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Physically confident older adults are not afraid to fall, but only if they have positive images of older people: a cross-sectional study in Japan

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Objective. Falls among older adults can significantly worsen their physical health. While it is important to prevent their falls, there is also a great need to reduce their fear of falling. In this study, we focus on confidence in their own physical strength as one of the variables associated with the fear of falling. We explored whether older adults with more confidence in their own physical strength have a lower fear of falling (Hypothesis 1). We also examined whether interactions between confidence in physical strength and subjective health/positive images of older adults affect the fear of falling (Hypotheses 2 and 3).
Methods. In this study, we surveyed 274 Japanese older adults. Multiple regression analysis was conducted with fear of falling as the dependent variable, confidence in physical strength, subjective health, positive images of older adults, their interactions, and the demographics as independent variables.
Results. The results showed that participants with more confidence in their physical strength had a lower fear of falling, supporting Hypothesis 1. No interaction was observed between confidence in one's physical strength and subjective health, rejecting Hypothesis 2. For those with more positive images of older adults, more confidence in one's physical strength was associated with a lower fear of falling, supporting Hypothesis 3.
Conclusions. We found that older participants with more confidence in their own physical strength had a lower fear of falling. Although this study has some limitations, it has implications for intervention research to reduce older adults' fear of falling.

Key words: accidental falls, fear, public health, stereotyping, diagnostic self evaluation

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INTRODUCTION

Population aging is progressing rapidly worldwide, including in Japan, where 28.9% of the population was aged 65 and over in 2021 [1]. Thus, efforts are needed to not only address social issues, including the shortage

of human resources in the nursing care field, but also reduce the number of older adults requiring nursing care. In Japan, 4,799,000 older adults (16.6% of those aged 65 and over) were certified as requiring nursing care in 2010; however, by 2023, this number had risen to 6,933,000 (19.0% of those aged 65 and over) [2,3]. Thus, older adults' healthy life expectancy urgently needs to be increased to ensure that more of this population can live well without nursing care [4].

Among older adults in Japan who are certified as requiring nursing care, the most common reasons for needing care are dementia (18%), cerebrovascular disease (16.6%), disability due to old age (13.3%), fractures and/or falls (12.1%), and joint disease (10.2%) [5]. The small distance between these percentages indicates that they all must be addressed. Falls are one of the most important issues in gerontology, because even a single fall can significantly worsen the physical health of older adults, leading to undesirable conditions requiring nursing care [6]. Recent efforts have been made to prevent falls among older adults, including barrier-free housing and public facilities and health training to maintain leg and hip strength [7,8]. In Japan, various exercise programs have been attempted to prevent falls among community-dwelling older adults [9-12]. Overall, reducing their falls through such efforts is meaningful.

Meanwhile, the 'fear of falling' also needs to be reduced among older adults. Older adults with a greater fear of falling are more likely to have actual falls [13], more severe depression [14-16], lower quality of life [17], less ability to perform activities of daily living [18], slower walking speed [19], and smaller living spaces [20]. In addition, a longitudinal study conducted in the US found that older adults who reported a fear of falling in multiple times were more likely to experience cognitive decline than those who did not [21]. Several other studies have also reported an association between a fear of falling and cognitive decline [22,23]. Furthermore, older adults with a greater fear of falling are more likely to have lower mobility and housework ability 2-5 years later [24], and higher mortality rates 2 years later [25] (for a review of other related factors of fear of falling and its negative consequences, see the article [26]). Considering the above, action should be taken to reduce the fear of falling among older adults.

AIMS AND HYPOTHESES OF THIS STUDY

In this study, we focused on participants' confidence in their physical strength as one variable associated with the fear of falling. In this cross-sectional study, we conducted a survey on community-dwelling older Japanese participants. This survey on older adults in Japan, where the population is aging at rate unparalleled elsewhere in the world, is significant for researchers in many countries that may face similar aging rates in the future. The study's first aim was to determine the association between confidence in one's physical strength and the fear of falling. We also focused on subjective health and positive images of older adults as factors that potentially moderate the association between confidence in one's physical strength and the fear of falling. The second aim was to examine whether the interactions between (1) confidence in one's physical strength and subjective health and (2) confidence in one's physical strength and positive images of older adults have effects on the fear of falling. The investigation into these interactions is only exploratory. A detailed description of each variable and hypothesis is provided below.

