Predictors of certification for long-term care need in community-dwelling older adults

Original Article

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Predictors of certification for long-term care need in community-dwelling older adults

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Abstract

Purpose: To determine which physical health, functional capacity, psychosocial health, and lifestyle habit factors predict the need for certification for long-term care in community-dwelling older adults.

Methods: Among 1,419 adults aged 70 years or older in B village in A prefecture, 1,381 subjects participated in this study; inpatients and current recipients of long-term care were excluded. Interviews using structured questionnaires were conducted during a health checkup in a community health center in July 2004; 443 subjects participated in the health checkup. Through random sampling, 8 of 16 districts were selected as the targeting area for home visits for non-participants in the health checkup, and 396 subjects were interviewed. Thus, 839 participants were followed for 18 months. Characteristics of subjects who received certification for long-term care were compared with non-certified subjects. The outcome was analyzed using the Kaplan-Meier life-table analysis and the log-rank test for survival curves. Cox's proportional hazard model was used to determine whether physical health, functional capacity, psychosocial health, and lifestyle habits could be used to predict outcome.

Results: A total of 817 participants were analyzed (20 subjects who died and 2 who moved were excluded). During the 18 months of follow-up, 42 participants (5.0%) were certified for long-term care. Cox's proportional hazard model revealed that age (hazard ratio [HR], 3.03; 95% confidence interval [CI], 1.46-6.25; $P<0.01$), standing time from a long sitting position on the floor (HR, 3.32; 95% CI, 1.40-7.87; $P<0.01$), functional capacity (HR, 2.69; 95% CI, 1.35-5.35; $P<0.01$), cognitive impairment (HR, 2.40; 95% CI, 1.04-5.52; $P<0.05$), and history of diabetes mellitus (HR, 2.34; 95% CI, 1.05-5.21; $P<0.05$) were significant predictors of need for long-term care.

Conclusions: Advanced age, standing time from a long sitting position on the floor (more than 4 seconds), low scores of functional capacity (10 points and less), cognitive impairment, and a history of diabetes mellitus were predictors of certification for long-term care need. These results suggest that the frailty of older adults can predict the need for long-term care. Further studies are necessary to identify additional predictors.

Key words

Certification for long-term care, Community-dwelling older adults, Cox's proportional hazard model, Health Checkup, Predictor

Introduction

In 2006, a new long-term insurance system was instituted in Japan. Under the new system, local authorities are requested to provide community support programs for older adults who are at risk for needing long-term care[1].

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Cerebrovascular disease and bone fractures resulting from falls are the major physical problems of older adults that lead to conditions requiring long-term care. In fact, according to a nationwide survey in Japan in 2006, the leading cause of needing care in adults younger than 74 years of age is cerebrovascular disease; however, with advancing age, cerebrovascular disease is less likely to lead to a condition needing care. Among persons 75 years and older who reguire care, fracture and senility are the two main causes[2]. In addition, approximately 30% of persons older than 85 years need care because of senility[2]. Those who are certified as "support needed" or "care level 1" may need more intensive care with advancing age due to bone fractures resulting from falls, arthritic diseases, and senility, all of which are related to a "disuse syndrome," a syndrome that accounts for approximately 50% of older adults who need long-term care. To prevent older adults from needing long-term care, it is important to take preventive measures so that adults can maintain functional capacity and physical performance with age.

Among community-dwelling older adults, it is reported that advanced age and poor walking ability are predictors for certification of a lower support level for long-term care, and advanced age and poor instrumental activities of daily living are predictors for certification for a higher support level[3]. Social networks and support from friends or family are also related to a decreased risk for long-term care requirements[4]. However, few studies have been conducted on predictors for long-term care certification.

To prevent older adults from requiring long-term care, a new basic checklist of screening for lower functional capacity was adopted in April 2006 in the "Basic Health Examination (BHE)" for adult residents who live in cities, towns and villages[5]. Public health nurses or chief care managers use this checklist to assess conditions of older adults. The addition of this checklist to the BHE, which is done to screen for lifestyle-related diseases, will allow local authorities to detect older adults who are at risk of needing care early. However, few studies are available on predictors of the onset of long-term care need. The purpose of this study was to determine which physical health, functional capacity, psychosocial health, and lifestyle habit factors predict the need for certification for long-term care in community-dwelling older adults.

