ROLE OF FAMILY RELATIONSHIP IN ASSOCIATION BETWEEN LOWER EXTREMITY MOBILITY LIMITATION AND DEPRESSIVE SYMPTOMS AMONG CHINESE ELDERLY

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Abstract. Lower extremity mobility limitation, a common mild physical impairment among the elderly, is commonly associated with depressive symptoms. The present study used a stress-buffering model to explore the extent to which family relationships buffer effects of physical impairments on older adults' mental health. Both univariate and multivariate analyses were performed to examine gender difference in the buffering role of family relationships obtained from the 2015 China Health and Retirement Longitudinal Study (CHARLS) of respondents ≥60 years of age. Among elderly married women, spousal relationship satisfaction had significant buffering effect on depressive symptoms; however, children relationship satisfaction aggravated the detrimental effects of physical limitation on psychological health. No buffering effect of family relation was found among elderly married men. In conclusion, gender difference is evident in the buffering effect of family relationship among older married couples. Thus, it is important for health care professionals to consider the dynamics of family relationship and gender-specific features to develop effective strategies to promote health of physically impaired elderly men and women.

Keywords: buffering effect, depressive symptom, family relationship, lower extremity mobility limitation

INTRODUCTION

Physical limitations measured by activities of daily living (ADL) or instrumental activities of daily living (IADL) represent relatively severe physical limitations (Tinetti *et al*, 2005; den Ouden *et al*, 2011). Mild or moderate physical limitations measured by mobility limitations are more common and usually preceed IADL or ADL limitations among elderly adults (Fried *et al*, 1994; Onder *et al*, 2005). Mild physical impairments, such as lower extremity mobility (LEM) limitations, are associated with depressive symptoms (Silva *et al*, 2015).

Depression in older adults is associated with disability, increased mortality and poorer outcome from physical illness (Rodda *et al*, 2011), thereby imposing substantial economic burden on patients, their families and society. In

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China the total cost of depression in 2002 is USD 6,264 million (Hu *et al*, 2007), and depression related medical expenditure contributed to 14.7% of total personal expected medical spending (Hsieh and Qin, 2018).

According to a stress buffering model, adverse consequences of stressors, such as poor physical health on mental health, can be eliminated or reduced through social support (Cohen and Wills, 1985). Social support buffers against depression in a variety of contexts, for example, family support moderates the association between stress and depressive symptoms among Mexican university applicants (Raffaelli *et al*, 2013). Because family is one of the most important sources of social support for older adults, a meta-analysis found marriage quality, not marriage status, importantly affects health (Robles *et al*, 2014), in particular a significant correlation with spousal support (Dehle *et al*, 2001) and couples with satisfactory relationship tend to provide more care to their spouses (Collins and Feeney, 2000) and have better health (Holt-Lunstad *et al*, 2008).

Children also play an important role in family relationship and thus may affect health of the elderly. For example, the elderly without children in rural China have significantly higher level of depression than those with children (Guo, 2014). Having children is correlated with better mental health among Chinese elderly, although this correlation is mediated by economic and utilitarian factors (Wu and Penning, 2019). However, these findings are not conclusive; for example, a study reported there is no significant link between having children and elders' well-being (Hank and Wagner, 2013), while other studies showed a quality relationship of elderly parents with their children is more important, with poor quality relationship having a negatively correlation with elderly parents' psychological well-being (Reczek and Zhang, 2016).

Although there are studies among Chinese older adults on the link between ADL or IADL limitations and depression (Li *et al*, 2012), or between family support and depression (Sun, 2004), there is no study exploring gender difference in family (including both spouse and children) between relation of common mild physical impairments (LEM limitations) and depression in China.Gender might play several critical roles in providing support when family members suffer from physical impairments. Firstly, gender difference is significant in prevalence of physical limitations; women tend to have more mobility limitations than their counterparts (Gordon *et al*, 2017). Secondly, there is gender difference in the role of care giving; traditional Confucian tenets stipulate care-giving is mainly women's responsibility (Park and Chesla, 2007), and compared with married women, married men are less likely to provide emotional support even when their spouses are inflicted by physical impairments (Thomeer *et al*, 2015). Here, a stress-buffering model was employed to examine gender difference in the role of family relationship on the association between LEM limitations and depression in a population of older adults ≥60 years of age in PR China.

