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Development of prediction models for domestic chores resumption among mild stroke patients three months after discharge from specialized rehabilitation wards: A multi-center prospective cohort study

Ryu Kobayashi and Norikazu Kobayashi

Department of Occupational Therapy, Graduate School of Human Health Sciences, Tokyo Metropolitan University, Tokyo, Japan

ABSTRACT

Background: Whether stroke patients resume domestic chores is one of the major issues associated with their quality of life. Prediction models for domestic chores resumption among stroke survivors can be useful for setting goals and planning rehabilitation.

Objectives: To develop prediction models for individual domestic chores resumption among mild stroke patients three months after discharge from specialized rehabilitation wards.

Methods: Ninety-one stroke patients admitted to specialized rehabilitation wardswere included in the analyses. We assessed the prestroke and three months post-discharge frequencies of six domestic chore items of the Frenchay Activities Index. Demographics and candidate predictors such as paralysis severity, cognitive function, walking speed, and self-efficacy were collected at discharge. Binary logistic regression analyses were performed to build prediction models for individual domestic chores resumption after stroke.

Results: The preparing meals model included walking speed (OR = 1.05) and cognitive function (OR = 1.29) as predictors; washing up model, walking speed (OR = 1.04); washing clothes model, walking speed (OR = 1.06), and number of family members living together (OR = 0.42); light housework model, walking speed (OR = 1.06); heavy housework model, walking speed (OR = 1.03), cognitive function (OR = 1.38), and self-efficacy (OR = 1.91); and local shopping model, walking speed (OR = 1.05), age (OR = 0.94), and number of family members living together (OR = 0.61).

Conclusions: Our models may be useful in clinical practice to streamline the setting of goals and development of therapeutic strategies for individual domestic chores resumption among mild stroke patients.

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Introduction

Stroke is a major health issue worldwide because it not only affects physical function but also leads to disability.[1] Disability is generally defined as inability or experiencing difficulty in performing activities, such as activities of daily living (ADL) and instrumental activities of daily living (IADL), that are essential to independent living.[2] Domestic chores, part of IADL, are one of the difficult activities to resume for stroke survivors.[3]

Engagement in domestic chores is associated with quality of life for stroke patients.[3] It also improves muscle strength and endurance due to its physical exercise aspect, which contributes to the maintenance and improvement of functional independence.[4] Thus, resuming domestic chores is crucial in terms of preventing mental and physical frailty after stroke, and should be considered a major goal in stroke rehabilitation.

It is important to understand the predictors and prediction models for domestic chores resumption among stroke patients to help set rehabilitation goals and develop therapeutic strategies. Several factors, such as sex, functional mobility, cognitive dysfunction, ADL score, and self-efficacy, have been associated with the frequency of performing domestic chores after stroke.[5,6] However, these studies did not investigate the predictors or prediction models for individual domestic chores resumption (e.g. preparing meals and washing clothes), which could be useful in tailoring rehabilitation to the needs of the patients.

CONTACT Norikazu Kobayashi n-koba@tmu.ac.jp Graduate School of Human Health Sciences, Tokyo Metropolitan University, 7-2-10, Higashi-ogu, Arakawa, Tokyo 116-8551, Japan.

To the best of our knowledge, only one study reported on predictors and prediction models for the resumption of individual domestic chores after stroke.[7] That study developed models to predict individual domestic chores resumption after discharge from a specialized rehabilitation ward based on data collected at discharge. In the models, women, faster walking speed, higher ADL score, and living alone were selected as positive predictors for domestic chores resumption. An external validity study indicated these models to have good predictive accuracy for domestic chores resumption three months after discharge from a specialized rehabilitation ward.[8] However, predictors such as cognitive function and psychological characteristics that may be related to domestic chores resumption were not sufficiently examined in that study.

This study aimed to identify predictors and develop new practical prediction models for individual domestic chores resumption among stroke patients three months after discharge from specialized rehabilitation wards.

Materials and Methods

Participants

For this multi-center prospective cohort study, participants were recruited from 719 stroke patients (infarction, hemorrhage, or subarachnoid hemorrhage) who were admitted to specialized rehabilitation wards of four hospitals in the Tokyo metropolitan area between May 2019 and March 2021. Stroke patients in specialized rehabilitation wards in Japan usually undergo a daily rehabilitation program, including physical, occupational, and speech therapy, for one to three hours during hospitalization. The study included patients who 1) had performed domestic chores before stroke, 2) were willing to resume domestic chores after discharge (confirmed by interview at recruitment), and 3) were discharged home. Exclusion criteria includes 1) mini-mental state examination[9] scores ≤ 23 and 2) medical problems, such as severe aphasia or physical illness, that hindered participation in the study.

