-item scale. The overall level of leisure activities was then categorized into low, moderate, and high levels based on the sample distributions.

Health conditions included disability in activities of daily living (ADL) and cognitive impairment. Following prior research, respondents who needed assistance in performing any of the six ADL tasks—i.e., bathing, dressing, indoor transferring, toileting, eating, and continence—he/she was classified as ADL disabled (Gu, Dupre, & Qiu, 2017). Cognitive impairment was measured by a previously-validated Chinese version of the Mini-Mental State Examination (MMSE), based on seven domains—i.e., orientation, attention/registration, calculation, drawing, short memory, naming, and language—with a total score of 30 (Zeng et al., 2008). Respondents with an MMSE score less than 24 were considered cognitively impaired (Wen & Gu, 2011). An alternative cut-point of 18 was also assessed and yielded similar results. Notice that there were 43.2% of the sampled persons who were cognitively impaired (including slightly impaired [15.9%], moderately impaired [11.2%] and severely impaired [16.2%]). Their information was answered by themselves or in some cases by proxy (usually the next-of-kin). Although previous research has shown that respondents with slightly or moderately impaired cognition could still provide reliable results (Lee, Wu, & Plassman, 2013), the biases are not free. Fortunately, our sensitive analysis produced comparable results (not shown).

A variable indicating survey year was also included in all models to account for possible period effects and/or changes in sample composition across CLHLS waves. With the exception of sex and ethnicity, all covariates were time-varying in the analyses.

2.3. Analytical strategy

The four waves of longitudinal CLHLS data were pooled with a stacked design as employed elsewhere in the literature (Gu et al., 2016; Hoffman, 2015; Zhang et al., 2017). Multilevel hazard regression models were used to examine the association between financial status and all-cause mortality. Five nested models were tested. Model I included sociodemographic factors, survey year, and each of the individual financial status indicators. Model II included sociodemographic factors, survey year, and all eight of the financial status indicators together. The subsequent models sequentially added family support factors (Model III), health behaviors (Model IV), and baseline health conditions (Model V) to Model II. Analyses were conducted for the entire older-adult sample and separately by age (65–79 and 80+), sex, and residential (urban and rural) groups to assess the well-established differences in financial status and mortality among these groups in China (Dupre, Liu, & Gu, 2008; Wen & Gu, 2011).

Preliminary analyses indicated no evidence of multicollinearity in the models—with variance inflation factors all below 3.5 (Chatterjee & Hadi, 2012). Because we include variables related to sample selection (i.e., age, sex, and urbanicity), sampling weights were not used in the multivariate regression models to avoid unnecessary inflation of standard errors (Winship & Radbill, 1994). To be sure, preliminary analyses used weighted analyses and the results were consistent with those reported here.

Participants lost to follow-up were excluded from the analyses. In total, about 21% of individuals who were interviewed in 2005, 2008 and 2011 waves were lost to follow-up in the subsequent wave. We found that the sample attrition was not random—i.e., those who were lost to follow-up were more unhealthy, in lower socioeconomic status, and had less family/social support. For sensitivity analyses, we also imputed the survival status and the length of survival for those lost to follow-up between an interval of two surveys – by assuming that the survival status and the length of survival of those lost to follow-up were the same as survivors with the same demographics, socioeconomic conditions, family/social support, health behaviors, and health

Table 1
Distribution of study variables, CLHLS 2005–2014.

	% [a]		%
Total # of individuals	20,285	**Covariates at baseline**	
		Mean age (years)	87.2
% death in 2005–2014	64.8	Sex	
		Women	57.7
Financial resources at baseline		Men	42.3
Objectively-measured		Rural-urban residence	
Financial independence		Rural	63.6
No	73.8	Urban	36.4
Yes	26.2	Ethnicity	
Owning 1+ house/apartment		non-Han	7.8
No	61.2	Han	93.2
Yes	38.6	Years of schooling	
Per capita household income		0 years	64.8
< ¥500	19.1	1–6 years	26.7
¥500–1,000 (< 500)	15.2	7+ years	8.5
¥1000–3,000 (< 500)	32.5	White collar occupation	
¥3000–8,000 (< 500)	22.5	No	90.0
¥8000–15,000 (< 500)	7.4	Yes	10.0
> =¥15,000 (< 500)	3.3	Covered by public medical care program	
Subjectively-measured		No	10.2
Having a power in making economic-related decisions		Yes	89.8
		Currently married	
Nothing	46.4	No	68.3
On own things	30.7	Yes	31.7
On everything	22.9	Coresidence with children	
Self-perceived adequacy of financial resources		No	35.0
		Yes	65.0
No	23.4	Levels of leisure activity	
Yes	76.6	Low	33.5
Self-rated family economic condition		Moderate	45.6
Fair/poor	85.2	High	20.9
Rich	14.8	ADL disabled	
		No	75.6
Culturally-measured		Yes	24.4
Receiving money from children		Cognitively impaired	
No	15.4	No	58.8
Yes	84.6	Yes	43.2
Giving money/foods to children		Survey dates (year)	
No	79.3	Wave 2005	31.5
Yes	20.7	Wave 2008/2009	33.9
		Wave 2011/2012	20.0

