J Frailty Aging 2022;in press
Published online November 4, 2022, http://dx.doi.org/10.14283/jfa.2022.63

Original Research

The Relationship between Psychological Distress and Physical Frailty in Japanese Community-Dwelling Older Adults: A Cross-Sectional Study

X. Liu[1], T. Chen[2], S. Chen[3], H. Yatsugi[4], T. Chu[1], H. Kishimoto[1]

1. Department of Behavior and Health Sciences, Graduate School of Human-Environment Studies, Kyushu University, Fukuoka City, Fukuoka, Japan; 2. Sports and Health Research Center, Department of Physical Education, Tongji University, Shanghai, China; 3. School of Nursing and Rehabilitation, Cheeloo College of Medicine, Shandong University, Jinan, China; 4. Faculty of Arts and Science, Kyushu University, Fukuoka City, Fukuoka 819-0395, Japan

Corresponding Author: Dr. Hiro Kishimoto, Faculty of Arts and Science, Kyushu University, IC15, 744 Motooka Nishi-ku, Fukuoka City, Fukuoka 819–0395, Japan, Tel: +81-92-802-6071, E-mail: kishimoto@artsci.kyushu-u.ac.jp

Abstract

BACKGROUND: Older adults' mental health and physical frailty have been a frequent research focus, but few studies have investigated the relationship between them.

OBJECTIVES: To investigate the association between mental health and physical frailty in community-dwelling older Japanese people.

DESIGN: Cross-sectional study from the Itoshima Frail Study.

SETTING: Itoshima City, Fukuoka, Japan.

PARTICIPANTS: A total of 919 community-dwelling older individuals aged 65–75 years.

MEASUREMENTS: Physical frailty was measured based on five criteria proposed by the Fried scale, and the subjects were classified into three groups: robust, pre-frailty, and frailty. Psychological distress was used to assess the subjects' mental health, with the Kessler 6-Item Psychological Distress Scale (K6) score; the subjects were divided into three groups based on their K6 score: 0–1, 2–4, and ≥5. Psychological distress was defined by K6 score ≥5. Ordinal logistic regression was used to estimate the odds ratios (OR) and 95% confidence intervals (CIs) between the psychological distress and physical frailty status.

Results: Psychological distress was identified in 190 subjects (20.7%). Forty-six subjects (5.0%) presented with physical frailty, and 24 subjects (2.6%) had both psychological distress and physical frailty. With the increase in the K6 score, more subjects had pre-frailty and physical frailty ($p<0.001$). Significant positive associations were observed between psychological distress and the risks of pre-frailty (OR 2.94, 95%CI: 1.95–4.43) and frailty (OR 10.71, 95%CI: 4.68–24.51), even in a multivariable-adjusted analysis. In a subgroup analysis of components of frailty, one-point increment in K6 score was associated with higher odds of shrinking and fatigue.

CONCLUSION: A severe psychological distress was associated with increased risks of physical frailty and the frailty sub-items of shrinking and fatigue in community-dwelling older Japanese adults.

Key words: Physical frailty, psychological distress, community-dwelling, older adult.

Introduction

The aging of populations worldwide presents challenges to the maintenance of a sense of health, sustained well-being, social engagement, and productivity over a more extended period, despite the development of illness and disability. Japan is one of the countries with the highest number of older people globally, and according to the Japanese Cabinet Office, 27.7% of Japan's population is over the age of 65 years (1). It is also expected that the number of late-stage older adults (aged ≥75 years) worldwide will increase significantly in the future. Various changes occur with aging in both the mind and body, and problems such as falls, disorders of daily life, frailty syndrome, deterioration of cognitive function, and the need for long-term care have been studied (2, 3).

Frailty syndrome is an intermediate stage in the transition from being healthy to needing care from other individuals. Older people have a weaker ability to recover when they experience physical, mental, and/or social damage when they are frail, due to decreases in their physiological reserve (4, 5). Physical frailty (referred to hereafter as 'frailty') is also very prevalent with age and can lead to adverse health effects such as falls, hospitalizations, disabilities, and mortality (2, 6–10). Frailty refers to several aspects of a condition that tends to occur with age such as weakened muscles, easy tiredness, and a tendency to stay home. Frailty is thus a multifaceted concept that includes physical disorders, mental problems such as cognitive dysfunction and depression, and social problems such as those posed by living alone and financial distress. Frailty has attracted more research attention in recent years. For example, the human body's muscle mass decreases by 1%–2% per year from the age of ~30 years, and approx. 30% of the muscle is lost by the age of 80 (11). Although a decrease in bone density also tends to occur with aging, there are significant individual differences. Frailty also leads to low physical activity. However, frailty has been suggested to be reversible, and it can be treated and delayed by interventions such as health promotion, nutrition, physical exercise and social support (12-14).

