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Socioeconomic Status, Frailty, and Subjective Well-Being:

A Moderated Mediation Analysis in Elderly Chinese

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Abstract

The study examined the mechanisms underlying the link between socioeconomic status (SES) and subjective well-being (SWB), and explored the role of social activities using a representative sample of older adults (N=2,773) in Shanghai, China. Results show that frailty mediated the relationship between SES and SWB and social activities moderated the model, such that the mediation effect of frailty was significant only when social activities were lower. Moreover, the moderated mediation model was significant only for women, not for men. Findings highlight the importance of addressing frailty of older adults and promoting social activities (especially for elderly women) in future interventions.

Keywords: SES, frailty, subjective well-being, social activities, Chinese

Introduction

The subjective well-being (SWB) of older adults has received increasing attention in social science literature. SWB provides a meaningful and complementary measure of health of older adults, when compared to objective measures, as SWB involves older adults' subjective appraisals of their life in older age from their own perspective (Camfield and Skevington, 2008; Tian, 2016). SWB consists of three aspects: life satisfaction, the presence of positive affect, and the absence of negative affect. Of these, life satisfaction has been found to be the most stable dimension over the life course (Diener, 1984). Previous research has examined the role of socioeconomic status (SES), health, and social activities in SWB, however, how these factors interplay and function on SWB is largely unknown (Menec, 2003). Examination of individual role of SES, health, and social activities contributes to a limited understanding of the entire picture regarding antecedents of older adults' SWB. This study aims to integrate these factors in a single model and to explore the mechanisms underlying the relationship between SES and SWB in a representative sample of older adults in Shanghai, China, where population aging is increasingly severe.

Research shows that SES is a robust positive predictor of SWB in older adults (George, 2010; Pinquart and Sörensen, 2000). SES could contribute to SWB through several mechanisms of both external and internal resources, including but not limited to, a positive appraisal of one's life, better material circumstances, more adaptive coping processes, and better health status (George, 2010; Pinquart and Sörensen,

2000). Of these mechanisms, there is evidence implying that physical health might be the most important pathway linking SES to SWB (Gwozdz and Sousa-Poza, 2010; Simone and Haas, 2013; Smith et al., 2002).

Previous studies show that various health indicators were associated with SWB, including chronic illness (Smith et al., 2002), self-perceived health (Gwozdz and Sousa-Poza, 2010), and activities of daily living (ADL) dependency (Kunzmann et al., 2000). Kirby et al. (2004) moved beyond each single health indicator and examined the effects of 16 variables in the domains of physical, nutritive, cognitive, and sensory functioning, or frailty on SWB. They found that frailty had a negative impact on SWB in older adults, and this impact was stronger compared to those observed in other studies using individual health indicators (Kirby et al., 2004). This highlights the advantages of examining frailty more closely when considering the relationship between physical health and SWB of older adults.

Frailty is a physiological state characterized by dysregulation in multiple bodily systems and increased vulnerability to adverse outcomes, e.g., falls, hospitalization, and even mortality (Mitnitski et al., 2001; Rockwood and Mitnitski, 2007). Among the various operationalizations for frailty, the frailty index (FI), which is based on a deficit accumulation approach by representing the proportion of present health deficits to the total number of deficits is widely used (Mitnitski et al., 2001). FI incorporates a broad range of psychological, physiological, and functional variables, and is a promising proxy for biological aging (Rockwood and Mitnitski, 2007; Searle et al., 2008). The individual health measures used in previous studies only capture either

objective or subjective health status. Nevertheless, FI combines both subjective and objective components and hence may be more comprehensive in capturing various indicators of physical health.

Furthermore, research shows that lower SES is associated with more chronic illnesses and disability (Taylor, 2010), poorer cognitive function (Mani et al., 2013), and poorer self-rated health (Foraker et al, 2011). In addition to these findings on individual health indicators, higher SES was found to be associated with lower frailty (Gu et al., 2009). Considering that frailty is negatively associated with SWB (Kirby et al., 2004; Simone and Hass, 2013), we propose that frailty will mediate the relationship between SES and SWB, such that higher SES will be associated with lower frailty, and lower frailty will be associated with higher SWB.

