Correlates of improvement of care need level in disabled older adults: Two-year follow-up study in 11,585 older people

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Abstract

Background The correlates to the improvements of care need level are not clear. In this study, we examined physical function, cognitive function, and ADL abilities that affect the improvement in the care need level for older adults who required low-level care at the baseline.

Methods This retrospective cohort study included 11,585 individuals aged 65 years and older who had received personal care for two or more years starting from the baseline assessment that is motor function, cognitive function, and activity of daily living. Subjects who had an improvement in their care need level from baseline to two years later were put into the Improved Group, while subjects who maintained the baseline level or deteriorated were put into the Maintained/Deteriorated Group. We conducted a univariate analysis using the t-test and chi-square test to compare the differences for each variable between the two groups. Multiple logistic regression analysis was conducted with motor function, cognitive function, and FIM binary classification where significant correlation was found as independent variables, and with the Improved Group and the Maintained/Deteriorated Group as dependent variables.

Results Motor function at baseline was not associated with improvement of the care need level in older adults who require low-level care, instead, MSQ (odds ratio (OR) 2.44 [95% confidence interval (CI) 2.13-2.79, $P < 0.01$]) and sub-scores of FIM included self-care (OR 1.20, 95%CI 1.01-1.33, $P < 0.05$), continence (OR 1.25 [95%CI 1.01-1.58, $P < 0.05$]), and social cognition (OR 1.34 [95%CI 1.14-1.58, $P < 0.01$]) were significantly correlated with the improvement of the care need level.

Conclusions The improvements of care need level were associated with cognitive function, self-care ability, bladder/bowel control, and social cognition ability at baseline, although there were no correlations between the improvements of care need level and motor function in older adults.

Background

The global rate of aging has increased from 5.1% in 1950 to 8.3% in 2015.¹ It is expected to increase to 18.1% by 2060, indicating that aging will progress rapidly in the latter half of this century.¹ Japan reached its highest level in 2005 and is expected to reach 30.3% in 2030. This trend is also associated with increased national healthcare costs, and from 2014 onwards, the national healthcare costs for older adults aged 75 years and older has accounted for 35.6% of total expenditures. Furthermore, with aging comes a steady, irreversible decline in mental and physical health as well as of life function. The long-term care insurance (LTCI) system was started in April 2000 as a plan to provide support in society as a whole to older adults transitioning to requiring care through a social insurance mechanism.²

Older adults aged 65 years or older submit an application to their municipality, receive nurse-care requirement authorization, and then, depending on the degree of care needed, a care service plan is created, and older adults can receive in-home care services or facility-based services. The cost of this LTCI has been increasing year-to-year, burgeoning from 3.6 trillion yen in 2000 to 10.4 trillion yen in 2016, which is placing pressure on public finances. Based on the above information, in various countries worldwide, and particularly in countries with rapidly aging populations, preventative care for older adults, preventing the exacerbation of existing conditions and improving the level of care are important issues.

According to a 2016 research and study project on the future shape of day care services, 20% to 25% of older adults at each level of care, from care need level 2 to care need level 4, had improved their care need level over the previous 12 months. This shows that a large number of older adults can expect improved care need levels, even during life maintenance phases, but previous studies did not state the factors that affected the improvement of their care need levels or any adopted improvement measures. Guralnik et al.³ conducted a longitudinal study on activities of daily living (ADL) targeting healthy older adults living in the community. They reported that the rate of decline in a score for ADL was around 2.5% per year. Harada et al.⁴ conducted a longitudinal study on ADL targeting independent older adults who were continuing to live in their own homes and reported the rate of decline in ADL as around 4.7% every 18 months. Tsuji et al.⁵ investigated the mortality rate of community dwelling older adults after three years, and they reported that only 7.7% of the older adults were independent in the first study, compared to 48.3% who already required nursing care.

We conducted a longitudinal study on ADL targeting older adults who required day care services. We found that 42.9% of the subjects were able to perform self-care, 13.1% of the subjects had bladder/bowel control, and 32.0% of the subjects were capable of transfer and movement. Each of these ADL abilities declined within the short time frame of six months.⁶ Other previous studies also identify the correlates to the occurrence of a need for nursing care,⁷⁻¹⁰ but the correlates to the improvements of care need level are not clear. In this study, we examined physical function, cognitive function, and ADL abilities that affect the improvement in the care need level for older adults who required low-level care at the baseline.

