A Pilot Trial to Predict Frailty Syndrome: The Japanese Health Research Volunteer Study

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Running headline: Prediction of frailty in older Japanese adults

Abstract

Most definitions of frailty utilize US populations in their development. The concept of frailty has not been well studied in Japan, which has the largest percentage of older patients (per capita) in the world. We created a 5-year prospective cohort study of community-dwelling older Japanese adults. Participants were not frail at baseline, based on our definition adapted from the Canadian Study for Health and Aging Clinical Frailty Scale. Participants underwent a comprehensive geriatric assessment (CGA) at baseline, and final assessments were either in person or via mailed survey. We enrolled 407 individuals (184 men, mean age 78 ± 4 years; 223 women, mean age 77 ± 4 years). Sixty-five participants met criteria for frailty by the end of the study. In univariate analyses, eighteen separate parameters were associated with frailty, some of which included: age, gender, handgrip, timed walk, systolic blood pressure, pulse pressure, cognitive status, living alone, and hearing deficits. In multivariate analyses, the following elements remained associated with frailty: timed walk, pulse pressure, cognition deficits and hearing deficits. We established cut-off points for timed walk (5 meters/3 seconds) and pulse pressure (60 mmHg). We then created a simple additive score for these four factors (present=1; absent=0). A score of 0 had a 93% negative predictive value for frailty while a score of 4 had a 70% positive predictive value. While further study is needed, this work creates an easy-to-administer tool that may be generalizable to other populations.

Keywords: frailty, prediction, gait speed, pulse pressure, cognitive deficits, hearing deficits

1. **Introduction**

Health maintenance and health promotion among older adults have become major societal issues worldwide, especially among Western nations (Cassel, 2009; Cruz-Jentroft et al, 2009). Furthermore, it is believed that such issues might have important cost and outcome benefits for society (Ackermann et al, 2008; Goetzel et al, 2007; Meng et al, 2009; Wieland, 2003). Although a comprehensive geriatric assessment (CGA) has long been used as the standard of care in the field of geriatrics (Li, 2010), another less formal and simpler types of assessment may be useful for active, relatively healthy older individuals (Jones et al, 2004,2005; Searle et al, 2008). In particular, proactively assessing these older adults for frailty may help determine which subjects need interventions to prevent poor health outcomes. However, a widely accepted, clinically applicable and easy-to-use definition of frailty has not yet been established. Fried and others (Fried et al, 2001) proposed the concept that frailty is a clinical phenotype characterized by several variables, although some of these variables (such as grip strength, timed walk) may not be readily clinically available. The Canadian Study for Health and Aging Clinical Frailty Scale (CSHA-CSF), on the other hand, uses symptoms and signs that do not require sophisticated clinical measurements (Rockwood et al, 2005). Controversy continues as to which of these models may be the most useful, and further research is needed to determine how the definition of frailty used relates to factors such as socio-economic status, comorbidities, and cognitive and sensory impairments (Lang et al, 2009).

In 2000, the “New Elderly Citizen Movement” was initiated at the Life Planning Center Foundation in Tokyo, Japan, with the goal of encouraging older adults to make lifestyle changes so they could remain active and productive. Within this group, a research cohort was established and as of 2002, the cohort has about 3,000 members. At baseline, these individuals were relatively healthy and active, although some had co-morbid illnesses that did not affect their functional status or ability to live independently. The details of their medical conditions and health-related behaviors have been reported elsewhere (Doba et al, 2011; Hinohara et al, 2005). The “Health Research Volunteer Study” was a cohort study within this program that examined the clinical phenotype and other factors associated with the development of frailty. This manuscript describes the factors associated with frailty in this study and proposes the validation of a prediction rule for frailty in this unique cohort of Japanese individuals.

2. **Methods**

2.1. Definition and assessment of frailty

A consensus on the concept and diagnostic criteria for frailty has not yet been established. While Fried and others (Fried et al, 2001) have done the most work on defining the frailty phenotype, their definition was not suitable for our population. In addition to being frail, this is in part due to the fact that some older adults in our study were not available for in-person assessments (e.g. to determine walking speed or grip strength) at the end of the study because they had moved away or did not have the assistance they needed to be able to come to our clinic.

