Original article

A retrospective cohort study on the risk assessment of newly certificated long-term care need of elderly individuals in a community: Basic checklist and specific health checkup

Toshiki Katsura[1], Megumi Fujimoto[2], Miho Shizawa[3], Akiko Hoshino[3], Kanae Usui[3], Eri Yokoyama[4], and Mayumi Hara[4]

[1] *Division of Preventive Nursing, Department of Human Health Sciences, Graduate School of Medicine, Kyoto University, Japan*
[2] *Kyoto Prefecture, Japan*
[3] *Division of Community Health Nursing, Graduate School of Health and Nursing, Prefectural University of Medicine, Japan*
[4] *Uji city, Japan*

Abstract

Objective: This study aimed to examine the factors influencing the requirement of a certificate of long-term care using a basic checklist and items listed in the Special Health Checkup.
Method: This study included 7,820 individuals living in Uji city, who were selected from among 8,000 elderly individuals who, in 2008, underwent a specific health checkup (hereafter referred to as the 'specific health checkup for the old-old elderly individuals') for those aged 75 years and above. They answered questions from basic checklists at the time, and 180 individuals were excluded as they had already qualified for requiring the certificate of long-term care at the time of the checkup. The follow-up period extended from the day of the specific health checkup for the old-old elderly individuals to March 31, 2013. The data were analyzed using the certificate of needing long-term care as the response variable. The explanatory variables were the basic attributes, items listed in the specific health checkup for the old-old elderly individuals, interview sheets, and basic checklists. Cox proportional hazards regression analysis was conducted.
Results: In total, 1,280 elderly individuals qualified for requiring the certificate of needing long-term care. The risk factors for the young-old elderly individuals aged 65 to 74 years were as follows:

hepatic dysfunction (hazard ratio {HR}=1.69), the presence of subjective symptoms (HR=1.41), an above-normal abdominal circumference (HR=1.36), old age (HR=1.13), a reduced frequency of going out since the previous year (HR=1.87), the use of support for standing up after being seated on a chair (HR=1.86), no deposit or withdrawals made (HR=1.84), the anxiety of falling down (HR=1.50), an inability to climb stairs without holding a railing or wall (HR=1.49), as well as an increased difficulty in eating tough food items compared with 6 months prior (HR=1.44). The risk factors for the old-old elderly individuals were as follows: a positive reaction on proteinuria (HR=1.27), anemia (HR=1.18), old age (HR=1.10), inability to travel on a bus or train by themselves (HR=1.53), the inability to climb stairs without holding a railing or wall (HR=1.48), weight loss (HR=1.36), a reduced sense of appreciation of the activities they had previously participated in, over a span of 2 weeks (HR=1.30), the use of support for standing up after being seated on a chair (HR=1.23), and the anxiety of falling down (HR=1.20).
Conclusion: The items listed in the specific medical checkup as well as the basic checklists were found to be risk factors for both the young-old elderly individuals and the old-old elderly individuals, indicating the need to utilize these lists for the prevention of nursing even in the late stages of life. Moreover, these results suggest the importance of screening elderly individuals suffering from hyperkinesis using the basic checklist and conducting preventive interventions in order to maintain and improve their physical functions.

Key words: newly certificated long-term care need, basic checklist, specific health checkup, cohort study, community elderlies

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Introduction

The number of elderly people in Japan has been on the rise, and in 2011, it was reported that there were 29.75 million elderly residents in the country, accounting for 23.3% of the total population.

While the total population of Japan is on the decline, the population of the elderly people was expected to reach 33.95 million in 2015 when those in the "baby boom generation" were 65 years of age or older, and this was likely to continue[1]. As this aging of the population progresses, an increasing number of people are certified as requiring assistance or long-term care. In particular, the number of recipients of low-level nursing care services (care needs assessment levels 1 and 2) is on the rise[2]. Therefore, in Japan, which is now a hyper-aged society, the extension of healthy life expectancy through preventive health intervention is an important and pressing issue.

The 2013 Comprehensive Survey of Living Conditions of the People on Health and Welfare found that the need for the Support Required 1 level or higher long-term care was the result of, in descending order, cerebrovascular disease (18.5%), dementia (15.8%), weakness due to old age (13.4%), fractures and falls (11.8%), or arthritic disorders (10.9%). When only people certified as requiring nursing support were considered, the most common reasons for that assistance were arthritic disorders followed by physical weakness, fractures and falls, and cerebrovascular disease[3]. With the increase in the number of elderly people certified as requiring low-level care, it is important to direct attention to the decline in vital function with aging as well as to identify and thus prevent the risks that give rise to the need for assistance.

To prolong healthy life expectancy, Japan has implemented two measures: preventive care to reduce the need for long-term care and measures directed against lifestyle-related diseases. In the current system, designated checkups and a basic checklist are the two main sources from which the administration obtains information regarding the health of the elderly individuals. If the Japanese government can gain a better understanding of the health of its elderly population by combining the results of the basic checklist and designated health checkups, a more efficient screening for appropriate candidates for its preventive care program will be possible. This way, care can be customized to the intended target population. However, previous studies[4–6] have used either a basic checklist or a health examination (a basic or designated health examination) to analyze the risk factors that lead to the need for long-term care among the elderly individuals.

This study aims to investigate the factors underlying the need for long-term care among elderly people in Japan by using a combination of the items in the basic checklist and the designated checkups, as no previously conducted studies have used this combination.

Research Methods

Research participants

The participants were 8,000 elderly people, aged 65 years or above, who lived in Uji city and underwent either a designated checkup or a 'specific health checkup for the old-old elderly individuals' for those aged 75 years or above. They answered questions from a basic checklist at the time of the designated checkup. Of the 8,000 participants, we analyzed the data from 7,820 elderly people who had not been certified as requiring long-term care at the time of cohort enrollment.

Research design and follow-up period

This was a retrospective cohort study in which elderly participants being certified to receive services under the long-term care insurance system was a study event. We followed these elderly individuals from the date of the designated checkup or the 'specific health checkup for the old-old elderly individuals' in 2008 through to March 31, 2013, to identify those who were newly certified for long-term care and to obtain data for the study.