Methods

1. Study sample

Adults aged 70 and older as of March 31, 2005 and living at B village in A prefecture were included in this study. We excluded inpatients and those who were already certified for long-term care as of June 30, 2004, leaving 1,381 older adults as participants. B village is located in Tohoku district and people older than 65 years accounted for 22.2% of the total population of 8,441 in 2004.

2. Data collection

A baseline survey was carried out at a community health center during the health checkup in July 2004[6]. Instructions and questionnaires about the health checkup were mailed in advance of the health checkup. Older adults who wanted to participate brought their filled out questionnaires to the health center. In addition, a random sampling of 8 of 16 districts in the village was conducted among non-participants in the health check-up to select subjects for in-home interviews; 490 of 938 non-participants in the health checkup were selected. The interviewers included public health nurses, nutritionists, home caregivers, and university graduate students from departments of medicine or departments of nursing. All interviewers were instructed how to conduct the survey before conducting interviews.

Participant observations took place for at least 548 days, with the last day being December 31, 2005. During the observation period, outcome data of death or moving-out and certification of recipients for care levels from lower support to higher "care levels 1-5" were examined.

3. Measures

Independent variables included sociodemographic factors, physical health, functional capacity, psychosocial health, and lifestyle habits. Physical health variables included criteria for evaluating

the degree of independence of disabled older adults in performing activities of daily living (ADL)[7], 5 ADL (walking, eating, toileting, bathing, and dressing), and other factors such as hearing/visual impairment, self-reported medical history (stroke, hypertension, heart disease, osteoporosis, diabetes mellitus, and mental disorder), chewing status, the Motor Fitness Scale (MFS) Japanese version[8], and falls experienced during the past year. The MFS is a self-rated measurement scale comprising 14 items in 3 subscales (morbidities, 6 items; strength, 4 items; and balance, 4 items) measuring the physical performance of older adults. The total score is 14, with higher scores representing better physical performance[9]. We also measured how long it took a participant to stand after sitting on the floor[6].

Functional capacity was measured using the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-Index of Competence)[10]. The TMIG-Index of Competence consists of 13 items: "Instrumental Self-maintenance" (5 items), "Intellectual Activity" (4 items), and "Social Role" (4 items). The response to each item is "yes (able to do)" or "no (unable)." Subjects score 1 point for "yes" responses and 0 points for "no" responses. The highest possible score is 13, with higher scores indicating better functional status.

Psychosocial health variables included the degree of cognitive impairment, self-rated health and the Geriatric Depression Scale (GDS) short version[11], social support, and homeboundness. Cognitive impairment was evaluated in terms of whether or not the subject had difficulty functioning in daily life because of cognitive dysfunction. The GDS short version is a self-reported depression inventory that consists of 15 true-false items. The response to each item was designed as "true" or "false", with each item being worth a single point. This scale has been shown to be both reliable and valid for older adults in Japan[12]. A score of 5 or greater shows the tendency for a depressive condition. A modified scale of social support[13] measured instrumental support or emotional support from family members living together or from others. The degree of homeboundness was measured by "frequency of going outdoors"[14]. As for the lifestyle habits, food intake frequencies of 10 major dietary items by the dietary variety score[15] were used. We collected data at the onset of certification for long-term care from a recipient list and a moving-out and death notification list of residents, including those who had been previously certified.

4. Statistical analyses

Comparisons among categorical variables were made using the chi-square test and Fisher's exact test (when the expected value was less than 5 per cell). Ordered variables were tested using the Mann-Whitney U test, and continuous variables were tested using the Student t test. For each significant independent variable, bivariate analyses of Cox's proportional hazards model was used to estimate the relative risk of events of certification for long-term care adjusted for age. In addition, for significant variables, the outcome was analyzed using the Kaplan-Meier estimation, and the log-rank test for survival curves. Among variables with mild correlations (correlation coefficient $>$ 0.40), we selected variables with a stronger correlation with events before multivariate analysis. We used a P value$<$0.05 for multivariate analysis using Cox's proportional hazards model with a backward stepwise procedure. Hazard ratios were controlled for age and degree of independence according to forced-entry linear regression. A significant difference was estimated for the two-sided P value, which was less than 5.0%. Statistical data were analyzed using SPSS/Ver.13.0J for Windows.