Note: All values are unweighted percentages for individuals, with the exception of total number of individuals and mean age.

conditions. The imputed results (available upon request) were very similar to those reported here. All analyses were performed using Stata 15.0.

3. Results

Table 1 presents the overall sample distributions for the study variables. Among 20,285 participants who were interviewed in 2005, 2008, and 2011, approximately 65% died by the time of the 2014 wave. Table 2 presents the adjusted relative risks (RR) of mortality for the separate and combined indicators of financial status. Model I shows that most indicators of financial status (except family income and upward transferring) were associated with lower risks of mortality when examined separately and adjusting for demographic factors and survey year. When all eight financial indicators were examined simultaneously (Model II), the results remained largely consistent—with the exception of one indicator (adequacy of financial resources) that was no longer significant. Models III and IV show that the associations between financial status and mortality were robust and independent of education, occupation, marital status, and coresidence with children. Homeownership was no longer significant when health behaviors were taken into account (Model V) and giving money/food to children was only marginally significant when baseline health conditions were further taken into account (Model VI). Overall, financial independence, economic decision-making power, and better family economic conditions were consistently associated with lower risks of mortality.

Table 3 shows that the pattern of associations between the indicators of financial status and mortality were generally similar among adults aged 65–79 and among adults aged 80 and over, except for a significant association between income and mortality among older adults aged 65–79. A similar associational pattern was also found between women and men, except a persistent significant association between financial independence and mortality in men when family/social support and behavioral factors and baseline health were adjusted for (Table 4). In addition, we further found that the associations were more or less the same in older adults in urban and rural areas with an exception for the significant association between income and mortality in urban older adults (Table 5).

4. Discussion

Based on the largest nationally representative dataset of older adults in contemporary China, this study investigated the association between financial status and mortality in the later life. Key strengths of this study included the use of multiple indictors for financial status, a wide range of covariates, and robust analyses across age, sex, and residential locations. Consistent with findings from other populations (e.g., Arber et al., 2014; Kondo, Saito, & Hikichi, 2015; Szanton et al., 2008), our results showed that financial status is an important predictor of mortality in later life, regardless of age, sex, urban-rural residence, and the type of measurement for financial status.

In line with prior research on the dynamics of socioeconomic inequalities in health at older ages (House et al., 1994; O'Rand & Hamil-Luker, 2005; Dupre, 2007), findings from this study shed new light on these issues in the context of China. Several studies from the West demonstrate evidence for diminishing social gradients in health with advancing age (Arber et al., 2014; House et al., 2005; Mackenbach, Meerding, & Kunst, 2007; McDonough, Duncan, Williams, & House, 1997). Yet there is also increasing evidence to suggest that the social-gradient in health may persist (or widen) among the Chinese elderly population (Wen & Gu, 2011; Zhu & Xie, 2007). Our research builds on this body of work and provides new evidence that the social gradient—measured by objective and subjective financial status—in mortality persists among oldest-old adults in China.

