CLINICAL & BASIC RESEARCH

Social Relationships and Onset of Functional Limitation among Older Adults with Chronic Conditions
Does gender matter?

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ABSTRACT: *Objectives:* This study aimed to examine the longitudinal association between social relationships and physical functioning among community-dwelling older adults with chronic conditions. *Methods:* Self-reported questionnaires were distributed and collected between 2014 and 2017 from participants ≥65 years old. The Index of Social Interaction was used to evaluate social relationships and the instrumental activities of daily living (IADL) subscale of the Tokyo Metropolitan Institute of Gerontology Index of Competence was used to examine functional status. *Results:* A total of 422 participants (190 males and 232 females) were included in the final analysis. High social relationships demonstrated significant adverse effects (odds ratio [OR] = 0.77, 95% confidence interval [CI]: 0.64–0.93) on the decline of IADL in the overall sample, particularly for females (OR = 0.71, 95% CI: 0.55–0.93) but not as much for males (P = 0.131). *Conclusion:* This finding suggests that functional limitation was influenced by social relationships among disabled older adults and the influence of social relationships on functional limitation differed based on gender.

Keywords: Interpersonal Relations; Functional Status; Gender; Aged; Chronic Disease; Longitudinal Studies; Health Behaviour; Japan.

Advances in Knowledge
- *This study found that social relationships may prevent physical deterioration among people with chronic conditions.*
- *This positive association was observed among the female group, whereas no effect was found among the male group.*
- *Taking measures to promote social relationships and being aware of gender differences may improve the physical functioning of older adults with chronic conditions.*

Application to Patient Care
- *Physicians, nurses and other health professionals should encourage disabled older people to engage in social relations that will benefit their health outcomes.*
- *Social relationships should be a focus of chronic disease management.*

Aging is a universal issue, with at least one person out of 11 being above 65 years of age in 2019. This number is expected to rise with an older person being one out of six people by 2050.[1] In Japan, the aging rate is 28.8% (approximately one out of four people) of the total population as of 2020.[2] Most countries are experiencing not only a rapidly aging population but also the impact of related functional limitations. The latter refers to physical restrictions in performing fundamental activities required in daily life (e.g. stooping, climbing stairs and ambulating).[3] Functional decline begins earlier and manifests more severely in older adults with chronic diseases.[4] It has been argued that individuals with functional limitations have higher risks of falling

and mortality.[5,6] However, older adults with chronic conditions are also willing to maintain their level of functioning and, therefore, identifying factors that can be linked to the maintenance of their physical function are needed.[7]

Social relationships are interactions between individuals and their social environment. Numerous studies have documented the effects of poor social relationships on health outcomes (e.g. depressive symptoms and mortality).[8,9] Additionally, social relationships have an impact on functional limitations. For example, a prospective study indicated that baseline social isolation predicted physical function decline after four years.[10] Another study suggested that lack of social relationships is linked to poor activities of

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daily living (ADL) and instrumental activities of daily living (IADL).[11] These studies have mainly focused on the general older population. However, little is known about the beneficial effects of social relationships and functional status on older adults with chronic health conditions. As individuals with chronic conditions generally have restricted social participation, it is necessary to investigate how social relationships affect them.[12] A recent study suggested that cancer survivors have higher chances of functional impairment when frequent contact with others declines and adults with type 2 diabetes with low levels of social support reported higher functional disabilities.[13,14] However, these studies only investigated the social relations of individuals with specific chronic diseases (e.g. cancer or diabetes). As multiple chronic diseases are increasing, studies investigating the comprehensive experiences of chronic diseases are required.

Regarding the gender differences in social relationships and health, it has been demonstrated that women spend more time and resources building social relationships than men. Consequently, it is plausible that the negative impact of poor social relationships is greater for women.[15] For example, Lee *et al.* found that social relations were significantly associated with cognitive function only in women.[16] However, Hajek *et al.* found that decreased social support impacts functional impairment in both genders.[17] Hence, consistent results regarding the influence of gender on social relationships and health have not been established. Furthermore, gender differences have not been thoroughly investigated in studies on individuals with chronic diseases.

To address these gaps in the research, the current study examined the association between social relation-ships and functional status among older adults with chronic diseases and assessed the effects of gender on these associations. The results can be used to further the understanding of social relationships and provide evidence for disease management in order to delay deterioration and improve health-related quality of life for older adults with chronic diseases.