5. Ethical approvals

The village office mailed subjects a written explanation about the survey along with the questionnaire before subjects underwent their health check-up. In addition, the purpose of the survey was explained in a face-to-face conversation for participants who came to the health center for a check up and for those who were interviewed during a home visit. Subjects had to provide verbal informed consent. To maintain the privacy of the subjects, names and identifying information were removed from the documents before data were

processed. This study was carried out as part of the prevention programs for long-term care at an autonomous regional office. The review board of the ethics committee of Kochi University approved this study.

Results

Among the 1,381 subjects, 443 (32.1%) underwent a health checkup and 396 (28.7%) underwent home interviews, for a total of 839 participants. The mean age of subjects was 77.9±5.3 years; 40.9% were men. During the observation period, 42 (5.0%) participants became certified recipients of long-term care, 20 (2.4%) died, and 2 (0.2%) moved. Of the newly certified recipients, 6 had "support required," 10 had "care level 1," 12 had "care level 2," 11 had "care level 3," 2 had "care level 4," and 1 had "care level 5." We excluded participants who died or moved, leaving 817 participants, and then compared variables between those who required certification and those who did not.

Participauts in the certified group were older, had lower degrees of independence, needed help walking and bathing, had hearing impairment, visual impairment, a higher rate of history of diabetes mellitus, lower physical performance, took a longer time to stand from a sitting position on the floor, had lower functional capacity and cognitive impairment, lower values in self-rated health, a tendency to depressive conditions, and went outdoors less than once a week (Table 1). For items showing a significant difference between groups, relative risk and a 95% confidence intervals (CIs) were calculated using the Cox proportional hazards model. Kaplan-Meier survival analysis confirmed the "crossing" of the survival curve with each variable. A significant difference in the following items was found: 1) age ($P<0.01$), 2) degree of independence ($P<0.01$), 3) walking ($P<0.05$), 4) bathing ($P<0.01$), 5) history of diabetes mellitus ($P<0.01$), 6) visual impairment ($P<0.05$), 7) physical performance ($P<0.01$), 8) standing time from a long sitting position on the floor ($P<0.01$), 9) functional capacity ($P<0.01$) 10) cognitive impairment ($P<0.05$), 11) self-rated health ($P<0.05$), 12) tendency to depressive condition ($P<0.05$), and 13) frequency of going outdoors ($P<0.05$) (Table 2). Among the variables with a correlation coefficient greater than 0.40, variables that were strongly associated with the event of certification according to Spearman's correlation coefficients were used for multivariate analysis. Table 3 shows the results of the backwards' stepwise procedure using the Cox proportional hazard model. As a result, the following 5 variables were obtained: 1) age (older than 80 years/70-79 years of age, hazard ratio (HR): 3.03 (95% CI, 1.46-6.25; $P<0.01$), 2) standing time from a sitting position on the floor (more than 4 seconds/less than 4 seconds, HR: 3.32 (95% CI, 1.40-7.87; $P<0.01$), 3) functional capacity (10 points and less/11 points or higher, HR: 2.69 (95% CI, 1.35-5.35; $P<0.01$), 4) cognitive impairment (mild or severely impaired/no impairment), HR: 2.40 (95% CI, 1.04-5.52; $P<0.05$), 5) history of diabetes mellitus (presence/absence), HR: 2.34 (95% CI, 1.05-5.21; $P<0.05$).

Discussion

Approximately 60% of adults older than 70 years in the rural community in this study were included in this investigation. This is an appropriate sample population compared with recent studies[3,4]. Our study showed that those with "support required" and "care level 1" accounted for 38% of new recipients, and other recipients who required higher levels of care accounted for 62% of new recipients. The percentage of new recipients requiring higher levels of care is higher than in recent studies[3,4]. This finding may reflect the fact that the age of participants in this study was limited to those older than 70 years.

