



Original Article

Factors associated with falls in community-dwelling older adults: an analysis based on subscales of the frailty screening index

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Abstract. [Purpose] We aimed to obtain new findings by investigating the relationship between the presence or absence of falls and the results from the Frailty Screening Index (FSI), which can be easily carried out. [Participants and Methods] A total of 780 community-dwelling older adults (age ≥ 65 years) were classified based on whether they had fallen in the past year as those who had fallen at least once (fall group), and those who had not (non-fall group). We compared the study groups using sub-items of the FSI to extract more specific fall-related factors. The FSI is a questionnaire that comprises five items with simple 'yes/no' responses. [Results] The following three out of five sub-items of the FSI were extracted as fall-related factors: 1) "no" to the question, "Do you do physical exercise, like walking, at least once a week?"; 2) "yes" to the question, "Do you think you walk slower than before?"; and 3) "yes" to the question, "Have you felt tired for no reason (in the past two weeks)?" [Conclusion] The study results suggest the significance of paying attention to participant responses to the sub-items on the FSI, instead of merely determining their frailty risk based on their total score.

Key words: Falls, Frailty, Community-dwelling older adults

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INTRODUCTION

Japan's population aging rate is continuing to rise. Elderly people often face multi-faceted problems, with not only physical but also psychological and social vulnerabilities. This condition is defined as frailty¹⁾. Frailty can be positioned as a stage prior to requiring long-term care and denotes a high-risk condition that can cause health problems, including autonomic dysfunction and death²⁾. Moreover, it has been suggested that frail, elderly people are at a higher risk of falls³⁾. Falls can lead to serious injuries such as femoral neck fractures and head injuries.

In Japan (all 47 prefectures on 16 April), a state of emergency was declared due to COVID-19 (Coronavirus disease 2019, hereinafter COVID-19), and many citizens were forced to stay at home and limit their social activities⁴⁾. The outbreak forced people to change their lifestyles and, in many cases, affected their activity, such as exercise, to maintain a certain level of physical activity and health⁵⁾. Using beacon location data, a study analyzed changes in activity patterns, including physical activity, caused by the COVID-19 outbreak, using an interrupted time series design; the declaration of a state of emergency was found to have a significant impact on walking distance, with a 20.3% decrease in daily walking distance (-186.8 m)⁶⁾. These results suggest the existence of a direct association between sedentary time and frailty⁷⁾.

We found changes in lifestyle due to COVID-19 and the resulting increase in the risk of frailty and nursing care need to be problematic. Therefore, we conducted a baseline survey to examine which elderly people were more likely to undergo or

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maintain these changes. To carry out the baseline survey, we noted that the Frailty Screening Index⁸⁾ has been widely used to determine frailty in community-dwelling older adults, and that it was able to capture changes in vulnerability over time. The Frailty Screening Index is a questionnaire that comprises five items answered with simple Yes/No responses and scoring ranging from 0 to 5. It does not require an actual measurement of grip strength or walking speed. The Frailty Screening Index, which is recommended in the 2017 Asia-Pacific Clinical Practice Guidelines for the management of frailty⁹⁾. Based on the above points, we aimed to obtain new findings by investigating the relationship between the presence or absence of falls and the results from the Frailty Screening Index, which can be carried out easily with no measuring instruments.

PARTICIPANTS AND METHODS

This was a cross-sectional study where a questionnaire was distributed to participants who returned it by mail. The questionnaire was distributed to 1,039 community-dwelling older adults (age ≥ 65 years) who had visited *kayoinoba* (e.g. recreational salons) or received surveillance support from the local welfare commissioner in Takasaki City, Gunma Prefecture, Japan. The survey was conducted from May 8 to 29, 2020. The questionnaire was distributed with the cooperation of local welfare commissioners and the regional support center that visited and monitored community-dwelling older adults.

Of 790 people who responded to the questionnaire (collection rate: 76%), 10 were excluded due to missing data. As a result, 780 (187 males, 593 females; average age 78.1 ± 6.3) were included in this study.