Response variable

In our analysis, the response variable was whether an elderly participant obtained certification to receive long-term care of the Support Required 1 level or above. The follow-up was terminated if participants died or moved out of the city, and their death or move were confirmed by the care needs assessment data from nursing care insurers as well as the notifications of death or change of address reports. The date of the incident that gave rise to the need for long-term care was defined as the date of application for certification showing the need for care (if the need for Support Required 1 or above was granted).

Explanatory variables

The explanatory variables included basic attributes; test items examined in the designated checkups or designated checkups for the old-old elderly individuals, participants' answers to the medical examinations by interviews, and answers to the questions on the basic checklist.

The basic attributes included age, sex, region of residence (daily living area), and whether or not the participant was a beneficiary of the government's primary prevention project (i.e., 2007 and 2008 governmental projects to pre-

vent motor function decline).

The test items in the designated checkups and the examinations by interviews were only used if the examinations were conducted in Uji.

The participants were grouped into categories using data from the designated checkup or designated checkup for the old-old elderly people, based on the criteria determined by the specific health guidance or the Japanese Society of Human Dry Dock[7, 8]. The respective target levels for the control of blood pressure, blood lipids, and blood sugar were set in reference to the target levels specified by the Japan Atherosclerosis Society and the Japan Diabetes Society[9–11].

Analysis method

Univariate analysis: The elderly individuals who received a long-term care certificate during the follow-up period were assigned to the certified group, and all others were assigned to the non-certified group. Differences between the two groups for age, body mass index (BMI), abdominal circumference, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, hemoglobin A1c, albumin, hemoglobin content, hemoglobin, red blood cell count, and checklist scores were examined using the Student's t-test if normally distributed or the Mann–Whitney test if not normally distributed. Chi-square tests were performed to determine if the observed differences in the frequencies of the values of the following variables occurred by chance: sex, the result of each test, past medical history, symptoms observed by a doctor, subjective symptoms, taking medicine (yes or no), an increase in weight by 3 kg or more in the past year (yes or no), and each test item on the basic checklist. Chi-square tests and residual analyses were used for the place of residence, blood pressure categories, alcohol intake frequency, and whether or not the participant was identified as a target of the government's secondary prevention project.

Multivariate analysis: Cox proportional hazard regression analysis was used to obtain the hazard ratio (HR) for elderly people being approved to receive long-term care. The analysis was first performed on the data for the entire sample and then on the data for the young-old and the old-old elderly individuals separately. The explanatory variables were a total of 25 items, including age, residential area, whether or not the participant took advantage of the nursing prevention project, and items in the designated health checkup.

Ethical considerations

To protect the personal identity of the participants, the information used in the analysis was provided by Uji city without names and with addresses only at the regional level; therefore, individual participants were not personally identifiable. In addition, this study was conducted with the approval (E1756) of the ethics committee of the Graduate School of Medicine and Faculty of Medicine, Kyoto University as well as the Kyoto University Hospital.

Results

Participants' attributes (Tables 1, 2, and 3)

The average follow-up period was $1,495 \pm 380$ days. The probability of elderly people being eligible for long-term care during the 5 years of the study was 18.8%. Of those who were eligible for care, 64.2% were from the young-old elderly population, 39.5% were female (60.5% male), and the average age was 72.8 ± 5.5 years.

The results of the designated checkup demonstrated that the average BMI was within the normal range (22.6 ± 3.0), 38.0% of the participants had level I high blood pressure or above, and 43.3% were on medication for the treatment of the same. Of those who underwent the designated checkup, including those with and without risk, it was found that 69.3% did not need to receive health guidance, 1.2% were at the level requiring the provision of information, 13.3% were at the level of requiring motivational support, and 16% were at the level of requiring aggressive support.

The results of the basic checklist demonstrated that of all the research participants, 51.0% exhibited no hypo-function, 27.5% revealed partial hypo-function, and 21.5% needed to be admitted to the secondary prevention project (15.8% of young-old elderly individuals and 31.7% of old-old elderly individuals were recommended for the secondary prevention project).

Factors influencing the need for long-term care (Tables 4, 5, 6 and 7)

(1) Entire dataset

Of the test items in the designated checkup that exhibited a statistically significant difference between the certified and non-certified groups, those with a HR > 1.00 were, in descending order, positive urinary sugar level (HR = 1.42), abnormal liver function (HR = 1.28), exhibiting subjective symptoms (HR = 1.28), urinary protein (HR = 1.18), anemia (HR = 1.17), and older age (HR = 1.12). The items in the basic checklist with an HR of 1.0 or above were "inability to climb stairs without holding on to handrails or walls" (HR = 1.50), "going out less frequently in comparison with 6 months prior" (HR = 1.39), "inability to enjoy what used to be fun, in the past two weeks" (HR = 1.37), "the use of support for standing up after being seated on a chair" (HR = 1.30), "inability to travel on a bus or train alone" (HR = 1.30), "being emaciated" (HR = 1.26), "having high levels of anxiety about falling down" (HR = 1.23), and "having fallen