In this study, 5.0% of subjects were certified to receive long-term care after 18 months, a value that is similar to those seen in recent studies (eg, 4.5% after 24 months[4] and 8% after 40 months[3]). In a cross-sectional study comparing the characteristics of older adults who underwent a health checkup to those who did not participate in the health checkup, non-participants were reported to be older and lower in functional capacity[16]; however, in this study, only a borderline association between participants and non-participants in the health

Table 1 Comparison between certified and non-certified participants at baseline (N=817)

		Non-certified[1] (n=775)		Certified[1] (n=42)		P-value[2]
		mean±SD, n	%	mean±SD, n	%	
Sociodemografic factors						
Gender	Men	317	40.9	14	33.3	0.33
	Women	458	59.1	28	66.7	
Age		77.6±5.0		83.0±6.1		<0.01
	≧80	248	32.0	30	71.4	<0.01
Living arrangement	Living alone	32	4.1	3	7.1	0.35
	Others	742	95.9	39	92.9	
Physical health						
Degree of independence	Partly or completely dependent	175	22.6	22	52.4	<0.01
Activities of daily living						
Walking	Partly or completely dependent	16	2.1	4	9.5	<0.05
Eating	Partly or completely dependent	4	0.5	0	0.0	1.00
Toileting	Partly or completely dependent	32	4.1	0	0.0	0.40
Bathing	Partly or completely dependent	9	1.2	3	7.1	<0.05
Dressing	Partly or completely dependent	0		0		-
Hearing impairment	Mildly or severely impaired	114	14.7	13	31.0	<0.05
Visual impairment	Mildly or severely impaired	64	8.3	8	19.0	<0.05
History of hypertension		352	45.5	19	46.3	0.91
History of heart disease		80	10.3	3	7.3	0.79
History of osteoporosis		76	9.8	6	14.3	0.30
History of diabetes mellitus		69	8.9	9	21.4	<0.05
History of stroke		51	6.6	6	14.3	0.07
History of mental disorder		9	1.2	1	2.5	0.40
Chewing status	Mildly or severely impaired	59	7.6	7	16.7	0.07
Falls experienced during the past year	Present	189	24.4	12	28.6	0.54
Motor Fitness scale		10.2±3.6		5.9±3.6		<0.01
Physical performance status	≧11	430	56.2	6	14.3	<0.01
	≦10	392	43.8	37	85.7	
Standing time from a long sitting position on the floor		3.8±2.6		5.9±3.4		<0.01
	≧4sec	298	38.5	35	83.3	<0.01
	<4sec	477	61.5	7	16.7	
Functional capacity						
TMIG Index of competence		11.5±2.1		8.7±3.2		<0.01
Instrumental self-maintenance		4.7±0.8		3.4±1.7		<0.01
Intellectual activity		3.4±1.0		2.4±1.5		<0.01
Social role		3.5±0.9		2.9±1.0		<0.01
Functional capacity status	≧11	599	77.3	15	35.7	<0.01
	≦10	167	21.5	27	64.3	
Psychosocial health						
Cognitive impairment	Mildly or severely impaired	32	4.1	7	16.7	<0.01
Self-rated health	Good	564	72.8	23	54.8	<0.05
	Poor	211	27.2	19	45.2	
Geriatric depression scale		3.7±2.8		5.0±3.0		<0.05
Tendency of depressive condition	≧5	250	33.4	22	55.0	<0.05
Social support						
Instrumental support from family		3.6±0.8		3.6±0.6		0.60
Emotional support from family		3.7±0.9		3.7±0.8		0.93
Total support from family		7.3±1.5		7.4±1.1		0.77
Instrumental support from others		2.8±1.4		2.8±1.3		0.77
Emotional support from others		3.3±1.2		3.3±1.1		0.63
Total support from others		6.2±2.4		6.2±2.1		0.73
Frequency of going outdoors	<1 / a week	125	16.1	15	35.7	<0.01
Lifestyle habits						
Dietary variety score		4.9±2.3		5.1±2.6		0.64
Health check-up	Participant	422	54.5	17	40.5	0.08
	Non-participant	353	45.5	25	59.5	

1) The sum of the percentage of items does not reach 100% because of missing data.
2) P-values are based on chi-square test or Fisher's exact test, except continuous or ordered data where p-values are derived from Student's t-test or Mann-Whitney's U test.

