International Journal of Gerontology 16 (2022) 231–236
https://doi.org/10.6890/IJGE.202207_16(3).0012

International Journal of Gerontology

journal homepage: http://www.sgecm.org.tw/ijge/

Original Article

Prevalence and Risk Factors of Frailty Using Fried Frailty Phenotype Questionnaire among Older People in a Depopulated Area: A Cross-Sectional Study

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ARTICLE INFO

Accepted 6 December 2021

Keywords:
aging,
frailty,
prevalence,
risk factors,
surveys,
questionnaires

SUMMARY

Background: In recent years, there have been increased hospital admissions, readmissions, and emergency visits due to sarcopenia and frailty; thus, new countermeasures are required. Therefore, this study examined the prevalence and risk factors of frailty using the Fried Frailty Phenotype Questionnaire among older people in a depopulated area.

Methods: This study enrolled 106 older people who voluntarily participated in an extensive medical examination for the early detection of age-related diseases in the depopulated town of Wakasa in Fukui Prefecture. After obtaining written informed consent from all subjects, we conducted a basic questionnaire survey and physical function measurement, followed by a Fried Frailty Phenotype Questionnaire survey and explanation of the results by a physician.

Results: Of the 106 older people, 36.7%, 53.7%, and 9.4% were classified into the nonfrail, prefrail, and frail groups, respectively. Multivariate analysis revealed that hospital admission was an independent risk factor of frailty.

Conclusion: In this survey using the Fried Frailty Phenotype Questionnaire, 9.4% were frail, while 53.7% were prefrail; thus, more than 60% needed to improve their frailty status. Effective interventions to prevent frailty are required after hospital discharge. Frailty checks should also be simple and administered to many older people.

1. Introduction

The aging population in Japan has been rapidly increasing.[1] In 2019, the aging rate was 28% compared with the world population aging rate of 9.0%, making Japan the most aged country worldwide.[2] Hence, the demand for medical services and nursing care in Japan is expected to increase sharply after 2025, when the baby boomer generation will start turning 75 years old.[1] To maintain the dignity of the older people as well as to support them in living independently, Japan promotes the construction of a comprehensive community care system.[3] However, healthcare disparities have been observed between major cities and rural areas.[4] The number of elderly patients in rural areas is expected to increase, with a significant decrease in the number of younger patients. Hence, the projected increase in the number of patients needing emergency care has become a major cause for concern among regional healthcare providers. In recent years, there have been increased hospital admissions, readmissions, and emergency visits due to sarcopenia and frailty; thus, new countermeasures are required.[5,6] Hence, our screening activities aimed to promote early diagnosis and treatment of age-related diseases, including sarcopenia and frailty, by conducting an extensive medical examination that covers a wider range of screening items than the usual, and to determine a new way of introducing complementary medical interventions in rural and depopulated areas.

In a county with an aging population such as Japan, countermeasures for physical frailty have gained considerable public attention.[7] The Japanese version of the Cardiovascular Health Study (CHS) for frailty investigation requires equipment and space to measure physical fitness and is also time consuming; thus, it is difficult to conduct in a large number of older people concurrently.[8] Furthermore, diagnosing frailty is challenging because it requires more than a week of wearing a tri-axis accelerometer to evaluate the physical activity level.[9] Therefore, a new screening method for physical frailty called Fried Frailty Phenotype Questionnaire (FFPQ) has been devel-

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oped, with five items and six questions.[10]

While the previously presented Japanese FRAIL scale (J-FRAIL) includes the assessment of "illness," the FFPQ focuses on detecting frailty phenotype by replacing the "illness" item with a question about inactivity. The FFPQ is highly valid and reliable, with diagnostic accuracy.[10] In this study, we aimed to evaluate physical frailty among older people living in a depopulated area by using the FFPQ, and to determine the prevalence and risk factors of frailty.

