Original Article

Work performance and needs for long-term care system of Japan using ROC curves in community-dwelling older adults.

-A cross-sectional study-

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Abstract

Purpose: This study aimed to examine the cut-off value of the Occupational Self-Assessment-Short Form (OSA-SF) in which older adults living in communities shift to the state of requiring long-term care.

Methods: The participants of the survey were living in B city, A prefecture. The study design was a cross-sectional study. Data were collected using a mail survey which included items for information regarding age, gender, presence or absence of long-term care system in Japan, and OSA-SF.

Results: A total of 1,889 people were analyzed. ROC curve analysis showed an OSA-SF score of 28.5 points, with an AUC of 0.65, a sensitivity of 61%, and a specificity of 38%. In terms of OSA-SF domains, performance domain showed 11.5 points (AUC: 0.59, sensitivity: 69%, specificity: 52%), habit domain showed 10.5 points (AUC: 0.62, sensitivity: 57%, specificity: 36%), and will area showed 7.5 points (AUC: 0.59, sensitivity: 58%, specificity: 43%).

Conclusion: The total scores of OSA-SF and those of each area can be used to predict the need for a long-term care system of Japan for older adults living in communities.

Key words: community-dwelling older adults, the Occupational Self Assessment-Short Form, ROC curve

I. Introduction

Japan is facing a rapidly aging society. According to the Cabinet Office, as of October 1, 2021, there will be 36.21 million people aged 65 and over, accounting for 28.9% of the total population. By 2065, about 1 in 2.6 people is expected to be over the age of 65[1]. Therefore, providing early support to prevent older adults from being in need of long-term care system Japan is important. According to the Ministry of Health, Labor and Welfare[2], interventions that focus on "mental and physical function" in addition to "activity" and "participation" are important. According to Shimada[3] et al., although some older adults have high motor function, there are also people who have a narrow range of activities of daily living; therefore, it is important to evaluate activities of daily living in addition to motor function, making it necessary to grasp activities of daily living as a method of supporting older adults living in communities.

Recently, the spread of COVID-19 infection has had a great impact on the older adults living in the community. Compared to before the spread of COVID-19 infection, the older adults living in the community felt that their physical activity and activities of daily living were actually reduced[4]. The lack of physical activity may lead to health hazards such as physical dysfunction[5]; therefore, efforts have been made to retain activities of daily living of older adults living in communities efforts to prevent the need for long-term care system in Japan by grasping it at an early stage and intervening appropriately.

It is necessary to understand the living functions of older adults and provide appropriate support before reaching the long-term care requirement. For this, the Kihon checklist prepared by the Ministry of Health, Labor and Welfare has been used to detect high-risk persons at an early stage. The Kihon checklist was developed to predict the risk of being in need of the long-term care system in Japan, and includes items such as "activity of daily living," "motor function," "nutrition," "oral function," "withdrawal," "cognitive function," and "depression." It is evaluated with "yes" and "no" responses to items [6]. However, it is unclear whether the five items on activities of daily living can cover a wide range of older adult's lives. In addition, since this basic checklist is a two-choice system, it is necessary to grade each item.

One of the indicators to evaluate how well people fare in their daily lives is the Occupational Self-Assessment: Short Form (OSA-SF)[7]. The reliability and validity of the OSA-SF have been investigated in previous studies[8]. Studies using the OSA-SF have reported it to be effective in determining the vocational ability and value of older adults[9]. The validity of the OSA-SF has also been examined in Japan[10]. In recent years, it has been used to practice occupational therapy programs focusing on activities and participation for older adults affected by the disaster and to verify their living issues[11]. Therefore, occupations that use OSA-SF have the advantage of making it easier for participants to identify difficulties in their daily lives.

We have conducted studies on the ability of older adults living in communities to work in their daily lives using the OSA-SF[12) 13)]. OSA-SF has three subcategories of "execution," "habit," and "will"[10]. This idea is indispensable for the prevention of a long-term care system in Japan, in which the older adults can carry out the necessary daily life activities, practice good lifestyle habits, and improve their mental will and motivation[14]. The Kihon checklist evaluates a number of features, whereas the OSA-SF evaluates from the viewpoints of "execution," "habit," and "will" in daily life. Therefore, the activities of daily living of older adults can be understood in more detail from a different point of view with the OSA-SF than with the Kihon checklist. In other words, the utilization of OSA-SF can be expected to prevent an increase in the number of people certified as requiring long-term care by reflecting it in preventive long-term care services.

