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Original Article

Factors Associated to Returning Home in the First Year after Stroke

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HIGHLIGHTS

- This study provided current status of return home during chronic stage and functional outcome at 1 year after stroke in the first-ever stroke patients in Korea.
- This information will be valuable for establishing comprehensive and systematic care system for stroke patients.

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ABSTRACT

The objective of this study was to investigate factors affecting the return home one year after a stroke. The subjects of this study consisted of patients who participated in a large-scale multi-objective cohort study of initial stage stroke patients who were admitted to 9 representative hospitals in Korea. We analyzed the distribution of the subjects who had experienced stroke a year earlier by distinguishing the group who returned home and the other group that was hospitalized in rehabilitation hospitals. Based on this distribution, we evaluated the demographic, environmental, clinical, and psychological factors that can affect the return home. Overall, there were 464 subjects in the 'Return home' group and 99 subjects in the 'Rehabilitation hospitalization' group. job status, inconvenient housing structures, residential types, diagnosis, Functional Ambulation Categories, modified Rankin Scale, Korea-Modified Barthel Index, Function Independence Measure, Fugl-Meyer Assessment, Korean version of Mini-Mental State Examination, Korean version of Frenchay Aphasia Screening Test, Psychosocial Well-being Index-Short Form, Geriatric Depression Scale-Short Form, EuroQol-five Dimensional showed a significant difference between the 2 groups one year after the stroke. The factors affecting the return home one year after a stroke include functional status, activities of daily living, cognition, depression, stress, quality of life, job status. It is expected that factors affecting the rehabilitation of patients with stroke can be considered as basic data for establishing rehabilitation goals and treatment plans.

Keywords: Rehabilitation; Stroke; Patient discharge

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Conflict of Interest

The authors have no potential conflicts of interest to disclose.

INTRODUCTION

Strokes are a major cause of long-term disability worldwide [1]. Strokes are a serious condition that require patients who experience them to live with various disabilities, such as hemiplegia and language, sensory, and cognitive impairments, depending on the area of brain damage. After a stroke, active rehabilitation services are required to improve a patient's quality of life and provide the ability to return to society [2]. Neurological and functional recovery of stroke patients occurs mainly within the first 6 months of the onset, so rehabilitation is known to be appropriate during this period [3]. However, it is known that the period of recovery varies depending on the severity of the stroke, and that a comprehensive rehabilitation treatment can result in significant functional improvements in gait or activity daily living to one year after the onset the stroke [4]. The criteria for rehabilitation therapy are important for the recovery of physical functions. However, socioeconomic factors such as social mobility, a patient's environment, support of the family, and the economic situation can often determine the outcome. Moreover, the term “rehabilitation” does not indicate complete recovery to the non-disabled state before the disease or accident, but rather a training to return to the active environment of the former life and become of a member of society once again. Therefore, patients in rehabilitation after a stroke must return home when they reach various functional levels, depending on their level of impairment and rehabilitation treatment [5,6]. Even though proper functional recovery has been achieved after rehabilitation, returning home is often delayed. Some patients are admitted to another hospital, and long-term hospitalization and difficulties in functional recovery have become common for stroke patients and their families [4-6].

Previous studies have been conducted to analyze the various factors of chronic stroke patients through long-term follow-up studies in relation to their post-discharge destinations when returning home. These include demographic variables such as age and gender and clinical variables such as lesion location, bladder and/or bowel incontinence, dysphagia, cognitive impairment, aphasia, poor balance, unilateral neglect and the presence of co-morbidities [7-11]. However, social factors such as caregiver availability have not been studied extensively.

The objective of this study was to examine demographic, environmental, clinical, psychological factors as predictors of home discharge for individuals with stroke following rehabilitation. We believe that we can provide rehabilitation services and basic data suitable for stroke patients to allow them to return homes and seek alternatives when chronic stroke patients return home.