2. Materials and methods

2.1. Study subjects

This cross-sectional study, which involved an extensive medical examination, was conducted in Miyake suburb situated in Wakasa town, Mikatakaminaka district, Fukui prefecture, on December 21 and 22 of 2019. We included Miyake residents who responded to the public invitation of Wakasa's town office to voluntarily participate in an extensive medical examination for the early detection of age-related diseases. We examined 109 participants aged above 70 years (78.3 ± 5.1 years), comprising 42 males and 67 females. All participants provided written informed consent. However, we excluded two participants who did not complete the FFPQ and one participant who lacked skeletal muscle mass measurement.

2.2. Characteristics of subjects in each group

In addition to comparing variables among three groups (nonfrail, prefrail, and frail groups), we made a comparison between the two groups with and without frailty, the latter comprising of nonfrail and pre-frail subjects.

2.3. Study area

Wakasa town is located in the southern part of Fukui prefecture and consists of eight suburbs, each with its own community center and regional development council.[11] It is an agricultural and fisheries town, with a population of approximately 14,248 people. As of 2021, its population aging rate (percentage of the population aged ≥ 65 years) was 35%, and the percentage of the population aged ≥ 75 years was 19%, making the town a super-aged society. In addition to being an aged society, population decline has become a problem. Miyake is one of the suburbs in Wakasa town, with a population of approximately 1,713 people. As of 2021, its population aging rate was 33% and the percentage of the population aged ≥ 75 years was 19%. We chose Miyake suburb for our research because it was a standard area representing the population structure of Wakasa town as a whole.

2.4. Examination items

After obtaining written consent from all participants, the examination was conducted in the following order: a basic questionnaire survey, measurement of physical functions (height, weight, walking speed, grip strength, and skeletal muscle mass), blood sampling (glycohemoglobin [HbA1c], total cholesterol, albumin, zinc, creatinine, glycoalbumin, and transferrin), FFPQ survey, and explanation of the results by a physician. Before the examination, all participants completed a basic questionnaire about their age, sex, past medical history (diabetes, hypertension, heart disease, dyslipidemia, and stroke), lifestyle (smoking and drinking), household composition, ambulance usage, and hospital admissions. Physical function related to sarcopenia was assessed using the Asian Working Group for Sarcopenia 2019 consensus.[12] For the walking speed, we measured twice the time duration for the participant to pass a 6 m mark at a normal walking speed without slowing down and then calculated the average.[12,13] Functional mobility was measured and evaluated using the Timed Up and Go (TUG) test.[14] In this test, the participants sat down in a chair and when instructed, stood up and walked around a marker located 3 m away, and sat back down on the chair.[14] The TUG score was measured once. Using the Smedley style hand grip dynamometer, we measured the grip strength for both hands and identified the maximum value for the analysis.[12,13] Furthermore, skeletal muscle mass was measured by bioelectrical impedance analysis using the Tanita multifrequency body composition analyzer (MC-780A).[15] With the permission of Professor Akizo Kumagai of Kyushu University, we used the FFPQ to determine physical frailty. The FFPQ consists of five items with six questions on fatigue, muscle strength, aerobic capacity, physical activity reduction, and weight loss.[10] The participants with one or two applicable FFPQ were considered pre-frail, and those with three or more applicable items were frail. Those who were found to have diseases, including sarcopenia and frailty, were given a patient referral document and encouraged to visit a medical institution in the local area. In particular, those with sarcopenia or frailty were planned to receive exercise guidance at a later date.

2.5. Statistical analysis

All statistical data were analyzed using the EZR ver.1.41 (Saitama Medical Center, Jichi Medical University, Saitama, Japan).[16] Age, systolic blood pressure, diastolic blood pressure, body mass index, TUG, walking speed, maximum grip strength, skeletal muscle mass index, HbA1c, total cholesterol, albumin, zinc, creatinine, glycoalbumin, and transferrin are expressed as mean $\pm$ SD. The nominal variables are presented as the number of cases and frequency (%) for each item. We performed univariate analyses to examine each variable between two and three groups in a data set collected by the aforementioned questionnaire. The two groups were compared using the Mann-Whitney U test for continuous variables and $\chi 2$ test (including Yates continuity correction) for nominal variables. The three groups were compared using the Kruskal-Wallis test (multiple comparisons of two groups at a time with post-hoc adjustment, and Steel-Dwass multiple comparisons) for continuous variables and Fisher's exact test (multiple comparisons of two groups at a time with Bonferroni adjustment) for nominal variables. To identify the risk factors associated with frailty, we also performed a multiple logistic regression analysis (Binomial Logistic Regression Analysis) with the presence of frailty as a dependent variable. In any case, $p < 0.05$ was considered statistically significant.

