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The status of readiness for hospital discharge of patients with post-stroke cognitive impairment and its relationship with post-discharge social isolation

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Abstract

Background The current status of readiness for hospital discharge (RHD) in patients with post-stroke cognitive impairment (PSCI) is not clear. This study aimed to investigate the current status of RHD in patients with PSCI, identify potential influencing factors, and explore the relationship between RHD and social isolation after discharge.

Methods This was an observational study reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. We selected patients with post-stroke cognitive impairment from the Department of Neurology at a tertiary hospital in Zhejiang Province, China, from August to December 2023. Data were collected via a general information questionnaire, the Montreal Cognitive Assessment, the Readiness for Hospital Discharge Scale, and the Lubben Social Network Scale.

Results We surveyed a total of 170 patients, and collected complete data from 155 patients. The total Readiness for Hospital Discharge Scale score ranged from 67 to 111 (mean ± SD: 87.46 ± 9.64), with 58 (37.4%) patients identified as underprepared. Multivariate linear regression analysis of the significant variables identified via univariate analysis revealed that annual household income, residence, and Montreal Cognitive Assessment scores significantly affected RHD. Correlation analysis revealed that National Institutes of Health Stroke Scale scores were significantly negatively correlated with Lubben Social Network Scale scores, whereas Montreal Cognitive Assessment scores were positively correlated. There was also a significant positive correlation between RHD and social isolation.

Conclusion Readiness for hospital discharge among patients with post-stroke cognitive impairment is at a medium level. Patients with higher annual household income, urban residence, and lower Montreal Cognitive Assessment scores had greater readiness for discharge. There is a significant correlation between readiness for discharge and social isolation after discharge. Improving patients' readiness for hospital discharge may help reduce social isolation.

Keywords Stroke, Post-stroke cognitive impairment, Readiness for hospital discharge, Social isolation, Analysis of influencing factors

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Introduction

In 2019, studies on the global burden of disease revealed that there were approximately 12.2 million new stroke cases worldwide, with 101 million patients. Stroke has become the second leading cause of death and the third leading cause of disability worldwide [1, 2]. Cognitive impairment is a common complication of stroke. Post-stroke cognitive impairment (PSCI) usually refers to a series of cognitive-related syndromes that occur within 6 months after stroke, including executive ability, memory, attention, cognitive function, understanding and learning ability, and functional impairment in visual and auditory spatial language [3]. The concept of PSCI comes from vascular cognitive impairment (VCI). VCI refers to the cognitive impairment caused by vascular risk factors and / or related to vascular factors, including the whole process from mild cognitive impairment to dementia [4]. As a subtype of VCI, PSCI is one of the main causes of recurrence and death after stroke [3].Approximately 1/3 to 1/2 of stroke patients will experience PSCI [5, 6]. PSCI not only severely affects the daily living ability of patients, but also imposes a heavy burden on the global aging society and health system [7]. Owing to their impaired memory, execution and cognitive function, PSCI patients have difficulty restoring their daily life and social ability after discharge, and are prone to readmission due to improper care [8, 9]. Good readiness for hospital discharge (RHD) is the key to improving patient prognosis.

Fenwick first proposed the concept of " readiness for hospital discharge " in 1979, which refers to the comprehensive assessment of a patient's physical, psychological and social health status by medical staff, and the analysis and judgment of whether the patient has the ability to leave the hospital, return to society and further recover [10]. Galvin suggested that RHD is both a state and a process, and summarized the attributes of RHD as: physical stability, adequate support, psychological ability, and adequate information and knowledge [11]. At present, the content of RHD is not completely unified, and there are still some differences in the terms used to describe RHD. However, the importance of RHD to patients, hospitals and society has been supported by a number of studies. Patients with good RHD have shortened hospitalization days, a reduced risk of readmission, accelerated turnover of hospital beds, and improved utilization of social medical resources [12–14]. Most stroke survivors face varying degrees of cognitive and functional challenges, such as limb motor dysfunction, aphasia, dysphagia, and cognitive decline [15]. This increases the difficulty of home care after discharge, and the risk of readmission for patients with deteriorating health status after discharge is greater if they are not prepared for discharge [16]. PSCI patients may have impaired memory, executive function and learning ability [5]. Patients are more likely to have a lower level of readiness, which may complicate the self-management ability of stroke survivors after discharge. These factors cause the daily life and health management of patients after discharge to face more challenges, such as post-discharge coping difficulties, unplanned readmission or social isolation.