Methods

Participants

We performed a national study of 11,585 individuals aged 65 years and older who had received personal care and who had used day care services continuously for two or more years starting from the baseline assessment (age 82.0 ± 6.5 years, men $n = 3822$, women $n = 7763$). The study included individuals who were enrolled in the Tsukui Ordered Useful Care for Health (TOUCH) program. To enroll in the TOUCH program, an individual had to be 65 years or older and have been certified as needing support or care from the Japanese public LTCI system. Detailed information was provided in a previous study.¹¹ In brief, TOUCH sites (241 day-care centers) are located throughout Japan and provide comprehensive, facility based day-care services (e.g., bath, lunch, physical and cognitive recreational activities, and physical exercise). Most TOUCH clients have some physical disability and frailty, defined as the presence of weakness, low physical activity, and/or slow gait speed, in accordance with the widely accepted definition of frailty.¹¹

The breakdown of the care need level was as follows: support need level 2: 16.0%, care need level 1: 54.0%, and care need level 2: 30.0%. The conditions for inclusion in the study were subjects with no apparent dementia who were able to undergo all examinations, who continuously used day care services for the following two years, and whose care need level could be traced. Cognitive function was evaluated using the mental status questionnaire (MSQ),^{12,13} and any potential subjects with 9 or 10 incorrect answers were excluded from the study. The subjects were divided into two groups. Subjects who had an improvement in their care need level from baseline to two years later were put into the Improved Group, while subjects who maintained the baseline level or deteriorated were put into the Maintained/Deteriorated Group. The Ethics Committee of the Tokyo Metropolitan Institute of Gerontology approved the study protocol. Written informed consent was obtained from the subject or their representing family member.

Measurements

Well-trained staff who had nursing, physiotherapy, occupational therapy, or similar qualifications conducted the assessment measures. Prior to the start of the study, all staff received training from the authors on the correct protocols for administering all the assessment measures. The assessment included several physical tests. Upper and lower limb muscle functions were assessed using the grip strength (GS) and chair stand test (CST), respectively.¹⁴ Gait function was assessed through walking time tests conducted at a comfortable pace (comfortable walking speed [CWS]) and using the timed up-and-go (TUG) test.¹⁵ GS was measured in kilograms for the participant's dominant hand using a Smedley-type handheld dynamometer (GRIP-D; Takei Ltd, Niigata, Japan). The CST involved sitting down and standing up five times using a chair without an armrest. The score showed the time taken to complete the task in seconds. Participants were asked to exert their maximum effort in GS and CST. CWS was measured in seconds with a stopwatch. Participants were asked to walk on a flat and straight surface at their CWS. Two markers were used to indicate the start and end of the path, and a 2 m and over approach was allowed before reaching the start marker so that participants could walk at their comfortable pace within the timed path. They were instructed to continue walking past the end of the path for a further 2 m and over to ensure that the walking pace was consistent throughout the task. The TUG test involved rising from a chair, walking 3 m, turning around, walking back to the chair, and sitting down.¹⁴ The TUG test is one of the most frequently used tests of balance and gait and is often used to assess fall risk in older people.¹⁶ The time to complete the TUG test was measured in seconds, at each participant's usual pace. Both walking tests were measured once, and if a walking aid was normally used inside the home, this aid was used during the tests.

The MSQ for individuals enrolled in the TOUCH program was used to measure cognitive function and as potential confounders in the association between performance-based physical assessments and functional dependence.¹² Individuals with three or more errors on the MSQ were considered to have cognitive impairment.^{12,13}

The Functional Independence Measure (FIM) was used to evaluate ADL, and the scores were calculated for the main headings: self-care, bladder/bowel control, transfer, movement, communication, and social cognition.^{17,18} Staff employed at each of the day care facilities performed these measurements and assessments after receiving training from a physiotherapist. When the person conducting the testing could not clearly score FIM, the scores were decided upon after discussion with other care staff.

Statistical analysis

We conducted a univariate analysis using the t-test and chi-square test to compare the differences for each variable between the two groups. Multiple logistic regression analysis was conducted with motor function, cognitive function, and FIM binary classification where significant correlation was found as independent variables, and with the Improved Group and the Maintained/Deteriorated Group as dependent variables (model 1). In addition, multiple logistic regression analysis adjusted for all motor functions, FIM major items, age, and gender were also performed (model 2).

Statistical software SPSS 22.0 for Windows was used for all statistical processing, and significant probability was set as less than 5%.

Results

The baseline characteristics of the subject are shown in Table 1. There were 1,298 subjects in the Improved Group (men n = 374, women n = 924, 81.6±6.6 years), and 10,287 subjects in the Maintained/Deteriorated Group (men n = 3,448, women n = 6,839, 82.1±6.4 years). There were no significant differences between the groups in any of the measurements of motor function. The Improved Group showed higher MSQ (p<.001) scores and FIM scores in self-care (p<.001), bladder/bowel control (p<.001), communication (p<.001), and social cognition (p<.001) compared to the Maintained/Deteriorated Group.