Procedure

Patients who met the inclusion provided informed consent. Demographics and candidate predictors were collected at discharge. Additionally, pre-stroke domestic chore frequencies were assessed by retrospective recall and post-discharge domestic chore frequencies were collected using a mail survey three months after discharge.

This study was approved by the ethics committees of Tokyo Metropolitan University (approval No. 18106) and participating hospitals, and was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.

Outcome measure

Domestic chores resumption was assessed using the Japanese version of the self-rating Frenchay Activities Index (FAI).[10,11] Based on previous studies examining the factor structure of the FAI,[12,13] six items were treated as domestic chores: preparing meals, washing up, washing clothes, light housework, heavy housework, and local shopping. Scores ranged from 0 (lowest frequency) to 3 (highest frequency) for each item. We measured the frequencies of each item before stroke and three months after discharge. For analyses, participants were dichotomized into resumed and non-resumed groups for each item. The resumed group comprised patients with a high frequency (2–3) before stroke and three months after discharge. The non-resumed group comprised patients with a high frequency (2–3) before stroke but a low frequency (0–1) three months after discharge.

Demographics and candidate predictors

Demographics, such as age, sex, type of stroke, hemisphere, and number of family members living together, were collected from medical records and self-reported questionnaires. Candidate predictors were selected based on previous studies that reported factors related to domestic chores, IADL, and social activities after stroke, including indicators for paralysis severity,[14,15] cognitive function,[16–18] balance,[6] walking speed,[7,18] ADL dependency,[5–7,15] social support,[19] and self-efficacy.[6,20]

Paralysis severity was assessed using the Brunnstrom recovery stages (BRS), which contains three items for the arm, hand, and leg.[21] These are scored on a 6-stage Likert-type scale (Stages I–VI).[22] Higher stages indicate better motor function. It is a short and easily administered measure,[21] with almost perfect inter-rater reliability.[23] For the analyses, Stages I–VI were converted to 1–6 points, respectively, and non-paralyzed patients were assigned 7 points.

Cognitive function was assessed using the Cognitive-related Behavioral Assessment (CBA), a reliable and valid tool for assessing various domains of cognitive function based on the behavior of the stroke patient's daily living.[24] It consists of six domains: consciousness, emotion, attention, memory, judgment, and awareness of the illness. Each domain is scored from 1 to 5. The total score ranges from 6 to 30. Lower scores indicate more severe cognitive impairment.

Balance was assessed using the Berg Balance Scale (BBS), which is used to assess static and dynamic balance ability in adults.[25] It is a valid measure of balance for stroke patients and has high intra- and inter-rater reliability, as well as excellent sensitivity to change.[26] The total scores range from 0 to 56. Higher scores indicate high balance function.

Walking speed was measured as the Maximum Walking Speed for 10 m (MWS),[27] whose reliability for individuals with stroke has been shown.[28] Participants were asked to walk as quickly as possible on a 16-m flat, straight surface using their usual assistive devices or orthoses. The time taken to walk the central 10 m was recorded in m/min using a digital stopwatch. If the participants were unable to walk, 0 was recorded.

ADL dependency was assessed using the Functional Independence Measure (FIM).[29,30] It was divided into motor and cognitive subscales for the analyses. The FIM motor score ranged from 13 to 91. Higher scores indicate greater independence in ADL, such as feeding, toileting, and bathing. The FIM cognitive score ranged from 5 to 35, with higher scores indicating greater cognitive and social abilities.

Social support was assessed using the Japanese short version of the Multidimensional Scale of Perceived Social Support (J-MSPSS), whose reliability and validity have been confirmed.[31] It consists of seven items regarding self-perceptions of social support from family and friends, with a score range of 1–7 for each item. The total score ranges from 7 to 49. Higher scores indicate greater social support.

Self-efficacy was assessed using the General Self-Efficacy Scale (GSES), a reliable and valid measure of an individual's general sense of perceived self-efficacy in coping with difficult situations.[32] The total score ranges from 0 to 16 points, which are converted into a five-point scale corrected for sex (1 = low, 2 = rather low, 3 = moderate, 4 = rather high, and 5 = high). The five-point scale was used in this study.