Social isolation refers to a reduction in individual contact with the outside world, a lack of social belonging and social satisfaction, and a lack of substantial and high-quality relationships [17]. Studies have shown that social isolation is associated with loneliness, cognitive decline and increased readmission rates in elderly individuals, which seriously threatens quality of life and even increases the risk of death [18, 19]. Social isolation is associated with an increased risk of stroke, which not only delays the recovery process of stroke patients, but also may lead to higher recurrence rates and worse quality of life [20, 21]. According to the theory of social support, social support networks can provide emotional support and practical help when individuals encounter health problems. A lack of such support may lead patients to be more likely to be isolated [22, 23]. Therefore, we speculate that patients with inadequate RHD are more likely to experience social isolation, and that adequate RHD may be crucial for alleviating social isolation and promoting the rehabilitation of patients with cognitive impairment.

The intersection between RHD and social isolation in PSCI represents a critical yet understudied area, while previous studies have established RHD's association with reduced readmission rates and improved medication adherence in general stroke patients [24, 25], significant knowledge gaps remain. Notably, Current assessments of readiness for hospital discharge often overlook cognitive-specific barriers and predominantly focuses on physical rehabilitation outcomes, with limited exploration of psychosocial consequences. Therefore, the purpose of this study was to investigate the current status of RHD in patients with PSCI, analyze its potential influencing factors, and explore the relationship between RHD and social isolation after discharge. Understanding this relationship will help improve discharge planning and post-discharge care, which may reduce social isolation and improve rehabilitation outcomes.

Materials and methods

Design

This study was an observational study and was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [26].

Setting

This study conducted a formal survey from August 2023 -- December 2023, and the survey was conducted in the Department of Neurology, a tertiary hospital in Zhejiang Province, China. Before the investigation, all participants were required to sign an informed consent form, and patients were guided by systematically trained nursing staff to fill out the questionnaire. If the patient could not understand the content of the questionnaire, the researchers provided oral explanations. On the day of discharge, the paper questionnaire was distributed to the inpatients. Before filling in the questionnaire, the researcher explained the purpose, method and standard of the questionnaire to the patients and their families. After completing the questionnaire, trained researchers collected and checked the integrity of the questionnaire on the spot, corrected the logical error of the questionnaire, or excluded the unqualified questionnaire. Post-discharge social isolation was investigated via outpatient follow-up visits or telephone interviews on the 30th day after discharge.

Participants

A convenience sampling method was used to recruit participants. The inclusion criteria were as follows: (1) age ≥ 18 years; (2) had a clinical diagnosis or imaging diagnosis of stroke; (3) had cognitive impairment, with a Montreal Cognitive Assessment (MoCA) score < 26 (this study obtained the permission of the MoCA); (4) was clearly conscious, had no communication barriers, could cooperate to complete the investigation; and (5) signed an informed consent form and volunteered to participate in this study.

The exclusion criteria were as follows: (1) patients diagnosed with dementia; (2) patients with audio-visual disorders and mental disorders; and (3) National Institutes of Health Stroke Scale (NIHSS) score ≥ 16 points [27].