Grip strength (15, 16), fatigue (15), and physical activity (17–19) have all been reported to be significantly correlated with mental distress. Psychological distress is a commonly used term used to describe a non-specific mental health disorder based on negative parameters such as self-deprecation, irritability, anxiety, depression, and social withdrawal as indicators (20); it is defined as a condition in which an individual's emotional state is characterized by depressive symptoms and anxiety (21). A recent survey revealed that the number of older individuals with mood disorders and depression in Japan has increased by approx. 1.8-fold in 15 years (1).

Received April 25, 2022
Accepted for publication September 28, 2022

Two studies have described a positive association between psychological distress and frailty (22, 23). However, the current research findings are mainly in adults over 65 years old (not younger adults), and little is known about the association between psychological distress and frailty in older Japanese individuals. With the rapid increase of aging in Japan's population, it is necessary to determine the association between psychological distress and frailty in early-older Japanese adults and to identify methods for the early detection and prevention of psychological distress and frailty.

We conducted the present study to clarify the relationship between measured psychological distress and frailty in community-dwelling older Japanese adults. We hypothesized that older Japanese adults with a higher level of psychological distress would be significantly associated with higher risks of frailty or pre-frailty.

Methods

Study design and subjects

This study was a cross-sectional analysis using the baseline data of the Itoshima Frail Study (IFS) conducted in 2017. The study design of the IFS has been described in detail (24). Briefly, the IFS is an ongoing community-based prospective study. Among approx. 10,000 older residents of the city of Itoshima, Japan aged 65–75 years who were not certified as requiring nursing care by the national long-term care insurance system, 5,000 were randomly selected according to the residential area, sex, and age. Of the 5,000 individuals we contacted, 1,631 returned the questionnaire we distributed, and 949 subjects completed further assessments (24). Subjects who were not in the age range (n=19), those lacking physical test data (n=1), and those with invalid questionnaire data (n=10) were excluded. A final total of 919 subjects with valid data were included as the study sample. The study was approved by the Institutional Review Board of Kyushu University, Japan. All subjects provided written informed consent (Approval No. 201708).

Physical frailty

Frailty and physical pre-frailty (referred to hereafter as 'pre-frailty') were defined based on the following five components. (i) Shrinking: unintentional weight loss of ≥2.0 kg in the previous 6 months, which is similar to the original definition of >10 lbs (4.5 kg) in the year prior. (ii) Low grip strength: the lowest 20% of grip strength (GS), measured by a handheld dynamometer (GRIP-D, T.K.K. 5401; Takei Scientific Instruments, Niigata, Japan), stratified by sex and body mass index (BMI) as follows. Men: BMI <18.5 kg/m^2 and GS ≤27.6 kg; BMI 18.5–24.9 kg/m^2 and GS ≤32.2 kg; BMI 25.0–29.9 kg/m^2 and GS ≤30.3 kg; BMI ≥30.0 kg/m^2 and GS ≤29.6 kg. Women: BMI <18.5 kg/m^2 and GS ≤19.9 kg; BMI 18.5–24.9 kg/m^2 and GS ≤19.4 kg; BMI 25.0–29.9 kg/m^2 and GS ≤20.4 kg; BMI ≥30.0 kg/m^2 and GS ≤20.0 kg. (iii) Fatigue: indicated by a positive answer to either or both of the following two questions regarding awareness in the past month: «Did you feel that everything you did was an effort?» and «Did you feel exhausted without any reason?» (these questions are from the Kessler 6-Item Psychological Distress Scale). (iv) Slowness: the slowest 20% of walking time (WT) in the 5-m walk test at one's maximum walking speed, stratified by sex and standing height, as follows. Men: height <165.0 cm and WT ≥3.07 s; height ≥165.0 cm and WT ≥2.83 s. Women: height <152.3 cm and WT ≥3.17 s; height ≥152.3 cm and WT ≥2.95 s. (v) Low physical activity: the lowest 20% of energy expenditure of physical activity stratified by sex, assessed for 1 week with a tri-axial accelerometer, as follows. Men ≤6.62 kcal/kg/day and women ≤8.23 kcal/kg/day (25).

All five of the original components of the Cardiovascular Health Study (CHS) frailty phenotype and their methodology to produce population-specific cut-off points were used in our study. Individuals with three or more affected components were considered frailty; those with one or two affected components were considered pre-frail, and those with no affected components were considered robust (2). We have reported the satisfactory internal validity of this operational definition of frailty in the Sasaguri Genkimon Study elsewhere (25).