Table 1 The list of categories

Variable	Category	Detail
The designated check-up		
BMI	being emaciated	BMI < 18.5
	standard figure	18.5 ≤ BMI < 25
	fatness	25 ≤ BMI
Abdominal circumference	no particular	male: < 85 cm, female: < 90 cm
	over	male: ≥ 85 cm, female: ≥ 90 cm
Level of health guidance	not required to receive health guidance (with no risk)	This group had no particular item in abdominal circumference, BMI, blood pressure, blood lipid and blood sugar.
	not required to receive health guidance (with risk)	This group had no particular item in abdominal circumference or BMI, and had a problem in blood pressure, blood lipid or blood sugar.
	the level requiring provision of information	This group had a problem in abdominal circumference or BMI, and had no particular item in blood pressure, blood lipid, and blood sugar.
	the level requiring motivational support	Either of the following (A or B) was true for this group. A: Their abdominal circumference was low and they were non-smokers. They had a problem in blood pressure, blood lipid, or blood sugar. B: Their BMI suggested being overweight and they were smokers. They had one or two problems in blood pressure, blood lipid, or blood sugar.
	the level requiring aggressive support	Either of the following (C or D) was true for this group. C: Their abdominal circumference was low. They had two or more problems in blood pressure, blood lipid, blood sugar, or smoking. D: Their BMI suggested being overweight. They had three or more problems in blood pressure, blood lipid, blood sugar, or smoking.
Blood pressure control	no particular	systolic pressure < 130 and diastolic pressure <85 without medication
	good control	systolic pressure < 140 and diastolic pressure < 90 with medication
	bad control	no medication or, systolic pressure ≥ 140 or diastolic pressure ≥ 90 with medication
Blood lipid control	no particular	triglyceride < 150 mg/dl and HDL cholesterol ≥ 40 mg/dl without medication
	good control	triglyceride < 150 mg/dl and HDL cholesterol ≥ 40 mg/dl and LDL cholesterol < 160 mg/dl with medication
	bad control	no medication or, triglyceride ≥ 150 mg/dl or HDL cholesterol < 40 mg/dl, or LDL cholesterol ≥ 160 mg/dl with medication
Blood sugar control	no particular	HbA1c < 5.2% without medication
	good control	HbA1c < 6.0% with medication
	bad control	no medication, or HbA1c ≥6.0% with medication
AST	no particular	≤ 30 U/L
	over	> 30 U/L
ALT	no particular	≤ 30 U/L
	over	> 30 U/L
γ-GTP	no particular	≤ 50 U/L
	over	> 50 U/L
Liver function	no particular	AST and ALT were no particular
	over	AST or/and ALT
Albumin	no particular	≥ 4.0 g/dl
	under	< 4.0 g/dl
Anemia	no particular	male: hemoglobin content ≥ 13.1, female: hemoglobin content ≥ 12.1
	anemia	male: hemoglobin content ≤ 13, female: hemoglobin content ≤ 12
eGFR (ml/minute/1.73 m^2)	no particular	≥ 60
	under	< 60
Sugar in urine	no particular	–
	over	≥ ±
Protein in urine	no particular	–
	over	≥ ±
Occult blood in urine	no particular	–
	over	≥ ±

Table 1 (continued)

Variable	Category	Detail
The basic checklist		
ADL	no particular	this group was defined as elderly participants with 9 or less negative conditions in questions 1–20
	score more than 9 out of 1-20 items	this group was defined as elderly participants with at least 10 or more negative conditions in questions 1–20
Physical strength	no particular	this group was defined as elderly participants with 2 or less negative responses to questions 6–10
	Lower physical strength	this group was defined as elderly participants with three or more negative responses to questions 6–10
Nutritional status	no particular	this group was assessed by positive answers to questions 11 or 12
	Lower nutritional status	this group was assessed by negative answers to questions 11 and 12
Oral function	no particular	this group was defined as elderly participants with 1 or 0 negative responses to questions 13–15
	Lower oral function	this group was defined as elderly participants with 2 or more negative responses to questions 13–15
Being housebound	no particular	this group was defined as elderly participants who answered "yes" to question 16
	Being housebound	this group was defined as elderly participants who answered "no" to question 16
Cognitive function	no particular	this group referred to elderly participants who had all positive conditions in questions 18–20
	Lower cognitive function	this group referred to elderly participants who had at least 1 or more negative conditions in questions 18–20
Depression	no particular	this group referred to elderly participants who had 1 or less negative responses to questions 21–25
	depression risk	this group referred to elderly participants who had 2 or more negative responses to questions 21–25
Risk for long-term care	non-risk group 1	this group did not have these lower functions
	non-risk group 2	the elderly participants in this group were defined by the criteria as those who had lower cognitive function, were housebound and had depression risks
	risk group	these adults were defined by the criteria as those who had lower functions, such as lower physical strength and lower nutritional/oral status

down in the past year" (HR = 1.18). The items with an HR < 1.00 were a good control of blood lipids (HR = 0.79) and "not visiting friends' homes" (HR = 0.79).

(2) The young-old elderly individuals

Of the items for which a statistically significant difference was observed between the certified and non-certified groups, those in the designated checkups with an HR > 1.0 were, in descending order, abnormal liver function (HR = 1.69), exhibiting subjective symptoms (HR = 1.41), abdominal circumference greater than the normal range (HR = 1.36), and older age (HR = 1.13). The items in the basic checklist were "going out less frequently than in the preceding year" (HR = 1.87), "the use of support for standing up after being seated on a chair" (HR = 1.86), "not being able to deposit or withdraw cash to and from their bank accounts" (HR = 1.84), "having high levels of anxiety about falling down" (HR = 1.50), "inability to climb stairs without holding on to handrails or walls" (HR = 1.49), and "difficulty in eating solid foods in comparison with 6 months prior" (HR = 1.44). The items with an HR < 1.00 were, in ascending order, male sex (HR = 0.64) and positive urine occult blood (HR = 0.76).

(3) The old-old elderly individuals

Of the items for which a statistically significant difference was observed between the certified and non-certified groups, those in the designated checkups with an HR > 1.0 were, in descending order, positive for urinary protein (HR = 1.27), anemia (HR = 1.18), and older age (HR = 1.10). Items in the basic checklist with an HR > 1.00 were "not able to go on a bus or train alone" (HR = 1.53), "inability to climb stairs without holding on to handrails or walls" (HR = 1.48), being emaciated (HR = 1.36), "being unable to enjoy what used to be fun, in the preceding two weeks" (HR = 1.30), "the use of support for standing up after being seated on a chair (HR = 1. 23), and having high levels of anxiety (HR = 1.20). The items with an HR < 1.00 were "not visiting friends' homes" (HR = 0.74) and a good control of blood lipids (HR = 0.77).