Sampling

The purpose of this study was to explore the current situation of RHD in PSCI patients. The sample size calculation formula of a cross-sectional study can be used to estimate the sample size. Owing to the lack of literature on RHD in stroke patients, this study conducted a pre-survey to estimate the required sample size. A pilot survey distributed 30 questionnaires, with 27 valid responses collected. The expected standard deviation (SD) of RHD of PSCI patients was 26.1, and the bilateral test (α) was required to be 0.05, with an allowable error (δ) of 5. The sample size was calculated according to the following formula. The required sample size was 105 patients. Considering a loss rate of 20%, the minimum sample size required for this study was 132 cases.

$$n = \left(\frac{z_{1-\alpha/2} * \sigma}{\delta} \right)^2$$

Measurement

Demographic and disease-related questionnaire

The questionnaire was designed on the basis of the literature review and discussion of the research team members. It consists of two parts. The first part explains the purpose of this study and the standard of completing the questionnaire to patients. The second part collected the patient's demographic information and disease-related information. Demographic information included gender, age, education level, marriages, occupation, family annual income, residence, and primary caregivers after discharge; disease-related information included stroke type, whether the first onset, hospitalization days, National Institutes of Health Stroke Scale (NIHSS) score, history of past illness, and family medical history.

Montreal cognitive assessment (MoCA)

The MoCA was developed by Nasreddine in 2005 based on the Mini-Mental State Examination (MMSE) [28], and is used to evaluate the cognitive function of patients. The MoCA can evaluate patients' short-term memory, visuospatial abilities, executive functions, attention, language and orientation to time and place, with a total of 30 items, the correct answer is 1 point, the wrong answer is not scored, and the total score is 30 points. The Cronbach's α coefficient of the Chinese version was 0.88. The scale is suitable for screening for mild cognitive impairment after stroke, and has good detection ability in executive function, which can be used for the evaluation of PSCI in acute stage. A total score > 26 points indicated normal cognitive function; a total score of 20–25 points indicated mild cognitive impairment; a total score of 16–19 points indicated moderate cognitive impairment; and a total score ≤ 15 points indicated severe cognitive impairment.

The readiness for hospital discharge scale (RHDS)

The tool was jointly developed by Weiss and Piacentine to evaluate the RHD of patients [29]. Lin translated the scale into Chinese in 2014 [30]. The RHDS has 12 items, and each item is given a score of 0–10 points, with a total score of 120 points. The higher the score is, the better the readiness for hospital discharge. The RHDS score was divided into four grades, representing very high (9–10), high (8–8.9), medium (7–7.9) and low (< 7) levels of readiness for hospital discharge. The Chinese version of the RHDS is divided into three dimensions: personal status (3 items), coping ability (5 items) and expected support (4 items). The Cronbach's α coefficient of the overall scale

was 0.89, and the Cronbach's α coefficients of the three subscales were 0.73, 0.90 and 0.89, respectively.

Lubben social network scale (LSNS)

The LSNS is a brief instrument compiled by Lubben and is designed to gauge social isolation in older adults by measuring perceived social support received by family and friends [31]. It was originally developed in 1988 and was revised in 2002 (LSNS-R) along with an abbreviated version (LSNS-6) and an expanded version (LSNS-18). In this study, the official Chinese version of LSNS-6 was obtained through the standard protocol from the Boston University research team's designated platform. Formal permission was secured by completing the required demographic form detailing our research objectives and methodology. [32]. The LSNS-6 includes two dimensions: the family network and the friend network. There are three items in each dimension. The score of each item is 0–5 points, and the total score is 0–30 points. A total score < 12 points indicates the existence of social isolation. The higher the score, the lower the risk of social isolation. A family network or friend network dimension score < 6 points, indicates the existence of family isolation or friend isolation. The Cronbach's α coefficient of the LSNS-6 was 0.83.

Statistical methods

Microsoft Excel was used for data entry, and IBM SPSS Statistics 26.0 was used for statistical analysis. Measurement data conforming to a normal distribution were described by means and standard deviations (SDs), verified by Shapiro-Wilk tests ($P > 0.05$). Categorical data are presented as frequencies and percentages. To analyze the differences in RHD among patients with different characteristics, parametric tests were selected after confirming assumption compliance: one-way analysis of variance with Levene's test for homogeneity of variance ($P > 0.05$) and independent t-tests with equal variance assumption confirmed by F-test were used for comparisons. The variables with statistical significance in the univariate analysis were included in the multivariate linear regression analysis to explore the influencing factors of RHD in PSCI patients. Pearson correlation analysis was used to analyze the correlation between RHD and social isolation after discharge. All statistical tests maintained $\alpha = 0.05$ with two-tailed interpretation. $P < 0.05$ was considered statistically significant.