Previous research has addressed physical function indicators as variables related to the fear of falling. For example, older adults engaged in exercise programs that improve lower-body muscle strength are more likely to have a low fear of falling [27,28]. Falls occur because of physical movement of the body. Thus, when addressing the fear of falling, it may be useful to focus on self-perceptions of physical health. Thus, we exploratively examine the psychological variable of confidence in physical strength. This reflects subjective confidence in one's own overall fitness, which differs from actual motor function indices. Older adults with more confidence in their own physical strength are more likely to believe that they would not suffer serious injury if they fell, and are therefore assumed to have lower fear of falling. Thus, we hypothesised that older adults with more confidence in their physical strength have lower fear of falling (Hypothesis 1).

Variables that may moderate the association between more confidence in one's physical strength and a lower fear of falling should also be explored. As moderators between these two variables, we focus on participants' (1) subjective health and (2) positive images of older adults. Regarding the former, even if older adults are confident in their physical strength, if they also have lower subjective health, they may be motivated to avoid falls. Consequently, they would have a greater fear of falling, because subjective health is a concept that includes self-perceptions about one's overall health, including mental and physical health [29-31]. Thus, the possibility that subjective health moderates the effect of confidence in one's physical strength on the fear of falling should be considered. This study explored the hypothesis that the interaction between confidence in one's physical strength and subjective health affects the fear of falling (Hypothesis 2).

Positive images of older adults may also moderate the association between confidence in one's physical strength and a fear of falling. Older adults who have

confidence in their own physical strength but lack positive images of their ingroup are more likely to associate themselves with negative stereotypes of older adults, including being fall-prone and vulnerable [32,33]. Consequently, their fear of falling would be stronger. In contrast, older adults who have positive images of the older adult population, including themselves, might be less likely to apply the negative stereotype that 'older people are prone to falling' to themselves. Thus, they are expected to have a lower fear of falling.

Along with getting older, people tend to internalise negative old-age stereotypes [34,35]. Accordingly, people who have negative perceptions of older adults may be more likely to have poor physical and mental health when they become older adults themselves (i.e., stereotype embodiment theory [36]). Research shows that older adults with more negative images of older adults are more likely to experience low self-efficacy, poor cognitive and physical function [37-40], and more severe loneliness and depression [41,42]. Therefore, this study explored the hypothesis that the interaction between confidence in one's physical strength and positive images of older adults influences the fear of falling (Hypothesis 3).

To examine the above hypotheses, we conducted a survey with community-dwelling older Japanese participants. We also controlled for several covariates. For example, fear of falling has been shown to be higher among those who have had a recent fall [43-46], go outside frequently [47,48], or have been hospitalised within the past year [49]. Therefore, we also measured and control for participants' recent fall history, outing frequency, and hospitalisation experience.

METHODS

Participants

A power analysis assuming a medium effect size (partial R^2 = .06, $N_{parameter}$ = 12, α = .05, 1-β = .80) yielded a required sample size of n = 126. A total of 274 community-dwelling older Japanese aged 54-86 years in an urban area participated (M = 71.41 years, SD = 5.30). Notably, the results were like those reported below when only the data from participants aged 65 years and over (n = 262) were analysed (see Open Science Framework [OSF] repository [https://osf.io/8uh24). Among the participants, 20 were male and 254 were female. Limitations caused by the high percentage of women among the participants are discussed below.

All participants were in a health program implemented by local governments in Japan in 2021-2022 to train volunteers to read picture books to community-dwelling children. Participants autonomously submitted applications for the health program. If there were too many applications for the program, participants were selected by lottery. Eligibility criteria dictated that individuals be a minimum of 50 years of age, possess the capacity to independently engage in each program, and lack a diagnosis of dementia. Consequently, the participant cohort excludes individuals necessitating caregiving assistance for daily activities or those confined to a bedridden state. In all cases, the data were collected prior to the program implementation; thus, the participants' experience with the health program did not affect the results.