Because of these limitations, we chose to use the CSHA-CFS definition of frailty, which clusters individuals along a continuum of being completely dependent and frail to completely healthy (Rockwood et al, 2005). The CSHA-CFS is defined as follows: very fit, robust, active, energetic, and highly motivated; well, without active disease, but less fit; well, with treated comorbid disease; apparently vulnerable, not dependent, but beginning to slow down; mildly frail, dependent on others for Instrumental Activity of Daily Living (IADLs); moderately frail, help is needed with IADLs; and severely frail, completely dependent or terminally ill. Both the probability of survival and the ability to remain independent measured by being able to avoid placement in a long-term care were significantly different among the seven groups during a 70-month follow-up period. These differences were especially obvious between the group with a score of 3 and the group with a score 4. Although various frailty models are available, and assessment of frailty remains very heterogeneous (Abellan van Kahn et al, 2008; Lang et al, 2009), the CSHA Clinical Frailty Scale is inline with the National Care Policy for Japan and could be adopted as one of the more widely used scales in both clinical and community practice (Chan et al, 2009). We used the CSHA-CFS to dichotomize subjects into two groups at the end of the 5-year follow-up period: a non-frail group comprised of those with scores from 1 to 3 and a frail group comprised of those with a score of 4 to 7.

2.2. Subjects

Criteria for being included in this analysis were: having contributed data for the 5-year period ending in 2011, having a score of 1 to 3 on the CHSA-CFS at the baseline assessment, and having had a stable weight for the 6 months before study entry. From the entire cohort of 3,000 members at the Life Planning Center 407 subjects were enrolled in the study based on the following entry criteria: age > 70 years, well-controlled comorbid illness, sufficiently independent in IADLs, and having active social connections (Entry criteria adapted from Rowe et al, 1998). All subjects were community-dwelling and were independent in their Activities of Daily Living (ADLs) and IADLs at baseline. We excluded patients if they had active chronic infective, inflammatory, neoplastic or other moderate to severe chronic diseases. Patients with stable medical conditions or who were receiving conventional medications for those conditions (e.g. antihypertensives, lipid-lowering agents, or oral hypoglycemic medications) were not excluded. Study endpoints were death, development of frailty, drop-out, or study termination.

At the end of the 5-year study period, all enrolled subjects were contacted and asked to come to the Life Planning Center for a final assessment. When subjects were unable because they were too ill or otherwise unavailable, we contacted them or their caregivers via telephone or mail. Subjects who could not be contacted at the final assessment were considered dropouts and were removed from the study. Written informed consent was obtained from all the participants, and ethical permission was obtained from the Committee of the Japan Society of Health Evaluation and Promotion.

2-3. Determination of Frailty

The study committee consisting of 21 members and included physicians, sociologists, psychologists, statisticians, dieticians, nurses and medical technicians who held regular meetings three times a year. Two physicians made the determination of frailty based on the pre-defined criteria, and these decisions were reported to the larger committee meeting where the final determination was accepted by a consensus process. When there was a lack of clarity as to whether a subject had a score of three or four (4 cases, 6% of subjects), the following additional criteria were used to make the frailty determination: exercise tolerance (inability to walk 800m without resting and/or to climb 10 steps with ease), fatigue, weight loss more than 5kg for past 1 year, fall with or without fracture and decreased physical strength. When one of these rare cases had two or more of these elements, they were classified as a score of 4. In addition, in years two and four, clinical updates were obtained via written surveys, telephone interviews or through other clinical avenues.

2-4. Assessment and Measurements

Interview materials were sent to all participants in advance, and they completed the instruments on their own. They then brought these forms in to be reviewed and confirmed by one of 4 trained study nurses in one-on-one conversations with subjects. Questions were multiple choice in nature, and response options were: none (0), slightly (1), obviously (2) [translated from Japanese]. For example, when asked about difficulties with hearing, 0 signifies no problems, 1 signifies slight problems in mildly noisy situation, and 3 signifies obvious hearing difficulty in any situation. All study procedures were carefully documented and monitored.

The survey instrument consisted of four parts: 1) a section assessing daily activities and changes in physical and cognition function; 2) a section reviewing their current medical conditions and treatments; 3) depression screening and 4) a detailed dietary assessment. Cognitive assessment was confirmed using the Minimum Data Set cognitive performance scale by Morris and others (Morris et al,1994). After completing these assessments, all subjects underwent a physical examination performed by the attending physicians at the Life Planning Center Clinic in Tokyo, who are specialized in internal medicine and cardiology.