Methods

Data for this three-year longitudinal study were extracted from a single-centre cohort project, the "Community Empowerment and Care for well-being and Health Longevity" (CEC), which was established in Japan in 1991.[18] The CEC aimed to explore the factors related to the well-being of residents in the context of the low birth rate, aging population and high medical expenditure. This project was conducted in Tobishima in Aichi Ken, central Japan; the entire population of around 4,800 participated in the survey. In 2020, the aging rate was approximately 28.0%. The present research project was conducted in collaboration with the local government municipality's health policy evaluation and the survey period was consistent with that of the municipal survey. Before 2011, the survey was conducted every one or two years. Since 2011, the survey has been conducted every three years. In each wave, the survey is performed from April to May. To avoid selection bias, all the residents were invited and agreed to participate in the survey. Questionnaires were mailed to all residents. The questionnaire encompassed demographic characteristics, nutrition, lifestyle habits, long-term care needs evaluation, evaluation of local services, social relationships and medical conditions.

Unlike previous research related to this project, the researchers focused on older adults living with chronic disease in the present study. The researchers used data collected from individuals aged ≥65 years
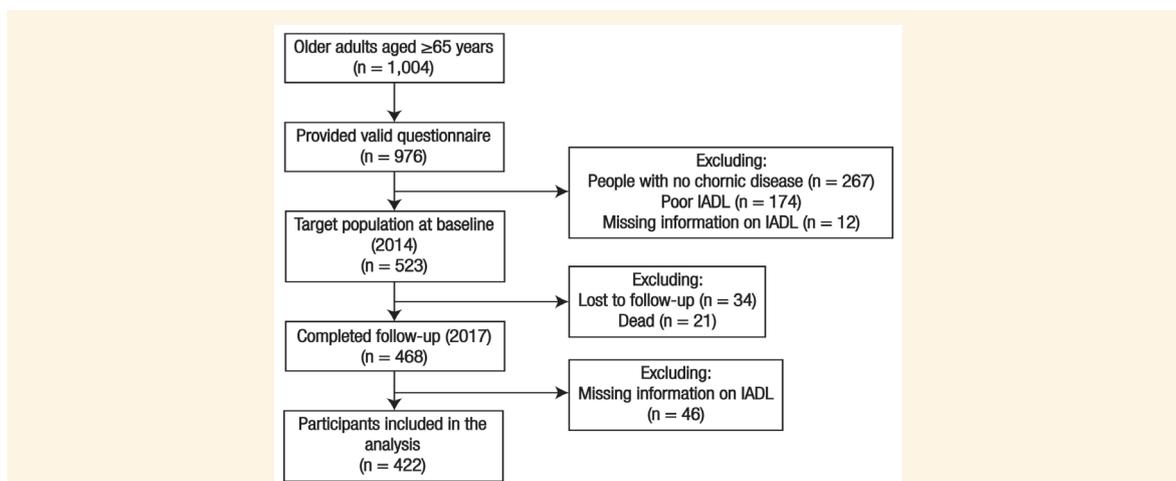

Figure 1: Flow chart of participants included in this study.
IADL = instrumental activities of daily living.

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with at least one chronic medical condition in 2014. The inclusion criteria were: (1) people with at least one chronic disease (hypertension, stroke, heart disease, diabetes, hyperlipidaemia, lung disease, arthritis, cancer, immune disease, depression, eye disease and ear disease); (2) physically independent at baseline; and (3) no missing information on IADL.

In 2014, 523 individuals who fit the inclusion criteria were enrolled. The chronic conditions were determined using the question, 'Do you have an illness that is being treated, or do you suffer from an illness sequela?' In 2017, a follow-up study was conducted to assess the participants for symptoms of physical functional decline. The data were collected from 1st of April 2014 to 15th of May 2017. Between 2014 and 2017, 55 participants could not be reached for the follow-up and 46 participants were excluded owing to missing IADL information [Figure 1]. The researchers calculated the required sample size using the G*power software. A minimal sample size of 191 was required based on the expected 0.8 power and a 0.05 level of significance.