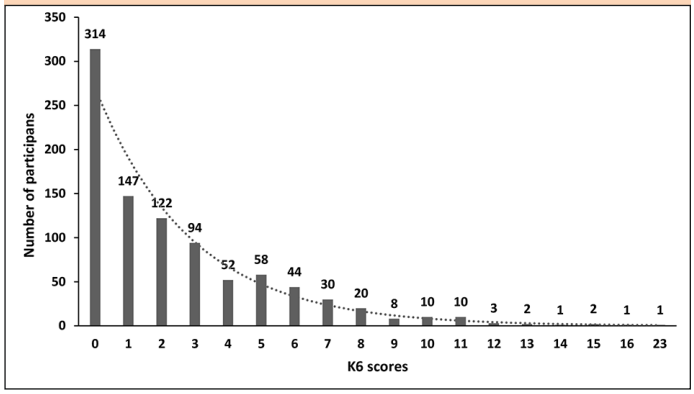
To clarify the repeated distracting item of fatigue, A four domains without fatigue of frailty also be defined in sub-study, individuals with one or more, two or more, three or more of frailty item affected components were considered frailty.

Psychological distress

Psychological distress was measured using the Kessler 6-Item psychological distress Scale (K6) score. We measured the frequency of non-specific psychological distress experienced by the subjects during the last 30 days by using the K6 score. The K6 consists of six questions asking how often the respondent felt: (i) nervous, (ii) hopeless, (iii) restless or fidgety, (iv) so depressed that nothing could cheer one up, (v) that everything was an effort, (vi) and worthless. A value of 0, 1, 2, 3, or 4 was assigned to each of five Likert-type response categories for each question: «none of the time,» «a little of the time,» «some of the time,» «most of the time,» or «all of the time,» respectively. Responses were summed with a possible score range of 0–24. Based on previous studies, the summed scores can be classified into three categories: (1) no or low psychological distress: 0–4 points; (2) moderate psychological distress: 5–12 points; and (3) high psychological distress: ≥13 points (26).

Our examination of the distribution of the subjects' K6 scores (shown in Fig. 1) revealed that only a few subjects scored ≥10 points (n=30, 3.19%) or >13 points (n=7, 0.74%). We considered a K6 score ≥5 points as indicating a condition of psychological distress. In addition, because there many more subjects with a K6 score <5 points compared to a previous study (27), we used the median (2 points) as the split value, and we divided the subjects into three groups based on their K6 scores.

Figure 1. Distribution of K6 scores



Other variables

Sociodemographic characteristics including the subjects' age, sex, living alone (yes/no), smoking (everyday, sometimes, quit, or never), alcohol consumption (everyday, sometimes, quit, or never), employment status (yes/no), living area (Shima, Nijo, or Maebaru), and chronic pain (with or without) were collected with the use of a questionnaire. The subjects' cognitive function was measured using the Montreal Cognitive Assessment-Japanese version (MoCA-J) (28), conducted by the public nurses and trained staff.

Statistical analysis

Baseline characteristics are presented as the mean ± standard deviation (SD) for continuous variables and as frequency (percentage) for categorical variables according to the groups of K6 score. The trends for these characteristics across the three groups of K6 score were tested using the Jonckheere–Terpstra test for continuous variables and the Cochran–Armitage test for categorical variables. Ordinal logistic regression was used to estimate the odds ratios (OR) and 95% confidence intervals (CIs) for the risks of frailty and pre-frailty according to the K6 score and one-point increments of the K6 score.

To clarify the independent association between the K6 score and the risks of frailty and pre-frailty, we adjusted for age and sex (as Model 2), BMI, smoking, alcohol consumption, employment status, living area, living alone, cognitive function, and chronic pain (as Model 3 including age and sex). We used ordinal logistic regression models to estimate the ORs and 95%CIs between the K6 score and the frailty sub-items. The statistical analyses were conducted using Statistical Analysis Software (SAS) ver. 9.4 (SAS Institute, Cary, NC, USA). The computation was carried out using the computer resources offered under the category of General Projects by the Research Institute for Information Technology, Kyushu University. Statistical significance was set at $p<0.05$.

Results

Table 1 summarizes the characteristics of the 919 subjects according to the K6 score. The prevalence of a K6 score ≥5 was 20.7% (n=190). The higher K6 score were older, had a higher percentage of women, and showed lower BMI, fewer regular alcohol drinkers, more chronic pain, lower educational levels, and lower MoCa-J score. These differences were all significant (all p for trend<0.05). Table 1 also presents the prevalence of frailty status and its sub-items according to the K6 score. The numbers of frail and pre-frail subjects were significantly increased with the higher K6 score ($p<0.0001$). The higher K6 score also showed greater prevalences of shrinking ($p<0.01$) and fatigue ($p<0.0001$).