All procedures were in accordance with the ethical standards of the authors' institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all participants.

Main variables

Fear of falling was measured using a single item [50]: 'Are you presently afraid of falling'? Participants responded with '1. not at all afraid', '2. not afraid', '3. fairly afraid', or '4. very afraid'.

Confidence in one's physical strength was measured using a single item: 'Do you have confidence in your overall fitness, such as muscle strength and balance'? Participants responded with '1. not at all', '2. not much', '3. a little', or '4. very much'.

Subjective health was measured using a single item [31]: 'Do you consider yourself healthy in general'? Participants responded with '1. not at all healthy', '2. not healthy', '3. fairly healthy', or '4. very healthy'.

Positive images of older adults were measured by eight items [51] following the lead statement: 'The following words represent general images of older adults. For each, please answer how well it applies to your image of older adults'. Participants responded to the items 'cheerful', 'aggressive', 'smart', 'strong', 'popular', 'happy', 'independent', and 'sociable' with '1. not at all applicable', '2. not applicable', '3. neither applicable nor unapplicable', '4. applicable', or '5. very applicable'. The mean was taken as the score (Cronbach's α = .76), with higher scores indicating a more positive image of older adults.

Demographics

Recent falls were measured using a single item: 'When was your most recent fall'? Participants responded with '1. within a week', '2. within a month', '3. within three months', '4. within six months', '5. within a year', or '6. more than a year ago'. Higher scores indicated a less recent fall experience.

Outing frequency was measured using a single item [52]: 'How often do you usually (in the last month or so) go out of the house for work, shopping, walks, hospital

visits, social activities, etc.? If you go out with assistance, please include it, but do not include outings in the yard or taking out the garbage'. Participants responded with '1. rarely go out', '2. once a week', '3. once every 2-3 days', '4. once every day', or '5. twice or more every day'.

In addition, participants were asked about their hospitalisation experience, age, years of education, and gender. Hospitalisation experience was measured using a single item [52]: 'Have you been hospitalised in the past year?' Participants responded with either '1. yes' or '2. no'.

Procedure and analysis

All participants received an explanation regarding the use of survey data for research purposes. The survey was using a paper questionnaire. Participants provided responses to each item, which was presented in the order: the demographics, subjective health, fear of falling, confidence in one's physical strength, and positive images of older adults. This survey was conducted as part of a larger study.

Analyses were conducted using the statistical software HAD (ver. 18) [53] and R (ver. 4.2.0). A multiple regression analysis was conducted with fear of falling as the dependent variable and confidence in one's physical strength, subjective health, positive images of older adults, interactions between confidence in physical strength and subjective health/positive images of older adults, and demographics as independent variables. If an interaction was statistically significant, then a simple slope analysis would be performed. Results of an ordinal regression analysis, in which the dependent variable, fear of falling, was treated as an ordinal variable, are available at the OSF repository. In that case, the obtained results were the same as those in the main text. The data used in the analysis and distributions of each indicator are posted at the OSF repository.

RESULTS

Table I presents the means, standard deviations, and correlation coefficients for each indicator. More confidence in one's physical strength, better subjective health, and more positive images of older adults were significantly associated with lower fear of falling (in order, r = -.32, 95% CI = [-.43, -.21], p < .001; r = -.25, 95% CI = [-.36, -.13], p < .001; r = -.13, 95% CI = [-.25, -.02], p = .03).