In the Kihon checklist, the cutoff value is set

for each item[6], and high-risk persons who reach the need for long-term care system of japan are extracted according to the criteria. However, since the OSA-SF does not have a cut-off value, it is unclear what kind of situation would make a person at high risk of reaching a state requiring long-term care. By clarifying the points of OSA-SF, it becomes easier to provide early support using OSA-SF.

The purpose of this study was to clarify the OSA-SF cut-off value at which community-dwelling older adults transition to a state of requiring long-term care, making it possible to predict whether or not they will transition to a care-requiring state based on their ability to perform daily tasks. This will make it easier for those who use OSA-SF to understand the situation of the target person in preventive care projects, which will lead to the provision of services.

II. Methods

Subjects

The subjects of this study were selected by the person in charge of city B, prefecture A, using a stratified random sampling method to select the general elderly aged 65 years or older and those certified as needing nursing care under the long-term care insurance system. A mail survey was conducted, and after collecting the survey forms, those who met the criteria were selected as the participants of this study. City B has a population of 32,185, 11,604 elderly people aged 65 and over (aging rate of 36.0%)[7] , and 2,095 people certified as requiring nursing care (or support)[8] (As of January 2020).

The survey was conducted from January to February 2020, and included basic demographics (age, gender) and OSA-SF items. After the survey was mailed, the participants read the enclosed instructions for the survey, completed the questionnaire if they gave their consent, and returned it to the B city in prefecture A. After returning it to the B city, it was anonymized by the person in charge of the city to prevent identification of the participants. Participants who could not give consent or had difficulty completing the evaluation form were excluded.

This study was conducted with the approval of the Ethics Committee (cc-012) of the AHRU Medical Care and Welfare Professional Training College.

Methods

The survey items included age, gender, and the presence or absence of long-term care system needs as basic attributes. The main outcome was OSA-SF.

For the evaluation of activities of daily living, a shortened version[7] of self-evaluation of work based on the human work model was used. The OSA-SF can be divided into "competence", which indicates how much work activity can be performed, and "value", which indicates how important work activity is in daily life. In this survey, 12 questions about "competence" were used according to the research purpose. The items covered execution [OSA-SF (execution)] 5 items: "Be careful of the body," "Go to where you have to go," "Manage money," "Do what you basically need," "Clearly recognize and solve problems," customs [OSA-SF (habit)] 4 items: "Get rid of what you have to do," "I have a satisfying daily routine," "I will fulfill my responsibilities properly," "I am involved in the role of volunteers, family members, etc.," will [OSA-SF (will)] 3 items: "Push toward my goal," "Determining based on what I think is important," "I am demonstrating my ability well." The scores ranged from 0 (“this does not apply to me”) to 4 (“I am doing this very well”) for each question; the highest possible score was 48. The higher the score, the higher the ability to perform tasks in daily life.

Statistical processing

For the age of the basic attributes, the average age ± standard deviation was calculated first. Next, the OSA-SF total score, the median value

of each area, and the 25-75 percentile value were calculated according to the presence or absence of long-term care system of japan. Then, using the Mann-Whitney U test, we examined the comparison of scores according to the presence or absence of certification long-term care system of japan. Finally, a Receiver Operating Characteristic curve: ROC curve was drawn in which the presence or absence of certification for long-term care system of japan was input to the state variable, and the OSA-SF total score and the score of each area were input to the test variable. In the examination using the ROC curve, first, in order to calculate the cutoff value for determining the presence or absence of certification for long-term care system of japan, the Youden index is used to calculate (sensitivity + specificity -1), and the point that becomes the maximum value is calculated. The cutoff value was used. In addition, area under the curve: AUC was obtained, and the predictive ability and diagnostic ability were judged.

The required sample size was calculated using pROC of statistical software R based on the previous study of Nancy et al.[15]. Assuming an AUC (Area Under the Curve) of 0.65, a power of 0.9, a significance level of 5%, a one-sided test, and a ratio of 1:1 with/without nursing care, the sample size was 33 in each group (total 66 cases) were calculated to be necessary.