Table 1. Characteristics of study subjects according to K6 score

	K6 score			P for trend
	0–1 (n=461)	2–4 (n=268)	≥5 (n=190)	
Age, yrs	70.7±3.0	70.9±3.1	71.1±3.1	0.049
Sex:				<0.01
Men	251 (54.5)	126 (47.0)	80 (42.1)	
Women	210 (45.5)	142 (53.0)	110 (57.9)	
BMI, kg/m^2:	23.2±3.2	22.9±3.3	22.5±3.2	0.03
<18.5	24 (5.2)	27 (10.1)	20 (10.5)	
18.5–24.9	319 (69.2)	176 (65.7)	130 (68.4)	
25.0–29.9	101 (21.9)	58 (21.6)	37 (19.5)	
≥30.0	17 (3.7)	7 (2.6)	3 (1.6)	
Living area:				0.20
Shima	104 (22.6)	69 (25.8)	47 (24.7)	
Nijo	126 (27.3)	70 (26.1)	53 (27.9)	
Maebaru	231 (50.1)	129 (48.1)	90 (47.4)	
Employed	168 (36.4)	82 (30.6)	62 (32.6)	0.11
Living alone	46 (10.0)	29 (10.8)	22 (11.6)	0.27
Smoking	45 (9.8)	15 (5.6)	14 (7.4)	0.08
Drinking	255 (55.3)	128 (47.8)	87 (45.8)	0.01
Chronic pain	266 (57.7)	186 (69.4)	144 (75.8)	<0.0001
Education, years	13.1±2.4	12.8±2.4	12.6±2.5	0.01
MoCa score	24.3±2.8	24.4±2.9	23.6±3.2	0.03
Frailty status:				<0.0001
Robust	235 (51.0)	116 (43.3)	44 (23.2)	
Pre-frailty	214 (46.4)	142 (53.0)	122 (64.2)	
Frailty	12 (2.6)	10 (3.7)	24 (12.6)	
Shrinking	35 (7.6)	27 (10.1)	30 (15.8)	<0.001
Low grip strengh	88 (19.1)	65 (24.3)	41 (21.6)	0.15
Fatigue	0 (0.0)	28 (10.5)	86 (45.3)	<0.0001
Slowness	89 (19.4)	58 (21.7)	43 (23.0)	0.13
Low physical activity	87 (19.5)	40 (15.8)	45 (24.3)	0.17

All data are mean ± SD or n (%). BMI: body mass index, MoCa, Montreal Cognitive Assessment. Smoking = smoke almost every day or sometimes. Drinking = consuming alcohol almost every day or sometimes; Frailty status is defined as 0 component for robust, 1–2 components for physical pre-frailty and ≥3 components for frailty.

The risks of pre-frailty and frailty status according to K6 score are shown in Table 2. In Model 1, the OR (95%CI, p-value) for the risk of pre-frailty in the K6 score 2–4 and ≥5 were 1.34 (0.99–1.83, p=0.06) and 3.05 (2.06–4.50, $p<0.0001$) compared with the K6 score 0–1. Moreover, the risk of pre-frailty was significantly higher with a one-point increase in the K6 score ($p<0.0001$). Similar significant associations

Table 2. Associations between K6 score and the risks of frail and pre-frail status

	Model 1			Model 2			Model 3		
	OR	95%CI	p-value	OR	95%CI	p-value	OR	95%CI	p-value
K6 total score					*Pre-frailty*				
0–1	1.00	Ref.	1.00	Ref.	1.00	Ref.			
2–4	1.34	0.99–1.83	0.06	1.34	0.98–1.83	0.07	1.32	0.95–1.81	0.10
≥5	3.05	2.06–4.50	<0.0001	3.07	2.07–4.57	<0.0001	2.94	1.95–4.43	<0.0001
One point increment of K6 score			<0.0001			<0.0001			<0.0001
					Frailty				
0–1	1.00	Ref.	1.00	Ref.	1.00	Ref.			
2–4	1.69	0.71–4.02	0.24	1.62	0.68–3.90	0.28	1.63	0.66–4.01	0.29
≥5	10.68	4.98–22.93	<0.0001	10.51	4.82–22.92	<0.0001	10.71	4.68–24.51	<0.0001
One point increment of K6 score			<0.0001			<0.0001			0.0001

Model 1: Non-adjustment. Model 2: Adjusted for age and sex. Model 3: Adjusted for body mass index, smoking, drinking, employment status, living area, living alone, cognitive function, chronic pain plus factors in model 2. OR: odds ratio, CI: confidence interval.