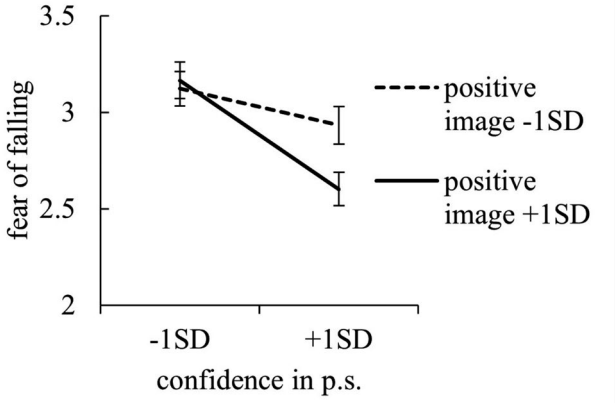
Then, a multiple regression analysis was conducted with fear of falling as the dependent variable and confidence in one's physical strength, subjective health, positive images of older adults, interactions between confidence in one's physical strength and subjective health/positive images of older adults, and the demographics as independent variables (Tab. I). No problems related to multicollinearity were observed. Results showed that more confidence in one's physical strength was associated with lower fear of falling (β = -.24, 95% CI = [-.35, -.12], p < .001). No interaction was observed between confidence in one's physical strength and subjective health (β = .08, 95% CI = [-.05, .20], p = .22); however, a significant interaction was found between confidence in one's physical strength and positive images of older adults (β = -.11, 95% CI = [-.23, .00], p = .047). The above results support Hypothesis 1, but not Hypothesis 2.

A simple slope analysis of the interaction between confidence in physical strength and positive images of older adults (Fig. 1) showed that, for those with lower positive images of older adults (-1 *SD*), confidence in one's physical strength was not significantly associated with fear of falling (β = -.12, 95% CI = [-.29, .05], p = .17). In contrast, for those with more positive images of older adults (+1 *SD*), more confidence in one's physical strength was associated with lower fear of falling (β = -.35, 95% CI = [-.51, -.20], p < .001). Thus, Hypothesis 3 was supported.

Table I. Means, standard deviations, and correlation coefficients of each indicator.

	M	*SD*	1	2	3	4	5	6	7
1	2.96	0.80	–						
2	2.54	0.70	-.32 **	–					
3	2.94	0.48	-.25 **	.33 **	–				
4	3.21	0.49	-.13 *	.13 *	.12 *	–			
5	5.34	1.20	-.14 *	.04	.01	.02	–		
6	3.89	0.73	-.06	.11 †	.09	.11 †	.12 †	–	
7	71.41	5.30	-.01	-.01	-.01	-.03	.02	-.17 **	–
8	14.16	2.32	-.06	.10 †	.18 **	.01	.03	.11 †	-.28 **

1: fear of falling; 2: confidence in one's physical strength; 3: subjective health; 4: positive image; 5: recent falling; 6: outing frequency; 7: age; 8: years of education. †p < .10, *p < .05, **p < .01.



Error bars represent standard error. p.s.: physical strength

Figure 1. The interaction between confidence in one's physical strength and positive images of older adults.

Table II. Multiple regression analysis results on fear of falling.

	β		95% CI	VIF
Confidence in physical strength	-.24	**	[-.35, -.12]	1.17
Subjective health	-.09		[-.22, .04]	1.40
Positive image	-.09		[-.20, .02]	1.05
Confidence×subjective health	.08		[-.05, .20]	1.29
Confidence×positive image	-.11	*	[-.23, .00]	1.08
Recent falling	-.14	*	[-.25, -.03]	1.02
Outing frequency	.00		[-.11, .11]	1.09
Hospitalization experience	-.06		[-.17, .05]	1.04
Age	.02		[-.10, .13]	1.14
Education	.01		[-.11, .12]	1.14
Gender (0 = men, 1 = women)	.20	**	[.09, .31]	1.06
Adjusted R^2	.17	**	[.09, .25]	–

Regression coefficients were standardised. *p < .05, **p < .01.

DISCUSSION

This study focused on the confidence in one's physical strength as a factor associated with the fear of falling. We found that participants with more confidence in their own physical strength had a lower fear of falling. In addition, we explored whether fear of falling was affected by the interactions between confidence in one's physical strength and subjective health/positive images of older adults. The results only showed an interaction between confidence in one's physical strength and positive images of older adults. Specifically, for participants with less positive images of older adults (-1 *SD*), no significant relationship was observed between confidence in one's physical strength and the fear of falling. In contrast, for participants with more positive images of older adults (+1 *SD*), more confidence in one's physical strength was associated with a lower fear of falling.