Results

Characteristics of the participants

In this study, a total of 170 patients were investigated. Among them, 15 patients failed to complete the follow-up due to death (2 patients), loss to follow-up (8 patients) and refusal of follow-up (5patients). Finally, data from 155 patients were effectively collected, and the effective rate was 91.2%. Among the 155 patients included in the study, 97 were males (62.6%), 86 patients (55.5%) had an education level of elementary school or below, 105 were married patients (67.7%), 80 were retired or unemployed patients (51.6%), 106 patients (68.4%) had an annual household income between 80,000 and 290,000 yuan, and 82 patients (52.9%) lived in cities. There were 98 patients (63.2%) who were mainly taken care of by family members after discharge, 116 patients (74.8%) with ischemic stroke, 122 patients (78.7%) with first occurrence, 132 patients (85.2%) with other chronic diseases, and 102 patients (65.8%) without family history. The age of the patients ranged from 38 to 97 years (M ± SD, 66.03 ± 12.44 years), the length of hospital stay ranged from 3 to 18 days (M ± SD, 9.33 ± 3.19 days), and the NIHSS score ranged from 1 to 26 points (M ± SD,10.54 ± 6.02 points). The specific general information is shown in Table 1.

Current status of the RHD

The total RHDS score of the 155 patients ranged from 67 to 111 (M ± SD, 87.46 ± 9.64) points, of which 58 (37.4%) patients had inadequate readiness, and the total score of the scale was less than 84 points. 65 (41.9%) patients had moderate RHD, and only 32 (20.7%) patients had high RHD. The score of the patients' personal status dimension ranged from 16 to 27 (M ± SD, 20.63 ± 2.42) points, and 80 (51.6%) patients had inadequate readiness in the personal status dimension. The score of the patients' coping ability dimension ranged from 25 to 47 (M ± SD, 36.64 ± 4.45), and 58 (37.4%) patients had inadequate readiness in the coping ability dimension. The score of patients' expected support dimension ranged from 23 to 38 (M ± SD, 30.19 ± 3.38), and 36 (23.2%) patients had inadequate readiness in the expected support dimension. The scores of each dimension are shown in Table 2.

Univariate analysis of RHD

The results of the univariate analysis revealed that the differences in age, education level, employment status, annual household income, residence, whether first occur, length of hospitalization, whether with other chronic diseases, NIHSS score and MoCA score in PSCI patients were statistically significant ($P < 0.05$), as shown in Table 1.

Multivariate analysis of RHD

The RHDS scores were used as the dependent variables, and the statistically significant variables in the univariate analysis were used as independent variables for multiple linear regression analysis. Multiple linear regression analysis identified annual household income ($\beta = 0.274$, $P < 0.01$), residence ($\beta = 0.163$, $P < 0.05$) and the MoCA score ($\beta = 0.669$, $P < 0.01$) had a significant effect on RHD,

Table 1 Univariate analysis of general information and factors influencing RHD in patients with PSCI($n=155$)