Statistical analyses

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, N.Y., USA). Statical significance was set at $P < .05$. Descriptive statistics were reported for demographic information and candidate predictors at discharge for all participants. Data are reported as means and standard deviation (SD) or median with interquartile range (IQR) for continuous variables, according to normality. Categorical variables are reported as percentages.

Demographics and candidate predictors in the resumed and non-resumed groups for each domestic chore were compared using univariate analysis. The non-paired t-test, Mann-Whitney U test, and χ^2 test (Fisher's exact test) were used to compare means, medians, and categorical variables, respectively. Variables that demonstrated a significant ($P < .05$) or marginally significant ($P < .10$) difference were entered into a binary logistic regression model (forward stepwise) of each domestic chore. Age and sex were considered potential confounders and were included in all models. Multicollinearity between predictors was checked. If the correlation was ≥ 0.7, one of the predictors considered clinically useful was entered into each model. The probabilities of entry and removal of a variable were set at 0.10 and 0.15, respectively, in the binary logistic regression models. Results are shown as odds ratios (ORs) with 95% confidence intervals (95%CI).

To avoid overfitting of the model, it is recommended that the size of the lesser outcome group should be ten times the number of predictors.[33]

Referring to previous studies,[7] we assumed that the number of predictors selected for the model would be approximately two and that the ratio of the non-resumed to the resumed groups would be approximately 1:2. Thus, the sample size required for this study was estimated to be ≥ 60.

We evaluated the performance of each model by assessing discrimination and calibration. Discrimination was assessed using the area under the receiver operating characteristic curve (AUC). Calibration was assessed using the Hosmer-Lemeshow (HL) test.

Results

Participant characteristics

Ninety-six stroke patients participated in this study. Of these, five dropped out at follow-up. Ultimately, 91 patients were included in the analyses. Demographic details and candidate predictors at baseline are shown in Table 1. Participants median age was 72 (64–79) years. Sixty-five (71.4%) were female. In total, 50 (54.9%) and 33 (36.3%) of the patients had suffered an infarction or hemorrhage, respectively. The median period since stroke was 120 (84–169) days. The median BRS for the arm, hand, and leg were all 6 (5–6). The median FIM motor and cognitive scores were 83 (79–86) and 33 (30–35), respectively. These results indicate that most participants suffered mild strokes.

Three months after discharge, 64 (76.2%), 72 (80.9%), 63 (74.1%), 61 (75.3%), 33 (47.1%), and 64 (72.7%) of the patients resumed preparing meals, washing up, washing clothes, light housework, heavy housework, and local shopping, respectively (Tables 2 and 3).

Table 1. Participant demographic characteristics and candidate predictors at baseline (n = 91).

Age, years, median (IQR)	72 (64-79)
Female, n (%)	65 (71.4)
Family structure	
Living alone, n (%)	22 (24.2)
Living with family, n (%)	69 (75.8)
Number of family members living together, median (IQR)	1 (1–2)
Stroke type	
Infarction, n (%)	50 (54.9)
Hemorrhage, n (%)	33 (36.3)
Subarachnoid hemorrhage, n (%)	8 (8.8)
Hemisphere	
Right, n (%)	42 (46.1)
Left, n (%)	36 (39.6)
Non-paralysis, n (%)	13 (14.3)
Days since stroke, median (IQR)	120 (84–169)
Brunnstrom recovery stage	
Arm, median (IQR)	6 (5–6)
Hand, median (IQR)	6 (5–6)
Leg, median (IQR)	6 (5–6)
CBA score, median (IQR)	26 (24–28)
BBS score, median (IQR)	54 (50–56)
MWS, m/min, mean (SD)	64.2 (28.6)
FIM motor score, median (IQR)	83 (79–86)
FIM cognitive score, median (IQR)	33 (30–35)
J-MSPSS score, median (IQR)	42 (37–48)
GSES score, median (IQR)	3 (2–4)

Abbreviations: IQR, interquartile range; SD, standard deviation; CBA, Cognitive-related Behavioral Assessment; BBS, Berg Balance Scale; MWS, Maximum Walking Speed for 10 m; FIM, Functional Independence Measure; J-MSPSS, Japanese short version of Multidimensional Scale of Perceived Social Support; GSES, General Self-Efficacy Scale