As part of these assessments, the following parameters were obtained: height (cm), weight (kg), body mass index, body fat ratio (%; bio-impedance method using TBF-110/210 equipment from TANITA), total body fat mass (kg), total body nonfat mass (kg; body weight – total body fat mass), and maximum mid-arm and mid-calf circumferences (cm). Skin-fold measurements (mm) were performed on the dorsal aspect of the triceps and the muscular area of the mid-portion of the upper arm. Other functional measurements that were obtained included: a single measurement of grip strength of the dominant hand (kg with Grip D, T.K.K.5401), timed walk (number of seconds to walk 5 meters using a start/stop methodology), resting metabolic ratio (kcal/min), bone mineral density of the 2nd to 4th lumbar vertebrae (DEXA: g/cm^2). Cardiovascular parameters assessed included: the systolic, diastolic, and pulse pressures (mmHg): heart rate (beats/minute); and brachial-ankle pulse wave velocity (cm/second). Laboratory tests included: complete blood count, creatinine, blood urea nitrogen, serum electrolytes (Na, K), total cholesterol, total protein, albumin, hemoglobin A1c, serum osmolality, cortisol, luteinizing hormone, free testosterone for men, dehydroepiandrosterone sulphate, C-reactive protein, and interleukin-6. Socio-demographic data collected included: whether the subject lived with a spouse (yes/no); whether the subject lived with other persons (yes/no); frequency of going out (frequency/week: frequent≧3 days, rare≦2 days); anorexia (yes/no); insomnia (yes/no); exercise tolerance (ability to walk 800 m without resting and ability to climb 10 steps with ease); subjective cognitive changes during the past 3 years (none, slight, or obvious); mood changes (none, slightly depressed, or depressed); fatigability (none, slight, or obvious); history of falls or fracture during the past 3 years (yes/no); hearing deficits (none, slight, or obvious); poor distance vision (none, slight, obvious) and decreased physical strength (none, slight, or obvious). This comprehensive geriatric assessment was performed at both the baseline and the study termination visits. A simplified version of the functional status questionnaire was sent to all the participants at the end of the second and fourth years to confirm their vital status (dead/alive), level of function, and degree of frailty.

2.5 Statistical analyses

All the data were analyzed using SPSS version 15.0J (Tokyo, Japan). Parametric variables were expressed as the mean ± 1 SD and were analyzed using the Student t-test. Non-parametric variables were analyzed using the Fisher exact test. The correction for the type 1 error was applied by Bonferroni's methods. A stepwise multiple logistic regression analysis was used to identify factors independently associated with the outcome of frailty. For significant parametric factors identified using the multiple logistic regression analysis, ROC curves were constructed to determine a cut-off point with an acceptable sensitivity and specificity. Furthermore, using the factors identified as significant in the multiple logistic regression analysis, a predictive model for frailty syndrome was developed and its negative and positive predictive values were determined. A two-tailed P value less than 0.05 was considered significant.

3. **Results**

3.1 Description of the Study Population

The mean age of the 407 subjects at baseline was 78 ± 4 years, with no difference between men and women (184 men, mean age of 78 ± 4 years; 223 women, mean age of 77 ± 4 years; p=0.349). During the 5-year follow-up period, 22 patients died (Table 1); there were no significant differences in terms of gender or age of deceased patients. The major cause of death was cancer (n=8, 36%) followed by cardiovascular and/or cerebro-vascular accidents (n=5, 23%). Overall, the dropout rate was 8.4% (Table 1); there were no significant differences in age or gender between those who stayed in the study and those who dropped out. There were no other statistically significant differences between those who dropped out in terms of the measured non-parametric and parametric variables.

3.2 Incidence of frailty

As per the inclusion criteria, none of the subjects who entered the HRVS were frail at baseline. After the 5-year follow-up period, 65 subjects were frail according to the CSHA-CFS (Table 1). Of these, 35 subjects had a frailty score of 4, 25 had a score of 5, 2 subjects were classified as level 6, and 3 subjects had a score of 7.

3.3 Prediction of frailty

Univariate analyses of the differences between non-frail and frail subjects revealed a slight but statistically significant difference in subjects' age (78 ± 4 years for men and 77 ± 4 years for women at baseline; p=0.049; see Table 2) and gender, with 19 men and 46 women meeting the criteria for frailty (p=0.006; see Table 3). Univariate analyses also revealed significant differences between the non-frail and frail groups for the following parametric variables: height, weight, upper arm muscle area, calf circumference, bone mineral density (BMD), hand-grip of dominant side, slow timed walk, systolic pressure, pulse pressure, hemoglobin, luteinizing hormone and dehydroepiandrosterone sulphate (see Table 2). Significant differences for the following non-parametric variables were also observed: gender, cognitive changes, hearing deficits, history of a fall, living with a spouse, and urinary incontinence (see Table 3).