MATERIALS AND METHODS

Participants recruitment

This study was based on the 2015 China Health and Retirement Longitudinal Study (CHARLS) which covered 21,097 respondents from 12,400 households (Zhao *et al*, 2014). Because most ADL-

disabled respondents have such serious physical disablements that they are not able to complete the interview by themselves, the interviews of these ADL-disabled respondents were conducted by proxies, and, thus, the Center for Epidemiological Studies Depression (CESD) scores of these ADL-disabled respondents were not available and were excluded and those who were non-ADL disabled but might still have LEM limitations were included.Respondents are classified as ADL-disabled if they have difficulty in any of these three items (bathing, dressing and eating). For the purposes of this study, respondents ≥60 years of age, who were non-ADL disabled, currently married and had at least one child at the time of survey and complete data regarding themselves and their spouses were included, constituting 1,414 couples, of whom 928 and 486 are rural and urban residents respectively.

The research protocol was approved by the Biomedical Ethics Review Committee of Peking University (IRB00001052-11,015) with annual update. All participants signed written informed consent forms upon the recruitment process.

Variables evaluated

Depressive symptoms were measured using a four-category response 10-item form (CESD-10), one of the most commonly used short forms of the 20-item CES-D (Onder *et al*, 2005).Total score of CESD-10 ranges 0-30, with higher score indicating more severe depressive symptoms.Quality of spousal and children relationships were measured based on degree of satisfaction. In CHALRS each respondent is asked the following two questions: "How satisfied are you with your relationship with spouse?" and "How satisfied are you with your relationship with children?". Satisfaction scores range from 1 (completely satisfied) to 5 (not at all satisfied). A binary variable is created to indicate whether the respondent has spousal satisfaction: 1 (completely satisfied/very satisfied) and 0 (satisfied/less satisfied). A similar binary variable was constructed for children relationship satisfaction.

LEM difficulties are measured using following four parameters: 1, ability to walk 100 m; 2, ability to walk up several flights of stairs; 3, ability to get up unaided from a chair; and 4, ability to stoop, keel or couch.Responses to each parameter were scored 0 (without any difficulty) or 1 (with difficulty) and summed to produce LEM limitation scores (ranging from 0 to 4, with higher score signifying more severe mobility limitation).

Memory is measured using sum of a 10-word immediate recall and delayed recall scores (ranging 0-20, with higher score indicating better memory performance). Other variables were self-evaluated health (SEH) (1, not good to 5, excellent), body mass index [BMI, weight (kg)/height(m^2)], and number of chronic conditions (ranging 0-13).

The study collected demographic characteristics and socioeconomic status [age, gender, community type (rural or urban), number of children, education level (0, middle school and below; 1, high/vocational school; and 2, college and above), net household wealth (sum of household equities minus debts), pension income (sum of income from public and private pension programs), and medical insurance (yes or no) as well as lifestyle variables related to depression [alcohol drinking (yes or no), smoking (yes or no) and social activities (such as interacting with friends, doing voluntary or charity work, or going to a sport or social club) (yes or no)].

Analytical methods

Univariate analysis was carried out between all variables and gender difference using t-test (for continuous variables) or chi-square test (for categorical variables). Separate multivariate analysis was carried out for male and female respondents.In order to examine stress-buffering effects of family satisfaction, two product terms (spousal relationship satisfaction x LEM limitation, and children relationship satisfaction x LEM limitation) were added to the model. All analyses were performed using STATA/MP 15.0 (STATA Corp, College Station, TX). Statistically significant difference is accepted when p-value < 0.05.

RESULTS

The average CESD-10 score of married men were approximately 25% lower than that of their spouses, indicating a much less severe depressive symptom for married men (Table 1). Married men were also in a much better physical health condition, as indicated by a 35% lower average LEM limitation score compared to that of their spouses.There is significantly higher rate of satisfaction with spousal relationship among married men but lower rate of satisfaction with children relationship. Compared to their spouses, married men had less chronic conditions and lower BMI. No differences of self-reported health and measured memory status were found between genders.

On average, married men were older than their spouse, same percent as spouse had medical insurance and participated in social activities, were less likely to have education of middle school and below but more likely to have education of high/vocational school or college and above, had income two times that of their spouse, and were more likely to be drinkers or smokers (Table 1).