The reasons for the strong association between financial status and mortality among older adults in China are multifactorial (Gu et al., 2016). Higher levels of financial standing may confer greater economic and material resources to purchase higher quality foods and nutrition, housing, and healthcare, as well as access to higher quality community facilities, infrastructure, and living environment (Arber et al., 2014; Bartley, 2004; Pampel, Krueger, & Denney, 2010; von Humboldt, 2016). Older adults with favorable financial status also may engage in better health behaviors and lifestyles—and enjoy larger social support networks—because they can afford participation in various social and leisure-time activities (Balia & Jones, 2008; Pampel et al., 2010). In addition, greater financial resources may provide better opportunities to develop better coping skills, limit exposure to financial hardship and stress (Chou & Chi, 2002), promote optimistic attitudes about the future and one's feelings of usefulness to others (Zhao, Sautter, Qiu, & Gu, 2017; Zhao, Dupre, Qiu, & Gu, 2017), and improve self-efficacy (see Balia & Jones, 2008; Gallo & Matthews, 2003; Lorant et al., 2003; Pampel et al., 2010). As a result, this constellation of financial-related resources are part of a wider repertoire of individual socioeconomic resources, may mitigate the progression of aging, functional decline, and ultimately, mortality.

In addition to these general mechanisms, the persistence of the social gradient in health among the Chinese oldest-old may be related to the context of China's transitional economy. Since the 1950's (and into

Table 2
Relative Risks of Mortality for Objective and Subjective Financial Status at Ages 65+, CLHLS 2005–2014.

	Model I	Model II	Model III	Model IV	Model V
Financial status					
Objective					
Financially independent (no)	0.76***	0.85***	0.87***	0.91**	0.88***
Owning 1+ house/apartment (no)	0.85***	0.93**	0.96+	0.99	0.99
Per capita household income ¥500–1,000 (< 500)	0.92	0.98	0.98	1.00	1.00
Per capita household income ¥1,000–3,000 (< 500)	0.96	1.04	1.03	1.06	1.06
Per capita household income ¥3,000–8,000 (< 500)	0.95	1.02	1.01	1.05	1.05
Per capita household income ¥8,000–15,000 (< 500)	0.92*	1.06	1.05	1.11*	1.11*
Per capita household income > =¥15,000 (< 500)	0.83*	0.99	0.98	1.03	1.03
Subjective					
Economic decision power on own things (no)	0.88***	0.76***	0.76***	0.84***	0.93**
Economic decision power on everything (no)	0.61***	0.57***	0.59***	0.69***	0.76***
Adequacy of financial resources (no)	0.97	1.00	0.99	1.00	1.02
Family economic condition, rich (fair/poor)	0.87***	0.90***	0.90***	0.93*	0.94*
Cultural					
Receiving money/foods from children (no)	1.00	0.96	0.97	0.99	1.00
Giving money/foods to children (no)	0.85***	0.89**	0.89*	0.95*	0.96+
Sociodemographic background					
Age	NA	1.07***	1.07***	1.06***	1.05***
Men (women)	NA	1.38***	1.42***	1.43***	1.49***
Urban (rural)	NA	1.00	1.00	0.98	0.96
Han (non-Han)	NA	1.07+	1.07+	1.04	0.97
1–6 years of schooling (0)	NA	0.99	1.00	1.04	1.05
7+ years of schooling (0)	NA	0.96	0.96	1.03	1.04
White collar (no)	NA	1.05	1.05	1.05	1.02
Covered by public medical care program (no)	NA	0.88***	0.88***	0.90**	0.91**
Family/social support					
Currently married (no)			0.84***	0.85***	0.85***
Coresidence with children (no)			1.03	1.01	0.99
Behaviors					
Leisure activity moderate level (low)				0.59***	0.70***
Leisure activity high level (low)				0.42***	0.52***
Health conditions					
ADL disabled (no)					1.50***
Cognitively impaired (no)					1.33***
Survey years					
Wave 2008 (2005)	NA	0.99	1.00	0.98	0.99
Wave 2011 (2005)	NA	0.97	0.98	0.97	0.95+

Note: Model I shows the estimates from eight separate models for the individual indicators of financial status. Separate estimates for the sociodemographic background and survey years are not reported for the eight models and are noted as not applicable (NA). Models II to Model V include all eight indicators for financial status. The categories in parentheses for each variable refer to its respective reference group.

+ $p < 0.1$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

the early 2000's), the eldercare system was established and matured though many reforms that have continued into recent years (Xiang et al., 2018). Under the long established system, urban residents, especially those who work for the public sector, receive favorable pensions, medical care, and many other resources for eldercare. In contrast, rural elders are institutionally disadvantaged, especially after early economic reforms when the management of health care was decentralized and regional disparities increased (Dong & Phillips, 2008; Zhang et al., 2017). In many ways, these regional, rural/urban, and public/non-public sectoral factors cemented the historical foundation for the health inequalities of current older-adults in China. To address these structural and intuitional mechanisms of health inequality, China has undergone recent reforms of its medical and pension systems, which will likely further impact the social disparities in health among Chinese older adults.