Functional competence was assessed by the IADL subscale of the Tokyo Metropolitan Institute of Gerontology Index of Competence. The IADL subscale comprises the following five items: using public transportation, shopping, preparing meals, paying bills and individual banking management. For each item, a positive response was coded as one and a negative response was coded as zero. For example, regarding the use of public transportation, the response options to the question 'Do you use public transportation (bus or train) to go out on your own?' were 'I can and do', 'I can but do not' and 'I cannot'. A response of 'I cannot' received zero points, whereas the other two responses received one point. The total score ranged from zero to five, and a score of five was considered a normal IADL, while a score of four or below indicated a low IADL.[19]

The Index of Social Interaction (ISI) was used to evaluate social relationships.[20] The ISI includes five subscales and 18 items. The Independence subscale had four items to assess motivation to live, motivation to maintain a healthy life, taking an active approach towards life and having a regular lifestyle. The Social Curiosity subscale measures habits of reading newspapers and books, using new equipment (e.g. a video system), hobbies and a feeling of importance in society. The Interaction subscale measures communication with family and non-family members and interacting with non-family members. The Participation subscale measures participation in social as well as neighbourhood groups, watching television and taking an active social role. The Feelings of Safety subscale tests if participants have someone who can offer

counselling and provide support during emergencies. For all items, a positive response was coded as one, and a negative response was coded as zero. Taking 'Do you have someone to counsel in a difficult situation?' as an example, the response options were 'always', 'frequently', 'sometimes' and 'never'. A response of 'never' received zero points, while the other three received one point. The total score was 18, with a higher score indicating good social interaction. The ISI was taken as a continuous variable in the analysis.

In accordance with previous studies, the researchers considered age, gender, living status, exercise, smoking and drinking as covariates.[12,21] Age was measured as a continuous variable. Exercise was evaluated with the question 'Do you usually exercise?' and was categorised as 'yes' if their response were 'always' or 'sometimes' and 'no' if otherwise. Living status was evaluated by asking if the participants lived alone or with others. Living with others included spouses, sons, daughters, daughters-in-law, grandsons, brothers/sisters and others. Smoking was evaluated by the question 'Do you smoke?'; those who responded 'every day' or 'sometimes' were regarded as current smokers, 'previously did but have stopped now' as ex-smokers and 'do not smoke' as non-smokers. Drinking was assessed by an item 'Do you drink?' and was dichotomised as 'yes' if participants answered 'every day' or 'sometimes' and 'no' if they answered 'do not drink'.

Baseline demographic information between gender groups was compared by Chi-squared (χ^2) tests or non-parametric tests. These tests were also implemented to examine demographic information and the IADL for categorical and continuous variables, respectively. A multiple logistic regression analysis was performed to examine the association between social relationships and declining IADL after controlling for covariates that were statistically significantly associated with IADL in the Chi-squared or non-parametric tests. The researchers then fitted additional models to examine gender differences in the association between the ISI and IADL using a gender stratified analysis. A sensitivity analysis was also completed to compare the demographic differences between included and excluded cases. All the analyses were performed using the Statistical Package for Social Science (SPSS), version 26.0 (IBM Corporation, Armonk, New York, USA).

This study was approved by the University of Tsukuba Ethics Committee (#1331-1). The survey data were anonymously provided by the local government.

Results

Data from 422 individuals were included in the analysis. Of the 422 participants, most were female,

not living alone, doing exercise, non-drinkers, non-smokers and diagnosed with one chronic disease. While social relationships, age, living status, exercise and disease status did not differ between males and females, drinking and smoking differed significantly (P <0.001 each). Specifically, males reported higher percentages of smoking and drinking [Table 1].

The bivariate analysis demonstrated that age, exercise and social relationships were associated with the IADL after three years [Tables 2 and 3]. After controlling for age and exercise in the logistic regression models, the results demonstrated that the higher social relationship index was (odds ratio [OR] = 0.77, 95% confidence interval [CI]: 0.64–0.93) inversely associated with a low IADL [Table 4].