Derivation of prediction models for individual domestic chores resumption

Tables 2 and 3 shows a comparison of demographics and candidate predictors between the resumed and non-resumed groups for each domestic chore. Using variables that showed significant and marginally significant differences in each domestic chore along with age and sex as independent variables, logistic regression analyses were performed. Consequently, six prediction models were constructed (Table 4). In the preparing meals model, the MWS (OR = 1.05, 95% CI = 1.02–1.07) and CBA (OR = 1.29, 95% CI = 1.03–1.62) were included as predictors; washing up model, MWS (OR = 1.04, 95%CI = 1.01–1.06); washing clothes model, MWS (OR = 1.06, 95%CI = 1.03–1.09) and number of family members living together (OR = 0.42, 95%CI = 0.22–0.79); light housework model, MWS (OR = 1.06, 95%CI = 1.03–1.09); heavy housework model, MWS (OR = 1.03, 95%CI = 1.01–1.05), CBA (OR = 1.38, 95%CI = 1.07–1.77), and GSES (OR = 1.91, 95%CI = 1.01–3.62); and local shopping model, MWS (OR = 1.05, 95%CI = 1.02–1.07), age (OR = 0.94, 95%CI = 0.88–1.00), and number of family members living together (OR = 0.61, 95% CI = 0.35–1.05).

The AUCs were 0.84 (95%CI = 0.74–0.94) for preparing meals, 0.75 (95%CI = 0.63–0.87) for washing up, 0.85 (95%CI = 0.76–0.94) for washing clothes, 0.86 (95%CI = 0.77–0.94) for light housework, 0.82 (95%CI = 0.72–0.92) for heavy house-

Table 2. Comparison of demographics and candidate predictors between the resumed and non-resumed groups for each domestic chore.

	Preparing meals			Washing up			Washing clothes		
Variables	Resumed n = 64 (76.2%)	Non-resumed n = 20 (23.8%)	*P*	Resumed n = 72 (80.9%)	Non-resumed n = 17 (19.1%)	*P*	Resumed n = 63 (74.1%)	Non-resumed n = 22 (25.9%)	*P*
Age, median (IQR)	71 (60–79)	75.5 (71–83)	0.054†	71.5 (62–80)	75 (71–78)	0.329	71 (63–79)	76 (71–81)	0.029*
Female, %	73.4	80.0	0.554	69.4	82.4	0.226	69.8	86.4	0.128
Number of family members living together, median (IQR)	1 (1–1)	1 (0–2)	0.631	1 (0–1)	1 (0.5–2)	0.171	1 (0–1)	1 (1–2)	0.018*
Stroke type									
Infarction, %	53.1	70.0	0.407	54.2	64.7	0.731	50.8	63.6	0.534
Hemorrhage, %	37.5	25.0		37.5	29.4		39.7	31.8	
Subarachnoid hemorrhage, %	9.4	5.0		8.3	5.9		9.5	4.6	
Hemisphere									
Right, %	45.3	50.0	0.813	47.2	41.2	0.826	49.2	45.5	0.589
Left, %	39.1	40.0		38.9	47.0		34.9	45.5	
Non-paralysis, %	15.6	10.0		13.9	11.8		15.9	9.0	
Brunnstrom recovery stage									
Arm, median (IQR)	6 (5–6)	5 (4–6)	0.087†	6 (5–6)	5 (4–6)	0.057†	6 (5–6)	5 (3–6)	0.036*
Hand, median (IQR)	6 (5–6)	5 (5–6)	0.232	6 (5–6)	5 (5–6)	0.179	6 (5–6)	5 (4–6)	0.083†
Leg, median (IQR)	6 (5–6)	5 (5–6)	0.088†	6 (5–6)	5 (5–6)	0.105	6 (5–6)	5 (4–6)	0.030*
CBA score, median (IQR)	26 (24–28)	24 (22–26)	0.008*	26 (24–28)	24 (23–26.5)	0.048*	26 (24–28)	24 (23–28)	0.157
BBS score, median (IQR)	54 (50–56)	51 (43–54)	0.001*	54 (50–56)	52 (44–54.5)	0.018*	54 (51–56)	49.5 (45–54)	<0.001*
MWS, m/min, mean (SD)	70.5 (25.7)	38.7 (26.2)	<0.001*	68.9 (27.0)	42.8 (27.4)	0.001*	71.0 (26.8)	40.2 (22.1)	<0.001*
FIM motor score, median (IQR)	83 (80–87)	79 (63–82)	<0.001*	83.5 (80–87)	79 (64–82.5)	0.002*	83 (80–87)	79.5 (66–83)	0.002*
FIM cognitive score, median (IQR)	33 (31–35)	31.5 (26–33)	0.004*	33.5 (31–35)	31 (27–33)	0.010*	33 (30–35)	32.5 (27–34)	0.125
J-MSPSS score, median (IQR)	43 (38–48)	38 (32–48)	0.298	42 (35–48)	42 (37–49)	0.667	42 (38–48)	45 (37–49)	0.712
GSES score, median (IQR)	3 (3–4)	3 (2–4)	0.230	3 (2–4)	3 (2–4)	0.566	3 (3–4)	3 (2–4)	0.383