In multiple logistic regression analysis, MSQ (odds ratio [OR] 2.45 95% confidence interval (CI) 2.15–2.80 P<0.01) and self-care (OR 1.21, 95% CI 1.04–1.41, P<0.05), continence (OR 1.28 95% CI 1.01–1.61 P<0.05), and social cognition (OR 1.35 95% CI 1.15–1.58 P<0.01) were significantly correlated with improvement in the care need level. These results remained essentially unchanged after controlling for age, sex, cognitive impairment, and other physical performance tests. In the next model (model 2), MSQ (OR 2.44 95% CI 2.13–2.79 P<0.01) and self-care (OR 1.20, 95% CI 1.01–1.33, P<0.05), continence (OR 1.25 95% CI 1.01–1.58 P<0.05), and social cognition (OR 1.34 95% CI 1.14–1.58 P<0.01) were significantly correlated with improvement in the care need level.

Discussion

The TOUCH cohort data showed the relationships between improvement in the care need level and baseline assessments of cognition and ADL scores in selfcare, continence, and social cognition in disabled older adults. Yokoi et al. reported that cognitive function disorders affected the decline in FIM motor-related items, indicating that subjects with moderate dementia were all independent in eating and transfer, but none were independent in their grooming, bathing, and changing clothes (top and bottom).¹⁹ Reisberg et al. reported that subjects with moderate to severe cognitive function disorders had impaired ability changing clothes, bathing, and using toilet facilities, and suffered urinary incontinence and fecal incontinence, in that order.²⁰ Yamada et al. reported

that even among ADL, motor functions such as “walking,” “getting out of bed,” “standing up,” and “standing on one leg,” were items that did not require comparative cognitive function.²¹ However, reports show that when cognitive function is reduced, tasks such as “putting on and taking off trousers,” “putting on and taking off jackets,” “brushing hair,” and “oral hygiene,” are items that require higher levels of observation and assistance. These previous studies suggest that cognitive function disorders and self-care are closely related with bladder/bowel control.

The present study identified cognitive function, self-care, and bladder/ bowel control as associated with improvements in care need level in disabled older adults. Social cognition ability may also be related to cognitive function and may affect ADL and care need level. In FIM, social cognition contains three items: problem solving, social interactions, and memory.^{16,17} When a person has a reduced problem solving ability, they may be unable to execute ADL even if they have high levels of physical function, and there are reports that this is a predictor for inhibiting improvement in care need level and that it is also related to medication management and self-care ability.²²

In FIM, social interaction evaluates a person's ability to “appropriately interact with people around them without causing trouble for strangers,” and it incorporates the skill of compromising and participating in groups in a community living setting.^{17,18} Previous studies have shown that older adults with more social interaction were found to have higher levels of cognitive function than people with less social interaction.^{23–27} Also, having a large social network, including socializing with friends and family, exerts a positive effect on cognitive function, and it has been reported to have a preventative effect on dementia.^{26,28} There are also reports that reduced social participation increases the risk of developing dementia.²⁹ This information demonstrates that the ability to socially interact is closely related to opportunities for social participation and cognitive function, and it is considered to be a factor that affects improvement in care need level.

In FIM, memory assesses the three points of “implementing requests,” “recognizing people who are encountered often,” and “remembering daily routines.”^{17,18} Questions relating to cognitive function in the nurse-care requirement authorization survey items are divided into “understanding daily routine,” “remembering date of birth, age,” “immediate recall,” “own name,” “understanding seasons,” and “understanding locations,” and this suggests that “daily routine” and “immediate recall” are related to the FIM memory items. “Daily routine” and “immediate recall” require all the elements of memorization and retention and of recalling details that change from moment to moment. These items are more difficult to retain than memories such as name and date of birth, so they are considered to be a memory ability that would easily affect the care need level.

The above information suggests that cognitive function, self-care ability, bladder/bowel control, and social cognition ability exert a stronger effect than motor function on the improvement of care need levels in older adults who require low-level care. Therefore, conducting a detailed evaluation of these factors is important. However, there is an extremely small number of rehabilitation professionals working in the day care services examined in this study, compared to the number working in medical institutions and in-home rehabilitation services. In this kind of environment, with such few rehabilitation professionals, it is important that rehabilitation professionals provide—to professionals other than rehabilitation professionals—advice and guidance on methods for the assessment of cognitive function, self-care, and bladder/bowel control and the respective approaches to be taken, thereby striving to improve the care need level through indirect intervention.