MATERIALS AND METHODS

Data collection procedures

The Korean Stroke Cohort for Functioning and Rehabilitation (KOSCO) study was a 10-year long-term follow-up study of stroke patients that used a prospective multi-center design and investigated residual disabilities, activity limitations, and quality of life in patients who suffered their first stroke. While ischemic and hemorrhagic strokes were included, transient ischemic attacks were excluded. The detailed rationale and protocols of KOSCO were described in a previous article [12]. Written informed consent was obtained from all patients or the patients' legally authorized representative before inclusion in the study, and the study protocol was approved by the ethics committees of Pusan National University Yangsan

Hospital (Institutional Review Board [IRB] No.05-2012-057) and the ethics committee of each of the other participating hospitals. To increase and maintain interrater reliability and accuracy, all raters in the KOSCO study underwent a standardized training program at the beginning of and every 3 months during the study.

Selection of KOSCO participants

This study presents interim KOSCO study results, focusing on the disability grade of patients who experienced their first stroke one year after onset. Data obtained from patients who were recruited to the KOSCO study group from August 2012 to January 2016 were analyzed in this study. The eligibility criteria were as follows: 1) first acute stroke (ischemic stroke or hemorrhagic stroke) with a corresponding lesion and/or evidence of acute arterial occlusion on computed tomography or magnetic resonance imaging/angiography scan; 2) patients who did not require a nasogastric tube and scored higher than 5 in the American Speech Language Hearing Association National Outcomes Measurement System (ASHA NOMS); 3) patients who were transferred to a rehabilitation department after being diagnosed with acute stroke; 4) patients who returned home or had an inpatient rehabilitation services including tertiary hospitals or general hospitals with rehabilitation facilities, rehabilitation hospitals and skilled nursing facilities one year after the stroke.

Study design and methods

This study analyzed the various factors influencing the return home of stroke patients one year after the onset of the stroke, such as the demographic, environmental, clinical, and psychological factors. Clinical evaluations and questionnaires were collected based on the results of the initial hospitalization and one year after the onset. To compare the differences of a specific variable, the patients were divided into groups: those who returned home and those who were hospitalized in a rehabilitation hospital one year after stroke. Rehabilitation hospital define as includes various therapies to help a person restore function after illness or injury. These therapies can include physical therapy, occupational therapy, speech therapy. The demographic factors including sex, age, educational background, religion, and job status were evaluated. Job status was an evaluation of job status at the time of survey. Environmental factors such as marital status, family type, housing type, and uncomfortable residence structures were analyzed. Housing type is divided into apartment, apartment unit in a house and detached dwelling. Clinical factors such as diagnosis, location of the brain lesion, Korea-Modified Barthel Index (K-MBI), Function Independence Measure (FIM), Fugl-Meyer Assessment (FMA), Functional Ambulation Categories (FAC), Korean version of Mini-Mental State Examination (K-MMSE), ASHA NOMS (**Supplementary Data 1**), modified Rankin Scale (mRS) and Korean version of Frenchay Aphasia Screening Test (K-FAST) (**Supplementary Data 2**) were evaluated. Psychological factors such as Family Support, Psychosocial Well-being Index-Short Form (PWI-SF) (**Supplementary Data 3**), Geriatric Depression Scale-Short Form (GDS-SF) (**Supplementary Data 4**), and the EuroQol-five Dimensional (EQ-5D) were investigated.

Measurement

K-MBI is the Korean version of Modified Barthel Index (MBI) translated by Jung et al. [13]. K-MBI is an assessment tool for assessing the degree of self-reliance in daily activities of patients with chronic disease. The FIM records the severity of disability of rehabilitation patients [14]. FMA is tool for quantitatively evaluating the functional recovery of stroke patients based in the recovery phase of motor function after stroke [15]. FAC is a walking ability assessment tool that evaluates functional walking [16]. K-MMSE is a simple, standardized mental status measurement tool [17]. ASHA NOMS is an assessment tool