SPSS Statistics 26.0 (manufactured by IBM) was used for statistical analysis, and the significance level was set to 5% in all tests.

III. Results

A total of 2,995 subjects were selected by City B in Prefecture A, regardless of whether or not they were certified as requiring long-term care. Subsequently, 1,893 questionnaires were collected by mail (collection rate: 63.2%). Of the 1,893 recovered, it was unknown whether or not they were certified as requiring long-term care system in Japan. Excluding four participants, 1,889 (460 males, 797 females, 632 unknowns; average age

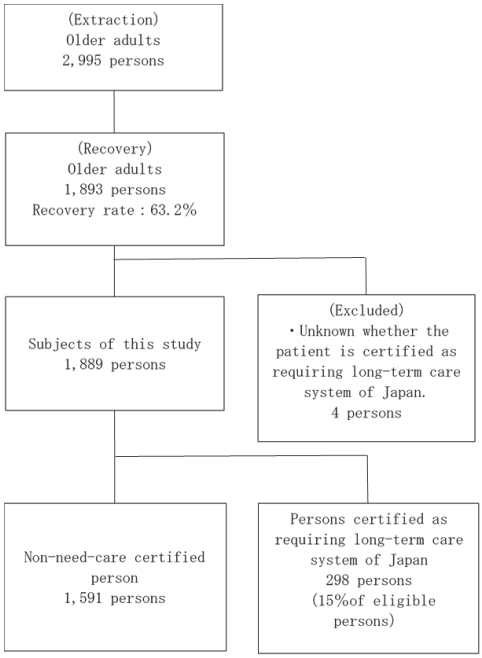

Fig. 1. Extraction of subjects

83.1 ± 2.6 years) were finally participated in this study. Of these, 298 (15%) people were certified as requiring long-term care system in Japan (Fig. 1).

Next, for OSA-SF, the total scores are shown according to the presence or absence of certification for long-term care system (Table 1). There were 1,591 patients in the certified non-care-requiring group and 298 in the non-care-requiring certified group. The OSA-SF scores for each group were (median) 31 points (25–75 percentiles; 25.3–36 points) for certified non-care-requiring group and (median) 27 points (25–75th percentiles; 21–33 points) for certified non-care-requiring groups. As a result of the Mann-Whitney Utest, the OSA-SF total score was significantly higher in the non-certified long-term care group than in the non-certified long-term care group. This effect size (r) was low. In addition, comparisons were made in each region of OSA-SF. As a result of the Mann-Whitney Utest, the OSA-SF score of the non-certified long-term care group was significantly higher than that of the non-certified long-term care group in all domains. This effect size (r) was low (Table 2).

ROC curve examined the relationship between

Table 1. Comparison of OSA-SF (total) by long-term care system of japan certification.

group	n	Median	Percentile value	p-value	Effect size
Non-care required certified person	1591	31.0	25.3-36.0	<.001	.18
Certified person requiring long-term care system of japan	298	27.0	21.0-33.0		

Mann-Whitney Utest

Effect size: r

Table 2. Comparison of scores by OSA-SF area.

area	Non-care required certified person		Certified person requiring long-term care system of japan		p-value	Effect size
	Median	25-75percentile value	Median	25-75percentile value		
OSA-SF (execution)	13.0	11.0-15.0	12.0	10.0-14.0	<.001	.11
OSA-SF (habit)	11.0	9.0-12.0	10.0	8.0-11.0	<.001	.13
OSA-SF (will)	8.0	6.0-9.0	7.0	6.0-9.0	<.001	.10

Mann-Whitney Utest

Effect size: r

each OSA-SF score and the presence or absence of the need for a long-term care system in the older adults living in the communities. The first is the ROC analysis of the OSA-SF total score. As a result of using the Youden index, the OSA-SF score was 28.5 points, showing AUC: 0.65, sensitivity: 61%, and 1-specificity: 38% (Fig. 2), which was accurate. Next, we calculated the cutoff values for each of the OSA-SF domains listed as necessary items, respectively, from the perspective of care prevention. OSA-SF (execution) showed AUC: 0.59, sensitivity: 69%,