Multivariate regression analysis (independent association) on independent variables (LEM limitation, spousal relationship satisfaction, children relationship satisfaction, and interaction between former and latter two variables) and on covariates (BMI, SEH, number of chronic conditions, age, gender, community type, number of children, education level, net household wealth, pension income, medical insurance, alcohol drinking, smoking and social activities) revealed significant association with dependent variable (CESD-10 score) in at least one of these two groups of variables (Table 2). Spousal relationship satisfaction, children relationship satisfaction, interaction in terms of spousal relationship satisfaction and children relationship satisfaction with LEM limitation were consistently significant in the regression analysis even if they are not significantly associated in univariate (dependent) analysis.

LEM limitation was associated with significantly higher level of depressive symptoms among both married men and women (Table 2). Spousal relationship satisfaction coefficients are not statistically significant, but children relationship satisfaction coefficients are and negatively associated with poor psychological health in Model 1 where covariates were used to evaluate the moderation effects on the association between mobility limitation and depression among older married men (b = -1.09, p-value <0.01), indicating high children relationship satisfaction was linked with significantly lower level of depression among married men. However, similar significant association of children relationship satisfaction with depressive symptoms were not observed for women in Model 2.

Table 1
Demographic and socioeconomic profiles and family relationships of participants based on the China Health and Retirement Longitudinal Study (2015).

Variable	Married male	Married female
CESD-10 score (range = 0-30), Mean (SD)	6 (5)	9 (6)**
LEM limitation (range = 0-4), Mean (SD)	0.8 (1.0)	1.2 (1.2)**
Spousal relationship satisfaction		
Yes (%)	54	44**
Children relationship satisfaction		
Yes (%)	57	64**
Self-evaluated health status (range = 1-5), Mean (SD)	2.2 (0.9)	2.2 (0.9)
Memory status (range = 0-20), Mean (SD)	6 (3)	6 (4)
Chronic condition (range = 0-13), Mean (SD)	2.1 (1.6)	2.3 (1.67)*
BMI (range = 15- 62 kg/m^2), Mean (SD)	23 (4)	24 (4)**
Age (range = 60-89 years), Mean (SD)	68 (5)	66 (5)**
Number of children living at home, Mean (SD)	3 (1)	3 (1)
Community type		
Urban (%)	34	34
Rural (%)	66	66
Education (%)		
Middle school and below	90	97**
High/vocational school	8	2**
College and above	2	<0.5**
Total household wealth (10,000 ¥), Mean (SD)	22 (117)	23 (117)
Pension income (10,000 ¥), Mean (SD)	0.7 (1.7)	0.3 (0.8)**
Medical insurance		
Yes (%)	94	92
Alcohol drinking		
Yes (%)	55	12**
Smoking		
Yes (%)	47	5**
Social activities		
Yes (%)	46	47

*p-value < 0.05; **p-value < 0.01; BMI: body mass index; CESD-10: Center for Epidemiological Studies Depression 10-item test; LEM: lower extremity limitations

In Model 1, interaction between spousal relationship satisfaction and LEM limitation or interaction between children relationship satisfaction and LEM limitation with depressive symptoms was not significant.These findings indicate although LEM limitation had significant positive effect on depressive symptoms, this effect was not moderated by spousal or children relationship satisfaction among older married males.

Spousal relationship satisfaction moderated the effect of LEM limitation on psychological health among married elderly women. Interaction between spousal relationship satisfaction and LEM limitation for women is significant (Table 2), indicating, in general, spousal satisfaction moderated association between LEM limitation and CESD-10 score.The buffering effect of spousal support on CESD-10 score increased with the rise of LEM limitation severity. When LEM limitation was at the severest level (4), association between LEM limitation and CESD-10 score among women without spousal relationship satisfaction was 14.21 (p-value <0.001), while the association decreased to 11.44 (p-value <0.001) among women with spousal relationship satisfaction, and this reduction in CESD-10 score is substantial and significant (-2.77, p-value <0.001) (Fig 2). On the other hand, having spousal relationship satisfaction was associated with a smaller decline (-1.21, p-value <0.001) in CESD-10 score when LEM was much less severe (level = 1).