Abbreviations: IQR, interquartile range; SD, standard deviation; CBA, Cognitive-related Behavioral Assessment; BBS, Berg Balance Scale; MWS, Maximum Walking Speed for 10 m; FIM, Functional Independence Measure; J-MSPSS, Japanese short version of Multidimensional Scale of Perceived Social Support; GSES, General Self-Efficacy Scale

*$P < 0.05$, †$P < 0.10$

work, and 0.85 (95%CI = 0.77–0.94) for local shopping, all models showed good discrimination (Figure 1). The HL tests of all models were $P > .05$, indicating good calibration (Table 4).

Table 5 presents the prediction formulae for all domestic chores. Their usage is shown below: First, the score is calculated using the prediction formula for each domestic chore. Next, the prediction probability is calculated using the formula "$P = 1/[1 + \exp(-1\times \text{score})]$." $P > .5$ and $P < .5$ predict resumption and non-resumption, respectively. The prediction accuracy of each model ranged from 71% to 83%.

Discussion

Most participants in this study had suffered mild strokes. However, approximately 20–50% had not resumed each domestic chore three months after discharge. Specifically, the proportion of those who had not resumed heavy housework was the highest (approximately 53%). This was consistent with previous research indicating that heavy housework was the most difficult domestic chore for stroke patients.[7,13] Alternatively, approximately 80% of participants had resumed washing up, similar to evidence suggesting that washing up may be relatively easy to resume after stroke.[6] The difficulty of each domestic chore should be considered when planning rehabilitation for the resumption of domestic chores after stroke.

The main aim of this study was to determine the predictors and develop practical models for predicting individual domestic chores resumption three months after discharge from the hospitals. We found several predictors, such as walking speed, cognitive function, self-efficacy, and the number of family members living together, and developed six prediction models. In the model for heavy housework, which was the most difficult to resume, several predictors were chosen. In contrast, the model for washing up, the easiest to resume, included only one predictor. Apparently, the difficulty of domestic chores is related to the complexity of the model.

Table 3. Comparison of demographics and candidate predictors between the resumed and non-resumed groups for each domestic chore

Variables	Light housework		*P*	Heavy housework		*P*	Local shopping		*P*
	Resumed n=61 (75.3%)	Non-resumed n=20 (24.7%)		Resumed n=33 (47.1%)	Non-resumed n=37 (52.9%)		Resumed n=64 (72.7%)	Non-resumed n=24 (27.3%)	
Age, median (IQR)	71 (62.5–79)	76.5 (72–81)	0.011*	67 (60–72.5)	75 (69–80)	0.006*	69 (59–79)	77 (73–83)	0.002*
Female, %	70.5	80.0	0.407	81.8	73.0	0.379	65.6	83.3	0.105
Number of family members living together, median (IQR)	1 (0–1)	1 (1–2)	0.071†	1 (1–1.5)	1 (0.5–2)	0.837	1 (0–1)	1 (1–2)	0.075†
Stroke type									
Infarction, %	49.2	70.0	0.146	36.4	67.6	0.014*	51.5	66.7	0.411
Hemorrhage, %	39.3	30.0		45.4	29.7		39.1	29.2	
Subarachnoid hemorrhage, %	11.5	0		18.2	2.7		9.4	4.1	
Hemisphere									
Right, %	49.2	45.0	0.294	51.5	43.2	0.110	46.9	45.8	0.610
Left, %	34.4	50.0		27.3	48.7		37.5	45.8	
Non-paralysis, %	16.4	5.0		21.2	8.1		15.6	8.4	
Brunnstrom recovery stage									
Arm, median (IQR)	6 (5–6)	5 (4–6)	0.021*	6 (5–6)	6 (4.5–6)	0.131	6 (5–6)	5 (4–6)	0.136
Hand, median (IQR)	6 (5–6)	5 (5–6)	0.079†	6 (5–6)	6 (5–6)	0.318	6 (5–6)	5.5 (5–6)	0.367
Leg, median (IQR)	6 (5–6)	5 (5–6)	0.053†	6 (5–6.5)	5 (5–6)	0.088†	6 (5–6)	5 (5–6)	0.106
CBA score, median (IQR)	26 (24–28)	24.5 (23–28)	0.063†	27 (25–29)	24 (23–27)	0.002*	26 (24–29)	24.5 (23–27)	0.078†
BBS score, median (IQR)	54 (51–56)	49.5 (45–54.5)	0.002*	55 (51–56)	51 (46–54.5)	0.003*	55 (51–56)	48 (45–53)	<0.001*
MWS, m/min, mean (SD)	71.8 (25.1)	37.0 (20.4)	<0.001*	74.7 (26.4)	51.8 (27.9)	0.001*	72.1 (27.1)	41.2 (20.4)	<0.001*
FIM motor score, median (IQR)	84 (80–87)	79.5 (66.5–83)	0.002*	85 (82–89)	80 (69–83.5)	<0.001*	84 (81–87)	79 (67–82)	<0.001*
FIM cognitive score, median (IQR)	33 (31–35)	33 (27–35)	0.251	34 (31–35)	32 (27.5–34.5)	0.019*	33 (31–35)	32 (26–34)	0.010*
J-MSPSS score, median (IQR)	42 (38.5–48)	45 (37–49)	0.667	43 (39.5–49)	41 (32.5–48)	0.143	42 (35.5–48)	44.5 (37–49)	0.451
GSES score, median (IQR)	3 (2.5–4)	3 (2–4)	0.765	4 (3–4)	3 (2–4)	0.096†	3 (3–4)	3 (2–4)	0.237

