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ORIGINAL RESEARCH

Exercise Intention and its Associated Factors Among Persons Post-Stroke: A Cross-Sectional Study

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Purpose: To investigate the level of exercise intention and its associated factors among persons post-stroke using the Theory of Planned Behavior.

Patients and Methods: In this cross-sectional study, a total of 333 participants admitted to the neurology units of a tertiary care hospital in China with a confirmed diagnosis of stroke were recruited. A self-administered instrument based on the Theory of Planned Behavior was used to determine the exercise intention and its associated factors among persons post-stroke.

Results: The results revealed that only 128 participants had exercise intention after discharge with a prevalence of 38.4%. Multivariable linear regression analysis revealed that monthly income, living situation, subjective norms, attitude, and perceived behavioral control were significant predictors of exercise intention of persons post-stroke. Perceived behavioral control and living situation were the most relevant factors of exercise intention.

Conclusion: The level of exercise intention among persons post-stroke was found to be low. Perceived behavioral control and living situation were particularly important and contributed to exercise intention. Healthcare professionals' adequate guidance on exercise should be provided, with a focus on educating both patients and their family members, especially spouses, to promote exercise intention in persons post-stroke.

Keywords: exercise intention, stroke, exercise adherence, Theory of Planned Behavior

Introduction

Stroke is one of the leading causes of death and disability worldwide.[1] In China, stroke is also the primary cause of death in urban and rural areas, accounting for 20.5% and 24.2% of all deaths, respectively.[2] The American Heart Association (AHA) strongly recommends persons post-stroke should regularly participate in aerobic exercise, resistance (strength) training, flexibility training, and neuromuscular training[3] to promote functional independence and range of movement and to prevent the recurrence risk of stroke and other cardiovascular diseases (CVDs).[4] However, a large body of evidence demonstrated that sedentary behavior and lack of physical activity and exercise are common issues among persons post-stroke[5–7] and exercise adherence was poor in persons post-stroke.[8–10] A recent systematic review found that most community-dwelling stroke survivors did not fulfill the recommended 30 minutes of daily moderate to vigorous physical activity (MVPA).[11] And a longitudinal study of objectively measured physical activity after stroke reported that less than one-third of the sample accumulated 30 min of daily MVPA in bouts of $\geq$ 10 min.[12] Inadequate physical activity and exercise after a stroke is correlated with reduced muscle strength and cardiopulmonary fitness, decreased ability to perform activities of daily living, and an increased risk of recurrent stroke and other CVDs events.[3,13–15] Lack of physical activity and exercise is known to be harmful to persons post-stroke. Considering the negative influences, it is critical to address low exercise adherence among persons post-stroke.

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One potential target to address poor exercise adherence is exercise intention, assumed as a motivational factor that influences behavior, which indicates how hard people are willing to try and how much effort they are planning to exert to perform physical activity and exercise.[16] The Theory of Planned behavior (TPB), widely applied in various populations and healthcare contexts, believes that a person's behavior can be predicted by the strength of a person' s intention.[16] As a key factor in predicting exercise behavior, exercise intention is valuable to be understood and serves as an effective target for developing interventions to promote exercise participation.[16–19] Previous studies have explored exercise intention based on the TPB, such as persons with CVDs, kidney transplant recipients, individuals with schizophrenia, pregnant women, and other populations.[20–23] The TPB is intriguing due to its applicability in investigating motivational factors involved in health promotion and its practicable framework for understanding the determinants of exercise.