Characteristic	*n* (%)	Mean ± SD [a]	t/F	*P*
Gender			1.22	0.225
Male	97(62.6)	7.35 ± 0.79		
Female	58(37.4)	7.19 ± 0.82		
Age(years)			6.23	< 0.001**
< 65	71(45.8)	7.68 ± 0.81		
≥ 65	84(54.2)	6.95 ± 0.63		
Education level			10.62	< 0.001**
Elementary school or below	86(55.5)	7.07 ± 0.68		
High school	52(33.5)	7.44 ± 0.88		
College degree or above	17(11.0)	7.92 ± 0.75		
Marital status			0.34	0.733
Married	105(67.7)	7.27 ± 0.80		
Single/Widowed/Divorced	50(32.3)	7.32 ± 0.82		
Employment status			3.29	0.001**
Employed	75(48.4)	7.50 ± 0.87		
Retired/Unemployed	80(51.6)	7.09 ± 0.68		
Annual household income (thousands/year RMB)			11.26	< 0.001**
< 80	26(16.8)	6.56 ± 0.62		
80 ~ 149	62(40.0)	7.27 ± 0.69		
150 ~ 299	44(28.4)	7.44 ± 0.81		
300 ~ 999	16(10.3)	7.75 ± 0.80		
≥ 1000	7(4.5)	8.13 ± 0.27		
Residence			-5.30	< 0.001**
Rural area	73(47.1)	6.96 ± 0.66		
City	82(52.9)	7.58 ± 0.81		
Primary caregiver			0.75	0.476
Family members	98(63.2)	7.29 ± 0.79		
Relatives and friends	25(16.1)	7.15 ± 0.80		
Nursing personnel	32(20.7)	7.41 ± 0.86		
Stroke type			2.25	0.109
Ischemic	116(74.8)	7.21 ± 0.80		
Hemorrhagic	24(15.5)	7.58 ± 0.73		
Transient ischemic attack (TIA)	15(9.7)	7.40 ± 0.85		
Whether first occur			2.67	0.010*
First occurrence	122(78.7)	7.37 ± 0.82		
Recrudesce	33(21.3)	7.00 ± 0.67		
Length of hospitalization (day)			5.33	< 0.001**
< 10[b]	90(58.1)	7.56 ± 0.80		
≥ 10	65(41.9)	6.92 ± 0.64		
With other chronic diseases			2.47	0.015*
No	23(14.8)	7.66 ± 0.74		
Yes	132(85.2)	7.22 ± 0.80		
Family history			1.78	0.076
No	102(65.8)	7.37 ± 0.78		
Yes	53(31.2)	7.13 ± 0.82		
NIHSS scores [c]			22.95	< 0.001**
0 ~ 1	2(1.3)	8.89 ± 0.53		
2 ~ 4	38(24.5)	7.97 ± 0.71		
5 ~ 14	68(43.9)	7.25 ± 0.60		
15 ~ 20	44(28.4)	6.75 ± 0.66		
21 ~ 42	3(1.9)	6.47 ± 0.31		
MoCA scores [d]			101.46	< 0.001**
20 ~ 25	56(36.1)	8.04 ± 0.56		

Table 1 (continued)

Characteristic	*n* (%)	Mean ± SD [a]	t/F	*P*
16 ~ 19	69(44.5)	7.05 ± 0.53		
≤ 15	30(19.4)	6.44 ± 0.48		
LSNS-6 score [e]			-3.92	< 0.001**
< 12	67(43.2)	7.01 ± 0.72		
≥ 12	88(56.8)	7.50 ± 0.80		

[a] Standardized score for The Readiness for Hospital Discharge Scale; [b] According to the Brief Report on Stroke Center in China, 2022, the median length of hospital stay for stroke patients is 10 days; [c] National Institute of Health Stroke Scale; [d] Montreal Cognitive Assessment; [e] The abbreviated version of the Lubben Social Network Scale;

*$p < 0.05$, **$p < 0.01$

Table 2 Readiness for hospital discharge scale scores in PSCI patients

Dimensions	Items	Score range	Total score M(SD)	Standard score M(SD)	Inadequate readiness (%)[1)]	Well readiness (%)[2)]
Personal status	3	3 ~ 30	20.63 ± 2.42	6.88 ± 0.81	80(51.6)	75(48.4)
Coping ability	5	5 ~ 50	36.64 ± 4.45	7.33 ± 0.89	58(37.4)	97(62.6)
Expected support	4	4 ~ 40	30.19 ± 3.38	7.55 ± 0.85	36(23.2)	119(76.8)
RHDS	12	12 ~ 120	87.46 ± 9.64	7.29 ± 0.80	58(37.4)	97(62.6)

1)Standard score of RHDS < 7; 2) Standard score of RHDS ≥ 7

Table 3 Multiple linear regression analysis of factors influencing RHD in patients with PSCI