In addition to the role of SES and frailty in older adults' SWB, social activities is also a topic that has received heated discussion in the literature. Social activities participation is an important component of the successful aging model proposed by Rowe and Kahn (1987). In addition, as suggested by activity theory (Havighurst, 1961), social activities offer older adults a great opportunity to carry out meaningful social roles and lead to social integration through activities embedded within social relationships and social interaction with others, which in turn could help form and sustain individuals' sense of meaning, identity, and personal mastery (Thoits, 1983). Moreover, remaining active in social activities and social interaction could greatly benefit older adults by conferring a number of benefits, including physiological (e.g., immune function), psychological (e.g., sense of belonging, purpose of life, access to

social support, and active coping strategies), and health behavioral domains (Adams, Leibbrandt, Moon, 2011; Glass et al., 2006; Menec, 2003; Umberson et al., 2010; Zhang et al., 2015). For instance, Zhang et al. (2015) used several social activities (e.g., chatting with others, dancing, playing pokers) as a social activity index and found that social activities confer health and psychological benefits. Nevertheless, people will experience stress if they are confronted with loss of resources, a threat of loss of resources, or failure to gain resources as suggested by the conservation of resource model (Hobfoll, 1989). Those with lower SES are often faced with a lack of resources or barriers to achievement of life goals, thus they are more likely to feel stressful. However, social activities could be especially protective against the adverse role of lower SES in health and subjective well-being, as social activities could provide multiple resources for individuals to better cope with the stress due to the above mentioned beneficial effects. In other words, the benefits associated with social activities could help compensate for the lack of resources due to lower SES (O'Brien, 2012). Thus, we expect that social activities would moderate the relationship between SES and FI, and the link between SES and SWB.

Moreover, literature shows that there are sex differences in the role of social activities in health and subjective well-being. Gendered social norms encourage the view that women are more social and could obtain more emotional support and other benefits from social activities than men (Fuhrer and Standfeld, 2002). Indeed, in the context of China, elderly women are more likely than men to participate in square dancing and other forms of social activities that are collective in nature (Zhang and

Chen, 2014). In addition, empirical research shows that participation in more social activities is associated with increased self-reported health and psychological well-being only for females, but not for males in a sample of older adults in Shanghai (Zhang et al., 2015). Thus, we also examined whether there would be sex differences in the moderated mediation model.

The Present Study

We focused on older adults from Shanghai, China in this study. China represents the largest elderly population in the world and Shanghai has the nation's largest proportion of older adults. According to the latest statistics (Shanghai Research Center on Aging, 2016), the percentage of its elderly population (60+) reached 30.2% by 2015, which is almost twice higher than that of the whole nation. In this sense, Shanghai becomes an ideal place to study older adults' SWB, since research findings could provide meaningful directions for urgently-needed interventions and policy-making.

The current study aims to examine the mechanisms underlying the link between SES and SWB. More specifically, we examined whether frailty would mediate the relationship between SES and SWB. Given the benefits associated with social activities, we also examined whether social activities would moderate the association between SES and SWB, and whether social activities would moderate the mediation model. We hypothesize that FI would mediate the relationship between SES and SWB (H1), that social activities buffer the relationship between lower SES and SWB (H2), and that social activities would moderate the mediation model, such that the

mediation role of frailty would be stronger among older adults with lower social activities than those with higher social activities (H3). Moreover, considering the sex differences in the effects of social activities discussed above (Zhang et al., 2015), we also examined whether the findings would differ as a function of sex.