The TPB also suggests that intention is determined by some components, including subjective norms, attitudes, and perceived behavior control.[16] Subjective norms refer to a person's perceived social pressure from significant others (e.g., family members, relatives, friends, and healthcare professionals (HCPs)) to perform a behavior. Attitudes reflect the degree to which a person has a positive or negative evaluation of behaviors. Perceived behavioral control indicates a person's perception of the relative ease or difficulty in performing a behavior based on past behavioral experience, including perceived skills/ability, resources, and facilitators/barriers.[16] According to the TPB, if a person perceives more social pressure from family ties or social networks, a more positive attitude, and greater beliefs in controlling facilitators or barriers in performing a given behavior, the stronger should be the individual's intention to engage in the behavior.[24]

Despite the impact of exercise intention on exercise participation, there is insufficient evidence regarding exercise intention and its related factors among persons post-stroke. One published study has investigated the will of exercise rehabilitation in young and middle-aged persons post-stroke in 2011,[25] and another study has found exercise intention was a predictor of rehabilitation exercise management behavior.[26] Both of these papers focused on young or middle-aged persons post-stroke, with one study conducted a long time ago and the other failing to explore the influencing factors. Understanding exercise intention in persons post-stroke and its associated factors is an essential prerequisite for effective intervention to enhance exercise participation in persons post-stroke, further promoting exercise and obtaining better health outcomes.

Thus, the purpose of this study was to investigate the level of exercise intention and its determinants among persons post-stroke based on the TPB.

Materials and Methods

Design

This study was a cross-sectional survey with a convenience sampling method with persons post-stroke in mainland China. The Strengthening the Reporting of Observational studies in Epidemiology (STROBE) statement was used to make sure items that should be reported in this study.[27]

Setting and Participants

The participants were recruited from neurology units of a large tertiary care hospital (with over 2000 inpatient beds) in Baoding, a city located in northern China. The potential participants met the following criteria: (a) with a confirmed diagnosis of stroke, following the diagnostic criteria compiled by the Chinese Medical Association Neuropathy Branch; (b) passed the acute period and had the ability to read and understand; (c) assessed with muscle strength at level 5- or 5 and able to engage in self-care. Patients were excluded if they: (a) had been diagnosed with severe organ dysfunction or malignant tumor; (b) had been diagnosed with mental health problems; (c) had severe conscious or cognitive impairment, or (d) had contraindications related to exercise rehabilitation, such as unstable angina, severe arrhythmias, uncontrolled hypertension, and abnormalities of the locomotor system that affected exercise.

The sample size was calculated by using the G*power software. The minimum sample size of patients was 194 based on a medium effect size of 0.15, α of 0.05, and a power of 0.95 (using the G*power 3.1 version).[28] A sample size of 233 was required, considering a 20% inefficiency rate.

Measures

Social-Demographic and Disease-Related Questionnaire

Participants' social-demographic and disease-related characteristics (age, gender, marital status, education, occupation, personal monthly income, living situation, medical payment methods, first onset of stroke, time after stroke, and comorbidity) were obtained using a self-administered questionnaire.

Exercise Intention Instrument for Stroke Patients

The exercise intention instrument for persons post-stroke was developed by researchers based on a comprehensive literature review, expert consultation, and the TPB.[12] The initial questionnaire had 29 items, and after two rounds of expert consultation, the 27-item questionnaire was obtained, which was subsequently tested for reliability and validity in the first 160 persons post-stroke of sample in this study. The overall Cronbach's α was 0.96, indicating high internal consistency. Cronbach's alpha specific to measures of subject norms, attitude, perceived behavioral control, and exercise intention, ranged from 0.87 to 0.92. Item content validity index (ICVI) was 0.8–1, and scale content validity index (SCVI) was 0.96, suggesting that the instrument had good content validity. An exploratory factor analysis (EFA) was carried out for the construct validity. Four principal factors were identified in the EFA, which explained 68.0% of the total variance. The final questionnaire consists of 27 items, all of which mapped to the TPB constructs, including subjective norms (5 items), attitude (7 items), perceived behavioral control (9 items), and exercise intention (6 items). Examples of questions are presented in Table 1. A 5-point Likert questionnaire was established (with 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree). Items on each dimension were summed such that higher scores represent higher levels of subjective norms, attitude, perceived behavioral control, and exercise intention, respectively. In addition, the average scores of exercise intention dimension ≥4 were regarded as having exercise intention.