Table 2 Participants' attributes

Attributes		Total (n = 7820)		Young-old elderly (n = 5018)		Old-old elderly (n = 2802)	
		n (%) or mean ± SD		n (%) or mean ± SD		n (%) or mean ± SD	
Sex	female	4733	60.5%	3070	61.2%	1663	59.4%
	male	3087	39.5%	1948	38.8%	1139	40.6%
Age		72.8 ± 5.5		69.4 ± 2.8		78.9 ± 3.5	
Elderly level	the young-old elderly	5018	64.2%	–	–	–	–
	the old-old elderly	2802	35.8%	–	–	–	–
Residence	A area	867	11.1%	540	10.8%	327	11.7%
	B area	1328	17.0%	850	16.9%	478	17.1%
	C area	1347	17.2%	824	16.4%	523	18.7%
	D area	1527	19.5%	997	19.9%	530	18.9%
	E area	1378	17.6%	965	19.2%	413	14.7%
	F area	1373	17.6%	842	16.8%	531	19.0%
Primary prevention	Used	55	0.7%	47	0.9%	8	0.3%
	not used	7765	99.3%	4971	99.1%	2794	99.7%
Long-term care	not needed	6540	83.6%	4519	91.9%	1832	65.4%
	Needed	1280	16.4%	499	8.1%	970	34.6%
Long-term care level	support required 1	454	35.5%	131	32.1%	323	37.0%
	support required 2	264	20.6%	95	23.3%	169	19.4%
	care level 1	287	22.4%	87	21.3%	200	22.9%
	care level 2	128	10.0%	50	12.3%	78	8.9%
	care level 3	77	6.0%	22	5.4%	55	6.3%
	care level 4	41	3.2%	11	2.7%	30	3.4%
	care level 5	29	2.3%	12	2.9%	17	1.9%
Cause of nursing care	arthritic disorders	353	27.6%	123	30.1%	230	26.4%
	fractures and falls	144	11.3%	43	10.5%	101	11.6%
	dementia	130	10.2%	33	8.1%	97	11.1%
	cancer	125	9.8%	57	14.0%	68	7.8%
	cerebrovascular disease	108	8.4%	41	10.0%	67	7.7%
	heart disease	71	5.5%	12	2.9%	59	6.8%
	respiratory disease	44	3.4%	8	2.0%	36	4.1%
	Parkinson disease	22	1.7%	7	1.7%	15	1.7%
	diabetes mellitus	18	1.4%	5	1.2%	13	1.5%
	weakness due to old age	15	1.2%	1	0.2%	14	1.6%
	vision disorder and hearing disorder	9	0.7%	2	0.5%	7	0.8%
	spinal cord injury	3	0.2%	0	0.0%	3	0.3%
	others	238	18.6%	76	18.6%	162	18.6%

Discussion

There have been many studies conducted worldwide, including in Japan, that have evaluated the factors related to care needs assessment[4–6,12–16] and the frail elderly individuals[17–25]. However, many of these studies pertained to the evaluation of motor function[13, 25], cognitive function[12, 17], financial conditions[12, 14], educational history[12, 14], and living conditions[12, 17] or used questionnaires that are not usually employed by the administration[20–25]. Because the data used in these studies were not those commonly held by the ad-

ministration, the results could not be effectively reflected in government projects or the activities of nursing staff. Therefore, it is important to search for methods to effectively utilize the health information available to the administration, to develop preventive measures aimed at reducing the need for long-term care.

Risk factors leading to approval for long-term care that are common in the elderly individuals of all ages

The factors that increased the need for long-term care among all elderly participants (the young-old and old-old el-

Table 3 The results of the designated checkup

Items		Total		Young-old elderly		Old-old elderly	
		n (%) or mean ± SD		n (%) or mean ± SD		n (%) or mean ± SD	
Level of health guidance	not required to receive health guidance (without risk)	639	8.2%	449	8.9%	191	6.8%
	not required to receive health guidance (with risk)	4776	61.1%	2731	54.4%	2060	73.6%
	requiring provision of information	93	1.2%	80	1.6%	12	0.4%
	requiring motivational support	1037	13.3%	537	10.7%	489	17.5%
	requiring aggressive support	1273	16.3%	1221	24.3%	48	1.7%
Blood pressure control	no particular	2063	26.4%	1489	29.7%	574	20.5%
	good control	1756	22.5%	1015	20.2%	741	26.4%
	bad control	3999	51.2%	2514	50.1%	1485	53.0%
Lipid control	no particular	4172	53.4%	2702	53.8%	1470	52.5%
	good control	1484	19.0%	895	17.8%	589	21.0%
	bad control	2164	27.7%	1421	28.3%	743	26.5%
Blood sugar control	no particular	4923	63.0%	2552	50.9%	2371	84.6%
	good control	147	1.9%	83	1.7%	64	2.3%
	bad control	2749	35.2%	2383	47.5%	366	13.1%
BMI		22.6 ± 3.0		22.7 ± 3.0		22.4 ± 3.1	
Blood pressure	systolic pressure	133.8 ± 17.2		132.9 ± 16.9		135.6 ± 17.4	
	diastolic pressure	76.4 ± 10.2		77.2 ± 10.1		75.2 ± 10.2	
History of stroke	no	7442	95.2%	4836	96.6%	2606	93.7%
	yes	344	4.4%	168	3.4%	176	6.3%
History of heart disease	no	6936	88.7%	4565	91.3%	2371	85.6%
	yes	833	10.7%	433	8.7%	400	14.4%
History of chronic renal failure	no	7704	98.5%	4950	99.0%	2754	98.7%
	yes	85	1.1%	48	1.0%	37	1.3%
Subjective symptom	no	6052	77.4%	3914	78.0%	2138	76.3%
	yes	1767	22.6%	1103	22.0%	664	23.7%
Objective symptom	no	6898	88.2%	4469	89.1%	2429	86.7%
	yes	921	11.8%	548	10.9%	373	13.3%
On medication to lower blood pressure	no	4436	56.7%	3069	61.1%	1372	49.0%
	yes	3384	43.3%	1954	38.9%	1430	51.0%
On medication to lower blood glucose	no	7316	93.6%	4705	93.8%	2611	93.2%
	yes	504	6.4%	313	6.2%	191	6.8%
On medication to lower cholesterol	no	5626	71.9%	3672	73.1%	1954	69.7%
	yes	2194	28.1%	1346	26.8%	848	30.3%
Regular smoker	no	7165	91.6%	4542	90.7%	2613	93.3%
	yes	655	8.4%	466	9.3%	189	6.7%
Weight gain or loss of ≥ 3 kg over the past year	no	6784	86.8%	4360	86.9%	2424	87.7%
	yes	997	12.7%	658	13.1%	339	12.3%
Alcohol consumption	rarely (can't drink)	4545	58.1%	2773	56.1%	1772	64.8%
	sometimes	1437	18.4%	988	20.0%	449	16.4%
	every day	1696	21.7%	1183	23.9%	513	18.8%

derly people) were three items in the basic checklist that are related to motor function. Motor function declines at an accelerated rate as a person grows older and this increases the risk of incidents that give rise to the need for long-term care.