A notable finding from this study is that subjective indicators of financial status are generally more powerful in predicting mortality than objective indicators. This result is largely in concordant with other studies that have compared objective and subjective measures of financial resources (Kim et al., 2017; Nummela et al., 2007; Shaked et al., 2016; Xiang et al., 2018), and is consistent with previous studies focusing on the overall subjective socioeconomic status of adults at middle and older ages (Demakakos et al., 2008; Singh-Manous et al., 2005). The greater importance of subjective measures may be attributable to several factors. First, subjective measures involve perceptions of actual financial conditions—which may be shaped by a wide range of interconnected factors, such as worldly beliefs and attitudes, cultural norms, habits of consumption, daily needs, living arrangements, environments, social comparisons, and other psychosocial processes (Angel et al., 2003; Arber et al., 2014; Gasiorowska, 2014; Kim et al., 2017; Tang et al., 2004; Whelan & Maitre, 2013). Thus, subjective indicators may capture more comprehensive information than the objective measures (Arber et al., 2014; Zimmerman & Katon, 2005), especially with regard to psychosocial dimensions, which may have a more direct impact on health outcomes (Karraker, 2014; Sun et al., 2009; Whelan & Maitre, 2013). Low subjective levels of financial status are often associated with other negative dispositions—such as feeling helpless, useless, lacking control, and lacking self-confidence (Angel et al., 2003; Xiang et al., 2018); as well as greater levels of anxiety, stress, and depression (Arber et al., 2014; Bartley, 2004: Kahn & Fazio,

Table 3
Relative Risks of Mortality for Objective and Subjective Financial Status in Older Adults Aged 65–79 and 80 +, CLHLS 2005–2014.

	Ages 65–79 (10,369)			Ages 80 + (n = 23,596)		
	Model I	Model II	Model V	Model I	Model II	Model V
Financial status						
Objective						
Financially independent (no)	0.69***	0.80**	0.83*	0.80***	0.90**	0.94+
Owning 1 + house/apartment (no)	0.77***	0.86*	0.90	0.87***	0.94*	1.00
Per capita household income ¥500–1,000 (< 500)	0.74*	0.79*	0.81+	0.97	0.97	0.97
Per capita household income ¥1,000–3,000 (< 500)	0.85	0.95	0.97	1.04	1.03	1.03
Per capita household income ¥3,000–8,000 (< 500)	0.75**	0.85	0.88	1.02	1.04	1.07
Per capita household income ¥8,000–15,000 (< 500)	0.77+	0.93	0.98	1.03	1.05	1.07
Per capita household income > =¥15,000 (< 500)	0.65*	0.79	0.84	0.93	1.00	1.02
Subjective						
Economic decision power on own things (no)	1.14+	0.81**	0.96	0.83***	0.74***	0.91***
Economic decision power on everything (no)	0.63***	0.62***	0.81*	0.62***	0.57***	0.78***
Adequacy of financial resources (no)	0.80***	0.889	0.94	0.95***	1.01	1.04
Family economic condition, rich (fair/poor)	0.96	1.08	1.12	0.83***	0.87***	0.92**
Cultural						
Receiving money/foods from children (no)	1.09	1.03	1.05	0.98	0.97	1.02
Giving money/foods to children (no)	0.81**	0.87 +	0.93	0.85***	0.91***	0.97
Sociodemographic background						
Age	NA	1.09***	1.08***	NA	1.06***	1.04***
Men (women)	NA	1.64***	1.61***	NA	1.34***	1.44***
Urban (rural)	NA	1.04	1.01	NA	0.99	0.95*
Han (non-Han)	NA	1.04	1.00	NA	1.06	0.97
1–6 years of schooling (0)	NA	0.97	1.03	NA	1.00	1.06
7 + years of schooling (0)	NA	0.93	1.01	NA	1.01	1.08
White collar (no)	NA	1.16	1.14	NA	1.02	0.98
Covered by public medical care program (no)	NA	0.77*	0.89	NA	0.89**	0.92*
Family/social support						
Currently married (no)			1.00			0.87***
Coresidence with children (no)			1.07			1.01
Behaviors						
Leisure activity moderate level (low)			0.55***			0.71***
Leisure activity high level (low)			0.46***			0.55***
Health conditions						
ADL disabled (no)			2.12***			1.49***
Cognitively impaired (no)			1.44***			1.33***
Survey years						
Wave 2008 (2005)	NA	1.03	1.01	NA	0.98	0.98
Wave 2011 (2005)	NA	0.89	0.81*	NA	0.97	0.96