This study was approved by the University of Fukui Medical Ethics Review Committee (20190014) and was performed in accordance with the ethical standards stated in the Declaration of Helsinki.

3. Results

3.1. Background of subjects

The mean age of all participants was 78.3 ± 5.1 years, and 65 (61.3%) were female (Table 1). Among all the participants, 66 (62.2%) were living with family members, indicating the most common household status. We found 39 nonfrail (36.7%), 57 prefrail (53.7%), and 10 frail (9.4%) participants. The frail group obtained a significantly higher number of hospital admissions than the nonfrail group

(30.0% vs. 0%, $p = 0.02$). We also found 5 patients (4.7%) with sarcopenia.

3.2. Physical functions and examination findings

The frail group had significantly higher TUG scores (8.3 ± 2.5sec vs. 6.5 ± 0.8 sec, $p = 0.030$) and glycoalbumin levels (16.4% ± 2.2% vs. 15.0% ± 1.7%, $p = 0.025$) and a significantly lower walking speed (1.4 ± 0.3 m/s vs. 1.7 ± 0.2 m/s, $p = 0.017$) than the nonfrail group (Table 2).

3.3. Background of the subjects (comparison between groups with and without frailty)

The group with frailty had a significantly higher hospital ad-

Table 1
Background of the participants.

	Total n = 106	Nonfrailty n = 39 (36.7)	Prefrailty n = 57 (53.7)	Frailty n = 10 (9.4)	*p*-value
Age (years)	78.3 ± 5.1	77.2 ± 5.1	78.6 ± 4.9	79.7 ± 5.5	0.206
≥ 75 years, n (%)	82 (77.3)	29 (74.4)	45 (78.9)	8 (80.0)	0.885
Sex (male/female)	41/65	19/20	18/39	4/6	0.243
Blood pressure					
Systolic blood pressure (mmHg)	139.8 ± 17.2	135.6 ± 18.4	142.0 ± 15.8	143.8 ± 18.8	0.372
Diastolic blood pressure (mmHg)	78.0 ± 12.9	78.7 ± 12.6	77.8 ± 11.6	76.7 ± 20.5	0.985
BMI	23.1 ± 3.3	22.7 ± 2.8	23.4 ± 3.5	22.5 ± 3.3	0.481
Lifestyle					
Smoking, n (%)	12 (11.3)	5 (12.8)	6 (10.5)	1 (10.0)	0.901
Drinking alcohol, n (%)	31 (29.2)	14 (35.9)	14 (24.6)	3 (30.0)	0.509
Subjective symptoms, n (%)	63 (59.4)	17 (56.4)	32 (56.1)	9 (90.0)	0.116
Underlying disease					
Diabetes mellitus, n (%)	13 (12.2)	2 (5.1)	9 (15.8)	2 (20.0)	0.188
Cardiac disease, n (%)	16 (15.0)	3 (7.7)	10 (17.5)	3 (30.0)	0.126
Dyslipidemia, n (%)	29 (27.3)	11 (28.2)	16 (28.1)	2 (20.0)	0.901
Hypertension, n (%)	61 (57.5)	24 (61.5)	33 (57.9)	4 (40.0)	0.474
Stroke, n (%)	5 (4.7)	3 (7.7)	2 (3.5)	0 (0.0)	0.634
Sarcopenia judgment					
Sarcopenia, n (%)	5(4.7)	2(5.1)	2 (3.5)	1 (10.0)	0.49
Household composition					
Single household, n (%)	8 (7.5)	4 (10.3)	3 (5.3)	1 (10.0)	0.454
Households of only a couple, n (%)	31 (29.2)	12 (30.8)	17 (29.0)	2 (20.0)	0.902
Households consisting of a couple and their children, n (%)	66 (62.2)	23 (59.0)	36 (63.2)	7 (70.0)	0.873
Households consisting of a couple and their parent, n (%)	2 (1.8)	1 (2.6)	1 (1.8)	0 (0)	1
Experience using ambulance, n (%)	4 (3.7)	2 (5.1)	2 (3.5)	0 (0)	1
Hospital admission, n (%)	7 (6.6)	0 (0)	4 (7.0)	3 (30.0)	0.0066[a]