Data Collection

The data were collected from July 2022 to September 2022. Before the survey, all the investigators were trained on the purpose, inclusion and exclusion criteria, communication skills, and data-collecting methods of this study. Once the patients met the inclusion criteria, the investigators asked eligible patients if they were willing to participate in this survey. Upon expression of interest, the investigators conducted the face-to-face survey with participants before discharge. Personal questionnaire data were reviewed from hospital medical records by researchers. For participants who had difficulty in reading and writing the questionnaires, investigators read the inquiries item-by-item and recorded their answers objectively. The survey took about 10–15 minutes to complete.

Table 1 Examples of Questions by the TPB Constructs

Construct	Items	Example Questions
Subjective norms	5	My family supports me to participate in physical exercise
		My attending physician supports me to participate in physical exercise
Attitude	7	I believe that participating in physical exercise could promote my recovery
		I believe that participating in physical exercise could improve my quality of life
Perceived behavioral control	9	I receive guidance from professionals on how to exercise properly
		The cost of physical exercise is not a problem for me
Exercise intention	6	I intend to participating in physical exercise after discharge
		I will persist in participating in physical exercise after discharge

Abbreviation: TPB, the Theory of Planned Behavior.

Ethics Consideration

This study conformed with the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of the Affiliated Hospital of Hebei University. The details of the study were given to the potential participants, and it was made clear that they were voluntary to decide whether to participate or not, and this would not have any impact on them. All participants provided written informed consent before the investigation. The participants were guaranteed that all data would be held securely and confidentially and that it would only be accessed by the research team.

Data Analysis

All analyses were carried out using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Bar charts and P-P plots were used to explore whether the continuous variables (subjective norms, attitude, perceived behavioral control, and exercise intention) followed a normal distribution. Socio-demographic and disease-related characteristics were described with frequency, percentage, standard deviation, mean, median, range, and percentiles. Bivariate relationships between socio-demographic and disease-related characteristics and exercise intention were analyzed using Student's *t*-test, one-way analysis of variance (ANOVA). Pearson correlation analysis was used to examine the relationships among subjective norms, attitude, perceived behavioral control, and exercise intention. Variables identified from *t*-tests, ANOVA, and correlation analysis that were statistically significantly correlated with exercise intention were included in the multiple linear regression analysis. Dummy variables were set for living situation and occupation, and the dummy variables needed to be entered into the regression model at the same time. For all statistical analyses, the significance level was $p<0.05$.

Results

Characteristics of the Participants

A total of 333 persons post-stroke were included in this study (Table 2). Their average age was 62.43 (SD 10.45). Most were male (66.7%), married (94.3%), farmers (80.5%), living with spouses or/and children (98.8%), and with co-morbid chronic diseases (69.4%). About half of the participants (44.2%) had attained middle school, and 46.9% of patients' monthly income were lower than 2000 CNY.

Table 2 Characteristics of Participants and Comparison of Exercise Intention Scores Among Persons Post-Stroke with Different Characteristics (n=333)

Characteristics		**N (%)**	**Exercise Intention Mean (SD)**	***t/F***	***P***
Age (Year)	<60	132 (39.6)	23.19 (3.69)	2.005	0.046
	≥60	201 (60.4)	22.31 (4.07)		
Gender	Male	222 (66.7)	22.92 (4.05)	1.716	0.087
	Female	111 (33.3)	22.14 (3.67)		
Marital status	Married	314 (94.3)	22.78 (3.92)	2.262	0.024
	Single (divorced/widowed)	19 (5.7)	20.68±3.84		
Education	Primary school or below	79 (23.7)	21.71 (3.56)	12.816	<0.001
	Middle school	147 (44.2)	21.91 (3.13)		
	High school	71 (21.3)	23.82 (4.40)		
	Colleges or above	36 (10.8)	25.50 (4.91)		

(*Continued*)

Table 2 (Continued).