Our study indicated the importance of preventive interventions to maintain and improve motor function, as a rising number of elderly people now have locomotive syndrome. Of the elderly people certified as requiring long-term care

Table 4 Results of the basic checklist

		Total n (%)		Young-old elderly n (%)		Old-old elderly n (%)	
ADL	no particular	7559	97.6%	4916	98.9%	2643	95.2%
	score of more than 9 out of 1-20 items	186	2.4%	54	1.1%	132	4.8%
Physical strength	no particular	6819	88.0%	4595	92.5%	2224	80.1%
	lower physical strength	926	12.0%	375	7.5%	551	19.9%
Nutritional status	no particular	7655	98.8%	4933	98.3%	2722	98.1%
	lower nutritional status	90	1.2%	37	0.7%	53	1.9%
Oral function	no particular	6792	87.7%	4483	90.2%	2309	83.2%
	lower oral function	952	12.3%	487	9.8%	465	16.8%
Being housebound	no particular	7071	91.6%	4578	92.4%	2493	90.2%
	housebound	646	8.4%	376	7.6%	270	9.8%
Cognitive function	no particular	5399	69.7%	3602	72.5%	1797	64.8%
	lower cognitive function	2346	30.3%	1368	27.3%	978	35.2%
Depression	no particular	6284	81.2%	4244	84.6%	2040	73.6%
	depression risk	1457	18.8%	724	14.4%	733	26.4%
Risk for long-term care	non-risk group 1	3946	51.0%	2809	56.5%	1137	41.0%
	non-risk group 2	2131	27.5%	1374	27.7%	757	27.3%
	risk group	1667	21.5%	786	15.8%	881	31.7%

in our study, more than half were in the "Support required" levels or "care level 1", and the main factors associated with their care needs certification were fractures and/or falls (38.9% of all certifications). This suggests that items related to motor function cause a significant increase in the risk of the elderly people being in situations that lead to the need for long-term care.

Differences in the risk factors based on age

We used slightly different sets of explanatory variables for the young-old and old-old elderly individuals because the designated checkups are different for the two groups. Nevertheless, differences were observed between the two groups in terms of the risk factors for the need for long-term care. While being emaciated was one of the risk factors for the entire sample population as well as the late elderly subset, visceral fat accumulation was uniquely identified as a risk factor among the young-old elderly participants. The 2010 Comprehensive Survey of the Living Conditions of the People on Health and Welfare found that cerebrovascular disease accounted for 40.0% of all events that caused the young-old elderly people to become dependent on long-term care; this was far more than in the case of the old-old elderly people (16.6%). This suggests a higher probability of the young-old elderly requiring long-term care due to lifestyle-related diseases. Visceral fat accumulation was the main risk factor for young-old elderly people becoming dependent on nursing care. This knowledge can be applied to take advantage of the outcomes of

the designated checkup to prevent the need for long-term care among the young-old elderly people. Alternately, for the effective preventive intervention among the old-old elderly individuals, signs of emaciation are of particular importance. Furthermore, the young-old elderly individuals differed from the old-old elderly people in that "falls in the preceding year" and "difficulty in eating solid foods in comparison with 6 months prior" in the basic checklist indicated risk in the old-old elderly people. If a young-old elderly person experiences these symptoms, he/she is experiencing a higher level of hypo-function than expected for his/her actual age. Recent changes in behavior, with respect to going out less frequently than usual, that is once a week or less[26], also presented a higher risk in the old-old elderly individuals. This suggests that elderly people who feel that they go out less frequently now than before face a higher risk than those who tended to stay in their homes for some time. Staying at home is recognized as a reason elderly people need long-term care, and the government has recommended the implementation of preventive measures for elderly people who are confined to their homes[26]. However, very few cross-sectional studies[15, 16] have investigated the well-being of withdrawn elderly people after they entered long-term care. In addition, there are some inconsistencies among these previous studies[15, 16] in terms of the definition of "withdrawal." No study has followed up on the elderly people identified as being withdrawn, with the definition of "withdrawal" being "going out once a week or less." Withdrawal defined in this way has not

been previously identified as a risk factor. This suggests a need to re-evaluate the criteria to identify the state of withdrawal in the basic checklist.

Results for the old-old elderly people were similar to those of previous studies[5, 6]; anemia, urinary protein levels, and emaciation were identified as risk factors. Anemia and emaciation are factors considered to promote feebleness among elderly people[27], thereby increasing the risk of incidents that give rise to the need for long-term care. Although the basic checklist indicates whether an elderly person is emaciated, the designated checkup provides a more objective, and therefore, a more effective measure of emaciation. In addition, data on anemia and urinary protein levels can only be obtained from the designated checkup. Therefore, a combination of the basic checklist and the designated health checkup is required to identify elderly people who need preventive health intervention even in the case of old-old elderly people. In addition, melancholia or depression in the old-old elderly people, as represented by the variable "being unable to enjoy what used to be fun in the past two weeks," increases the risk of the need for care. It is well known that elderly people live longer when they have something to live for[28]. In fact, the present study suggests a link between the loss of "something to live for" and the likelihood of the occurrence of incidents that give rise to the need for long-term care.

Importance of longitudinal evaluation

Of the 25 items in the basic checklist, those identified as risk factors were the items that indicate recent changes in behavior or physical capacity, such as "difficulty in eating solid foods when compared to 6 months prior," "going out less frequently than the preceding year," and "becoming unable to enjoy what used to be fun in the past 2 weeks." These items help to evaluate the progression of loss of function in elderly people and are useful in identifying those who are likely to need long-term care. The checkup items pertaining to the present conditions of the elderly individuals could not provide information on the changes or deterioration in their function. However, evaluating the items in the basic checklist every year and comparing the results with the previous year can help identify a decline in physical function. A longitudinal examination of the items in the basic checklist determines whether there has been a loss in function, thereby providing a better screening process to accurately identify the elderly people who need preventive health intervention. In the future, changes in the basic checklist items must be incorporated when examining the risk factors that give rise to the need for long-term care.

Factors that reduced the risk of needing long-term care

The factors that reduced the need for long-term care were positive urine occult blood for the young-old elderly people and good lipid control and "not visiting friends' homes" for the old-old elderly people. Good lipid control was identified as a factor reducing the need for long-term care in the entire elderly participant population as well as in old-old elderly participants because, for elderly individuals, low total cholesterol values are a risk factor[14] and good control with a slightly high level of serum lipid reduces the risk of needing care. The effect of the variables "not visiting friends' homes" and positive results for urine occult blood observed in our study is inconsistent with previous studies[4–6] and warrants further investigation.