Regarding our hypotheses

Regarding Hypothesis 1, an association was observed between more confidence in one's physical strength and a lower fear of falling. However, regarding Hypothesis 2, the interaction between confidence in one's physical strength and subjective health was not seen. Furthermore, no significant main effect of subjective health on the fear of falling was found (Tab. II). Thus, when the effect of confidence in physical strength was included, the association between subjective health and the fear of falling was no longer observed. These findings suggest that an approach of increasing confidence in one's physical strength, a concept that focuses on only physical health (not 'whole' subjective health), is effective in reducing the fear of falling. However, this study only examined the correlational relationships. Thus, future studies are expected to examine whether a causal relationship exists between increased confidence in one's physical strength and a reduced fear of falling.

Regarding Hypothesis 3, the interaction between confidence in one's physical strength and positive images of older adults was associated with the fear of falling. Specifically, for participants with more positive images of older adults (+1 *SD*), more confidence in one's physical strength was associated with a lower fear of falling. Thus, fear of falling was low only when both confidence in one's physical strength and positive images of older adults were high (Fig. 1). When positive images of older adults are lacking, individuals are more likely to associate themselves with negative stereotypes of older adults, including being fall-prone and vulnerable [32,33]. Consequently, when participants had fewer positive images of older adults, more confidence in their own physical strength would not be significantly correlated with a lower fear of falling. Therefore, we should focus not only on confidence in physical strength but also on the psychological variable of positive images of older adults.

Implications from our findings

Our findings provide a new perspective on health programs already in place to reduce the fear of falling among older adults. For example, Nick et al. [54] found that older adults who participated in yoga classes for eight weeks had less fear of falling than those in the control group. Padala et al. [55] examined the effects of an exercise program that could be implemented at home for older adults with mild Alzheimer's disease and found that participants' fear of falling was also lower after the intervention. Such health programs directly approach the physical function of the participants but fail to adequately consider the effect of positive images

of older adults. Thus, efforts to raise awareness of the positive aspects of older adults would be a worthwhile addition to these existing intervention strategies.

Fall prevention programs for older adults are often long-term and consist of multiple sessions, and it would be helpful to incorporate an affirming approach to the image of older adults early in the program. For example, as they age, older adults are freed from social roles and superficial relationships and retain stronger altruistic motives (i.e. gerotranscendence [56]). By emphasising these positive aspects of aging to older participants, their images of older adults can experience positive change [57,58]. It may also be useful to incorporate a brief lecture on the positive aspects of older adults. The above efforts would more efficiently reduce fear of falling among older citizens.

This study focused on positive images of older adults as a variable that interacts with confidence in one's physical strength. Broadly speaking, affirming the images that older adults have of their ingroup is important for maintaining their physical and mental health. Studies have shown that older adults' negative images of their ingroup can lead to a decline in their self-efficacy and cognitive function [37-40]. Studies have also suggested that older adults with a more positive self-image are more likely to use new scientific technology and electronic devices [59,60] and hold more positive attitudes towards other generations, including youth [61]. Therefore, older adults should generally be encouraged to develop positive their images of their ingroup.

In this study, the fear of falling was higher among participants who had experienced a fall more recently (Table II; note that higher scores indicate a less recent fall). This is consistent with the results of previous studies showing that the fear of falling is higher among those who have had a recent fall [43-46]. Therefore, older adults who have recently experienced falls should receive encouragement to help them avoid excessive fear that 'they will fall again'. Notably, several participants in this study responded that their most recent fall experience was 'within a year' or 'more than a year ago' (see the distribution on the OSF repository), suggesting that participants may have been biased towards older adults in better health. For older adults with especially poor physical health, a recent fall experience may have a stronger effect on their fear of falling. In this study, we asked about the 'timing' of participants' most recent fall, but it would also be important to focus on the 'frequency' of falls [62], including whether the number of falls has increased in the past year (i.e. objective indicator) and whether participants perceive that the number of their falls increased (i.e. subjective indicator). Thus, we should follow up this study by subdividing the indicators related to recent fall experiences.