Items extracted from the questionnaire included age, gender, presence or absence of falls in the past 12 months, and the Frailty Screening Index. The questionnaire was designed to take about five minutes to complete. Participants must be able to fill out and post the survey form for themselves. They were not asked to state the names of diseases or their eligibility status for funded nursing care.

Based on the presence or absence of falls in the past 12 months, those who had one or more falls were categorized into the fall group and those who had no falls were categorized into the non-fall group. This was based on a previous study's finding¹⁰⁾ that a prior history of falls is a risk factor. The Frailty Screening Index is comprised of the following five items: one point each is given for a "yes" to the questions "Have you lost two to three kg or more over the past six months? (Yes/No)"; "Do you think you walk slower than before? (Yes/No)"; and "Have you felt tired for no reason (for the past two weeks)? (Yes/No). One point each is given for a "no" to the questions "Do you do physical exercise like walking at least once a week? (Yes/No)"; and "Can you recall what happened five minutes ago? (Yes/No)." Participants were diagnosed as frail if their score was 3 points or above. It has been reported that those who are diagnosed as frail have a higher chance of being certified as requiring long-term care in the next two years⁸⁾.

Compared to studies that focus on the total score of the Frailty Screening Index, very few studies have analyzed responses to sub-items of the Frailty Screening Index. Accordingly, we compared study groups by sub-items of the Frailty Screening Index to extract more specific fall-related factors.

Before comparing ages and total scores on the Frailty Screening Index between groups, the Shapiro-Wilk test was used to check normality. Since normality was not noted in either the fall or non-fall group, the Mann-Whitney U test was selected. To compare scores on the sub-items of the Frailty Screening Index and gender, a chi-square test was performed. In addition, a binomial logistic regression analysis was performed using the presence or absence of falls as the dependent variable, and each item compared between groups as the independent variable to calculate the odds ratio and 95% confidence intervals. For the statistical analysis, Excel Statistics by Social Survey Research Information Co., Ltd. (BellCurve for Excel version 3.2.0) was used, and the significance level was set at 5%.

The study was approved by the research ethical review committee at Takasaki University of Health and Welfare (Approval number: 2009) and was conducted in accordance with the tenets of the Declaration of Helsinki. This study was registered with the University Hospital Medical Information Network (UMIN000040335). A document describing the purpose and content of this study, as well as contact information, was distributed to the participants along with the questionnaire and pamphlet. The participants' consent to participate was confirmed by their signature on the questionnaire survey.

RESULTS

A total of 139 participants (17.8%) were classified as the fall group, while 641 participants were classified as the non-fall group. The group comparisons for each variable revealed that the fall group was significantly frailer ($p < 0.001$) and older ($p < 0.001$) than the non-fall group (Table 1). In terms of between groups comparisons of the sub-items of the Frailty Screening Index, significant differences were noted in "Do you do physical exercise like walking at least once a week?" ($p < 0.001$), "Do you think you walk slower than before?" ($p < 0.001$), "Have you felt tired for no reason (in the past two weeks)?" ($p < 0.001$), and "Have you lost two to three kg or more in the past six months?" ($p < 0.05$) (Table 2).

A binomial logistic regression analysis with the presence or absence of falls as the dependent variable was performed based on five independent variables found to differ significantly between groups. We excluded the total score of the Frailty Screening Index and used forced entry logistic regression to exclude the composite. The following three of five sub-items of the Frailty Screening Index were extracted as fall-related factors: "no" to the question "Do you do physical exercise like walking at least once a week?" (odds ratio: 1.86, 95% confidence interval: 1.23–2.81, $p < 0.01$); "yes" to the question "Do

Table 1. The group comparisons for ages, gender, total score of the Frailty Screening Index