Effect of the primary prevention project

Participation in the primary prevention project was not recognized as a factor leading to a significant improvement in terms of the need for care. Our research included only a small number of elderly people in the project (55), which may explain the insignificant effect. However, the HR was 0.13 (p = 0.063) for the young-old elderly people, and it is possible that the project had a preventive effect for that group. Further analysis of its impact is necessary.

Limitations of the study

Because our research was based on data from elderly people who answered the basic health checklist and underwent the designated checkup in Uji, a bias toward the health-conscious is highly likely.

In addition, only items that were available in the basic checklist and designated checkups were used as explanatory variables. Therefore, the study did not consider some factors that were considered in previous studies[12][14], such as educational history, financial condition, family structure, subjective health awareness, and the role in the family.

Furthermore, because abdominal circumference, serum uric acid, and estimated glomerular filtration rate are not measured in the designated checkup for the old-old elderly people, only BMI was used to determine the visceral fat level at the health guidance level. Therefore, there is a difference in the criteria between the young-old and old-old elderly individuals.

In the present study, the response variable indicates the occurrence of an elderly person getting certified as requiring assistance or long-term care. Although we treated approvals for assistance or long-term care of any level in the same manner, the factors contributing to the need for assistance, long-term care in general, and long-term care of level 3 or higher are considered to be significantly different. In our study, more than half of the participants ap-

Table 5 Factors of long-term care (total)

Variables	Categories	HR	95% CI	P-value
Sex	female	1.00		
	male	0.91	0.78–1.07	0.255
Age		1.12	1.11–1.14	0.000
settlement	C area	1.00		
	A area	0.93	0.74–1.18	0.576
	B area	0.96	0.78–1.19	0.736
	D area	0.88	0.71–1.08	0.213
	E area	0.87	0.71–1.08	0.215
	F area	0.98	0.81–1.20	0.877
Care prevention service	not used	1.00		
	used	0.54	0.17–1.69	0.286
Blood pressure control	no particular	1.00		
	good control	0.99	0.82–1.19	0.915
	bad control	0.90	0.77–1.06	0.204
Lipid control	no particular	1.00		
	good control	0.79	0.67–0.94	0.007
	bad control	0.88	0.76–1.02	0.089
Blood sugar control	no particular	1.00		
	good control	0.95	0.61–1.48	0.817
	bad control	0.90	0.77–1.06	0.199
Liver function	no particular	1.00		
	particular	1.27	1.08–1.50	0.004
Anemia	no particular	1.00		
	anemia	1.17	1.02–1.34	0.030
Sugar in urine	no particular	1.00		
	over	1.42	1.10–1.85	0.008
Protein in urine	no particular	1.00		
	over	1.18	1.01–1.38	0.036
Subjective symptom	no	1.00		
	yes	1.24	1.08–1.43	0.003
Objective symptom	no	1.00		
	yes	1.02	0.86–1.21	0.828
History of stroke	no	1.00		
	yes	1.14	0.88–1.47	0.315
History of heart disease	no	1.00		
	yes	1.13	0.95–1.35	0.173
History of chronic renal failure	no	1.00		
	yes	1.19	0.74–1.90	0.472
Regular smoker	no	1.00		
	yes	1.24	0.98–1.56	0.072
Weight gain or loss of ≥ 3 kg over the past year	no	1.00		
	yes	1.11	0.89–1.37	0.348
Alcohol consumption	rarely (can't drink)	1.00		
	sometimes	0.89	0.74–1.06	0.197
	every day	1.02	0.85–1.23	0.816

Table 5 (continued)

Variables	Categories	HR	95% CI	P-value
1. Do you go on buses or trains by yourself?	yes	1.00		
	no	1.30	1.02–1.64	0.030
2. Do you go shopping to buy daily necessities by yourself?	yes	1.00		
	no	1.20	0.90–1.62	0.218
3. Do you manage your own deposits and savings at the bank?	yes	1.00		
	no	0.97	0.78–1.21	0.792
4. Do you sometimes visit your friends?	yes	1.00		
	no	0.79	0.65–0.97	0.024
5. Do you turn to your family or friends for advice?	yes	1.00		
	no	1.06	0.86–1.30	0.598
6. Do you normally climb stairs without using handrails or walls?	yes	1.00		
	no	1.50	1.29–1.74	0.000
7. Do you normally stand up from a chair without aid?	yes	1.00		
	no	1.30	1.10–1.54	0.002
8. Do you normally walk continuously for 15 minutes?	yes	1.00		
	no	1.10	0.89–1.36	0.386
9. Have you experienced a fall in the past year?	no	1.00		
	yes	1.18	1.02–1.38	0.030
10. Do you have a fear of falling while walking?	no	1.00		
	yes	1.23	1.06–1.42	0.005
11. Have you lost 2 kg or more in the past 6 months?	no	1.00		
	yes	0.95	0.77–1.17	0.635
12. BMI (Body Mass Index)	standard figure	1.00		
	being emaciated	1.26	1.02–1.55	0.033
	fatness	0.98	0.83–1.15	0.773
13. Do you have any difficulties eating tough foods compared to 6 months ago?	no	1.00		
	yes	0.94	0.81–1.10	0.450
14. Have you choked on your tea or soup recently?	no	1.00		
	yes	0.90	0.76–1.06	0.209
15. Do you often experience having a dry mouth?	no	1.00		
	yes	1.08	0.94–1.25	0.283
16. Do you go out at least once a week?	yes	1.00		
	no	0.98	0.79–1.20	0.829
17. Do you go out less frequently compared to last year?	no	1.00		
	yes	1.39	1.20–1.62	0.000
18. Do your family or your friends point out your memory loss? e.g., "You ask the same question over and over again."	no	1.00		
	yes	1.04	0.88–1.23	0.671
19. Do you make calls by looking up phone numbers?	yes	1.00		
	no	1.13	0.92–1.40	0.249
20. Do you find yourself not knowing today's date?	no	1.00		
	yes	1.01	0.86–1.18	0.903
21. In the last 2 weeks have you felt a lack of fulfillment in your daily life?	no	1.00		
	yes	1.07	0.87–1.31	0.525
22. In the last 2 weeks have you felt a lack of joy when doing the things you used to enjoy?	no	1.00		
	yes	1.37	1.10–1.69	0.004
23. In the last 2 weeks have you felt difficulty in doing what you could do easily before?	no	1.00		
	yes	0.98	0.82–1.16	0.794
24. In the last 2 weeks have you felt helpless?	no	1.00		
	yes	0.98	0.82–1.17	0.822
25. In the last 2 weeks have you felt tired without a reason?	no	1.00		
	yes	0.98	0.83–1.16	0.799

HR: Hazard Ratio, 95%CI: 95% Confidence Interval.