In this study, we measured fear of falling, confidence in one's physical strength, and subjective health using a single item each, considering the burden on the participants. Meanwhile, the correlations between each variable do not conflict with the findings of previous studies; thus, we have determined that this study adequately measured each psychological concept. However, fear of falling, the dependent variable in this study, can be measured using some existing scales, including the Falling Efficacy Scale [63], Activities-specific Balance Confidence Scale [64,65], and Geriatric Fear of Falling Measurement [66] (for a review of measures of fear of falling. please see the article [67]. In addition, positive images of older adults might be better to measure with more commonly used ageism-related scales [68-70]. In future studies, more appropriate scales should be used to measure each concept, while taking care not to overburden the participants.

Limitations

Despite the above findings, this study had three major limitations. First, the adjusted R^2 value of the multiple regression analysis was not large. In this study, we included participants' recent fall experience, outing frequency, and hospitalisation as control variables. Physical function indicators, including physical activity, muscle mass, and agility, have been shown to be strongly associated with the fear of falling [71-73]. Research has also shown that older adults with better sleep quality [74] and less severe depression [13,75] have a lower fear of falling. Therefore, our results should be re-examined after controlling for such indicators.

Second, the gender ratio of the participants was skewed towards women. This is because the participants were all older adults who had applied to a health program that trained volunteers to read storybooks to children (note that the data were collected before the program was implemented). Additional analyses limited to the female sample (see the OSF repository) supported Hypothesis 1, like in the main text. However, we did not find any interaction between confidence in physical strength and subjective health/positive images of older adults, which does not support Hypotheses 2 and 3. One reason for this may be that, in our main multiple regression analysis, the effect of gender on fear of falling was significant (Tab. II). The explanatory power of the model was greatly reduced when analysing the data from only female participants, because the effect of gender was not included. Notably, in this study, women had a greater fear of falling than men, which is consistent with previous studies [20,44,50,76]. Therefore, the men who participated in this study (n = 20) were unlikely to be very different from the general older male

population. Nevertheless, we should ensure a sufficient sample of male older adults in future research to follow up on our results.

Third, participants were limited to older adults who lived in urban areas and voluntarily participated in a health program that trained volunteers to read storybooks. The association between city size and the fear of falling has shown mixed results, with rural older adults having a higher fear of falling than their urban counterparts in some studies [77] and no significant differences between them in others [78]. In addition, a study conducted in the US found that fear of falling was higher among older adults who felt their neighbourhoods had more drainage ditches and poorly maintained sidewalks [79]. A large survey of Japanese participants reported that older adults living in cities with larger populations took more steps per day [80]. In Japan, urban and rural areas have very different aging rates. In 2021, the percentage of the population aged 65 and over in Tokyo was 22.9%, while in rural Akita Prefecture, it was 38.1% [1]. Thus, the effect of participants' place of residence on their fear of falling should be examined in detail. In addition, our participants were limited to older adults who were able to participate on their own in health programs conducted at local facilities; thus, their health status might be better than that of the general older population. Therefore, this study should be followed up with a wider range of healthy older adults using methods such as mail surveys.

CONCLUSIONS

In this study, we conducted a survey of community-dwelling older Japanese adults and found that participants with more confidence in their own physical strength had a lower fear of falling. However, this association was found only for participants with more positive images of older adults. This study was a cross-sectional survey and causal relationships were not examined. However, the identification of complex relationships with fear of falling and multiple psychological variables has great significance. To reduce the fear of falling among older adults, future studies should focus on their confidence in their own physical strength and positive images of older adults.

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Conflict of interest statement

The authors declare no conflict of interest.

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Author contributions

YS: conceived the idea, conducted statistical analyses, and interpreted the results, drafted the original manuscript. All authors contributed the data acquisition. HS: supervised this study. All authors reviewed the manuscript draft and revised it critically on intellectual content. All authors approved the final version of the manuscript to be published.

Ethical consideration

All procedures were in accordance with the ethical standards of the research committee of Tokyo Metropolitan Institute for Geriatrics and Gerontology, and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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