The gender-stratified data revealed different results. In model one, a higher social relationship index demonstrated a significant inverse association with a low IADL in males (OR = 0.77, 95% CI: 0.61–0.98) and females (OR = 0.69, 95% CI: 0.56–0.85). After adjusting for age (model two) and exercise (model three), higher social relationship index was inversely related to low IADL in females (OR = 0.66, 95% CI: 0.51–0.86 and OR = 0.71, 95% CI: 0.55–0.93, respectively). However, social relationships index adjusted for age and exercise demonstrated no statistical association with a low IADL in males (P = 0.070 and P = 0.131, respectively) [Table 4].

The sensitivity analysis demonstrated the difference in age between the excluded case (72.9 ± 6.0) and

Table 1: Baseline characteristics of the participants included in this study (N = 422)

Characteristic	n (%)			P value
	Total (n = 422)	Male (n = 190)	Female (n = 232)	
Mean age ± SD	72.8 ± 6.1	72.7 ± 6.1	72.9 ± 6.1	0.680
Living status				
Not alone	388 (94.4)	176 (95.1)	212 (93.8)	
Alone	23 (5.6)	9 (4.9)	14 (6.2)	0.560
Missing	11	5	6	
Exercise				
Yes	254 (62.1)	115 (63.2)	139 (61.2)	
No	155 (37.9)	67 (36.81)	88 (38.8)	0.686
Missing	13	8	5	
Drinking				
Yes	142 (35.1)	106 (41.1)	36 (16.1)	
No	262 (64.9)	74 (58.9)	188 (83.9)	<0.001
Missing	18	10	8	
Smoking				
Current	32 (8.2)	30 (17.0)	2 (0.9)	
Ex-smoker	99 (25.4)	93 (52.5)	6 (2.8)	
Non-smoker	259 (66.4)	54 (30.5)	205 (96.3)	<0.001
Missing	32	13	19	
ISI				
Mean ± SD	16.5 ± 1.6	16.6 ± 1.5	16.4 ± 1.6	
Missing	45	15	30	0.763
Number of diseases				
1	235 (55.7)	103 (54.2)	132 (56.9)	
≥2	187 (44.3)	87 (45.8)	100 (43.1)	0.581

SD = standard deviation; ISI = Index of Social Interaction.

Table 2: Baseline characteristics of participants per follow-up level of instrumental activities of daily living subscale (N = 422)

Characteristic	n (%)		χ²/Z	P value
	Normal (n = 359)	Low (n = 63)		
Mean age ± SD	71.9 ± 5.4	78.5 ± 6.8	-6.995	<0.001
Living status				
Not alone	329 (94.0)	59 (96.7)		
Alone	21 (6.0)	2 (3.3)	0.728	0.552
Missing	9	2		
Exercise				
Activity	227 (65.0)	27 (45.0)		
Inactivity	122 (35.0)	33 (55.0)	8.739	0.003
Missing	10	3		
Drinking				
Yes	118 (65.8)	24 (59.3)		
No	227 (34.2)	35 (40.7)	0.927	0.336
Missing	14	4		
Smoking				
Current	27 (8.1)	5 (8.8)		
Ex-smoker	83 (24.9)	16 (28.1)		
Non-smoker	223 (67.0)	36 (63.1)	0.322	0.851
Missing	26	6		
ISI				
Mean ± SD	16.6 ± 1.4	15.7 ± 1.9		
Missing	41	4	-3.317	0.001
Number of diseases				
1	198 (55.2)	37 (58.7)		
≥2	161 (44.8)	26 (41.3)	0.278	0.598

SD = standard deviation; ISI = Index of Social Interaction.

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Table 3: Baseline characteristics and follow-up level of instrumental activities of daily living subscale by gender (N = 422)