Table2 Hazard ratios[1] for Cox's proportional hazard model and correlation coeffcients[2] for Spearman's rank-order correlation of each independent variable related to certification for long-term care at baseline

Independent variables	Coding	Hazard ratio[1]	95% Confidence interval	P-value	Correlation coefficient[2]
Age	≧80 / 70-79	5.05	2.59- 9.86	<0.01	0.18
Physical health					
Degree of independence	Partly or completely dependent / Independence	2.73	1.47- 5.03	<0.01	0.15
Activities of daily living					
Walking	Partly or completely dependent / Independence	3.05	1.08- 8.63	<0.05	0.11
Bathing	Partly or completely dependent / Independence	4.88	1.50-15.84	<0.01	0.11
History of diabetes mellitus	Presence / Absence	2.96	1.41- 6.18	<0.01	0.10
Hearing impairment	Mildly or severely impaired / No impaired	1.67	0.85- 3.26	0.14	0.10
Visual impairment	Mildly or severely impaired / No impaired	2.29	1.06- 4.96	<0.05	0.10
Physical performance	≦10 / ≧11	5.01	2.05-12.21	<0.01	0.19
Standing time from a long sitting position on the floor	<4sec / ≧4sec	5.41	2.35-12.40	<0.01	0.20
Functional capacity	≦10 / ≧11	4.53	2.37- 8.66	<0.01	0.22
Psychosocial health					
Cognitive impairment	Mildly or severely impaired / No impaired	2.90	1.27- 6.60	<0.05	0.13
Self-rated health	poor / good	2.10	1.14- 3.85	<0.05	0.10
Tendency of depressive condition	≧5 / ≦4	2.09	1.12- 3.90	<0.05	0.10
Frequency of going outdoors	<1/ week / ≧1/ week	2.24	1.19- 4.24	<0.05	0.11

1) Hazard ratios per each independent variable were calculated using Cox's proportional hazard model adjusted for age(≧80/70-79).
2) Correlation coefficients were calculated between each independent variable and presence or absence of certification.

Table3 Hazard ratios for predictors of certification for long-term care

Independent variables	Coding	Hazard ratio[1]	95% Confidence interval	P-value
Age	≧80 / 70-79	3.03	1.46-6.25	<0.01
Degree of independence	Partly or completely dependent / Independence	1.27	0.67-2.46	0.48
Standing time from a long sitting position on the floor	≧4sec / <4sec	3.32	1.40-7.87	<0.01
Functional capacity	≦10 / ≧11	2.69	1.35-5.35	<0.01
Cognitive impairment	Mildly or severely impaired / No impaired	2.40	1.04-5.52	<0.05
History of diabetes mellitus	Presence / Absence	2.34	1.05-5.21	<0.05

1)Multivariate analysis using Cox's proportional hazard model by forced entry of age and degree of independence. Backward stepwise entry (likelihood ratio): all variables are entered in a single step.

checkup was found among subjects receiving certification for long-term care.

As a result of the multivariate analysis, we first focused on functional capacity measured by the total scores of the TMIG index of competence. Among 7 stage competences advocated by Lawton[17], higher-level activity competence is defined as "functional capacity"[18-22]. The term "functional capacity" was accepted as a fundamental concept in mutual languages by the World Health Organization in the International Classification of Functioning, Disability and Health (ICF) in 2001[23]. The definition of functional capacity in the ICF describes physical and mental functions, ADL, and ability to join social activities as a whole, including "daily activities" such as keeping house, vocational abilities, walking outside, and "participation" in fulfilling the social roles of private and social life. This study showed that subjects who scored 10 points and less on the functional capacity scale had a high risk of requiring certification for long-term care. The apparent cut-off point of the functional capacity scale was not determined in this study, but Haga et al.[24] implied that candidates with 10 points and less on the functional capacity scale could be considered high-risk subjects who would need long-term care.

We also measured standing time from a long sitting position on the floor, a measurement that is gaining interest as a simple physical index of older adults at home because it is easy to test and is based on the traditional Japanese lifestyle activity of sitting on the floor or "tatami"[6]. This simple measurement is useful in a community setting,

especially in older adults, and was shown to be an effective predictor for long-term care certification. However, when interviewees check this measurement, they have to be careful that subjects do not fall.