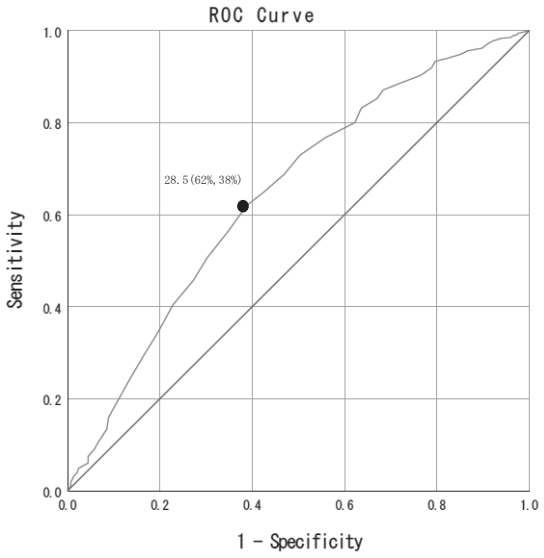

Fig. 2. Cutoff value for transition to long-term care system of Japan in OSA-SF (total).
Cutoff value: 28.5 points, ACU:0.65 (p<0.01), Specificity: 61%, Sensitivity: 38%

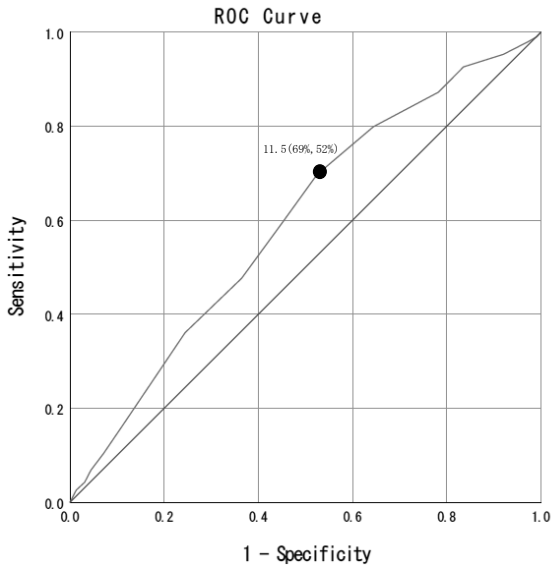

Fig. 3. Cutoff value for transition to long-term care system of Japan in OSA-SF (Execution).
Cutoff value: 11.5 points, ACU:0.59 (p<0.001), Specificity: 69%, Sensitivity: 52%

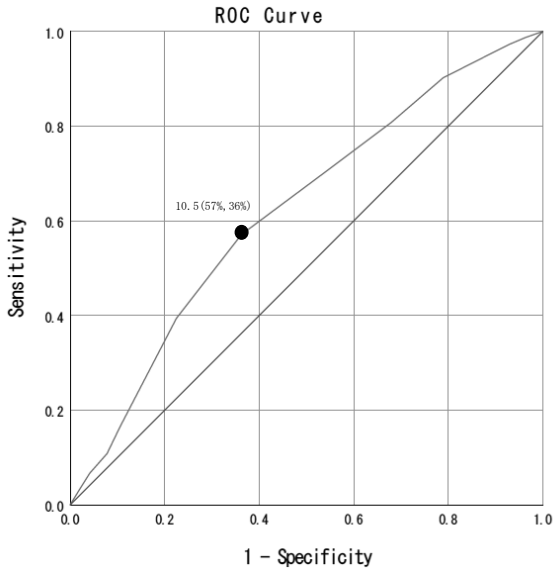

Fig. 4. Cutoff value for transition to long-term care system of Japan in OSA-SF (custom).
Cutoff value: 10.5 points, ACU:0.62 (p<0.001), Specificity: 57%, Sensitivity: 36%

and 1-specificity: 52% at 11.5 out of 20 points (Fig. 3). OSA-SF (habit) showed AUC: 0.62, sensitivity: 57%, and 1-specificity: 36% at 10.5 out of 16 points (Fig. 4). OSA-SF (will) showed AUC: 0.59, sensitivity: 58%, and 1-specificity: 43% at 7.5 out of 12 points (Fig. 5).