Characteristic	Male				Female			
	n (%)		χ^2/Z	*P* value	n (%)		χ^2/Z	*P* value
	Normal (n = 161)	Low (n = 29)			Normal (n = 198)	Low (n = 34)		
Mean age ± SD	71.9 ± 5.5	77.1 ± 7.2	-3.686	<0.001	71.8 ± 5.3	79.6 ± 6.3	-6.153	<0.001
Living status								
Not alone	147 (94.2)	29 (100.0)			182 (93.8)	30 (93.8)		
Alone	9 (5.8)	0 (0.0)	1.759	0.359	12 (6.2)	2 (6.2)	0.000	1.000
Missing	5	0			4	2		
Exercise								
Activity	102 (65.4)	13 (50.0)			125 (64.8)	14 (41.2)		
Inactivity	54 (34.6)	13 (50.0)	2.268	0.132	68 (35.2)	20 (58.8)	6.777	0.009
Missing	5	3			5	0		
Drinking								
Yes	87 (56.5)	19 (73.1)			31 (16.2)	5 (15.2)		
No	67 (43.5)	7 (26.9)	2.527	0.112	160 (83.8)	28 (84.8)	0.024	0.876
Missing	7	3			7	1		
Smoking								
Current	25 (16.5)	5 (19.2)			2 (1.1)	0 (0.0)		
Ex-smoker	77 (51.0)	16 (61.6)			6 (3.3)	0 (0.0)		
Non-smoker	49 (32.5)	5 (19.2)	1.834	0.400	174 (95.6)	31 (100.0)	1.416	0.493
Missing	10	3			16	3		
ISI								
Mean ± SD	14.9 ± 2.3	13.8 ± 2.6	-2.080	0.038	14.7 ± 2.6	13.1 ± 2.4	-2.656	0.008
Missing	15	0			26	4		
Number of diseases								
1	88 (54.6)	15 (51.7)	0.085	0.770	110 (55.6)	22 (64.7)	0.991	0.320
≥2	73 (45.4)	14 (48.3)			88 (44.4)	12 (35.3)		

SD = standard deviation; ISI = Index of Social Interaction.

included case (75.9 ± 6.6). The excluded group is older than the included cases (*P* <0.05); however, a gender difference was not observed.

Discussion

This study examined the effects of social relationships on the functional status of older adults with chronic conditions. The results demonstrated that a higher social relationship index could reduce older adults' functional decline. However, the beneficial effects of a social relationship index are significantly evident only among females.

The stress-buffering model and main effect model are the two main theoretical models linking social relationships to health outcomes.[22] The stress-buffering model posits that social resources, such as social companionship, may reduce stress by increasing positive moods. The main effect model proposes that social support can reduce problematic behaviours (e.g. smoking, drinking and not seeking medical help) associated with poor health outcomes. Based on these theoretical models, chronic diseases and their consequences are stressors, which may be reduced by their social resources. Meanwhile, social relationships can directly benefit functional status.

Table 4: Logistic regression models of the association between baseline of the index of social interaction and follow-up of low instrumental activities of daily living subscale

Variable	Model 1			Model 2			Model 3		
	OR	95% CI	*P* value	OR	95% CI	*P* value	OR	95% CI	*P* value
Total									
ISI	0.73	0.62–0.85	<0.001	0.73	0.61–0.87	<0.001	0.77	0.64–0.93	0.006
Age				1.18	1.12–1.24	<0.001	1.17	1.11–1.23	<0.001
Exercise							1.67	0.86–3.26	0.130
Male									
ISI	0.77	0.61–0.98	0.035	0.79	0.61–1.02	0.070	0.80	0.60–1.07	0.131
Age				1.13	1.06–1.21	<0.001	1.11	1.04–1.19	0.003
Exercise							1.21	0.44–3.28	0.714
Female									
ISI	0.69	0.56–0.85	0.001	0.66	0.51–0.86	0.002	0.71	0.55–0.93	0.011
Age				1.24	1.14–1.35	<0.001	1.25	1.36–1.45	<0.001
Exercise							2.56	0.98–6.65	0.054

OR = odds ratio; CI = confidence interval.

Social relationships seem to have adverse effects on the functional decline among older adults with chronic diseases. This result aligns with previous research conducted in six countries, which demonstrated that social capital and well-being were positively associated regardless of chronic diseases.[23] A systematic review indicated that social relationships play an important role in improving well-being and mental health among people with disabilities.[24] Moreover, another previous study also demonstrated that strong social relationships could decrease functional decline even among individuals with multiple chronic diseases.[21] Social relations affect health outcomes through a reciprocity exchange—social relations might enhance resources, including transportation support and care, which can affect health-related behaviours.[25] For instance, social contacts may allow individuals with chronic diseases to undergo medical check-ups, access important health-related information and gain confidence in health-promoting behaviours, which can delay the onset of physical decline.