	Overall (n=780)	Fall group (n=139)	Non-fall group (n=641)	p-value
Age, median (interquartile range)	78 (73–83)	80 (74–85)	78 (73–82)	0.001
Gender (males/females), n (%)	187 (24)/593 (76)	29 (21)/110 (79)	158 (25)/483 (75)	0.402
Frailty Screening Index (score), median (interquartile range)	1 (0–2)	2 (1–2)	1 (0–1)	0.001

Table 2. The group comparisons for scores on the sub-items of the Frailty Screening Index

	Overall (n=780)	Fall group (n=139)	Non-fall group (n=641)	p-value
“Have you lost two to three kg or more over the past six months? (Yes/No)”, n (%)	69 (9)/711 (91)	20 (14)/119 (86)	49 (8)/592 (92)	0.017
“Do you think you walk slower than before? (Yes/No)”, n (%)	345 (44)/435 (56)	88 (63)/51 (37)	257 (40)/384 (60)	0.001
“Do you do physical exercise like walking at least once a week? (Yes/No)”, n (%)	584 (75)/196 (25)	84 (60)/55 (40)	500 (78)/141 (22)	0.001
“Can you recall what happened five minutes ago? (Yes/No)”, n (%)	731 (94)/49 (6)	126 (91)/13 (9)	605 (94)/36 (6)	0.146
“Have you felt tired for no reason (for the past two weeks)? (Yes/No)”, n (%)	135 (17)/645 (83)	41 (29)/98 (71)	94 (15)/547 (85)	0.001

Table 3. Results of binominal logistic regression analysis

Independent variable	Odds ratio	95% Confidence interval	p-value
Age	0.97	0.94–1.00	0.061
“Have you lost two to three kg or more over the past six months? (Yes)”	1.62	0.90–2.90	0.104
“Do you think you walk slower than before? (Yes)”	1.85	1.23–2.79	0.003
“Do you do physical exercise like walking at least once a week? (No)”	1.86	1.23–2.81	0.002
“Have you felt tired for no reason (for the past two weeks)? (Yes)”	1.70	1.08–2.68	0.020

you think you walk slower than before?” (odds ratio: 1.85, 95% confidence interval: 1.23–2.79, $p < 0.01$); and “yes” to the question “Have you felt tired for no reason (in the past two weeks)?” (odds ratio: 1.70, 95% confidence interval: 1.08–2.68, $p < 0.05$) (Table 3).

DISCUSSION

In this study, we performed an analysis of community-dwelling older adults to extract fall-related factors. Among all study participants, comparisons were made between the fall group and non-fall group. As a result, the following three of five sub-items of the Frailty Screening Index were extracted as fall-related factors: “no” to the question “Do you do physical exercise like walking at least once a week?”, “yes” to the question “Do you think you walk slower than before?”, and “yes” to the question “Have you felt tired for no reason (in the past two weeks)?” It is widely known that frail, older people are at high risk of falls. The present study’s results demonstrate the significance of paying attention to participants’ responses to the sub-items, instead of merely determining their frailty risk based on their total score on the Frailty Screening Index.

It has been reported that the prevalence of frailty increases linearly if the number of daily steps falls below 4,000, and a slight increase in the number of current steps by, for example, 1,000 steps/day (approximately 10 minutes of activity) may help prevent frailty¹¹). The results revealed that, among other items, items that represent more physical characteristics were associated with the presence or absence of previous falls. The factors associated with falls were intuitively understandable items related to ambulatory function and physical strength, and these results are expected to motivate the elderly to improve and maintain them.

Lastly, we would like to mention some limitations and challenges in this study. First, there is little information on the basic

attributes of the study participants, and this may reduce the generalizability of the results. Second, there was a considerable difference in the number of male and female participants. Previous research¹²⁾ pointed out that mail survey has a low response rate from men. This point should have been considered for the present survey. Furthermore, the present study is a cross-sectional survey, presenting only subscales related to the history of falls. Therefore, we are planning to conduct a longitudinal survey with the same study participants in the future¹³⁾.

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Conflicts of interest

The authors declare no conflicts of interest.

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