IV. Discussion

In this study, we calculated the total score of OSA-SF and the cut-off value for transition to the state of requiring long-term care system in Japan for older adults living in the communities. OSA-SF is scored on a scale of 48 points for "execution," "habit," and "will." do. It was clarified that the cutoff value was AUC: 0.65, sensitivity: 61%, and 1-specificity: 38% at 28.5 out of 48 points. According to the systematic review, the sensitivity or specificity for new certification for

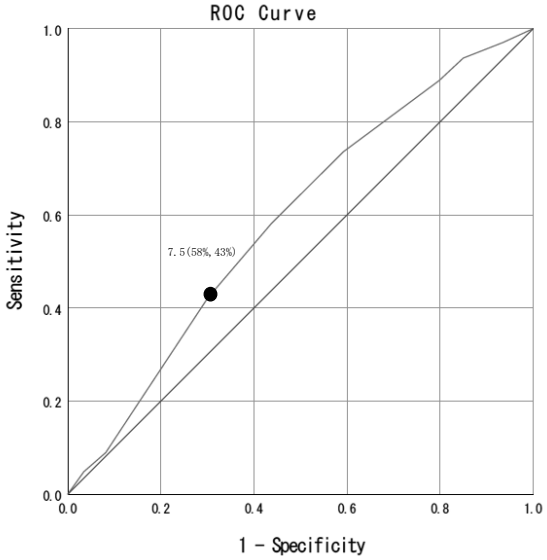

Fig. 5. Cutoff value for transition to long-term care system of Japan in OSA-SF (will).
Cutoff value: 7.5points, ACU:0.59 ($p<0.001$), Specificity: 58%,Sensitivity: 43%

long-term care systems using the Kihon checklist is reported to be 60%–86.4%[16]. The OSA-SF had similar sensitivity but lower specificity than the Kihon checklist. Furthermore, the AUC of OSA-SF was over 0.5. In other words, we speculated that it would be possible to sufficiently predict new certifications for long-term care by using the OSA-SF.

Next, the impact of the domains of "executive ability," "habit," and "mental will" is relevant to care prevention. In addition to the scores on the OSA-SF as a whole, clarifying whether or not any of these domains are declining would enable support specific to that domain. Therefore, cutoff values were also examined for each region of the OSA-SF. As a result, we found that the OSA-SF (executive) had the highest sensitivity as an item that can predict new persons requiring long-term care in each domain of the OSA-SF. The question content of OSA-SF (execution) include physical management. It is a means of activities of daily life such as things related to movement, money management, and so on. Decreased means of activities of daily living are factors for certification of need for long-term care and withdrawal[17]. Therefore, the OSA-SF (execution) cut-off value obtained in this study predicts certification for long-term care. The one with the highest sensitivity was OSA-SF (will), which included mental items such as "work toward the goal." "Depression prevention / support" is a similar area in the Kihon checklist. The sensitivity and specificity were 65.2% and 70.0%, respectively. The sensitivity and specificity of OSA-SF (will) were 58.2% and 43.8%, respectively, showing no significant differences between the two. Therefore, it may be possible to make predictions similar to the mental area of the Kihon checklist by utilizing OSA-SF (will). Finally, because OSA-SF (habit) does not have a similar area in the Kihon checklist, it was difficult to compare. OSA-SF (habit) sensitivity was 62%, which was lower than the other two areas; however, its AUC was the highest, so it can be fully utilized as a predictor of certification for long-term care.

The sensitivity of OSA-SF was almost the same as that of the Kihon checklist, but its specificity was low. Therefore, it may be utilized while considering the possibility of false positives.

Until now, the Kihon checklist of the Ministry of Health, Labor and Welfare has been used as an index for grasping the need for long-term care system of japan of older adults living in the

community. It is a multifaceted questionnaire such as mental function. Therefore, it became clear that OSA-SF can also be used to predict long-term care system of japan certified students using “execution” and “will”.

The following are the limitation of this study: although the sample size was sufficient, many participants had unknown genders and so, we could not consider gender differences. There was only one target area Therefore, it is presumed that the predictability was low due to the bias in the number of samples. There were ranks of mild to severe in need of care, but the severity rank could not be grasped. Details, such as the environmental factors of the participants were not collected. Therefore, future studies can explore the gender differences and proportion of severity in requiring long-term care, conduct investigations in multiple areas, and examine the cutoff value.

V. Conclusion

In this study, it was found that the OSA-SF was sufficient in predicting long-term care in Japan. The OSA-SF also predicted the domains of "execution," "habit," and "will".

Conflicts of interest and research funding

None to declare

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