One of the limitations of our study is that we analyzed limited performance tests. In our sample, motor function at baseline was not associated with improvement in the care need level in older adults who require low-level care. Further investigation using various tests to predict functional decline in older people is recommended. Another limitation is that many frail older people using healthcare services cannot walk because they have multiple diseases or geriatric syndromes, and since non-ambulatory participants were excluded from our study, we acknowledge that the study findings may not be generalized to this frailer group.

Conclusions

In summary, this study provides preliminary evidence that clinical tests of cognitive function, self-care ability, bladder/bowel control, and social cognition ability may be able to predict the risk of functional decline in older people. Further investigation in this area is needed, and future research should include intervention studies to prevent functional decline in this population.

Abbreviations

ADL: activities of daily living

CI: confidence interval

CST: chair stand test

CWS: comfortable walking speed

FIM: Functional Independence Measure

GS: grip strength

LTCl: long term care insurance

MSQ: mental status questionnaire

OR: odds ratio

TUG: timed up-and-go

TOUCH: Tsukui Ordered Useful Care for Health

Declarations

Ethics approval and consent to participate

The Ethics Committee of the Tokyo Metropolitan Institute of Gerontology approved the study protocol. Written informed consent was obtained from the subject or their representing family member.

Consent for publication

Not applicable.

Availability of data and material

The datasets generated and analyses performed during the current study are not publicly available due to the consent requirement of participants, but Anonymized data are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

HY, SH and HS were all involved in the conception and design of the study. HY managed day-to day research activities, data collection, and data entry. HY, SH and HS drafted the manuscript. HY, SH and HS contributed to the critical revision of the paper, approved the final version before submission and are accountable for their contributions. All authors read and approved the final manuscript.

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Tables

Table1. The subject attributes, measurement results and univariate analysis

	All subject (n=11585)	Improved Group (n=1298)	Maintained/ Deteriorated Group (n=10287)	P
Age[years]	82.3±6.5	81.6±6.6	82.1±6.4	0.091
Sex				
Men,n(%)	3822(33.0)	374(28.8)	3448(33.5)**	p<.001
Women,n(%)	7763(67.0)	924(71.2)	6839(66.5)**	p<.001
Care level in the LTCL,n(%)				
Support need level 2	1849(16.0)	251(19.3)	1598(15.5)**	p<.001
Care need level 1	6260(54.0)	350(27.0)	5910(57.5)**	p<.001
Care need level 2	3476(30.0)	697(53.7)	2779(27.0)**	p<.001
GS(kg)	17.1±7.3	17.2±6.8	17.1±6.9	0.519
CST-5(s)	14.2±6.7	13.9±6.1	14.1±6.8	0.100
The one-leg standing(s)	7.3±10.5	7.6±13.9	7.0±12.4	0.195
CWS(m/s)	0.6±0.3	0.6±0.3	0.6±0.3	0.088
TUG(s)	16.3±9.2	16.3±8.8	18.3±9.3	0.804
MSQ	3.5±2.7	2.2±2.2	3.7±2.7**	p<.001
FIM(points)				
Selfcare	37.9±6.4	38.8±5.8	37.8±6.5**	p<.001
bladder/bowel control	13.0±2.2	13.2±2.0	12.9±2.3**	p<.001
Transfer	18.4±3.3	18.5±3.0	18.4±3.3	0.073
Movement	11.5±2.6	11.5±2.4	11.5±2.6	0.485
Communication	12.1±2.7	12.7±2.3	12.0±2.7**	p<.001
Social cognition	17.1±6.9	18.1±3.9	16.6±4.5**	p<.001

Age,motor function and FIM:Mean ± standard deviation

* ≤0.05 **≤0.01

Sex,Care level:χ² test

Age,GS,CWS,FIM:t-test

CST-5,The one-leg standing,TUG:Mann-Whitney U test

Model 1 was crude ORs

Model 2 was adjusted for age, sex, care level in the LTCL, motor function, and FIM score.

Table2. A factor that affects improvement of the care need level

	Model 1		Model 2	
	OR	95%CI	OR	95%CI
MSQ	2.45**	2.15-2.80	2.44**	2.13-2.79
Selfcare	1.21*	1.04-1.41	1.20*	1.01-1.33
bladder/bowel control	1.28*	1.01-1.61	1.25*	1.01-1.58
Communication	1.08	0.89-1.30	1.07	0.88-1.29
Social cognition	1.35**	1.15-1.58	1.34**	1.14-1.58