Characteristics		N (%)	Exercise Intention Mean (SD)	*t/F*	*P*
Occupation	Workers	29 (8.7)	24.76 (4.02)	19.287	<0.001
	Professionals	36 (10.8)	25.58 (4.70)		
	Famers	268 (80.5)	22.04 (3.56)		
Personal monthly income	Low (<2000 CNY)[a]	156 (46.9)	21.23 (3.32)	49.711	<0.001
	Medium (2000–4000 CNY)	93 (27.9)	22.17 (2.47)		
	High (≥4000 CNY)	84 (25.2)	25.85 (4.51)		
Living situation	Alone	4 (1.2)	17.75 (0.96)	5.416	0.001
	With spouse	231 (69.3)	22.76 (3.68)		
	With children	22 (6.6)	20.36 (4.24)		
	With both spouse and children	76 (22.9)	23.26 (4.35)		
Medical payment methods	Residents' medical payment	270 (81.1)	22.10 (3.59)	−4.819	<0.001
	Employee' medical payment	63 (18.9)	25.03 (4.50)		
First onset	Yes	232 (69.7)	22.65 (3.81)	−0.078	0.938
	No	101 (30.3)	22.68 (4.24)		
Time after stroke (Year)	<2	252 (75.7)	22.70 (3.84)	3.284	0.021
	2~	43 (12.9)	22.19 (4.15)		
	5~	18 (5.4)	20.89 (4.25)		
	10~	20 (6.0)	24.70 (3.77)		
Combined with chronic disease	Yes	231 (69.4)	22.47 (3.71)	−1.243	0.216
	No	102 (30.6)	23.09 (4.40)		

Note: [a]2000CNY=approximately 263EUR or 283USD.

Mean Score of Subjective Norms, Attitude, Perceived Behavioral Control and Exercise Intention

Exercise intention was 3.78 (SD 0.66) (consistent with a level of agreement corresponding with "neutral" to "agree"). Only 128 (38.4%) participants had exercise intention, whose score of exercise intention was higher than 4. The score specific to subjective norms was 3.34 (SD 0.62), attitude was 3.56 (SD 0.67), and perceived behavioral control was 3.46 (SD 0.52). The five items with the lowest scores are listed in Table 3.

Association Between Socio-Demographic and Disease-Related Characteristics and Exercise Intention

The association between participants' socio-demographics and disease-related characteristics and exercise intention is shown in Table 2. On univariate analysis, the following were all significantly associated with exercise intention: age (t=2.005, p=0.046), marital status (t=2.262, p=0.024), education level (F=12.816, p<0.001), occupation (F=19.287, p<0.001), personal monthly income level (F=49.711, p<0.001), living situation (F=5.416, p=0.001), medical payment methods (t=−4.819, p<0.001), and time after stroke (F=3.284, p=0.021).

Table 3 The Five Items with Lowest Scores (n=333)

Constructs	Items	Mean (SD)
Perceived behavioral control	I receive guidance from professionals on how to exercise properly	2.12 (0.66)
Subjective norms	My charge nurse supports me to participate in physical exercise	2.95 (0.85)
	My attending physician supports me to participate in physical exercise	2.99 (0.84)
Perceived behavioral control	I believe that I can keep physical exercise no matter what happens	3.18 (0.88)
Subjective norms	I have learned from many sources that stroke patients should exercise to improve their prognosis	3.29 (0.86)

Abbreviation: SD, standard deviation.

Correlation Among Subjective Norms, Attitude, Perceived Behavioral Control and Exercise Intention

The bivariate correlations between the TPB constructs and exercise intention among persons post-stroke revealed significantly moderately positive correlations (Table 4). Perceived behavioral control had the highest correlation to exercise intention (r=0.765, p<0.001), followed by attitude (r=0.739, p<0.001); subjective norms had the lowest correlation to exercise intention (r=0.613, p<0.001).