developed by the ASHA to assess the extent of a patient's swallowing function. It is can be assessed from grade 1, which is non-oral, to grade 7 which can be swallowed without restriction [18]. mRS is an assessment tool that measure the dependence and degree of disability of daily activity in stroke patients [19]. K-FAST was developed by Enderby et al. [20]. Topics include language understanding, language expression, reading, and writing. Social support was used as a tool of family support assessment [21]. PWI-SF is a tool that detect recent physical and psychological conditions and measure stress level [22]. The lower the score, the healthier you are from stress. GDS-SF questions are answered "yes" or "no." A 5-category response set is not utilized in order to ensure that the scale is simple enough to be used when testing ill or moderately cognitively impaired individuals, for whom a more complex set of answers may be confusion, or lead to inaccurate recording of responses [23]. EQ-5D is a standardized tool developed by the EuroQol group to measure health-related quality of life. The sub-items consist of mobility, self-care, usual activities, pain/discomfort, anxiety/depression [24]. Sociodemographic variables were derived from the questionnaire. Questionnaires for patients includes uncomfortable residence structure, age, gender, education, job. Uncomfortable residence structures include stairs, thresholds, ramps that mentioned as an obstacle in the home modification manuals for the disabled as an evaluation of the house structure in which participants reside.

Statistics

Descriptive statistics were used to provide information on patient demographics and environmental, clinical, and psychological characteristics. An independent t-test was performed for the comparison of continuous variables between the home group and the rehabilitation hospital group. The χ^2 test was used for categorical variables. Results for continuous variables are shown as mean (standard deviation), and those of categorical variables, as numbers (percentage). The p values less than 0.05 were considered statistically significant. All analyses were performed using R program 3.5.1 for Windows (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Study population

Among the 10,635 patients registered with KOSCO, a total of 5,129 patients were included. From the 5,129 patients, after applying the exclusion criteria, 563 patients remained, and 464 and 99 patients were classified into the returned home group and the hospital rehabilitation group, respectively (Fig. 1).

Demographic and environmental characteristics of the patients

The demographic and environmental factors of the patients are presented in Table 1. There were no significant differences in age, sex, religion, and education level between the home group and the rehabilitation hospital group. Job status was significantly higher in the home group than the hospital rehabilitation group ($p < 0.05$). The proportion of stroke patients with the job in the home group and the hospital rehabilitation group was 23.9% and 6.1%, respectively. In environmental factors, an uncomfortable structure status was significantly higher in the hospital rehabilitation group than the home group ($p < 0.05$). The proportion of stroke patients with the uncomfortable structure in the home group and the hospital rehabilitation group was 23.1% and 54.5%, respectively. Housing type was significantly difference in the hospital rehabilitation group than the home group ($p < 0.05$).

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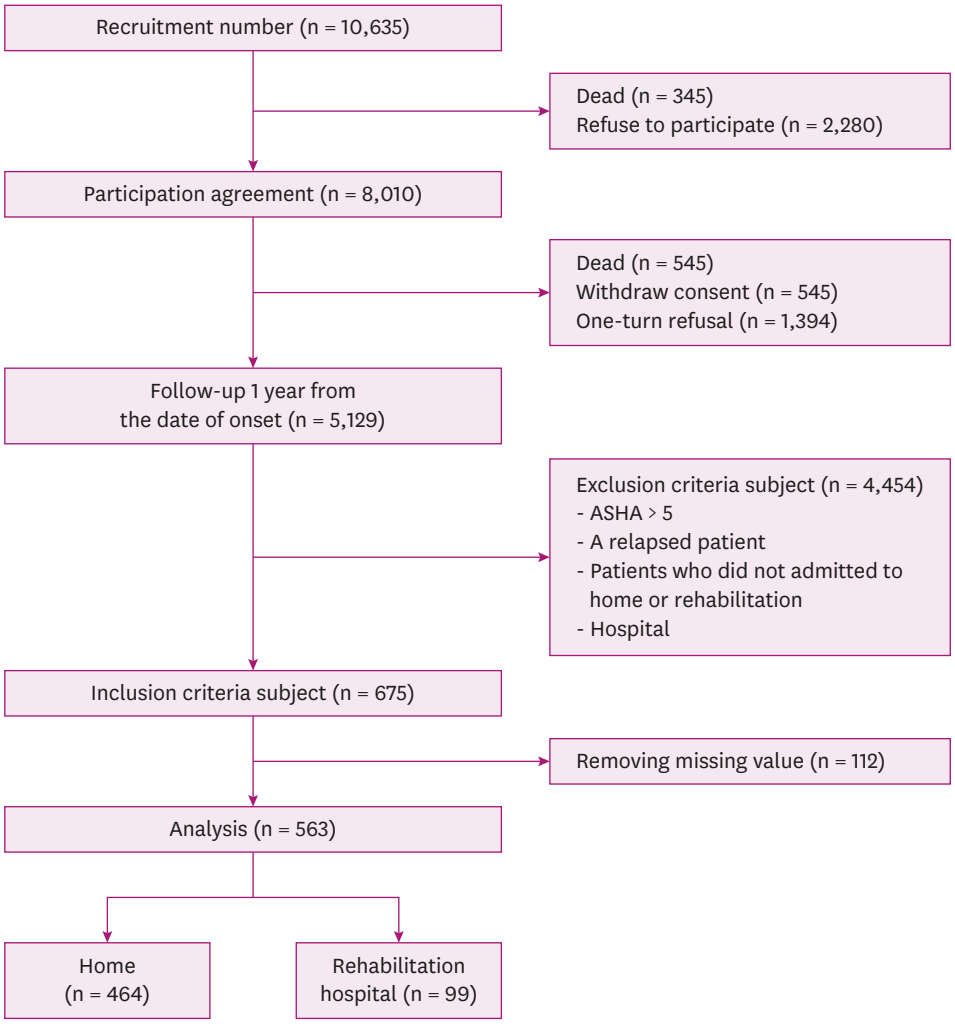