Mean ± standard deviation, Number of cases (% or Unit), BMI: body mass index; Kruskal–Wallis test (multiple comparisons of two groups at a time with post hoc adjustment and Steel–Dwass multiple comparisons).
Fisher's exact test (multiple comparisons of two groups at a time with Bonferroni adjustment) a: Nonfrailty vs. Prefrailty (0.14), Nonfrailty vs. Frailty (0.02), Prefrailty vs. Frailty (0.12).

Table 2
Physical functions and examination findings.

	Total n = 106	Nonfrailty n = 39 (36.7)	Prefrailty n = 57 (53.7)	Frailty n = 10 (9.4)	*p*-value
Physical function					
Timed up and go (s)	7.4 ± 3.0	6.5 ± 0.8	7.8 ± 3.8	8.3 ± 2.5	0.011[a]
Walking speed (m/s)	1.6 ± 0.4	1.7 ± 0.2	1.5 ± 0.4	1.4 ± 0.3	0.014[b]
Maximum grip strength (kg)	26.3 ± 7.2	27.9 ± 6.7	25.4 ± 7.8	25.20 ± 3.9	0.21
Maximum grip strength: male (kg)	32.8 ± 6.4	32.8 ± 5.9	33.9 ± 7.0	28.3 ± 3.0	0.319
Maximum grip strength: female (kg)	22.2 ± 3.9	23.4 ± 3.4	21.5 ± 4.3	23.1 ± 3.0	0.304
SMI (kg/m^2)	6.6 ± 1.0	6.6 ± 1.1	6.5 ± 1.1	6.7 ± 0.8	0.651
SMI: male (kg/m^2)	7.4 ± 0.8	7.4 ± 0.6	7.5 ± 0.6	6.8 ± 0.7	0.245
SMI: female (kg/m^2)	6.0 ± 0.8	5.9 ± 0.5	5.9 ± 0.9	6.6 ± 0.9	0.206
Laboratory data					
HbA1c (%)	5.7 ± 0.7	5.7 ± 0.4	5.7 ± 0.8	5.9 ± 0.5	0.343
T-cho (mg/L)	185.6 ± 32.6	190.1 ± 28.3	186.1 ± 25.4	165.0 ± 66.4	0.514
Albumin (mg/dL)	4.1 ± 0.2	4.1 ± 0.2	4.1 ± 0.2	4.1 ± 0.3	0.986
Zinc (μg/dL)	78.2 ± 15.2	76.1 ± 12.9	80.1 ± 16.9	75.5 ± 12.8	0.355
Creatinine (mg/dL)	0.8 ± 0.3	0.8 ± 0.4	0.7 ± 0.2	0.81 ± 0.4	0.456
Glycoalbumin (%)	15.3 ± 1.8	15.0 ± 1.7	15.3 ± 1.7	16.4 ± 2.2	0.034[c]
Transferrin (mg/dL)	241.5 ± 37.3	238.5 ± 34.3	244.6 ± 54.8	244.6 ± 54.8	0.763