The Multiple Linear Regression Analysis of Exercise Intention

Monthly income (β=0.149, p=0.006), living with spouse (β=0.385, p=0.006), living with both spouse and children (β=0.338, p=0.009), subjective norms (β=0.183, p<0.001), attitude (β=0.241, p<0.001) and perceived behavioral control (β=0.436, p<0.001) were significant predictors of exercise intention of persons post-stroke (Table 5). The model was

Table 4 Means and Correlation Matrix for the TPB Constructs (n=333)

	Total Score, Mean (SD)	1	2	3	4
1 Subjective norms	3.34 (0.62)	1			
2 Attitude	3.56 (0.67)	0.661***	1		
3 Perceived behavioral control	3.46 (0.52)	0.552***	0.777***	1	
4 Exercise intention	3.78 (0.66)	0.613***	0.739***	0.765***	1

Note: ***P<0.001.
Abbreviations: TPB, the Theory of Planned Behavior; SD, standard deviation.

Table 5 Multivariable Linear Regression Model for Predicting Exercise Intention of Stroke Patients (n=333)

Predictor	*B*	*SE*	*β*	*t*	*P*
Norm	−2.046	1.785		−1.147	0.252
Living with spouse (alone as reference)	3.288	1.181	0.385	2.783	0.006
Living with both spouse and children (alone as reference)	3.169	1.203	0.338	2.634	0.009
Personal monthly income	0.712	0.258	0.149	2.762	0.006
Subjective norms	0.233	0.056	0.183	4.132	<0.001
Attitude	0.202	0.048	0.241	4.210	<0.001
Perceived behavioral control	0.370	0.046	0.436	8.080	<0.001

Note: β, standardized coefficients.
Abbreviation: SE, standard error.

significant and explained 66.5% of exercise intention (R^2=0.665, F=48.092, p<0.001). Perceived behavioral control and living situation were the strongest correlates of exercise intention.

Discussion

This study investigated the level and associated factors of exercise intention among persons post-stroke. The mean score of exercise intention was 3.78 (SD 0.66), which was in accordance with a level of agreement corresponding with "neutral" to "agree". Our results revealed that only 38.4% of persons post-stroke intended to exercise after discharge, which supports previous findings reporting low levels of exercise among persons post-stroke.[8,9] Notably, this result was lower than those reported in previous studies,[25,26] both of which investigated young and middle-aged persons post-stroke (age <60y). The inconsistency may be attributed to younger patients who undertake more family responsibilities, are willing to return to work, have higher rehabilitation motivation,[29] and display better adherence to rehabilitation programs.[30] Our univariate analysis results also indicated that older persons post-stroke had lower exercise intention.

Identifying what factors predict the exercise intention of persons post-stroke will provide a reference for HCPs to evaluate high-risk patients with low intention and deliver effective care. Our study found that perceived behavioral control was the primary determinant of exercise intention among persons post-stroke, which agrees with the findings of previous studies.[20,23,31] If patients perceive more barriers, their intention to exercise is likely to decrease. Our results showed that inadequate guidance on exercise from HCPs was perceived as the strongest barrier to exercise among persons post-stroke ("I receive guidance from professionals on how to exercise properly" item had the lowest score (2.12)). These results conform to Mahmood et al study, which found that lack of education by the HCPs would result in poor knowledge about stroke exercise and further lead to non-adherence.[32] In addition, the period of inpatient rehabilitation may be an opportune time to influence long-term physical activity.[33] Therefore, from the view of exercise intention promotion, HCPs' guidance on exercise should be emphasized and incorporated into inpatients care.

Except for perceived behavioral control, living situation is another strongest predictor of exercise intention. Our study found that persons post-stroke living with a spouse or both a spouse and children were more likely to intend to exercise, which is congruent with the evidence from earlier studies.[34] A supportive family is recognized as the most crucial factor in enhancing exercise participation. Family members assist persons post-stroke to carry out a task, encourage them to continue exercises and provide psychological support,[32] all of which contribute to promoting the intention to exercise. One important finding is that our results emphasized the vital role of the spouse in facilitating exercise intention, which is supported by the previous evidence that family caregivers, mainly spouses, played an especially critical role in providing support.[34] Recent studies have demonstrated that caregiver-mediated intervention with exercise could improve persons post-stroke basic activity of daily life.[35] Doing exercises together appears to make patients and caregivers actively involved in rehabilitation.[36] Caregiver-mediated exercise interventions, a promising approach to augment stroke rehabilitation, are suggested for broader application and practice. Moreover, the results imply that persons post-stroke living alone and without a spouse should be supported from multiple sources. Nurses, especially community nurses, are in a key position to facilitate these supports by reaching out to individuals, families, and communities.[37] The prerequisite is that nurses should have high levels of awareness on providing professional support and further promoting exercise intention of persons post-stroke.