In the multivariate analysis, the following five variables were significantly associated with frailty: pulse pressure, cognitive changes, slow timed walk, calf circumference, and hearing deficits. The ROC curves for the three parametric variables revealed the following cut-off points: 3.0 seconds/ 5 meters for timed walk, 60 mmHg for pulse pressure, and 35 cm for calf circumference. A logistic model was assembled using these five variables, and the following four variables were found to be statistically significant for the prediction of frailty: pulse pressure (>= 60 mmHg), subjective cognitive changes (present), slow timed walk (> 3 seconds/5 meters) and presence of hearing deficits (see Table 4).

Since the magnitudes of the odds ratios for the four explanatory variables were similar (see Table 4), a predictive scoring model was developed that consisted of simply adding the presence of elements together (present, 1; absent, 0) (see Table

5). In this scoring system, a pulse pressure >= 60 mmHg was given 1 point; presence of cognitive changes was given 1 point; slow timed walk was given1 point if it took more than 3 seconds to walk 5 meters; and hearing deficits were scored 1 point if present. This model for frailty showed a 93% negative predictive value for a score of 0 (n=55, non-frailty= 51) and a 70% positive predictive value for a score of 4 (n=10, frailty=7). The ROC area of this model was 0.734 (95%CI, 0.661 – 0.806).

4. Discussion

This is the first longitudinal cohort study of community-dwelling older adults examining the incidence of frailty in Japan. We found the incidence of frailty in this population to be approximately 16.0% during the 5 year follow-up period; slow timed walk, pulse pressure, cognitive status, and hearing deficits were significant predictors of the frailty syndrome. We also created and validated a simple prediction scale for frailty.

4.1 Biological significance of variables associated with frailty

In our study, the incidence of frailty was 2.3 times higher among women than among men, and this is in line with what previous studies have reported. This gender difference has traditionally been explained as being related to sarcopenia as well as neuroendocrine and/or immune deficiencies (Abdel-Rahman et al, 2009; Byalow et al, 2007; Maggio et al, 2010; Sharifi et al, 2005, Walstone et al, 1999). For example, muscle mass has been assumed to be larger among men than among women; therefore, a longer time is required for the development of sarcopenia in men than in women. Another element is that growth hormones and androgens also affect muscle mass, thus making it more likely that women would lose muscle mass. Finally cortisol dysregulation, which is seen more frequently in women than in men, may also play a role in the development of frailty by gender.

Decreased movement at baseline is another characteristic finding in frail elderly individuals, and this characteristic can be evaluated using the timed walk or other assessments of gait speed (Working Group on Functional Outcome Measure for Clinical Trials, 2008, Abellum van Kan et al, 2009). Our finding that having a slow timed walk was one of the most significant predictors of frailty. This is consistent with that reported in the literature, and may be related to both morphological and functional declines in the musculo-skeletal system (Drey et al, 2011; Theou et al, 2008) as well as cognitive deficits (Abellan van Kan,2011; Ijmker, 2011).

The relation between frailty and cardiovascular disease is well established, although most studies focus on ischemic heart disease and heart failure (Afilalo et al, 2009; Cacciatoreetal,20005). Only a few studies have examined the relationship between hypertension and frailty (DiBriet al, 2004; Gray et al, 2009). In our study, the multivariate analysis using both forward and backward stepwise regression revealed the pulse pressure to be a significant predictor of frailty. For the past several years, discussions have focused on the utility of antihypertensive treatment for patients over the age of 80 years, and several studies have supported this treatment (Forette et al, 2002; Mancia et al, 2008; O'Rourk, 2005; Yano et al, 2011). However, adequate blood pressure levels for the treatment of very elderly hypertensive populations have not been described. The Japanese Society of Hypertension Committee has recommended 140/90 mmHg as being the upper acceptable limits for hypertension in older adults, but this recommendation has not been backed with evidence from studies of adults in Japan (Ogihara etal, 2009).

Thus our study may add further evidence for close monitoring of blood pressure in older Japanese adults. although further study about the relationship of controlling hypertension and the development of frailty is needed.