Table 3. Associations between one-point increments of K6 score and sub-item of frailty

	Model 1			Model 2			Model 3		
	OR	95%CI	p-value	OR	95%CI	p-value	OR	95%CI	p-value
Shrinking	1.12	1.06–1.20	<0.001	1.12	1.06–1.20	<0.001	1.10	1.03–1.17	<0.01
Low grip strength	1.03	0.98–1.09	0.25	1.03	0.97–1.08	0.33	1.01	0.96–1.07	0.66
Slowness	1.03	0.98–1.09	0.26	1.03	0.97–1.09	0.34	1.01	0.95–1.07	0.77
Low physical activity	1.03	0.97–1.09	0.34	1.03	0.97–1.08	0.38	1.04	0.98–1.11	0.16
Fatigue	2.01	1.80–2.25	<0.0001	2.01	1.80–2.25	<0.0001	2.05	1.82–2.31	<0.0001

Model 1: Non-adjustment. Model 2: Adjusted for age and sex. Model 3: Adjusted for body mass index, smoking, drinking, employment status, living area, living alone, cognitive function, chronic pain plus factors in model 2.

were observed between K6 score and the risk of frailty. The OR (95%CI, p-value) was 1.69 (0.71–4.02, p=0.24) in the 2–4-points group and 10.68 (4.98–22.93, p<0.0001) in the ≥5 point group. These associations did not change even when the models were adjusted for the confounding factors in Model 2 or 3. The OR (95%CI) of pre-frailty and frailty in the K6 score 2–4-points group was not lower significantly than that of the 0–1-points group, but these point estimates were above 1.00.

To clarify the repeated distracting item of fatigue, we also examined the association between psychological distress and frailty components (four domains without fatigue). As shown in Supplementary Table S1, a significant association was revealed between the K6 score and frailty score ≥2 (multiple-adjusted OR = 1.74, 95%CI: 1.05–2.88, p=0.03). A significant association was also observed between a one-point increment of K6 score and frailty score ≥2 points (p<0.01).

Table 3 provides the data of the association between K6 score and sub-items of frailty. Shrinking and fatigue were significantly associated with the K6 score in Model 1; the ORs (95%CI, p-value) were 1.12 (1.06–1.20, p<0.001) for shrinking and 2.01 (1.80–2.25, p<0.0001) for fatigue. These significant associations were also observed in Model 2 and Model 3; the ORs (95%CIs, p-values) were 1.12 (1.06–1.20, p<0.001) for shrinking and 2.01 (1.80–2.25, p<0.0001) for fatigue in Model 2, and 1.10 (1.03–1.17, p<0.01) and 2.05 (1.82–2.31, p<0.0001), respectively in Model 3.

Discussion

This study examined the relationship between psychological distress and the frailty of the older Japanese adults living in their community. Our analyses revealed significant positive associations between psychological distress and the risks of pre-frailty and frailty. These associations were unchanged after adjustment for potential confounding factors. The results are in agreement with our study hypothesis. To our knowledge, this is the first study to investigate the associations between psychological distress and frail status in relatively younger-aged (65–75 years) adults in Japan.

Relationship between psychological distress and frailty

The prevalence of psychological distress in our study population was 20.7%; this prevalence is similar to that of another older cohort (25). Using the K6 score of 108 older Japanese adults, Yamamoto et al. (29) reported a 16.7% prevalence of psychological distress. The difference between studies may be due to the exclusion of subjects with sprains or pain by Yamamoto et al. (29).

The prevalence of frailty in our study population was 5.0%, which is lower than those in other studies of community-dwelling older adults (2, 25, 30, 31). The age range of our subjects was 65–75 years old, which is relatively younger

than the ages of the subjects in these previous studies. Chen et al. reported that the prevalence of frailty among subjects aged 65–69 was ~2.0% and among those aged 70–74 the prevalence was ~5.0%; they noted that the prevalence increased dramatically (to ≥15.0%) in the subjects aged ≥75 years (25).

Our present findings demonstrated that psychological distress was positively associated with the risks of frailty and pre-frailty, which is consistent with the results of earlier investigations. Studies of older Chinese adults observed that an increased level of psychological distress would increase the risk of frailty (32, 33). From a clinical point of view, a higher K6 score may indicate a decrease in intention, which leads to a decrease in activities of daily living, a decrease in exercise capacity, a decrease in muscle mass, and a low nutritional state, which are likely to increase the prevalence of frailty or pre-frailty. Frailty has both physical and mental aspects, but a study using psychological tests showed that subjects with frailty often have a strong sense of anxiety or depression in addition to a feeling of mental fatigue (34). From a sociological point of view, a higher K6 score may decrease older adults' social behavior and physical exercise, leading to physical dysfunction and ultimately increasing the risk of frailty or pre-frailty (35).