Independent variables	B	SE	β	t	*P*	VIF*
Constant	47.034	6.193		7.594	< 0.001**	
Age (year)	0.010	0.049	0.013	0.205	0.838	2.398
Education level	0.385	0.699	0.027	0.551	0.582	1.463
Employment status	0.052	0.947	0.003	0.053	0.958	1.525
Annual household income	2.551	0.429	0.274	5.946	< 0.001**	1.256
Residence	3.131	0.902	0.163	3.471	0.01*	1.303
Whether first occur	0.63	1.008	0.003	0.062	0.951	1.094
Length of hospitalization	-0.478	0.335	-0.158	-1.426	0.156	7.312
With other chronic diseases	1.629	1.194	0.060	1.365	0.175	1.157
NIHSS scores	0.109	0.187	0.068	0.584	0.560	8.091
MoCA scores	1.551	0.142	0.669	10.939	< 0.001**	2.221

Note: $R^2 = 0.757$, adjusted $R^2 = 0.740$;

Abbreviations: B, regression coefficient; SE, standard error; β, standardized regression coefficient; VIF, variance inflation factor

*$p < 0.05$, **$p < 0.01$

Table 4 Correlations between the NIHSS, MoCA, RHDS, and LSNS-6 scores (r)

	NIHSS	MoCA	RHDS	LSNS-6
NIHSS	1			
MoCA	-0.687**	1		
RHDS	-0.576**	0.790**	1	
LSNS-6	-0.300**	0.414**	0.448**	1

Abbreviations: NIHSS, National Institute of Health Stroke Scale; MoCA, Montreal Cognitive Assessment; RHDS, Readiness for Hospital Discharge Scale; LSNS-6, abbreviated version of the Lubben Social Network Scale

**$p < 0.01$

whereas other variables did not have a significant effect in multivariate analysis ($P > 0.05$). These results show that higher annual household income, living in the city and higher MoCA scores are associated with higher RHD, and the variance inflation factor (VIF) are < 10, indicating that the regression model does not have multicollinearity. See Table 3.

Relationship among stroke severity, cognitive impairment severity, readiness for hospital discharge, and social isolation

We used the NIHSS to evaluate the severity of stroke, the MoCA to evaluate the severity of cognitive impairment, the RHDS to evaluate readiness for hospital discharge, and the LSNS-6 to evaluate the degree of social isolation. Table 4; Fig. 1 show the correlations between these indicators. The results revealed that the NIHSS score was significantly negatively correlated with the LSNS-6 score (r=-0.30, $p < 0.01$), indicating that the more severe the stroke was, the greater the degree of social isolation. There was a significant positive correlation between the MoCA score and the LSNS-6 score ($r = 0.41$, $p < 0.01$),