Abbreviations: IQR, interquartile range; SD, standard deviation; CBA, Cognitive-related Behavioral Assessment; BBS, Berg Balance Scale; MWS, Maximum Walking Speed for 10 m; FIM, Functional Independence Measure; J-MSPSS, Japanese short version of Multidimensional Scale of Perceived Social Support; GSES, General Self-Efficacy Scale

*$P < 0.05$, †$P < 0.10$

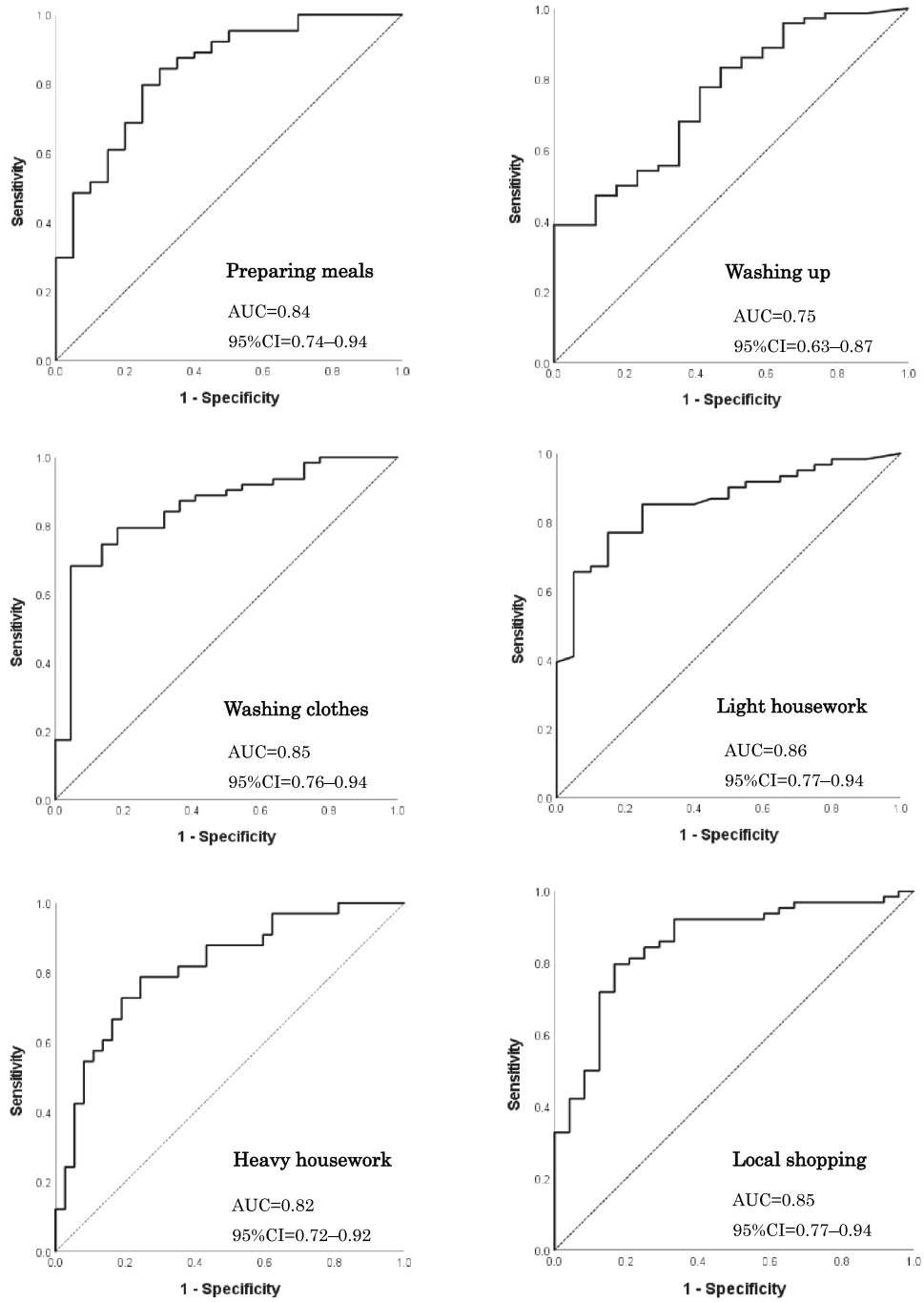

Figure 1. Receiver operating characteristic (ROC) curves of prediction models for individual domestic chores resumption.

The predictive effect of walking speed was consistent across all domestic chores, with faster walking speed leading to the resumption of domestic chores. This finding is supported by previous research.[7] Moreover, walking speed can predict social activity,[18] life-space mobility,[34] and return to employment[35] after stroke. Therefore, walking speed seems to be useful in predicting various life behaviors in stroke patients.

Cognitive function is a predictor of IADL disability after stroke.[16–18] In the present study, cognitive function assessed by the CBA was a predictor for the resumption of preparing meals and heavy housework. Preparing meals requires attention, memory, and judgment, such as thinking about menus, proceeding according to recipes, and handling fire and knives safely. Heavy housework includes tasks such as scrubbing floors and carrying

Table 4. Logistic regression models for individual domestic chores resumption