Fig. 1. Summary of the study population.
ASHA, American Speech Language Hearing Association.

Clinical and psychological characteristics of the patients

The clinical and psychological factors of the patients are presented in Table 2. In clinical factors, the proportion of hemorrhagic stroke patients was significantly higher in the hospital rehabilitation group than the home group ($p < 0.05$). The proportion of stroke patients with the hemorrhage stroke in the home group and the hospital rehabilitation group was 24.1% and 39.4%, respectively. FAC, FIM, K-MBI, FMA-affected, K-MMSE, K-FAST scores were significantly higher in the home group than the hospital rehabilitation group ($p < 0.05$). The mean FAC score in the home group and the hospital rehabilitation group was 4.4 and 2.6, respectively. The mean mRS score in the home group and the hospital rehabilitation group was 41.5 and 3.1, respectively. The mean K-MBI score in the home group and the hospital rehabilitation group was 92.0 and 68.5, respectively. The mean FIM score in the home group and the hospital rehabilitation group was 114.8 and 91.4, respectively. The mean FMA-affected score in the home group and the hospital rehabilitation group was 87.4 and 54.0, respectively. The mean K-MMSE score in the home group and the hospital rehabilitation group was 26.5 and 25.6, respectively. The mean K-FAST score in the home group and the hospital rehabilitation group was 24.3 and 22.2, respectively. The ASHA NOMS

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Table 1. Distribution of demographic and Environmental patient characteristics

Variables	Home group (n = 464)	Rehabilitation hospital group (n = 99)	p value
Sex (male:female)	61.6:38.4	54.5:45.5	0.231
Age	63.0 ± 12.3	61.2 ± 13.7	0.207
Educational level			0.902
No educational	10.1	13.1	
Elementary school	15.9	15.2	
Middle school	20.0	21.1	
High school	33.6	30.3	
College graduates	20.3	20.2	
Religion			0.494
Atheists	49.1	47.5	
Buddhists	23.9	28.3	
Christians	18.5	13.1	
Catholic	8.0	11.1	
Another religion	0.4	0	
Job (yes:no)	23.9:76.1	6.1:93.9	0.000*
Marital status			0.863
Married living together	75.1	72.7	
Married not living with	2.8	2.0	
Widowed	13.1	17.2	
Divorcees	3.2	3.0	
Single	4.7	5.1	
Type of family			0.300
Living alone	8.6	13.1	
Immediate family	85.8	79.8	
Large family	5.6	7.1	
Housing type			0.043*
Apartments	45.0	38.4	
Apartment unit in a house	43.5	42.4	
Detached dwelling	10.6	15.2	
Others	0.9	4.0	
Uncomfortable residence structures (yes:no)	23.1:76.9	54.5:45.5	0.000*

All values are expressed as mean ± standard deviation or percentage (%).
*$p < 0.05$ analyzed by analysis of variance.

was no significant difference between the home group and the rehabilitation hospital group. In psychological factors, The PWI-SF, EQ-5D and GDS-SF scores were significantly difference in the hospital rehabilitation group than the home group ($p < 0.05$). The mean PWI-SF score in the home group and the hospital rehabilitation group was 17.1 and 21.6, respectively. The mean EQ-5D score in the home group and the hospital rehabilitation group was 0.8 and 0.6, respectively. The mean GDS-SF score in the home group and the hospital rehabilitation group was 5.7 and 6.8, respectively.