The association between psychological distress and frailty sub-items

A cross-sectional study demonstrated a significant positive association between fatigue and the K6 score [36]. We also observed a positive association between the frailty sub-item shrinking and the K6 score, which was not reported in previous studies. We suggest that this is because an increase in the K6 score is associated with poor appetite, which leads to weight loss (37). The positive association between shrinking and the K6 score is thus also in line with our initial hypothesis.

Interestingly, a positive correlation between low physical activity and psychological distress has been reported (38) but was not observed in the present study. This absence of a correlation may have been obtained because we assessed low physical activity based on the average daily calorie consumption by sex (38), which as an objective measure revealed that the precise calorie consumption values were not significantly different between the present older adults with and without physical distress. Self-reported moderate-to-vigorous physical activity (MVPA) or the weekly activity time has been used to assess low physical activity (39).

There are some study limitations to address. The subjects were 65–75 years old and not representative of the entire older population. The questionnaire response rate was relatively low, which could cause bias in interpreting the results since the subjects who self-selected to participate in the study may be different from those who did not. For example, only a few subjects had a total K6 score >13, and thus the relationship between severe psychological distress and frailty could not be explained (27). In addition, the causal relationship between variables could not be determined because the data were corrected by a cross-sectional design. Prospective studies are needed to explore causal relationships.

Conclusion

A severe psychological distress score was associated with increased risks of frailty and its sub-items of shrinking and fatigue in the present population of community-dwelling older Japanese adults.

Acknowledgements: We thank all of the subjects, the Itoshima City office for their support of the participant recruitment, and Emeritus Professor Shuzo Kumagai, the initiator of this study.

Statement of Ethics: This study was approved by the Institutional Review Board of Kyushu University, Japan (approval no. 201708, Principal Investigator: Shuzo Kumagai). All participants provided written informed consent.

Conflict of Interest Statement: The authors report no conflicts of interest related to this article.

Funding Sources: This study was supported in part by Grants-in-Aid for Scientific Research (B) (nos. JP20H04016 and JP20H04030) and (C) (nos. JP20K102692, JP20K11446, and JP20K12510) and for Activity Start-up (no. JP19K24259) from the Ministry of Education, Culture, Sports, Science and Technology of Japan; by Itoshima City (2021-0032), Asanohi Orthopaedic Clinic (2020-0528) and NTT docomo Inc. (2021-0085). None of the funding sources had any role in the study design, data analysis, data interpretation, writing of the manuscript, or decision on the submission of this manuscript.

Author Contributions: All authors contributed to the data analysis, the drafting and revision of the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Data Availability Statement: All of the study data can be obtained from the corresponding author upon reasonable request.