Mean ± standard deviation (unit), HbA1c: glycohemoglobin; SMI: skeletal muscle mass index; T-cho: total cholesterol.
Kruskal–Wallis test (multiple comparisons of two groups at a time with post-hoc adjustment and Steel–Dwass multiple comparisons).
[a] Nonfrailty vs. Prefrailty (0.050), Nonfrailty vs. Frailty (0.030), Prefrailty vs. Frailty (0.444). [b] Nonfrailty vs. Prefrailty (0.077), Nonfrailty vs. Frailty (0.017), Prefrailty vs. Frailty (0.50). [c] Nonfrailty vs. Prefrailty (0.406), Nonfrailty vs. Frailty (0.025), Prefrailty vs. Frailty (0.162).

mission (30.0% vs. 4.2%, $p = 0.013$) than the group without frailty (Table 3).

3.4. Physical functions and examination findings (comparison between groups with and without frailty)

The group with frailty had a significantly higher glycoalbumin level (16.4% ± 2.2% vs. 15.2% ± 1.7%, $p = 0.024$) than the group without frailty (Table 4).

3.5. Risk factors associated with frailty

Hospital admission was found to be a risk factor of frailty (odds ratio, 9.9; 95% confidence interval 1.440–68.700; $p = 0.020$) (Table 5). It was defined as any hospitalization of between December 1 of 2018 and November 30 of 2019.

Table 3
Background of the subjects (Comparison between groups with and without frailty).

	Without frailty (Nonfrailty and Prefrailty) n = 96 (90.6)	Frailty n = 10 (9.4)	*p*-value
Age (years)	78.0 ± 5.0	79.7 ± 5.5	0.327
≥ 75 years, n (%)	74 (77.1)	8 (80.0)	1
Sex (male/female)	37/59	4/6	0.243
Blood pressure			
Systolic blood pressure (mmHg)	139.4 ± 17.1	143.8 ± 18.8	0.654
Diastolic blood pressure (mmHg)	78.2 ± 12.0	76.7 ± 20.5	0.875
BMI	23.1 ± 3.3	22.5 ± 3.3	0.541
Lifestyle			
Smoking, n (%)	11 (11.5)	1 (10.0)	1
Drinking alcohol, n (%)	28 (29.2)	3 (30.0)	1
Subjective symptoms, n (%)	54 (56.2)	9 (90.0)	0.083
Underlying disease			
Diabetes mellitus, n (%)	11 (11.5)	2 (20.0)	0.782
Cardiac disease, n (%)	13 (13.5)	3 (30.0)	0.358
Dyslipidemia, n (%)	27 (28.1)	2 (20.0)	0.86
Hypertension, n (%)	57 (59.4)	4 (40.0)	0.399
Stroke, n (%)	5 (5.2)	0 (0.0)	1
Sarcopenia judgment			
Sarcopenia, n (%)	4 (4.2)	1 (10.0)	0.965
Household composition			
Single household, n (%)	7 (7.3)	1 (10.0)	1
Households of only a couple, n (%)	29 (30.2)	2 (20.0)	0.756
Households consisting of a couple and their children, n (%)	59 (61.5)	7 (70.0)	0.851
Households consisting of a couple and their parent, n (%)	2 (2.1)	0 (0)	1
Experience using ambulance, n (%)	4 (4.2)	0 (0)	1
Hospital admission, n (%)	4 (4.2)	3 (30.0)	0.013

Mean ± standard deviation, number of cases (% or unit), BMI: body mass index; Continuous variables: Mann-Whitney U test, Nominal variables: $\chi 2$ test (including Yates continuity correction).

Table 4
Physical functions and examination findings (Comparison between groups with and without frailty).