DISCUSSION

In this study, data from 563 patients were analyzed. We determined the distribution of subjects who experienced a stroke one year previous by distinguishing a group of patients who returned home and another group in rehabilitation hospitals. Based on the distribution, we evaluated the demographic, environmental, clinical, and psychological factors that can affect the return home.

The demographic factor of job status showed a significant difference between the 2 groups one year after the stroke. Because returning work is a part of social participation, the risk

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Table 2. Distribution of clinical and psychological patient characteristics

Variables	Home group (n = 464)	Rehabilitation hospital group (n = 99)	p value
Location of brain lesion			0.565
Right	48.7	55.6	
Left	45.9	40.4	
Both	5.4	4.0	
Diagnosis (ischemic:hemorrhagic)	75.9:24.1	60.6:39.4	0.003*
ASHA NOMS	6.817 ± 0.435	6.717 ± 0.535	0.085
FAC	4.4 ± 1.1	2.6 ± 1.5	0.000*
mRS	1.5 ± 1.2	3.1 ± 1.2	0.000*
K-MBI	92.0 ± 14.5	68.5 ± 23.1	0.000*
FIM	114.8 ± 15.7	91.4 ± 20.7	0.000*
FMA-affected	87.4 ± 21.5	54.0 ± 29.4	0.000*
FMA-unaffected	98.9 ± 3.0	97.5 ± 8.0	0.095
K-MMSE	26.5 ± 4.2	25.6 ± 4.4	0.049*
K-FAST	24.3 ± 6.7	22.2 ± 7.1	0.003*
PWI-SF	17.1 ± 10.0	21.6 ± 7.4	0.000*
GDS-SF	5.7 ± 4.2	6.8 ± 3.5	0.007*
EQ-5D	0.8 ± 0.2	0.6 ± 0.2	0.000*
Family support	47.8 ± 7.2	47.3 ± 7.1	0.523

All values are expressed as mean ± standard deviation or percentage (%).
ASHA NOMS, American Speech Language Hearing Association National Outcomes Measurement System; FAC, Functional Ambulation Categories; mRS, modified Rankin Scale; K-MBI, Korea-Modified Barthel Index; FIM, Function Independence Measure; FMA, Fugl-Meyer Assessment; K-MMSE, Korean version of Mini-Mental State Examination; K-FAST, Korean version of Frenchay Aphasia Screening Test; GDS-SF, Geriatric Depression Scale-Short Form; PWI-SF; Psychosocial Well-being Index-Short Form; EQ-5D; EuroQol-five Dimensional.
*$p < 0.05$ analyzed by analysis of variance.

factors that limit participation, such as strength and endurance and mental functions can lead to more patients failing to return to work [25]. The association of work with returning home could be influenced by physical factors as well. In this study, differences are seen results that physical and mental factors affect the return to home. Thus, the relationship between job status and returning home seems to be complex and is influenced by a multitude of physiological and social factors. However, it only reflects the results of the cross-sectional state of job status after 1 year of onset, which may be a limitation. In this regard, our cohort study groups are conducting another study of return to work after a stroke, and this limitation will be reported further in the study.

Whereas other factors like gender, age, and level of education had no influence on patient outcomes. Some previous studies focused on sex and revealed that sex had no effect on destination prediction after the stroke [26-28]. However, some studies have shown that sex predicts the destination of patients when discharged [6,29,30]. Brosseau et al. [31] reported that older patients have less endurance, making it difficult for them to engage in intensive rehabilitation programs, which consequently affected their destination after discharge. Spieler et al. [11] reported that lesser education levels decreased the chances of patients to return home.