References

1. Cabinet Office Annual Report on the Ageing Society: 2018 (Summary). https://www8.cao.go.jp/. Accessed on 2 April 2019.
2. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: Evidence for a phenotype. Cardiovascular Health Study Collaborative Research Group. J Gerontol A Biol Sci Med Sci. 2001;56(3):M146–M156. doi: https://doi.org/10.1093/gerona/56.3.M146.
3. Song X, Mitnitski A, Rockwood K. Prevalence and 10-year outcomes of frailty in older adults in relation to deficit accumulation. J Am Geriatr Soc. 2010;58(4):681–687. doi: https://doi.org/10.1111/j.1532-5415.2010.02764.x.
4. Ferrucci L, Cavazzini C, Corsi A, et al. Biomarkers of frailty in older persons. J Endocrinol Invest. 2002;25(10 Suppl):10–15.
5. M. Hale, S. Shah, A. Clegg Frailty, inequality and resilience. Clin Med. 2019;19(3):219-223. doi: https://doi.org/10.7861/clinmedicine.19-3-219.
6. Bandeen-Roche K, Xue QL, Ferrucci L, et al. Phenotype of frailty: Characterization in the women's health and aging studies. J Gerontol A Biol Sci Med Sci. 2006;61(3):262–266. doi: https://doi.org/10.1093/gerona/61.3.262.
7. Gill TM, Gahbauer EA, Allore HG, Han L. Transitions between frailty states among community-living older persons. Arch Intern Med. 2006;166(4):418–423. doi: https://doi.org/10.1001/archinte.166.4.418.
8. Graham JE, Snih SA, Berges IM, Ray LA, Markides KS, Ottenbacher KJ. Frailty and 10-year mortality in community-living Mexican American older adults. Gerontology. 2009;55(6):644–651. doi: https://doi.org/10.1159/000235653.
9. Ensrud KE, Ewing SK, Cawthon PM, et al. A comparison of frailty indexes for the prediction of falls, disability, fractures, and mortality in older men. J Am Geriatr Soc. 2009;57(3):492–498. doi: https://doi.org/10.1111/j.1532-5415.2009.02137.x.
10. ARMS Ekram, R L Woods, C Britt, et al. The Association between Frailty and All-Cause Mortality in Community-Dwelling Older Individuals: An Umbrella Review. J Frailty Aging. 2021;10(4):320-326. doi: https://doi.org/10.14283/jfa.2021.20.
11. Keller K, Engelhardt. Strength and muscle mass loss with aging process. Age and strength loss. Muscles Ligaments Tendons J. 2013;3(4):346–350. doi: https://doi.org/10.11138/mltj/2013.3.4.346.
12. R B Silva, H Aldoradin-Cabeza, G D Eslick, et al. The Effect of Physical Exercise on Frail Older Persons: A Systematic Review. J Frailty Aging. 2017;6(2):91-96. doi: https://doi.org/10.14283/jfa.2017.7.
13. R Otsuka, S Zhang, C Tange, et al. Association of Dietary Intake with the Transitions of Frailty among Japanese Community-Dwelling Older Adults. J Frailty Aging. 2022;11(1):26-32. doi: https://doi.org/10.14283/jfa.2021.42.
14. R Jiwani, J Wang, C Li, et al. A Behavioral Lifestyle Intervention to Improve Frailty in Overweight or Obese Older Adults with Type 2 Diabetes: A Feasibility Study. J Frailty Aging. 2022;11(1):74-82. doi: https://doi.org/10.14283/jfa.2021.17.
15. McHugh JE, Dowling M, Butler A, Lawlor BA. Psychological distress and frailty transitions over time in community dwelling older adults. Ir J Psychol Med. 2016;33(2):111–119. doi: https://doi.org/10.1017/ipm.2015.67.