Table 6 Factors of long-term care (young-old elderly)

Variable	Categories	HR	95% CI	P-value
Sex	female	1.00		
	male	0.64	0.45–0.90	0.010
Age		1.13	1.08–1.18	0.000
Settlement	C area	1.00		
	A area	0.71	0.44–1.14	0.153
	B area	0.92	0.63–1.36	0.689
	D area	0.68	0.46–1.01	0.056
	E area	0.80	0.54–1.19	0.267
	F area	0.85	0.58–1.25	0.409
Care prevention service	not used	1.00		
	used	0.13	0.02–1.12	0.063
Abdominal circumference	no particular	1.00		
	over	1.36	1.00–1.86	0.049
Blood pressure control	no particular	1.00		
	good control	0.91	0.64–1.28	
	bad control	0.84	0.63–1.11	0.580
Lipid control	no particular	1.00		0.214
	good control	0.82	0.59–1.14	
	bad control	0.78	0.59–1.03	0.242
Blood sugar control	no particular	1.00		0.084
	good control	0.74	0.29–1.87	
	bad control	0.87	0.68–1.11	0.518
Liver function	no particular	1.00		0.254
	particular	1.69	1.27–2.24	0.000
Anemia	no particular	1.00		
	anemia	1.00	0.73–1.36	0.998
Albumin	no particular	1.00		
	under	1.52	0.95–2.43	0.080
Uric acid	no particular	1.00		
	under	2.03	0.47–8.67	0.341
	over	0.81	0.49–1.34	0.412
eGFR	no particular	1.00		
	under	0.86	0.60–1.24	0.413
Sugar in urine	no particular	1.00		
	over	1.38	0.87–2.21	0.173
Protein in urine	no particular	1.00		
	over	1.09	0.79–1.52	0.594
Occult blood in urine	no particular	1.00		
	over	0.76	0.58–1.00	0.050
Subjective symptom	no	1.00		
	yes	1.41	1.08–1.83	0.011
Objective symptom	no	1.00		
	yes	1.21	0.88–1.68	0.242
History of stroke	no	1.00		
	yes	0.94	0.54–1.64	0.831
History of heart disease	no	1.00		
	yes	1.03	0.69–1.52	0.901
History of chronic renal failure	no	1.00		
	yes	1.46	0.52–4.13	0.473
Regular smoker	no	1.00		
	yes	1.15	0.76–1.74	0.503
Weight gain or loss of ≥ 3 kg over the past year	no	1.00		
	yes	1.19	0.79–1.81	0.407

Table 6 (continued)

Variable	Categories	HR	95% CI	P-value
Alcohol consumption	rarely (can't drink)	1.00		
	sometimes	0.84	0.61–1.15	0.282
	every day	0.99	0.69–1.41	0.949
1. Do you go on a bus or train by yourself?	yes	1.00		
	no	1.23	0.72–2.10	0.458
2. Do you go shopping to buy daily necessities by yourself?	yes	1.00		
	no	0.84	0.42–1.65	0.606
3. Do you manage your own deposits and savings at the bank?	yes	1.00		
	no	1.84	1.20–2.82	0.005
4. Do you sometimes visit your friends?	yes	1.00		
	no	0.96	0.64–1.45	0.861
5. Do you turn to your family or friends for advice?	yes	1.00		
	no	1.03	0.65–1.63	0.895
6. Do you normally climb stairs without using handrails or walls for support?	yes	1.00		
	no	1.49	1.12–1.98	0.007
7. Do you normally stand up from a chair without any aid?	yes	1.00		
	no	1.86	1.31–2.63	0.001
8. Do you normally walk continuously for 15 minutes?	yes	1.00		
	no	1.09	0.71–1.68	0.684
9. Have you experienced a fall in the past year?	no	1.00		
	yes	1.30	0.96–1.76	0.087
10. Do you have a fear of falling while walking?	no	1.00		
	yes	1.50	1.16–1.95	0.002
11. Have you lost 2 kg or more in the past 6 months?	no	1.00		
	yes	1.09	0.72–1.65	0.687
12. BMI (Body Mass Index)	standard figure	1.00		
	emaciated	1.15	0.72–1.85	0.554
	overweight	1.03	0.74–1.44	0.849
13. Do you have any difficulties eating tough foods compared to 6 months ago?	no	1.00		
	yes	1.44	1.06–1.95	0.021
14. Have you choked on your tea or soup recently?	no	1.00		
	yes	1.03	0.73–1.44	0.866
15. Do you often experience having a dry mouth?	no	1.00		
	yes	1.30	0.98–1.73	0.065
16. Do you go out at least once a week?	yes	1.00		
	no	0.90	0.58–1.38	0.616
17. Do you go out less frequently compared to the past year?	no	1.00		
	yes	1.87	1.39–2.53	0.000
18. Do your family or your friends point out your memory loss? e.g., "You ask the same question over and over again."	no	1.00		
	yes	1.19	0.86–1.65	0.297
19. Do you make calls by looking up phone numbers?	yes	1.00		
	no	0.97	0.61–1.53	0.890
20. Do you find yourself not knowing today's date?	no	1.00		
	yes	0.90	0.65–1.24	0.529
21. In the past 2 weeks have you felt a lack of fulfillment in your daily life?	no	1.00		
	yes	1.38	0.95–2.00	0.089
22. In the past 2 weeks have you felt a lack of joy when doing the things you used to enjoy?	no	1.00		
	yes	1.17	0.76–1.78	0.479
23. In the past 2 weeks have you felt difficulty in doing what you could do easily before?	no	1.00		
	yes	0.99	0.71–1.38	0.954
24. In the past 2 weeks have you felt helpless?	no	1.00		
	yes	0.92	0.63–1.34	0.652
25. In the past 2 weeks have you felt tired without a reason?	no	1.00		
	yes	0.96	0.70–1.33	0.813

HR: Hazard Ratio, 95%CI: 95% Confidence Interval.