Environmental factors uncomfortable structures showed a significant difference between the 2 groups one year after a stroke. Brauer et al. [7] noted that housing type prior to stroke are the exact predictors of the destination after discharge. Also, the residential environment of stroke patients is less secure than before when they were living as healthy adults and require a lot of help in their residential lives [32]. In addition, another studies reported that there should be no home barriers and that there should be no inconvenience in moving outside the house and the greater the number of obstacles in the home, the less community participation

[33,34]. In other words, it will be necessary to reduce home obstacles by improving the residential environment in order to promote community participation or a returning home.

Regarding the clinical factors, the FIM score that measured the functionality dependence influenced patients returning home. In this study, the group that returned home scored significantly high. Some studies reported that there was a 90% chance of return home if there were more than FIM 80 scores at the time of discharge, and 70% of patients who scored less than 40 scores going to the nursing home [35]. So, the results in this study are similar to those of previous studies suggesting a connection between FIM scores and the destination of patients after discharge [36-40]. The MBI score, assessing the patient's ability to engage in everyday activities, was showed to have an influence on a patient's return home. In this study, the group that returned home scored significantly high, too. Previous studies reported that the MBI score can be a predictor of a patient's destination after discharge and claimed that if the MBI score increased by one point, a patient will be 1.03 times more likely to head home, enforcing the results in the study [28,41]. In a study of patients who are not seriously stroke during the subacute period, the lower the motor FIM score at discharge, the more likely they are to be discharged from the hospital to non-home [39]. The cognitive functionality measured by K-MMSE was a factor that affected a patient's ability to go home. Wee and Hopman [42] conducted a study on stroke patients that evaluated the Mini-Mental State Examination (MMSE); as a result, the MMSE score was related to the measured FIM score discharge function and discharge pattern. In this study, the results support previous studies.

In recent years, there has been an increase in the number of studies focusing on depression among stroke patients. Even though the period of depression after a stroke was relatively wide, ranging from 4 to 141 months, depression itself was found to be closely related to cognitive function, daily activity level, and motor function [43]. In this study, the GDS-SF score revealed the difference between patients that were hospitalized and the ones at home. Another previous study suggested that activities of daily living, quality of life, and depression were closely related, and a comprehensive approach to rehabilitation was needed [5].

Stroke is a disease that results in physical, mental, and social disabilities, depending on its severity, and is supported by relatively long-term rehabilitation treatment and management. According to this study, the factors affecting the return home one year after a stroke include functional status, cognition, depression, stress, quality of life, job status, and housing type. The factors affecting rehabilitation of stroke patients are expected and can be considered as basic data to establish rehabilitation goals and treatment plans.

In the results, the proportion of hemorrhagic stroke patients was significantly higher in the hospital rehabilitation group. This may be considered as one of the factors that prevent the hemorrhagic stroke from returning home compared to the ischemic stroke. However, in the case of the hemorrhagic stroke, most of the subjects included in this cohort study were distributed in severe cases. Otherwise, most subjects with mild severity were not included. We believe that selection bias affected the result of the above. In the future, it may be necessary to supplement in further studies.

Nonetheless, this study has several limitations. First, there was an inability to implement information on patients that were outside of the scope of experiencing a stroke within one year. It is known that the functional recovery of stroke patients short at one year or 3–5 years in long-term cases. Second, family surveys were not included. The hospitalization of

stroke patients is determined not only through the willingness of the patient but also of their caregiver. Despite these limitations, this study revealed the correlation between the various specific factors of patients returning home one year after the onset of the stroke.

In conclusion, this study suggests that factors that restrict the ability to return home after a patient's stroke, such as a lower job status, uncomfortable structures status, lower K-MBI score, lower physical activity, higher stress, lower quality of life were influential factors. Therefore, health professionals such as a doctors, occupational therapists, physical therapists, nurses, and social workers involved in the rehabilitation of these patients should focus on the promotion of functional independence and improvements in emotional health to optimize returning home following a stroke.

SUPPLEMENTARY MATERIALS

Supplementary Data 1
American Speech Language Hearing Association National Outcomes Measurement System (ASHA NOMS)

Click here to view

Supplementary Data 2
Korean version of Frenchay Aphasia Screening Test (K-FAST)

Click here to view

Supplementary Data 3
Psychosocial Well-being Index-Short Form (PWI-SF)

Click here to view

Supplementary Data 4
Geriatric Depression Scale-Short Form (GDS-SF)

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