Domestic chores	Variables	B (SE)	*P*	OR (95%CI)	Hosmer-Lemeshow test	Prediction accuracy
Preparing meals	MWS (m/min)	0.045 (0.013)	0.001*	1.05 (1.02–1.07)	*P*=0.947	83.3%
	CBA	0.252 (0.115)	0.028*	1.29 (1.03–1.62)		
	Intercept	-7.694 (2.912)				
Washing up	MWS (m/min)	0.036 (0.011)	0.002*	1.04 (1.01–1.06)	*P*=0.256	83.1%
	Intercept	-0.539 (0.630)				
Washing clothes	MWS (m/min)	0.056 (0.015)	<0.001*	1.06 (1.03–1.09)	*P* =0.408	80.0%
	Number of family members living together	-0.877 (0.325)	0.007*	0.42 (0.22–0.79)		
	Intercept	-0.860 (0.731)				
Light housework	MWS (m/min)	0.059 (0.015)	<0.001*	1.06 (1.03–1.09)	*P* =0.720	80.2%
	Intercept	-2.082 (0.777)				
Heavy housework	MWS (m/min)	0.029 (0.011)	0.011*	1.03 (1.01–1.05)	*P* =0.569	71.4%
	CBA	0.320 (0.127)	0.012*	1.38 (1.07–1.77)		
	GSES	0.646 (0.327)	0.048*	1.91 (1.01–3.62)		
	Intercept	-12.404 (3.874)				
Local shopping	MWS (m/min)	0.045 (0.013)	0.001*	1.05 (1.02–1.07)	*P* =0.993	83.0%
	Age	-0.062 (0.031)	0.049*	0.94 (0.88–1.00)		
	Number of family members living together	-0.498 (0.278)	0.073†	0.61 (0.35–1.05)		
	Intercept	3.613 (2.541)				

Abbreviations: SE, standard error; OR, odds ratio; CI, confidence interval; MWS, Maximum Walking Speed for 10 m; CBA, Cognitive-related Behavioral Assessment; GSES, General Self-Efficacy Scale

*$P < 0.05$, †$P < 0.10$

Table 5. Prediction formulae for individual domestic chores resumption among mild stroke patients.