16. Davison KM, Lung Y, Lin SL, Tong H, Kobayashi KM, Fuller-Thomson E. Psychological distress in older adults linked to immigrant status, dietary intake, and physical health conditions in the Canadian Longitudinal Study on Aging (CLSA). J Affect Disord. 2020;265(15):526–537. doi: https://doi.org/10.1016/j.jad.2020.01.024.
17. Andrade-Gomez E, Martínez-Gomez D, Rodriguez-Artalejo F, Garcia-Esquinas E. Sedentary behaviors, physical activity, and changes in depression and psychological distress symptoms in older adults. Depress Anxiety. 2018;35(9):884–897. doi: https://doi.org/10.1002/da.22804.
18. Carrapatoso S, Cardon G, Dyck DV, Carvalho J, Gheysen F. Walking as a mediator of the relationship of social support with vitality and psychological distress in older adults. J Aging Phys Act. 2018;26(3):430–437. doi: https://doi.org/10.1123/japa.2017-0030.
19. Gyasi RM, Phillips DR. Risk of psychological distress among community-dwelling older adults experiencing spousal loss in ghana. Gerontologist. 2020;60(3):416–427. doi: https://doi.org/10.1093/geront/gnz052.
20. Cuijpers P, Smits N, Donker T, Have M, Graaf R. Screening for mood and anxiety disorders with the five-item, the three-item, and the two-item mental health inventory. Psychiatry Res. 2009;168:250–255. doi: https://doi.org/10.1016/j.psychres.2008.05.012.
21. Masse R, Poulin C, Dassa C, Lambert J, Belair S, Battaglini A. The structure of mental health: Higher-order confirmatory factor analyses of psychological distress and well-being measures. January 1998 Social Indicators Research 45(1):475–504. doi: https://doi.org/10.1023/A:1006992032387.
22. Fu P, Zhou C, Meng Q. Associations of sleep quality and frailty among the older adults with chronic disease in China: The mediation effect of psychological distress. Int J Environ Res Public Health. 2020;17(14):5240. doi: https://doi.org/10.3390/ijerph17145240.
23. Rebecca IBS, Cathal DW, Anne-Marie C, Joseph PW, Joanna EM, Brian AL. Psychological distress as a key component of psychosocial functioning in community-dwelling older people. Aging Ment Health. 2012;16(2):199–207. doi: https://doi.org/10.1080/13607863.2011.604024.
24. Chen S, Chen T, Kishimoto H, Yatsugi H, Kumagai S. Development of a Fried frailty phenotype questionnaire for use in screening community-dwelling older adults. J Am Med Dir Assoc. 2020;21(2):272–276. doi: https://doi.org/10.1016/j.jamda.2019.07.015.
25. Chen S, Honda T, Chen T, et al. Screening for frailty phenotype with objectively-measured physical activity in a west Japanese suburban community: Evidence from the Sasaguri Genkimon Study. MC Geriatr. 2015;15:36. doi: https://doi.org/10.1186/s12877-015-0037-9.
26. Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry. 2003;60:184–189. doi: https://doi.org/10.1001/archpsyc.60.2.184.
27. Tomitaka S, Kawasaki Y, Ide K, Akutagawa M, Ono Y, Furukawa TA. Distribution of psychological distress is stable in recent decades and follows an exponential pattern in the US population. Sci Rep. 2019;9(1):11982. doi: https://doi.org/10.1038/s41598-019-47322-1.
28. Fujiwara Y, Suzuki H, Yasunaga M, et al. Brief screening tool for mild cognitive impairment in older Japanese: Validation of the Japanese version of the Montreal Cognitive Assessment. Geriatr Gerontol Int. 2010;10(3):225–232. doi: https://doi.org/10.1111/j.1447-0594.2010.00585.x.
29. Yamamoto Y, Suzuki H, Yutaka Owari, Miyakate N. Relationships between physical activity, sleeping time, and psychological distress in community-dwelling elderly Japanese. Medicine. 2019;55:318. doi: https://doi.org/10.3390/medicina55070318.
30. Op het Veld LPM, van Rossum E, Kempen GIJM, de Vet HCW, Hajema K, Beurskens AJHM. Fried phenotype of frailty: Cross-sectional comparison of three frailty stages on various health domains. BMC Geriatr. 2015;15:77. doi: https://doi.org/10.1186/s12877-015-0078-0.
31. Chittrakul J, Siviroj P, Sungkarat S, Sapbamrer R. Physical frailty and fall risk in community-dwelling older adults: A cross-sectional study. J Aging Res. 2020;2020:3964973. doi: https://doi.org/10.1155/2020/3964973.
32. Ye B, Gao J, Fu H. Associations between lifestyle, physical and social environments and frailty among Chinese older people: A multilevel analysis. BMC Geriatr. 2018;18(1):314. doi: https://doi.org/10.1186/s12877-018-0982-1.
33. Jing Z, Li J, Wang Y, et al. The mediating effect of psychological distress on cognitive function and physical frailty among the elderly: Evidence from rural Shandong, China. J Affect Disord. 2020;268:88–94. doi: https://doi.org/10.1016/j.jad.2020.03.012.
34. Hideyuki Hattori: Frail and depression. In: M. Katsutani, T. Ameumi (eds.), Frail – The most important issues and preventive strategies in a super-aged society. Ishiyaku Publications, Tokyo, 2014, 72–77.
35. Chu W, Chang SF, Ho HY, Lin HC. The relationship between depression and frailty in community-dwelling older people: A systematic review and meta-analysis of 84,351 older adults. J Nurs Scholarsh. 2019;51:547–559. doi: https://doi.org/10.1111/jnu.12501.
36. Holden L, Scuffham P, Hilton M, Vecchio N, Whiteford H. Psychological distress is associated with a range of high-priority health conditions affecting working Australians. Aust NZ J Public Health. 2010;34(3):304–310. doi: https://doi.org/10.1111/j.1753-6405.2010.00531.x.
37. Mariana SZ, Joao VN, Carla VR, et al. The association between appetite loss, frailty, and psychosocial factors in community-dwelling older adults adults. Clin Nutr ESPEN. 2022;47:194–198. doi: https://doi.org/10.1016/j.clnesp.2021.12.016.
38. Okoro CA, Stoodt G, Rohrer JE, Strine TW, Li C, Balluz LS. Physical activity patterns among U.S. adults with and without serious psychological distress. Public Health Rep. 2014;129:30–38. doi: https://doi.org/10.1177/003335491412900106.
39. Liu X, Kishimoto H. Relationship between psychological distress and physical frailty in the older adults. Journal of Health Science. 2021;43: 43–50. (in Japanese). doi: https://doi.org/10.15017/4372013.

How to cite this article: X. Liu, T. Chen, S. Chen, et al. The Relationship between Psychological Distress and Physical Frailty in Japanese Community-Dwelling Older Adults: A Cross-Sectional Study. J Frailty Aging 2022; http://dx.doi.org/10.14283/jfa.2022.63