Chronic diseases are usually lifelong and cause earlier functional limitations; subsequently, measures should be taken to prevent the deterioration of these conditions. This study contributes to the existing literature through the identification of a cost-effective method to gather evidence for chronic disease management. Being aware of the benefits of social relationships for health outcomes may provide evidence and directions for chronic disease management and suggests that health promotion programmes should be expanded to include social relationships and traditionally modified factors (e.g. physical activity and healthy eating behaviour).

The researchers' findings further indicated that higher social relationship index could reduce the probability of functional decline among females, but not males. This finding aligns with a previous 10-year-long longitudinal study, which found that females with positive social support had lower mortality risks than those with poor social support; however, this association was not observed among males.[26] Additionally, another longitudinal study examining the effects of participation in social activities and cognitive decline among older adults found that social activities impacted cognitive decline only among females.[27] The benefits females experience due to strong social relationships are particularly relevant in potentially improving their conditions as females with chronic diseases are more likely to experience functional disabilities.[28] One plausible reason is that females generally maintained stability in their social activities, whereas males' social activities declined over time.[29] Moreover, older females tend to have larger social networks than older males.[30] These findings support the present study's results on the gender-moderated effects of social relationships on functional status.

It is already known that behaviour change and improvements in the treatment of chronic diseases may improve quality of life.[31]

The present study demonstrated that the social relationship index, which encompass independence, social curiosity, interaction with others, participation in social activities and a feeling of safety in daily life, are

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effective in maintaining optimal physical functioning. Regarding the practical implications of these findings, physicians, nurses and social workers need to consider the impact of social relationships on health and develop chronic disease management interventions such as promoting interactions with family and non-family members, using new equipment (e.g. video camera, internet) and reading newspapers. Moreover, team-based strategies should be developed; these must include various parties such as medical staff, social workers, health policymakers and other health stakeholders. Furthermore, considering the gender differences in the effects of social relationships on health, more integration measures should be included for males. Additionally, longitudinal research could facilitate the identification of other relevant aspects of males' social relations.

This study has several limitations. First, disease severity and duration were not examined, which may have affected the results. Individuals with more severe and longer-lasting chronic diseases may experience worse functional deterioration. Subsequently, it is unclear if the effects of social relationships differ among people with chronic diseases of different severity and duration. Further studies taking disease severity and duration into consideration are, therefore, necessary. Second, although some diseases can affect individuals' social interactions, the researchers did not explore the effect of social relationships on functional limitation by individual diseases. Identifying the effects of specific diseases may facilitate the development of targeted measures. Third, the specific types and frequency of social relationships index were not examined. Knowing the specific source of social relationships would yield more specific evidence for intervening to promote social engagement. Fourth, only one indicator (IADL) was used to examine functional status; combining subjective and objective measurements for functional indicators might strengthen the reliability of the results. Fifth, even though the present study highlighted the importance of social relationship index with regards to decreasing the odds of functional decline, the effects of interaction were not examined. Thus, studies examining the interaction effects (multiplicative or additive) of social relationship index and chronic conditions, which might offer deeper insight into the target population, will be significant for public health and psychosocial research. Finally, this study was conducted in just one area, which may limit the generalisability of the results. Considering that culture is crucial to social relationships, studies using data from various countries to provide insight into the comparative impacts of social relationships on health outcomes across cultures are necessary.

Despite these gaps, this study addresses the association between social relationships and functional status among community-dwelling older adults with chronic conditions and gender differences. The results further imply that it may be beneficial to consider gender differences when encouraging social relationships for disease management. A better understanding of gender-based differences can help further develop interventional programmes and studies to promote health outcomes linked to gender differences.

Conclusion

Social relationships influence physical functioning among older adults with chronic diseases. Based on the results of this study, social relationships were related to functional decline after three years among people with chronic disease; furthermore, this association differed by gender. Professionals should assist older adults with developing, maintaining and strengthening their social relations in daily life through interventions, such as using new equipment, interacting with family and non-family members, participating in various activities, receiving support from others and taking an active approach to life in order to increase the sustainability of their functional independence. Given their significance, social relationships should form an important part of health policy decisions. In addition, being aware of the moderating effects of gender differences may facilitate the development of more appropriate measures to reduce functional decline among older adults and encouraging older females to maintain social relationships may be effective in reducing their vulnerability to functional limitations.

AUTHORS' CONTRIBUTION

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CONFLICTS OF INTEREST

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