Table 2
Multivariate regression analysis of demographic and socioeconomic profiles and family relationships of participants based on the China Health and Retirement Longitudinal Study (2015).

Variable	Married male Model 1 Beta (SD)	Married female Model 2 Beta (SD)
LEM limitation	1.57 (0.28)***	1.54 (0.29)***
Spousal relationship satisfaction	-0.48 (0.51)	-0.20 (0.64)
Spousal relationship satisfaction x LEM limitation	-0.40 (0.38)	-0.82 (0.38)*
Children relationship satisfaction	-1.09 (0.52)*	-0.90 (0.68)
Children relationship satisfaction x LEM limitation	-0.30 (0.39)	0.83 (0.39)*
Self-reported health	-0.75 (0.21)**	-1.04 (0.25)***
Memory status	-0.23 (0.05)***	-0.24 (0.06)***
Chronic illness	0.49 (0.12)***	0.58 (0.13)***
Body mass index	-0.10 (0.05)*	-0.18 (0.05)***
Age	-0.10 (0.04)**	-0.10 (0.05)*
Social activity	-0.90 (0.36)*	-1.56 (0.41)**
Adjusted R^2	0.26	0.27

*p-value <0.05; **p-value <0.01; ***p-value <0.001; LEM: lower extremity mobility.

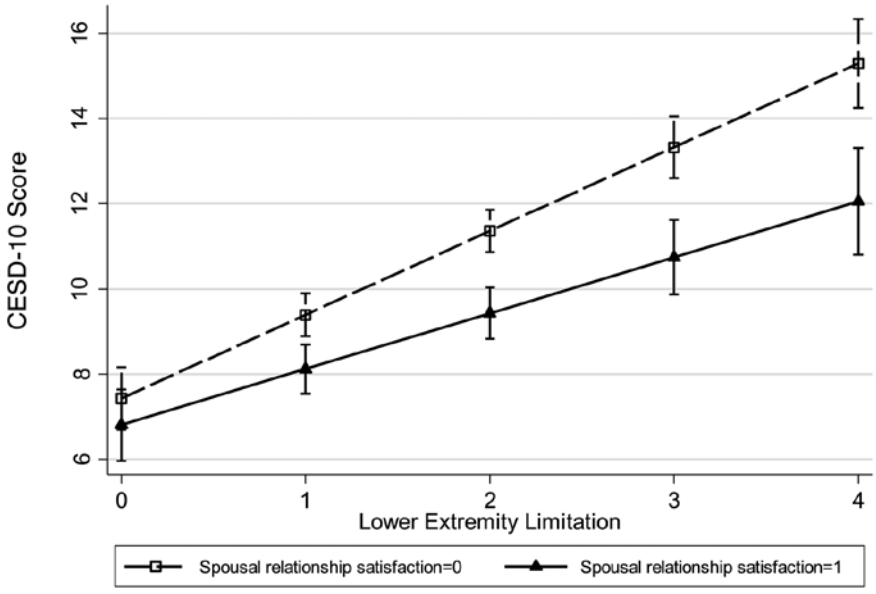

Fig 1-Effect of level of spousal relationship satisfaction on depressive symptoms among married women based on the China Health and Retirement Longitudinal Study (2015).Vertical line indicates 95% confidence interval. CESD-10, Center for Epidemiological Studies Depression 10-item test.

However, children relationship satisfaction did not have similar moderating effects, and, instead, it amplified the association between LEM limitation and depressive symptoms among married elderly women, as indicated by the interaction between children relationship satisfaction and LEM limitation in Model 2 is positively significant ($b = 0.83$, p-value <0.05) (Table 2).

DISCUSSION

The aim of this study was to explore whether family relationship moderated the effect of LEM limitations on older adults' depressive symptoms and whether this buffering effect was gender dependent. There were two main findings: (i) spousal but not children relationship satisfaction moderated the effect of LEM limitation on depressive symptoms among married women, and (ii) neither spousal nor children relationship satisfaction had any moderating effect of LEM limitation on psychological health among married men.