Our model includes sensory impairment as a potential predictor of frailty. This is an important distinction, as other models focus almost exclusively on physiologic parameters but not common geriatric syndromes. Thus our model provides potential insight into the role of geriatric syndromes in the development of frailty, which is currently relevant given the increasing worldwide health initiatives that have begun to focus on older adults who require assistance with their ADLs (Lang, 2009) The findings from our pilot study concur with those previously published by Rockwood and colleagues (Searle, 2008). In addition, our relationship of sensory impairment to frailty is consistent with that of others in the literature (Cigolle, 2007; Gurina, 2011;Lang, 2009). However, in our study, pure tone audiometry with both 2,000Hz and 4,000Hz did not reveal significant differences between frail and non-frail subjects. We hypothesize that peripheral auditory receptive mechanisms are intact and the difficulty in hearing may be related to other central nervous system factors or cognitive function in these older adults (Gates, 2008; Idrizbegovic, 2011).

4.2 Study limitations

This study was a single-center prospective observational cohort study, and the inclusion criteria clearly defined the participants as being healthy and independent at baseline. In addition, all the participants in the study were members of the New Elderly Citizens Movement, the primary purpose of which is to encourage older adults to lead not only physically, but also socially, and spiritually active lives. As a result, there may have been a selection bias to include participants who were interested in not becoming frail. While we had specific reasons for choosing the CSHA-CFS based on both Japanese culture as well as our population in particular, some have questioned its use. Another limitation is that we could not obtain some data on a portion of the frail population at the end of the study because they were unable to visit the Life Planning Center Clinic for a final assessment. Additionally, of the subjects who were not able to visit the center at the end of the study, 45 were judged as frail, and this represents a relatively large portion of the total population of frail subject. While this is a limitation, its impact is lessened somewhat by the fact that it was easy to discern the frailty status of these individuals; that is, there was no difficulty in scoring these 45 subjects who are not interviewed in person. Also, since our model would be that our sample size of frailty was small (65 subjects), it is clear that further study is needed to validate our frailty index in other large scale populations of older adults. Even though our population was from a single center, the evaluation of the frailty phenotype in this group of Japanese older adults helps to explore differences in the ways the CHSA scale diagnoses frailty in non-Caucasian populations. Our future work will need to further elucidate the inter-relationship of these factors as well through another 5 year follow-up study to the same cohort, and also some trials for preventative approach to subjects defined at risk could be designed.

4.3 Conclusion

The concept of frailty undoubtedly plays an important role in terms of health promotion and maintenance, but also in terms of improving caregiver burden and decreasing costs. This importance will only become increasingly apparent in the future given the nature of rapidly aging societies across the world. Although numerous studies have examined models of frailty and reported on its natural outcomes, studies on its incidence have been reported less often. This is especially true for populations outside the United States. While further work is needed to validate our finding, these results describe a specific phenotype that may be easily applied to predict frailty and thus improve health outcomes for older adults.

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CAPTIONS FOR TABLES

Table 1: Final disposition of study subjects

Table 2: Baseline characteristics of frail versus non-frail participants (parametric variables)

Table 3: Baseline characteristics of frail versus non-frail participants (non-parametric variables, determined using the Fisher exact test).

Table 4: Variables near or reaching statistical significance according to multivariate logistic regression analysis

Table 5: Predictive scoring model for frailty

Table 1. Final disposition of study subjects

	Male	Female	Total	%
Dropout	１３	２１	３４	８．４
Death	１４	８	２２	５．４
Frail/phone or mail	１１	３４	４５	（１１．0)
Frail/CGA	８	１２	２０	（４．９）
Frailty total	１９	４６	６５	１６．０
Non-frail/phone or mail	１１	１	１２	（２．９）
Non-frailty/CGA	１２７	１４７	２７４	（６７．３）
Non-frailty/total	１３８	１４８	２８６	７０．２
Total	１８４	２２３	４０７	１００．０

CGA: Comprehensive Geriatric Assessment

Table 2. Baseline Characteristics of frail versus non-frail participants (parametric variables)