Preparing meals	Score = 0.045× MWS+0.252× CBA-7.694
Washing up	Score = 0.036× MWS-0.539
Washing clothes	Score = 0.056× MWS-0.877× Number of family members living together-0.860
Light housework	Score = 0.059× MWS-2.082
Heavy housework	Score = 0.029× MWS+0.320× CBA+0.646× GSES-12.404
Local shopping	Score = 0.045× MWS-0.062× Age-0.498× Number of family members living together+3.613

Abbreviations: MWS, Maximum Walking Speed for 10 m (m/min); CBA, Cognitive-related Behavioral Assessment (score range: 6–30); GSES, General Self-Efficacy Scale (score range: 1–5)

The usage: First, calculate the score by the prediction formula for each domestic chore. Next, substitute the calculated score for " $P = 1/[1+ \exp(-1\times \text{score})]$." $P > 0.5$ predicts resumption and $P < 0.5$ predicts non-resumption.

burdens. While these tasks require a high level of physical ability, they also require attention and problem-solving skills to deal with risks such as falls. The CBA may have been selected as a predictor of the resumption of these items because it can assess multiple domains of cognitive function necessary for performing the above tasks.

Self-efficacy was a predictor for the resumption of heavy housework. Self-efficacy is described as confidence in one's ability to perform a task or specific behavior.[36] It is believed that people with high self-efficacy can make efforts without giving up even in difficult situations and can be proactive in taking appropriate problem-solving action.[31] Since heavy housework is the most difficult item to resume, it is considered that high self-efficacy is required. In addition to improving physical and cognitive function, rehabilitation strategies to increase self-efficacy are also crucial for the resumption of heavy housework.

The number of family members living together was selected as a predictor of washing up and local shopping. More family members living together had a negative impact on the resumption of these items, consistent with previous reports that stroke patients living alone were more likely to engage in domestic chores and IADL than those living with family.[7,16,37] Previous evidence indicates that when many family members live together, family members may substitute stroke patients in activities such as shopping.[37] This may result in stroke patients performing such activities less frequently. Hence, stroke patients living with family members may be less likely to resume specific domestic chores, due to family members' overprotective behaviors. Alternatively, there were some items for which the number of family members living together was not selected as a predictor. We speculated that there are some items that are more or less influenced by family members, but the reason is not clear.

In this study, paralysis severity, balance, and ADL dependency, which were previously reported to be related to the frequencies of domestic chores and IADL after stroke, were not selected as predictors in any models. For these scales, scores were relatively high in the resumed and non-resumed groups because most participants had mild strokes. Therefore, we speculated these scales were not sufficiently sensitive to predict whether mild stroke patients would resume domestic chores and may not have been selected as predictors. Social support was also not selected as a predictor. Previous research indicates that social support had a positive impact on improvement of functional status for severe stroke patients, while mild stroke patients were less affected by social support.[38] Therefore, it is thought to not have been selected as a predictor in any models.

Our models showed good discrimination and calibration. Although the prediction accuracy of each model was comparable to those of previous models,[7] each model could predict with fewer variables than previous models. Additionally, these models were constructed with reliable and valid scales that can easily be evaluated in clinical practice. Thus, these models can be used easily and routinely in clinical practice and may help clinical practitioners in planning rehabilitation and therapeutic strategies for resuming domestic chores.

This study has several limitations. First, there is the possibility of a type II error with respect to the statistical power of the predictors. Therefore, it is necessary to include a larger sample size in the future. Second, recall bias cannot be ruled out because the data on pre-stroke frequencies of domestic chores were assessed by retrospective recall. Third, this study did not consider other factors, such as physical environmental barriers,[39] which may have influenced outcomes. Therefore, further studies are needed. Finally, we cannot assure that our models are applicable to other populations because they have not undergone external validation. Caution is needed to apply the findings of this study to stroke patients in other settings.

Conclusions

We developed six models to predict individual domestic chores resumption among mild stroke patients three months after discharge from specialized rehabilitation wards. These models included predictors such as walking speed, cognitive function, self-efficacy, and the number of family members living together. Each model showed good discrimination and calibration. The models could provide valuable information for determining rehabilitation plans and therapeutic strategies for resuming domestic chores among mild stroke patients.

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ORCID

Ryu Kobayashi http://orcid.org/0000-0002-1699-1289
Norikazu Kobayashi http://orcid.org/0000-0003-4680-9078

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