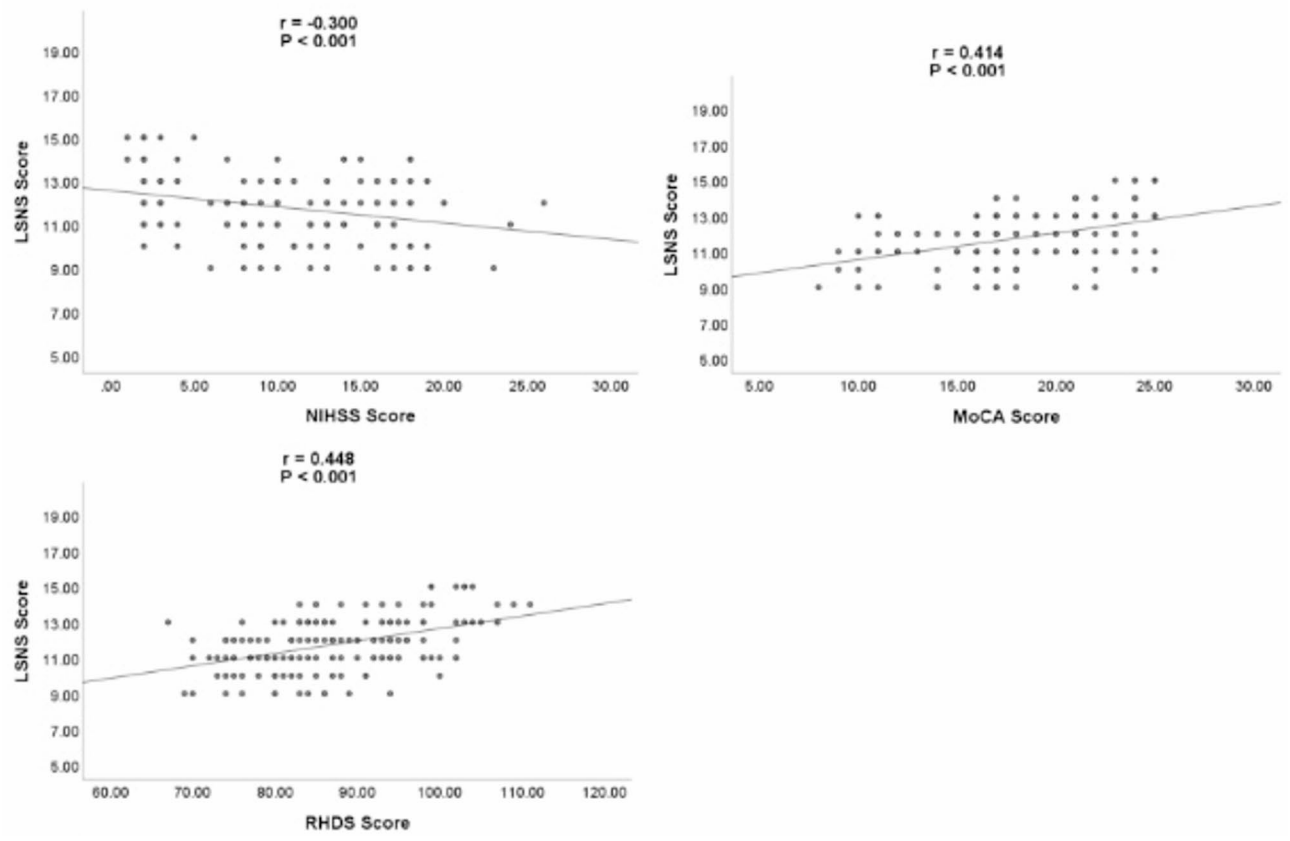

Fig. 1 Scatterplots with regression line show the correlations of LSNS score with NIHSS score, MoCA score and RHDS score

indicating that patients with severe cognitive impairment have difficulties in social recovery after discharge, which may affect their ability to adapt to rehabilitation. There was also a significant positive correlation between RHD and social isolation ($r = 0.45$, $p < 0.01$), suggesting that patients with low RHD may face greater risk of social isolation.

Discussion

This study explored the current status of RHD in PSCI patients and its relationship with social isolation after discharge. The RHD of PSCI was moderate (87.46 ± 9.64). Multiple linear regression analysis revealed that annual household income (β = 0.274, $P < 0.01$), residence (β = 0.163, $P < 0.05$) and the MoCA score (β = 0.669, $P < 0.01$) were the main factors affecting patients' RHD. Correlation analysis revealed that there was a significant correlation between stroke severity, cognitive impairment severity, RHD and post-discharge social isolation. Specifically, more severe stroke severity and cognitive impairment, as well as lower RHD, were associated with an increased probability of post-discharge social isolation.