Note: Model I shows the estimates from eight separate models for the individual indicators of financial status. Separate estimates for the sociodemographic background and survey years are not reported for the eight models and are noted as not applicable (NA). Models II to Model V include all eight indicators for financial status. The categories in parentheses for each variable refer to its respective reference group.

+ $p < 0.1$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

2005). Accordingly, some studies have argued that subjective measures of financial status may better reflect the "real world" economic conditions faced by individuals beyond the conventional objective metrics of financial resources (Chan et al., 2002; Garner, Stinson, & Shipp, 1996).

Second, similar to the subjective measure of socioeconomic status that encompasses self-judgment about cumulative resources over one's lifetime (Demakakos et al., 2008), subjective measures of financial resources likely involve the self-perception of one's lifetime cumulated financial resources. If this is the case, subjective measures may better reflect the advantages and disadvantages of individuals over the life course, and in turn, better reflect health disparities among older adults in the population (O'Rand & Hamil-Luker, 2005). Third, it is also possible that in a collective society like China, and individual's health behaviors and health care decisions are made at the family level rather than at the personal level. Consequently, this dynamic would diminish the role of income in affecting health compared with the decision-making power in financial resources.

Fourth, some studies have shown that people tend to reduce their social participation when they perceive some degree of financial inadequacy (Arber et al., 2014; Bartley, 2004). Consequently, these individuals may have higher rates of social isolation, exclusion, and loneliness, which in turn, are among well-known predictors of mortality at old ages (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). Fifth, studies have shown that those with low-income do not always report financial strain (Angel et al., 2003); alternatively, others tend to report financial adequacy even when their income appears to be relatively low (Litwin & Sapir, 2009). Such scenarios further underscore the salience of subjective measures over objective measures in predicting risks of mortality.

Another noteworthy finding is that downward wealth transfers (from older parents to adult children) was associated with lower risks of mortality—when baseline health status was not taken into account. As such, studies have shown that providing financial and instrumental support to adult children helps to increase older adults' self-esteem and perceived value to other family members (Silverstein et al., 2006; Zhao, Dupre et al., 2017). Downward intergenerational transfers also may

Table 4
Relative Risks of Mortality for Objective and Subjective Financial Status in Older Men and Women, CLHLS 2005–2014.

	Women (n = 19,163)			Men (n = 14,802)		
	Model I	Model II	Model V	Model I	Model II	Model V
Financial status						
Objective						
Financially independent (no)	0.77***	0.87**	0.94	0.75***	0.84***	0.85***
Owning 1 + house/apartment (no)	0.86***	0.92**	0.95	0.85***	0.94*	1.01
Per capita household income ¥500–1,000 (< 500)	0.90	0.92+	0.95	0.95	0.98	0.96
Per capita household income ¥1,000–3,000 (< 500)	0.95	0.99	1.00	0.99	1.06	1.05
Per capita household income ¥3,000–8,000 (< 500)	0.95	1.00	1.03	0.96	1.06	1.05
Per capita household income ¥8,000–15,000 (< 500)	0.90+	0.98	1.03	0.94	1.11	1.11
Per capita household income > =¥15,000 (< 500)	0.78***	0.88+	0.91	0.90	1.13	1.13
Subjective						
Economic decision power on own things (no)	0.80***	0.73***	0.91**	0.99	0.80***	0.97
Economic decision power on everything (no)	0.63***	0.59**	0.79**	0.60***	0.57***	0.75***
Adequacy of financial resources (no)	0.98	1.01	1.04	0.96	0.99	1.03
Family economic condition, rich (fair/poor)	0.88***	0.90**	0.94	0.86***	0.88**	0.93*
Cultural						
Receiving money/foods from children (no)	0.98	0.97	1.04	1.02	0.97	1.01
Giving money/foods to children (no)	0.85***	0.83*	0.95	0.86***	0.91**	0.98
Sociodemographic background						
Age	NA	1.07***	1.05	NA	1.07***	1.05
Urban (rural)	NA	1.02	0.98	NA	0.97	0.95
Han (non-Han)	NA	1.11*	1.04	NA	1.00	0.92
1–6 years of schooling (0)	NA	0.99	1.06	NA	0.99	1.05
7 + years of schooling (0)	NA	0.92	1.00	NA	0.98	1.04
White collar (no)	NA	1.02	0.97	NA	1.07	1.06
Covered by public medical care program (no)	NA	0.91*	0.94+	NA	0.82***	0.87**
Family/social support						
Currently married (no)			0.83***			0.89**
Coresidence with children (no)			0.97			1.03
Behaviors						
Leisure activity moderate level (low)			0.70***			0.70***
Leisure activity high level (low)			0.48***			0.55***
Health conditions						
ADL disabled (no)			1.46***			1.57***
Cognitively impaired (no)			1.43***			1.23***
Survey years						
Wave 2008 (2005)	NA	0.99	1.00	NA	0.97	0.96
Wave 2011 (2005)	NA	0.96	0.96	NA	0.95	0.92