Parametric variables	Non-frail(n=286)	Frail(n=65)	p value
Age (years)	77±4	78±4	0.049
Height (cm)	156±8	153±8	0.032
Weight (kg)	55±9	52±9	0.017
Body Mass Index	23±3	22±3	0.256
Upper Arm Skin Fold (mm)	15±7	16±3	0.617
Upper Arm Muscle Area (cm^2)	38±9	35±7	0.015
Upper Arm Circumference(cm)	26±3	26±3	0.098
Calf Circumference(cm)	35±3	34±3	0.007
Bone Mineral Density(g/cm^2)	0.90±0.21	0.82±0.20	0.002
Hand Grip dominant side(kg)	26±7	22±7	0.001*
Timed walk(sec/5 meters)	2.7±0.5	3.1±0.8	0.000*
Resting Metabolic Rate (kcal/min)	1.058±0.294	0.987±0.225	0.072
Audiometry right 2,000Hz(dB)	29±18	25±18	0.169
Audiometry right 4,000Hz(dB)	43±21	41±20	0.580
Audiometry left 2,000Hz(dB)	29±18	28±18	0.727
Audiometry left 4,000Hz(dB)	42±21	42±21	0.976
Systolic Pressure (mmHg)	135±17	140±21	0.046
Diastolic Pressure (mmHg)	78±10	77±11	0.796
Pulse Pressure (mmHg)	57±12	64±18	0.000*
Ankle Brachial Index	1.15±0.09	1.13±0.10	0.128
Pulse Wave Velocity (cm/sec)	1845±353	1933±414	0.080
Heart Rate (bpm)	69±11	70±12	0.680
Hemoglobin (g/ml)	13.6±1.3	13.1±1.2	0.002
Total Cholesterol (mg/dl)	217±32	214±34	0.485
Serum Creatinine (mg/dl)	0.81±0.22	0.76±0.21	0.099
Serum Total Protein (g/dl)	7.2±0.4	7.2±0.4	0.576
Serum Albumin (g/dl)	4.2±0.2	4.2±0.2	0.498
Serum Cortisol (micg/dl)	10.9±9.5	11.6±3.8	0.188
Luteinizing Hormone (ng/ml)	14±9	19±11	0.002
Dehydroepiandrosterone (ng/ml)	756±435	587±316	0.003
C-Reactive Protein (mg/dl)	1.11±0.43	0.09±0.10	0.450
Interleukin-6(pg/ml)	2.01±2.95	2.33±1.98	0.410
Lymphocyte count (n/μl)	1179±544	1711±554	0.363

*Significant by Bonferroni’s correction for type I error (p<0.05/33=0.0015

Table 3. Baseline characteristics of frail versus non-frail participants (non-parametric variables, determined using the Fisher exact test)

Nonparametric variables	Non-frail (N=286)	Frail (n=65)	Two-tailed P value
Sex (female/male)	148/138	46/19	0.006
Hypertension (a/p)	207/79	46/19	0.878
Hypercholesterolemia (a/p)	246/39	54/10	0.692
Diabetes mellitus (a/p)	258/27	57/7	0.649
Smoking (a/p)	263/23	61/4	0.798
Living with spouse (y/n)	130/156	19/46	0.018
Living with others (y/n)	103/183	27/38	0.477
Frequent going out (f/r)	145/118	27/32	0.198
Appetite loss (a/p)	276/10	65/0	0.218
Cognitive change (a/p)	159/127	22/43	0.002*
Fall (a/p)	233/53	44/21	0.018
Fracture (a/p)	256/30	52/13	0.056
Hearing deficit (a/p)	212/74	34/31	0.001*
Pain (a/p)	235/51	46/19	0.057
Insomnia (a/p)	216/70	51/14	0.748
Urinary incontinence (a/p)	256/31	51/14	0.037

* Significant by Bonferroni's correction for type I error ($p<0.05/15=0.0033$)
Abbreviations: a(absent), p(present), y(yes), n(no), f(frequent), r(rare).

Table 4. List of parameters near or reaching significance according to multivariate logistic regression analysis

Variables	Walt value	Two-tail P value	Odds ratio	95% confidence interval of odds ratio
Calf circumference	3.374	0.066	1.794	0.962～3.347
Timed walk	14.665	0.000	3.282	1.786～6.030
Pulse pressure	5.767	0.016	2.074	1.144～3.761
Cognitive change	9.389	0.002	2.641	1.419～4.915
Hearing deficit	6.471	0.011	2.186	1.197～3.995

Table 5. Prediction scoring model for frailty

Variables	Score
Timed walk>=3 secconds/5 meters	1
Pulse pressure>=60 mmHg	1
Cognitive change (yes)	1
Hearing deficit(yes)	1

Highlights

- Taking more than 3 seconds to walk 5 meters was a significant predictor of frailty.
- Others predictors were a wide pulse pressure, cognition and hearing deficits.
- We constructed a simple additive score for predicting frailty.
- A score of 0 had a 93% negative predictive values for frailty.
- A score of 4 had a 70% positive predictive value for frailty.