Methods

Participants

We used the 2013 Survey of the Shanghai Elderly Life and Opinion, which was conducted by the Shanghai Research Center on Aging (SRCA) via in-home interviews using questionnaires by trained staff of SRCA. The survey used a multistage cluster sampling design to reflect the age, gender, and rural/urban structure of the local elderly population (see Feng et al., 2013, for detailed information about the survey). A total of 3500 respondents aged 50 and above participated in the survey. The final valid sample size was 3418. Our current study focused on the elderly aged 60 and above with a sample of $N=2773$. Informed consent was obtained from each respondent. Ethics approval was obtained from the University.

Measures

Subjective Well-Being (SWB). SWB was operationalized as life satisfaction in this study (Gwozdz and Sousa-Poza, 2010), which was assessed by 13 items in various life domains. For example, participants were asked "How satisfied are you with your family relationships?" Each item was rated on a 5-point Likert scale ranging from 1=*extremely satisfied* to 5=*extremely unsatisfied*. Each item was reversely coded and all the items were summed, such that the composite scores represent participants'

life satisfaction, with higher scores denoting higher levels of life satisfaction. The reliability of the scale in this study was Cronbach's $\alpha = .88$.

Frailty Index(FI). We used 52 indicators in various domains to construct FI, including self-reported health, cognitive functioning, disability in activities of daily living (ADL) and instrumental ADL, and chronic illnesses, and these indicators are similar to those used in previous research (Gu et al., 2009). Each binary item was coded as 1 when a deficit was present and 0 when a deficit was absent; the options to continuous variables were mapped onto the interval between 0 (if a deficit was absent) and 1 (if a deficit was present) (Searle et al., 2008). For example, the options to the question "How often did you experience headache in the past 3 months?" were based on a 5-likert scale from 1=*never*, 3=*sometimes* to 5=*always*. As such, *never* was coded as 0, *sometimes* as 0.5, and *always* as 1. The final value of FI was obtained by dividing the sum of the present health deficits of a given respondent by the number of the total health deficits under study (i.e., 52). Thus, FI scores ranged from 0 to 1, with higher scores indicating higher levels of frailty.

Socioeconomic Status(SES). Similar to FI, we constructed a socioeconomic vulnerability index (SEVI) from 4 indicators, including education, occupation, family economic status, and access to health care services following the deficit accumulation model proposed by Andrew and colleagues to assess social vulnerability (Andrew et al., 2008). For example, the options to the question "How would you describe your family economic status?" were based on a 5-likert scale from 1=*very rich*, 3=*so so* to 5=*very poor*. As such, *very rich* was coded as 0, *soso* as 0.5, and *very poor* as 1. The

final value of SEVI was obtained by summing up all values of deficits and dividing by 4. The SEVI scores ranged from 0 to 1, with higher scores denoting lower levels of socioeconomic status.

Social Activities. Social activities was measured by involvement in five social-related activities, such as playing chess or poker, singing or dancing, travelling, and chatting with others (Feng et al., 2011; Zhang et al., 2015). Each respondent was asked whether he or she participated in the following activities and each item was rated yes or no. Responses on these five items were added to form a composite score, with higher scores denoting higher level of social activities.

Covariates. Basic demographics including single year of age, sex and urban/rural residence, marital status, and living arrangement were treated as covariates, as previous studies show that these variables were related to subjective well-being, frailty, and social vulnerability (Andrew et al., 2008; Diener et al., 1999; Gu et al., 2009).

Methods of Analysis

Data analyses were conducted using SPSS version 20. The models were tested using bootstrapping approach with Hayes' (2013) PROCESS macro. The bootstrap confidence interval for the indirect effect is estimated based on 10,000 bootstrap samples, and is bias-corrected. We first examined the mediation model:

SES--FI--SWB while controlling for the covariates. Then we further tested the moderating model in which social activities moderated the relationship between SES and SWB, and the moderated mediation model to see whether social activities

moderated the mediation model. Given the possible sex differences in the effects of social activities, we also examined whether the moderated mediation model holds true for both women and men.