	Without frailty (Nonfrailty and Prefrailty) n = 96 (90.6)	Frailty n = 10 (9.4)	*p*-value
Physical function			
Timed Up and Go (s)	7.3 ± 3.1	8.3 ± 2.5	0.065
Walking speed (m/s)	1.6 ± 0.4	1.4 ± 0.3	0.061
Maximum grip strength (kg)	26.4 ± 7.4	25.20 ± 3.9	0.867
Maximum grip strength: male (kg)	33.4 ± 6.4	28.3 ± 3.0	0.139
Maximum grip strength: female (kg)	22.1 ± 4.0	23.1 ± 3.0	0.509
SMI (kg/m^2)	6.5 ± 1.1	6.7 ± 0.8	0.486
SMI: male (kg/m^2)	7.4 ± 0.8	6.8 ± 0.7	0.147
SMI: female (kg/m^2)	5.9 ± 0.8	6.6 ± 0.9	0.078
Laboratory data			
HbA1c (%)	5.7 ± 0.7	5.9 ± 0.5	0.529
T-cho (mg/L)	187.8 ± 26.6	165.0 ± 66.4	0.393
Albumin (mg/dL)	4.1 ± 0.2	4.1 ± 0.3	0.944
Zinc (μg/dL)	78.5 ± 15.5	75.5 ± 12.8	0.556
Creatinine (mg/dL)	0.82 ± 0.3	0.81 ± 0.4	0.456
Glycoalbumin (%)	15.2 ± 1.7	16.4 ± 2.2	0.024
Transferrin (mg/dL)	241.1 ± 54.8	244.6 ± 54.8	0.987

Mean ± standard deviation, number of cases (% or unit), BMI: body mass index; Continuous variables: Mann-Whitney U test, Nominal variables: $\chi 2$ test (including Yates continuity correction).

Table 5
Risk factors associated with frailty.

	Odds ratio	95% CI Upper–lower	*p*-value
≥ 75 years	0.9	0.123–6.68	0.922
Sex (male)	0.7	0.170–3.45	0.728
Glycoalbumin	1.3	0.991–1.96	0.056
Walking speed (m/s)	0.04	0.001–1.380	0.076
Timed up and go	0.7	0.517–1.150	0.207
Hospital admission	9.9	1.440–68.700	0.020

Multiple logistic regression analysis (Binomial Logistic Regression Analysis), CI: confidence interval.

4. Discussion

This study examined the prevalence and risk factors of frailty by using the FFPQ in older people living in a depopulated area. Our results showed that 36.7%, 53.7%, and 9.4% of the participants were nonfrail, prefrail, and frail, respectively. The frailty prevalence rate among community-dwelling older people in other countries is approximately 7%–10%.[17] In Japan, the frailty and prefrailty rates are 4.4%–33.3% and 42.7%–64.7%, respectively, indicating a great variation depending on the frailty assessment method.[18–21] In the Kyoto-Kameoka study, frailty was examined using both the CHS index and the Kihon Checklist.[20,22] The frailty prevalence according to the CHS index was 9.9% in males and 10.0% in females, but according to the Kihon Checklist, the prevalence was 30.8% in males and 33.3% in females; thus, the two different methods showed a great difference.[20] Given that some methods assess frailty from multiple angles, the study results should be interpreted with caution. Another survey used the CHS index for older people (≥ 65 years old) living in communities throughout Japan, and reported that 8.7% of them were frail, with a higher percentage in western Japan than in eastern Japan, indicating regional differences.[23] In the Chubu region (Central region), 8.0%, 42.6%, and 49.5% were frail, prefrail, and nonfrail, respectively.[23] The prefrailty percentage is similar to that in industrial cities in Japan, while the frailty percentage is similar to that in Sasaguri, Fukuoka Prefecture. In our study, more than 60% of the older people living in Miyake, which is a depopulated area, needed improvement for their prefrail and frail conditions. Of note, the frailty index we used is different from those used in other studies, and our participants were above 70 years old.

In this study, no significant differences were found in the age and percentage of participants aged ≥ 75 years among nonfrail, prefrail, and frail groups. However, because more than 70% of the participants were aged ≥ 75 years, it is necessary to consider the relationship between aging and frailty. The prevalence of frailty has been reported to increase as people get older, with a marked increase after the age of 75 years.[24] This study included only volunteer participants and may have underestimated the prevalence of frailty by leaving out more severely frail older people. A longitudinal study on adults aged 50 years and over living in private households in England assessed trends in frailty associated with loneliness and social isolation over a 14-year period. The authors reported that both loneliness and social isolation increased the risk of developing frailty.[25] Therefore, future screening activities should be designed to meet the needs of older people who are reluctant to participate due to social withdrawal, etc.