Table 7 Factors of long-term care (old-old elderly)

Variables	Categories	HR	95% CI	P-value
Sex	female	1.00		
	male	0.97	0.80–1.18	0.777
Age		1.10	1.08–1.12	0.000
settlement	C area	1.00		
	A area	1.01	0.76–1.34	0.946
	B area	0.97	0.76–1.26	0.843
	D area	0.92	0.71–1.18	0.506
	E area	0.88	0.67–1.15	0.348
	F area	0.97	0.76–1.25	0.837
Care prevention service	unused	1.27		
	used	1.00	0.31–5.21	0.743
Blood pressure	no particular	1.00		
	good control	1.03	0.81–1.32	0.809
	bad control	0.91	0.72–1.13	0.387
Lipid control	no particular	1.00		
	good control	0.77	0.62–0.94	0.012
	bad control	0.87	0.72–1.05	0.145
Blood sugar control	no particular	1.00		
	good control	1.13	0.67–1.89	0.645
	bad control	0.96	0.74–1.25	0.790
Liver function	no particular	1.00		
	particular	1.09	0.88–1.35	0.419
Anemia	no particular	1.00		
	anemia	1.18	1.00–1.39	0.043
Sugar in urine	no particular	1.00		
	over	1.25	0.90–1.73	0.181
Protein in urine	no particular	1.00		
	over	1.27	1.06–1.53	0.011
Subjective symptom	no	1.00		
	yes	1.12	0.94–1.33	0.222
Objective symptom	no	1.00		
	yes	0.96	0.77–1.19	0.694
History of stroke	no	1.00		
	yes	1.04	0.77–1.40	0.820
History of heart disease	no	1.00		
	yes	1.12	0.91–1.37	0.300
History of chronic renal failure	no	1.00		
	yes	1.29	0.74–2.26	0.368
Regular smoker	no	1.00		
	yes	1.16	0.86–1.57	0.330
Weight gain or loss of ≥ 3 kg over the past year	no	1.00		
	yes	1.14	0.87–1.49	0.335
Alcohol consumption	rarely (can't drink)	1.00		
	sometimes	0.92	0.74–1.15	0.483
	every day	1.08	0.86–1.36	0.502

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Table 7 (continued)

Variables	Categories	HR	95% CI	P-value
1. Do you go on a bus or train by yourself?	yes	1.00		
	no	1.53	1.17–1.99	0.002
2. Do you go shopping to buy daily necessities by yourself?	yes	1.00		
	no	1.36	0.97–1.91	0.073
3. Do you manage your own deposits and savings at the bank?	yes	1.00		
	no	0.84	0.64–1.10	0.203
4. Do you sometimes visit your friends?	yes	1.00		
	no	0.74	0.58–0.94	0.013
5. Do you turn to your family or friends for advice?	yes	1.00		
	no	1.05	0.82–1.33	0.717
6. Do you normally climb stairs without using handrails or walls for support?	yes	1.00		
	no	1.48	1.23–1.77	0.000
7. Do you normally stand up from a chair without any aid?	yes	1.00		
	no	1.23	1.00–1.50	0.045
8. Do you normally walk continuously for 15 minutes?	yes	1.00		
	no	1.13	0.87–1.45	0.367
9. Have you experienced a fall in the past year?	no	1.00		
	yes	1.15	0.96–1.39	0.138
10. Do you have a fear of falling while walking?	no	1.00		
	yes	1.20	1.01–1.44	0.042
11. Have you lost 2 kg or more in the past 6 months?	no	1.00		
	yes	0.89	0.69–1.15	0.378
12. BMI (Body Mass Index)	standard figure	1.00		
	emaciated	1.36	1.06–1.73	0.014
	overweight	0.90	0.74–1.11	0.339
13. Do you have any difficulties eating tough foods compared to 6 months ago?	no	1.00		
	yes	0.96	0.80–1.15	0.638
14. Have you choked on your tea or soup recently?	no	1.00		
	yes	0.86	0.70–1.05	0.136
15. Do you often experience having a dry mouth?	no	1.00		
	yes	1.04	0.88–1.24	0.630
16. Do you go out at least once a week?	yes	1.00		
	no	1.03	0.80–1.33	0.793
17. Do you go out less frequently compared to the past year?	no	1.00		
	yes	1.19	0.99–1.43	0.053
18. Do your family or your friends point out your memory loss? e.g., "You ask the same question over and over again."	no	1.00		
	yes	0.97	0.79–1.19	0.771
19. Do you make calls by looking up phone numbers?	yes	1.00		
	no	1.12	0.86–1.44	0.403
20. Do you find yourself not knowing today's date?	no	1.00		
	yes	1.13	0.94–1.37	0.205
21. In the past 2 weeks have you felt a lack of fulfillment in your daily life?	no	1.00		
	yes	1.02	0.80–1.31	0.847
22. In the past 2 weeks have you felt a lack of joy when doing the things you used to enjoy?	no	1.00		
	yes	1.30	1.00–1.68	0.049
23. In the past 2 weeks have you felt difficulty in doing what you could do easily before?	no	1.00		
	yes	0.97	0.79–1.19	0.778
24. In the past 2 weeks have you felt helpless?	no	1.00		
	yes	1.02	0.82–1.26	0.860
25. In the past 2 weeks have you felt tired without a reason?	no	1.00		
	yes	1.00	0.81–1.23	0.993

HR: Hazard Ratio, 95%CI: 95% Confidence Interval.

proved for long-term care were certified for assistance-level care, which may have obscured the factors that gave rise to the need for higher-level long-term care. In future analyses, the occurrence of certification for long-term care or higher-level long-term care should be used as response variables.

Conclusion

This study demonstrates that preventive healthcare should focus on the prevention of lifestyle related diseases in the young-old elderly individuals and on the prevention of emaciation and reduced muscular strength in the old-old elderly people.

The results indicate that it is essential to review the criteria for the secondary preventive project and identify separate sets of criteria that are each suited to the young-old and old-old elderly populations.

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