Results

Sample descriptions

As shown in Table 1, the mean age of the participants was 71.38 years old ($SD=8.74$), and males accounted for 47.02% of the sample. The majority of the participants were married (75.40%), living in the urban areas (86.90%), living with their family (85.30%), received 1+year of schooling (87.3%), and had access to health care services (93.60%). The distribution of these factors by sex is also shown in Table 1. The means of FI and SEVI in women were higher than those in men, and the mean of SWB was lower in women than in men. The distributions of the demographic factors (marital status, education, occupation, and living arrangement) varied between the two sex groups, except for urban/rural residency status and access to health care services.

[Insert Table 1 about here]

Bivariate correlations among the key variables show that level of social activities was negatively associated with SEVI ($\gamma = -.04, p = .02$) and FI ($\gamma = -.14, p < .001$), but was positively related to SWB ($\gamma = .12, p < .001$). SEVI was positively related to FI ($\gamma = .25, p < .001$), and negatively related to SWB ($\gamma = -.24, p < .001$). FI was negatively associated with SWB ($\gamma = -.45, p < .001$).

Results of mediation analysis

Results using the bootstrap approach show that the total and the direct effect of SEVI on SWB were significant [$B = -14.57$, standard error(SE)=1.46, $p < .001$; $B = -10.69$, SE=1.34, $p < .001$, respectively]. The indirect effect of SEVI on SWB via FI was significant [$B = -3.88$, SE=0.71, 95% confidence interval(CI) = (-5.32,-2.49), excluding zero]. More specifically, SEVI was positively associated with FI (a path: $B = 0.16$, $p < .001$), and FI in turn was negatively associated with SWB (b path: $B = -24.66$, $p < .001$). The whole model was significant, $R^2 = 0.26$, $F(8,2764) = 122.28$, $p < .001$. The findings suggest that FI mediated the relationship between SEVI and SWB.

Results of moderation and moderated mediation analysis

We further examined whether social activities moderated the relationship between SES and SWB and whether social activities moderated the above mediation model. Results show that social activities didn't significantly moderate the relationship between SES and SWB ($B = 0.22$, SE=1.66, ns). However, the moderated mediation model in which social activities moderated the above mediation model was significant. In particular, the indirect effect of SEVI on SWB via FI was significant only when social activities were lower, but not significant when social activities were higher. The index of moderated mediation was 2.36, 95% CI:[0.58,4.18], excluding zero. These findings suggest that higher social activities could attenuate the mediation effect of FI on the relationship between SEVI and SWB. In other words, SEVI could decrease SWB via FI only when older adults' social activities were lower. Overall the moderated mediation model was significant, $R^2 = 0.26$, $F(9,2763) = 108.65$, $p < .001$.

Results of moderated mediation analysis by sex

Building on our previous analysis, we took a step further and examined the significant moderated mediation model by sex (Table 2). Results show a significant moderated mediation model in women, but not in men. Among women, the indirect effect of SEVI on SWB via frailty was significant only when social activities were lower, whereas such indirect effect was not significant when social activities were higher. The index of moderated mediation was 3.19, and the 95% CI:[1.04,5.41] excluded zero. Among men, the moderated mediation model was not significant. The indirect effect of SEVI on SWB via FI remained significant regardless the level of social activities. The index of moderated mediation was 0.01, and the 95% CI:[-3.01,3.02] included zero.

[Insert Table 2 about here]

Discussion

Despite a large number of studies examining the roles of SES, health, and social activities in SWB, how these factors inter-play on SWB is rarely studied. Our study contributes to the literature by integrating these factors in a single model and providing a better understanding of the mechanisms on how these factors operate together in affecting SWB. The current study extended previous research by examining the mediating role of frailty underlying the link between SES and SWB, and exploring the moderating role of social activities in a representative sample of older adults in Shanghai, China. Results showed that frailty mediated the relationship between SES and SWB (H1 supported), and this replicated the health pathway linking

SES to SWB in previous research. Moreover, this mediation model was significant only when social activities were lower, such that higher social activities attenuated the mediating role of frailty in the relationship between SES and SWB (H3 supported), although such relationship was significant only for women.