Unfortunately, the FFPQ was not concurrently compared with other frailty indices, but considering that our participants were older people, the results may be similar to those obtained in previous studies.

Frailty refers to a progressive decline in physical and cognitive functions caused by a combination of malnutrition, loss of muscle strength/muscle mass, and physical activity reduction triggered by aging and chronic diseases.[26] Early detection of frailty and effective interventions are crucial in Japan, where the society has become super-aged. In our study, the walking speed and functional mobility of the frail group decreased, as measured by the TUG test. A high walking speed is associated with a reduced mortality risk.[27] Walking speed is an important indicator of health status; it contributes not only to the improvement of the frailty status but also to life expectancy. The TUG score is also associated with the activities of daily living (ADL).[28,29] Exercise therapy is the most important intervention for preventing or lowering the frailty level.[30] In our study, exercise therapy was expected to improve the walking ability and ADL of the frail group, leading to the postponement of frailty and extension of a healthy life span. Regarding the nutritional status, the glycoalbumin level (16.4% ± 2.2%) was significantly higher in the frail group than in other groups. A glycoalbumin level of 15.6%–16.5% is considered higher than normal, indicating prediabetes.[29] Implementing nutritional therapies for the frail group may help prevent diabetes mellitus. Diabetes mellitus increases the risk of developing frailty and vice versa; thus, this chronic condition must be prevented.[13,32,33]

For the explanation of the association between hospital admission and frailty, we cannot estimate exact causality due to its cross-sectional study design. However, the hospital-acquired disability may be the reason for future frailty after discharge. In a previous report examining the outcomes of both short- and long-term hospital admissions among frail older people, frailty positively correlated with 2-year mortality; thus, the older people with frailty who were discharged from the hospital may have a deteriorated health status.[34] Given that frailty is a midpoint between a healthy state and a state requiring nursing care, early and appropriate intervention and support for older people who have been hospitalized are essential to help resume their independent and healthy state.

However, this study has several limitations. First, we were not able to cover all of Wakasa. However, because our study area was a standard suburb in the town, the estimated frailty prevalence among the sample can be generalized to older people in the entire town. Second, the participants could possibly be highly health-conscious. Third, the conventional frailty questionnaires have not been thoroughly evaluated. Fourth, considering that the medical history and lifestyle were determined according to the participants' self-report questionnaire during their medical interview, making considerations based on actual influencing factors was impossible. Fifth, the length of hospital admission was not considered. Lastly, the onset of frailty was not considered during hospital admission. The six abovementioned limitations should be considered in future studies.

5. Conclusion

In this study using the FFPQ, 10 (9.4%) and 57 (53.7%) of the older people in a depopulated area were frail and prefrail, respectively, and more than 60% needed frailty improvement. Effective interventions for frailty prevention are essential, especially for those who have been discharged from the hospital. Frailty checks should also be simple and administered to many elderly people.

Competing interests

The authors have no proprietary interest in any aspect of this study.

Funding

There was no additional financial support from public or private sources.

Data sharing statement

All data underlying the findings are within the paper.

Consent to publish

Not applicable.

Acknowledgments

This study was conducted in cooperation with the medical staff (doctors, nurses, public health nurses, radiological technologists, dieticians, occupational therapists, physical therapists, and clinical laboratory technologists), office workers, and students as well as with Wakasa Town Office and Fukui Dietetic Association. We would like to express our gratitude to them. We are also grateful to Yuka Nakamura, Mie Yamashita, Noriko Sadakane, and Satoko Hirose for their assistance with the office work and preparation. We thank Enago (www.enago.jp) for English language editing. We are grateful to Shuzo Kumagai, Professor Emeritus of Kyushu University, for his cooperation in the use of the Fried Frailty Phenotype Questionnaire. We thank J-CLUB (www.j-club.net) for English Translation Support.

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