Our study found a positive correlation between attitude and exercise intention among persons post-stroke, which aligns with the constructs of TPB.[16] This finding is consistent with previous research indicating significant correlations between attitude and exercise intention among other populations as well.[18,38] Attitude is more closely related to a person's own self-perception and beliefs[23] and persons post-stroke with positive attitude and strong beliefs on exercise, were more actively to participate in exercise as previously reported.[39] Hence, according to the TPB, this finding suggests that, for persons post-stroke, intervention strategies should be focused on formulating patients' positive attitudes about exercise (eg, providing exercise education and instruction, highlighting the benefits of exercise, and emphasizing the necessity and feasibility of exercise) to increase exercise intention, which, in turn, improves their exercise behaviors.

The findings that subjective norms were significantly associated with exercise intention, conform to earlier studies in other populations.[20,31] Subjective norms reflect the effect of important persons or groups on individual behavioral decisions.[16] Persons post-stroke with supportive significant others would have stronger exercise intention than those

with less supportive networks.[33] HCPs, family members, and friends were identified as significant persons who provide the subjective norms and influence exercise intention.[23,40,41] However, this study found that persons post-stroke perceived a low level of support from HCPs regarding their exercise. Our results revealed that support from physicians and nurses had the lowest score in the subjective norm dimension (Table 3). Hence, more guidance and education on exercise for persons post-stroke should be given during the period of inpatient rehabilitation, and also their family members and friends should be encouraged to provide positive support for exercise after discharge.

Besides, a higher level of income was associated with stronger exercise intention in persons post-stroke, which is in accordance with previous study.[20] One possible explanation is that persons post-stroke face increased financial burden due to long-term or even lifelong medication and disability resulting from the stroke.[2] A systematic review revealed that the highest post-stroke care costs were observed in the USA, with rehabilitation services being the main cost driver.[42] Currently, post-stroke outpatients need to be admitted to hospitals for professional rehabilitation exercise in China, but there is a limited budget for rehabilitation exercise and exercise-related information for persons post-stroke with low-income levels. In contrast, higher-income patients could have better access to professional rehabilitation exercise training and obtaining more exercise-related information.[26] Given this, nurses, as the key role in educating patients,[43] can provide more available exercise-related information for stroke patients with low-income levels. For instance, community nurses could organize community walking programs[44,45] or promote the adoption of effective and low-cost Chinese traditional exercise, such as Tai Chi, Baduanjin, and Qigong.[46–48]

Limitations

Our study has several limitations. First, participants were recruited from neurology departments in a single hospital using a convenient sampling method, thereby limiting the representativeness of the sample. Second, the sample with better limb strength and self-care ability were included, which may restrict the transferability of our findings to stroke patients with poor limb strength. Third, the cross-sectional study design was applied in this study, which does not lend itself to causal inference and can provide information only on correlation and prediction of these factors. Thus, future longitudinal and intervention studies are needed to provide a more comprehensive understanding of the relationship between the factors we identified and exercise intention in persons post-stroke.

Conclusion

This study sheds light on the low level of exercise intention among persons post-stroke and found it was affected by many factors, with perceived behavioral control and living situation being the strongest associations. It underscores the need to increase the guidance provided by HCPs on exercise after stroke. Additionally, caregiver-mediated exercise program should be developed and suggested to broadly applied in persons post-stroke and their caregivers. Also, particular attention should be given to persons post-stroke with low income and those who live without a spouse, as they are more likely to have low exercise intention.

Data Sharing Statement

The data underlying this article will be shared on reasonable request to the corresponding author.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

No conflicts of interest has been declared by the authors.

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