This study has several strengths. First, prior studies on SES often use income, occupation, or education as indicators and examine their individual effects on health and SWB (Hsu et al., 2015; Wu and Rudkin, 2000). However, in this study we followed the cumulative approach when constructing SEVI (Andrew et al., 2008). This approach has several advantages, including the multidimensional nature of the construct that overcomes the difficulties in modeling a number of components (Andrew et al., 2008), and inclusion of access to health care services, which is an issue that is especially important in the context of China (Gu et al., 2009).

Second, our study extended previous evidence that health is an important mechanism linking SES to SWB by using a more comprehensive measure of health: Frailty. As a departure from prior research using individual health indicators, FI represents the effect of accumulated health deficits over the life course and includes both subjective and objective measures to indicate overall health status for older adults (Gu et al., 2009; Mitnitski et al., 2001). A frailty index could detect "mild-effect" health traits that would lose their predictive power when examined individually (Mitnitski et al., 2001). Our findings also suggest that SES is associated with older adults' overall health status above and beyond specific health indicators. Moreover, the mediation model highlights the importance of targeting frailty in older

adults in health care provision and in policy-making. The challenge of an increasing aging population is to achieve a healthier and happier survival at older ages, and to identify, delay, reverse frailty could effectively promote older adults' SWB (Lee et al., 2012). However, there is still a long way to go to monitor and manage older adults' frailty, given that the current health care system in China is largely focused on providing care for single-system illnesses. Any transformation of the current medical system may need to incorporate the increasing levels of frailty and provide more comprehensive geriatric care.

Furthermore, we found that social activities moderated the mediation role of frailty in the relationship between SES and SWB. Higher social activities decreased the association between lower SES and both physical and psychological health, and this is consistent with previous research demonstrating the health benefits of participating in social activities (Bennett et al., 2005; Glass et al., 2006; Menec, 2003; Umberson et al., 2010; Zhang et al., 2015). Social activities are beneficial to older adults' health and could provide resources for coping and act as a buffer against life adversity or sources of chronic stress such as lower SES (O'Brien, 2012; Zhang et al., 2015). However, the moderating role of social activities in the relationship between SES and SWB was not significant (H2 not supported). Perhaps social activities may play a more direct role between SES and FI than between SES and SWB, though these possible alternative explanations need more research.

Interestingly, we also found sex differences, that is, the moderated mediation model was significant for women, but not for men. There are several possible

explanations for this sex difference. First, as aforementioned, women are usually more social and could obtain more benefits from social activities than men as suggested by gendered social norms (Fuhrer and Standfeld, 2002). Second, compared to men, women usually experience lower SES and are more disadvantaged in health than men (Andrew et al., 2008; Gu et al., 2009). This may lead to a stronger moderating effect of social activities for women due to the more benefits derived from social activities than for men. Actually, the findings in our study are in line with previous research showing sex differences in the role of social activities on health (O'Brien, 2012; Zhang et al., 2015). More importantly, the level of social activities the elderly participate in is a modifiable factor and it is meaningful to consider for promoting older adults' involvement in social activities (Adams et al., 2011; Glass et al., 2006; Menec, 2003; Umberson et al., 2010). For instance, policies and interventions could create more opportunities for meaningful social engagement, establish a more age-friendly community, and provide more infrastructure for social activities with an ultimate goal of promoting their SWB (World Health Organization, 2007).