Note: Model I shows the estimates from eight separate models for the individual indicators of financial status. Separate estimates for the sociodemographic background and survey years are not reported for the eight models and are noted as not applicable (NA). Models II to Model V include all eight indicators for financial status. The categories in parentheses for each variable refer to its respective reference group.

+ $p < 0.1$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

help to reduce the risk of loneliness, social isolation, and unhealthy behaviors of older adults by enhancing social connections with family members (von Humboldt, 2016). Our findings provide new evidence to suggest that culturally-sensitive measures of financial status are important to the survival of older adults in China. Nevertheless, we encourage additional studies to further validate these findings and explore the potential pathways contributing to these associations.

Although the associational patterns of financial conditions with mortality at later life are generally similar for both the young-old and the oldest-old, and for women and men, and for rural and urban older adults, some distinction deserves a discussion. In comparison with women, the Chinese men are the main source of earning for the family, more educated, and more likely to have pensions or retirement wages (Zeng, Liu, & George, 2003). A man without a pension/retirement salary in China usually has a low status in family, and is more likely to have a depression (Feng, 2018). Therefore, for them, financial independence may matter to health more for older men than for older women.

Our findings have potentially important policy implications. China is among the large developing nations with the large elderly population in the world (United Nations, 2017). With under-developed system of care for older adults, many Chinese are now facing financial challenges with advancing age—especially in rural and economically disadvantaged areas. In the absence of a mature national pension system and a medical insurance scheme, many older adults in China are faced by low levels of income, few economic opportunities, and limited recourses to pay for medical bills in later life (Ding, 2013). Thus, our analyses of multiple measures of financial status provide new insights that may help to better target subgroups in the population who are at the greatest risks of financial hardship and excess mortality. These findings also have important implications for future research. As demonstrated here, objective measures alone may be inadequate in capturing important dimensions of financial status (Chan et al., 2002; Sun et al., 2009). Instead, we find that perceived reports of financial status provide a more comprehensive picture of the financial conditions of older adults (Krause, 1997). Therefore, future studies should consider including both objective and subjective measures when examining the complex relationship between financial resources and health outcomes (Arber et al., 2014; Bartley, 2004; Chan et al., 2002; Wilkinson & Pickett, 2010). However, more research is needed to determine which

Table 5
Adjusted Relative Risks of Mortality for Objective and Subjective Financial Status in Older Adults in Rural and Urban Areas, CLHLS 2005–2014.