For older adults who are losing memories of daily life, the possibility of mild cognitive impairment increases. In 2006, projects aimed at preventing and supporting older adults with mild cognitive impairment were introduced and developed in community activities. In particular, early recognition for those with mild cognitive impairment is important for the treatment of the disease. Some diagnostic standards and screenings for those with cognitive impairment are available, but established tools for screening mild cognitive impairment in the community setting are scarce[25]. Self-reported mild or severely cognitive impairment is easy to assess and will likely become a useful predictor for long-term care certification.

Finally, our study showed that a history of diabetes mellitus is associated with the risk of needing long-term care, a fact that has not been clarified[26,27]. More recently, diabetes mellitus has become a focus of attention as part of the metabolic syndrome[28]. The National government has emphasized that projects aimed at preventing metabolic syndrome are important. Because diabetes was associated with the need for long-term care in our study, the prevention of diabetes is an important variable to help prevent the need for long-term care.

Except for diabetes mellitus, predictors of certification for long-term care in this study were consistent with ones adopted for the care prevention project. A basic checklist was introduced to the BHE in 2006. This list comprises 25 items (3 related to instrumental ADL, 2 to social roles, and 20 to the following 6 fields: improving physical function, improving nutrition, improving oral function, preventing and supporting houseboundness, improving cognitive impairment, and improving depression. Because this study started before this basic checklist was introduced, the items on our questionnaire were not exactly the same as on the basic checklist; however, the same fields are covered. These results suggest that the frailty of older adults can predict the need for long-term care. Additional evidence of other predictors is needed.

Conclusions

Predictors of certification for long-term care need from this study are as follows:

- Age (older than 80 years)
- Standing time from a long sitting position on the floor (more than 4 seconds)
- Functional capacity (10 points and less)
- Cognitive impairment
- History of diabetes mellitus

The findings of age, functional capacity, and mild cognitive impairment as predictors support the prior findings related to certification of long-term care. It is of particular importance that we consider the cut-off point of functional capacity to be 10 points and that older adults with mild cognitive impairment are at risk of needing long-term care because few studies are available on evidence of cut-off point for functional capacity and mild cognitive impairment as a certification for long-term care risk.

Furthermore, this study indicates that standing time from a long sitting position on the floor and history of diabetes mellitus are necessary predictors for the need for certification of long-term care. These results suggest that maintaining physical performance and preventing lifestyle-related diseases may be helpful and reducing the need for long-term care in older adults.

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地域高齢者における要介護認定の予測因子に関する検討

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要　旨

目的：高齢者を対象とした健康診査（以下健診）受診者の身体的特性、生活機能、心理社会的特性、生活習慣に関する項目から、要介護認定を予測する因子について明らかにする。
方法：A県B村在住の満70歳以上の全高齢者1,419人のうち、要介護認定を受けている者と入院中の者を除く1,381人を対象として、2004年7月の健診問診時に面接調査を実施した。未受診者については対象地区を1/2抽出し、家庭訪問による面接調査を実施した。その後、これらの面接対象者839人について、要介護認定の新規発生の有無を18カ月間追跡した。
結果：18カ月間の新規認定者は42人（5％）であった。要介護認定を事象の発生としたCox比例ハザードモデルによる多変量解析の結果、年齢（ハザード比=3.03、95%信頼区間（以下95% CI）：1.46－6.25）、長座位立ち上がり時間（ハザード比=3.32、95%CI：1.40－7.87）、生活機能（ハザード比=2.69、95%CI：1.35－5.35）、もの忘れ（ハザード比=2.40、95%CI：1.04－5.52）、糖尿病（ハザード比=2.34、95%CI：1.05－5.21）の5変数が抽出された。
結論：将来の要介護認定を予測する因子として、高年齢（80歳以上）、長座位立ち上がり時間（4秒以上）、生活機能（10点以下）、もの忘れあり、糖尿病の既往ありという結果が得られた。これらは、高齢者の虚弱性が要介護発生を予測できる可能性を示唆している。今後は、介護予防の視点から、予測因子の根拠を蓄積していく必要があると考える。