We note that there are several limitations of this study. First, the cross-sectional nature of the study cannot substantiate causality among the variables. Future research with a longitudinal design across the life-course is needed. Second, this study focused on the elderly in Shanghai, China, and the findings of the study might not be generalized to other populations in other cities of China or other cultural contexts. Third, social activities were measured using the composite score of several items with binary options, which didn't provide information on the frequency, the quality, and the

meaningfulness of social activities. For instance, previous research shows that the frequency and time commitment of social engagement also plays a role in health and SWB (Baker et al., 2005). In addition, the social activities included in this study were not a comprehensive list and they may also include other activities, e.g., visiting family or friends (Brajša-Žganec et al., 2011). It would benefit in future research to incorporate more detailed information (e.g., frequency and quality of social activities) and cover a wider range of social activities that might also be relevant to the elderly.

Conclusion

Despite these limitations, our study found that frailty mediated the relationship between SES and SWB, and social activities moderated the mediation model, such that the mediation model was significant only when social activities were lower. In addition, the tested moderated mediation model was significant only for women, but not for men. These findings highlight the importance of conducting comprehensive geriatric assessment to measure frailty for older adults in the clinical practice in China, which could enable a better understanding of older adults' health status. Moreover, our research suggest that it is meaningful to facilitate and create more opportunities for older adults' social activities by providing more infrastructures, especially for the benefit of elderly Chinese women.

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Table 1. Descriptive Statistics for the Key Variables: Total Sample and by Sex

	Total (N=2773)	Women (N=1469)	Men (N=1304)	Differences
Mean of Age (SD)	71.38(8.74)	72.18(9.05)	70.48(8.29)	$p < .001^a$
Mean of Frailty index (SD)	0.19(0.14)	0.21(0.14)	0.17(0.13)	$p < .001^a$
Mean of SEVI (SD)	0.41(0.10)	0.43(0.12)	0.38(0.08)	$p < .001^a$
Mean of SWB	49.99(7.63)	49.56(7.53)	50.48(7.73)	$p < .01^a$
Mean of family economic status	3.09(0.61)	3.06(0.57)	3.13(0.65)	$p < .05^a$
Marital status				
Married	75.40%	65.10%	87.00%	$p < .001^b$
Others	24.60%	34.90%	13.00%	
Urban/rural residence				
Urban	86.90%	86.20%	87.70%	ns^b
Rural	13.10%	13.80%	12.30%	
Education				
No schooling	12.70%	20.10%	4.20%	$p < .001^b$
1-8 year Schooling	52.70%	53.00%	52.40%	
9+ year schooling	34.60%	26.80%	43.40%	
Occupation				
White collar	23.70%	19.10%	28.80%	$p < .001^b$
Others	76.30%	80.90%	71.20%	
Living arrangement				
Living with family	85.30%	81.90%	89.00%	$p < .001^b$
Others	14.70%	18.10%	11.00%	
Access to health care services				
Yes	93.60%	94.10%	97.70%	ns^b
No	6.40%	5.90%	2.30%	

Note. ^a p values were obtained from t-test, ^b p values were obtained from the chi-square test.

Table 2. Bootstrapped indirect effects of SEVI on SWB via frailty index at specific values of social activities

Mediator	Moderator	Total sample				Women				Men			
		Boot	Boot	Boot		Boot	Boot	Boot		Boot	Boot	Boot	
		B	SE	LLCI	ULCI	B	SE	LLCI	ULCI	B	SE	LLCI	ULCI
	Social activities												
Frailty index	-1 SD	-5.64	1.09	-7.83	-3.57	-4.88	1.36	-7.66	-2.35	-7.00	1.74	-10.57	-3.71
	0 ^a	-3.73	0.72	-5.16	-2.34	-2.25	0.86	-3.97	-0.58	-6.99	1.30	-9.62	-4.46
	+1 SD	-1.78	0.98	-3.72	0.13	0.38	1.15	-1.87	2.62	-6.98	1.85	-10.69	-3.44

Note: N = 10000 Bootstrapping resamples; ^aSocial activities has been centered around the mean.

SEVI=socioeconomic vulnerability index, SWB=subjective well-being. B=unstandardized coefficient, SE=standard error, LLCI and

ULCI=lower level and upper level of the bias-corrected 95% bootstrap confidence interval. SD=standard deviation.