	Rural (n = 20,206)			Urban (n = 13,759)		
	Model I	Model II	Model V	Model I	Model II	Model V
Financial status						
Objective						
Financially independent (no)	0.64***	0.72***	0.77***	0.85***	0.98	1.00
Owning 1 + house/apartment (no)	0.84***	0.92**	0.97	0.86***	0.94+	0.99
Per capita household income ¥500–1,000 (< 500)	0.95	0.98	0.99	0.80**	0.81**	0.82**
Per capita household income ¥1,000–3,000 (< 500)	0.97	1.03	1.05	0.87*	0.91+	0.91+
Per capita household income ¥3,000–8,000 (< 500)	0.97	1.05	1.08+	0.86**	0.90+	0.91
Per capita household income ¥8,000–15,000 (< 500)	1.00	1.12*	1.17**	0.81***	0.88+	0.89+
Per capita household income > =¥15,000 (< 500)	0.92	1.07	1.12	0.72***	0.84*	0.84*
Subjective						
Economic decision power on own things (no)	0.86***	0.76***	0.93**	0.91**	0.77***	0.93*
Economic decision power on everything (no)	0.64***	0.62***	0.81***	0.58***	0.53***	0.71***
Adequacy of financial resources (no)	0.98	0.99	1.01	0.96	1.01	1.07+
Family economic condition, rich (fair/poor)	0.90**	0.91*	0.94+	0.83***	0.87**	0.94
Cultural						
Receiving money/foods from children (no)	1.00	0.99	1.05	0.99	0.97	1.00
Giving money/foods to children (no)	0.85***	0.90**	0.95	0.85***	0.90***	0.98
Sociodemographic background						
Age	NA	1.07***	1.05***	NA	1.07***	1.05***
Men (women)	NA	1.43***	1.52***	NA	1.35***	1.49***
Han (non-Han)	NA	1.09*	0.98	NA	1.00	0.94
1–6 years of schooling (0)	NA	0.99	1.05	NA	0.98	1.04
7 + years of schooling (0)	NA	0.97	1.04	NA	0.98	1.06
White collar (no)	NA	1.11+	1.05	NA	1.00	0.99
Covered by public medical care program (no)	NA	0.86***	0.89**	NA	0.90 +	0.95
Family/social support						
Currently married (no)			0.88***			0.84***
Coresidence with children (no)			1.01			0.99
Behaviors						
Leisure activity moderate level (low)			0.70***			0.70***
Leisure activity high level (low)			0.55***			0.49***
Health conditions						
ADL disabled (no)			1.55***			1.42***
Cognitively impaired (no)			1.27***			1.44***
Survey years						
Wave 2008 (2005)	NA	1.02	1.02	NA	0.94+	0.93+
Wave 2011 (2005)	NA	0.94 +	0.90**	NA	0.99	0.99

Note: Model I shows the estimates from eight separate models for the individual indicators of financial status. Separate estimates for the sociodemographic background and survey years are not reported for the eight models and are noted as not applicable (NA). Models II to Model V include all eight indicators for financial status. The categories in parentheses for each variable refer to its respective reference group.

+ $p < 0.1$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

subjective or objective measures should be pursued to best measure financial resources among older adults in different contexts, including China.

We acknowledge several limitations of this study. First, due to the lack of available data, our analyses could not address the role of neighborhood conditions (e.g., poverty) that are closely linked with individual financial resources and also may affect feelings such as usefulness (Boardman & Robert, 2000; Pals & Kaplan, 2013). Second, we recognize that several psychometric scales that were recently developed to measure financial hardship, distress, and well-being (see Altice, Banegas, Tucker-Seeley, & Yabroff, 2017) were not included in the CLHLS. Therefore, future research may incorporate these scales to assess whether they provide greater predictive power over the measures used in the current study. Third, recent research has called for additional empirical efforts to examine discrepancies among objective and subjective measures of financial resources (e.g. Kim et al., 2017). We acknowledge these issues and encourage future research to further substantiate and extend the results of this analysis.

Ethics approval and consent to participate

No ethics approval was required for this study. The data were obtained from a publicly accessible database of the Chinese Longitudinal Healthy Longevity Survey at the National Archive of Computerized Data on Aging, University of Michigan (http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/36179) with a signed data use agreement.

Consent for publication

Not applicable.

Availability of data and materials

The CLHLS datasets are publicly available at the National Archive of Computerized Data on Aging, University of Michigan (http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/36179). Researchers can obtain these data after submitting a data use agreement to the CLHLS team.

Conflict of interests

No Conflict of interest.

Funding

The authors declare that they have no financial support for this study.

Authors' contributions

D.G. designed, drafted, and revised the text. D.G. also supervised the data analysis. R.W. drafted the literature review, revised the draft, and provided some interpretations for the results. Q.F and M.E.D. revise the draft, revised the paper, and interpreted the results. A.G., H.L., Y. Z. interpreted and revised manuscript. L.Q. prepared the data and performed the analyses. All authors read and approved the final version of the manuscript.

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

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