The stress-buffering effect of spousal relationship satisfaction was confined only among married women. The positive association of LEM limitation with CESD-10 score was weaker among married women with than those without spousal relationship satisfaction. Prior studies reported marital satisfaction is significantly correlated with spousal support (Dehle *et al*, 2001) and the latter is associated with better psychological health (Gove *et al*, 1983; Robles *et al*, 2014).

Traditionally women are predominantly caregivers especially in societies and cultures that endorse

women as natural caregivers (Kabitsi and Powers, 2002; Li and Dai, 2019), but changes in demographics and social norms have resulted in men increasingly assuming roles as caregivers (Hirst, 2001; Sharma *et al*, 2016). As a result, elderly mobility-limited women might reap substantial benefits from support of their spouses.The findings in the present study highlighted the importance of male spousal support in protecting married/partnered women from the negative effects of LEM limitations on their psychological health. CESD-10 used in this study has outstanding sensitivity and reliability in screening for major depression in elderly adults (Irwin *et al*, 1999).Validity of CESD-10 has been confirmed in elderly Chinese (Cheng and Chan, 2005; Cheng *et al*, 2006; Chen and Mui, 2014) and found to be appropriate for nonclinical, general population (Yu *et al*, 2013).

Although several studies concluded having children in general is associated with better mental health among older adults, this is valid only in comparison to those without children (Guo, 2014; Wu and Penning, 2019) and do not answer the question whether children relationship satisfaction could buffer the negative effects of elderly parents' physical limitation on their psychological health. So this study also added to the literature that mostly concentrated on the comparisons between those elderly with children and those without children. An explanation for the negative effects of children relationship satisfaction among elderly married women is that, due to their traditional upbringing, elderly mothers might still adhere to the traditional Confucian gender stereotype that married women should be faithful wives, good mothers and clean housekeepers (Pimentel, 2006), and, thereby, receiving care from their adult children might make the more older married women have a sense of guilt and indebtedness as it violated their image of being good mothers.This finding was consistent with studies demonstrating older adults receiving support is often associated with poorer well-being (Thomas, 2010) and older adults with moderate physical limitations receiving too little or too much support from adult children is associated with higher depression level (Djundeva *et al*, 2015).

The absence of buffering effect of spousal relationship satisfaction on elderly married men might be explained by their reluctance to receive care from others for fear of loss of masculinity (Addis and Mahalik, 2003; Galdas *et al*, 2005; Seidler *et al*, 2018). Married men are more likely to find support from their spouses threatening, especially when they fail to effectively cope with their impairments and, therefore, become more dependent on their spouse (Crockett and Neff, 2013). One study even found spousal support does not reduce depressive symptoms, but, to the contrary, increases frustration and sadness among married men with physical impairments (Carr *et al*, 2017). We speculate men's masculinity produces opposing emotions: the need to accept their wives' support and, at the same time, suffering the feeling of loss of masculinity, thereby negating the buffering effect of spousal support.

The lack of moderating effect of children relationship satisfaction among married men could be explained by that, in Chinese culture, adult children have a filial obligation to provide care for their elderly parents (Mao and Chi, 2011; Sun, 2017). As a result, married men who had support from their adult children may

take it for granted, thereby making the buffering effect of children relationship satisfaction not significant.

The study had two major limitations. Firstly, the study was cross-sectional in design and so no causal relationship could be ascertained between any variables; future studies should adopt a longitudinal design to explore possible causal relationships among the variables. Secondly, constrained by the questions raised in the 2015 CHARLS survey, measurements of quality of relations could only be evaluated by degree of satisfaction, which obviously have limitations, which were to some extent alleviated by the fact satisfaction is traditionally utilized as a scale of marital quality and is consistently one important dimension of the more complex measurement tools of marital quality (Robles *et al*, 2014).

In conclusion, the study reveals among elderly married men, neither spousal nor children relation satisfaction moderated the association between limitations and depressive symptoms. Among elderly married women, spousal relationship satisfaction has a significant moderating effect on the association of lower extremity mobility limitations with depressive symptoms, but children relationship satisfaction did not have a similar buffering effect and instead amplified the detrimental effects of lower extremity mobility limitations on psychological health. As spouses and their adult children are often the primary source of care for the elderly with physical disabilities, it is important health care professionals to consider dynamics of family relationship and gender-specific features to develop effective strategies to promote the health of lower extremity mobility-impaired elderly men and women.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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