The RHD of PSCI patients in this study was at a moderate level, consistent with findings by Li. Shuang et al. [15], suggesting the reliability of our results. Multiple linear regression analysis revealed that annual household income, residence and MoCA score were the main influencing factors of RHD in stroke patients. A higher annual household income can reduce the economic pressure of patients and their families in terms of medical expenses and rehabilitation costs [33]. This sense of economic security helps patients focus on postoperative rehabilitation and improve their RHD. In addition, this study revealed that the RHD of patients living in urban areas was significantly greater than that of patients living in rural areas, which was consistent with the results of Qian, Jingyu et al. [34], who reported that residence was an independent influencing factor of RHD. Medical institutions in cities are more concentrated, and patients can more easily obtain high-quality medical services and rehabilitation resources. However, medical resources in rural areas are relatively scarce, and medical facilities and professional nursing staff are insufficient. It is difficult for patients living in rural areas to obtain comprehensive rehabilitation guidance and services in time after surgery. The city's wider social support network, including community health centers, rehabilitation clubs and other institutions, as well as the support of relatives and friends, helps patients better prepare for discharge and rehabilitation. Patients with cognitive impairment

may have difficulties with information understanding, memory, and executive ability. They may not be able to fully understand complex medical information. Patients with cognitive impairment often experience by memory loss, making it difficult for them to remember the post-discharge care requirements and daily activity arrangements, thus affecting their readiness for hospital discharge [35, 36].

This study demonstrates a significant association between cognitive function and RHD potentially mediated by a range of neurobehavioral, psychosocial, and physiological mechanisms. Higher levels of cognitive functioning—particularly in domains such as memory and executive function—facilitate patients' comprehension of discharge education, medication management, and the ability to anticipate complications. Conversely, individuals with cognitive impairment exhibit reduced information processing capacity [37, 38], which markedly diminishes their RHD. Notably, disease-specific cognitive deficits, such as visuospatial impairments commonly observed in stroke patients, exert a disproportionately greater impact on RHD. From a mechanistic perspective, cognitive resources directly influence the execution of self-care behaviors through the "plan–action chain," and indirectly enhance patients' engagement through mediating factors such as self-efficacy and the effective utilization of social support [15, 39, 40]. These processes collectively foster patients' motivation to acquire disease-related knowledge and participate in rehabilitation, thereby promoting RHD. At the neurophysiological level, structural damage to the prefrontal cortex and the parietal-thalamic circuits—frequently observed in stroke—disrupts executive function networks [41, 42], adversely affecting post-discharge medication adherence and follow-up compliance. Furthermore, systemic inflammatory responses may exacerbate prefrontal dysfunction and impair working memory [43, 44], increasing the likelihood of failure in discharge preparation. These findings underscore the critical importance of developing targeted interventions aimed at enhancing cognitive function among stroke patients, with the goal of optimizing their readiness for hospital discharge.

This study shows that good RHD is significantly associated with lower risk of social isolation. By analyzing the reasons, higher RHD may reduce the risk of social isolation through three interrelated ways: first, self-efficacy may play an intermediary role in it. Good RHD can improve patients' self-efficacy, enhance self-management confidence, increase their willingness to participate in social activities and interact with others, and indirectly reduce social avoidance behavior and thus reduce the possibility of social isolation [45]. In contrast, patients who are not adequately prepared at discharge may lack sufficient self-efficacy, which may lead to less participation in social activities and increase the risk of social isolation [40]. Secondly, high RHD patients activate social participation opportunities through systematic discharge planning, such as community rehabilitation service referrals, have a greater probability of using community resources, increase the frequency of participation in stroke support groups, and patients who do not receive sufficient support and resources. Their social skills may be limited, further exacerbating social isolation [46]. Third, patients with high RHD usually have a good family and community support network, and caregivers build a' protective social network' through emotional support and instrumental support to help them better integrate into social life [47]. Education and training before discharge can improve the knowledge and skills of patients and their families in disease management, so that they can face the life after discharge more confidently [48]. In addition, patients with high RHD are usually confident in rehabilitation, and they are more likely to actively participate in social activities. Underprepared patients may feel anxious and upset, reducing their social enthusiasm [49, 50].

This study indicates that enhancing the RHD among patients may contribute to a reduction in social isolation. Improving RHD in PSCI patients requires multidimensional and individualized interventions. Central to this approach is the promotion of functional compensation and cognitive-behavioral adaptability through systematic assessment and dynamic intervention. Previous research has shown that inadequate RHD is often closely associated with reduced self-care ability, difficulties in environmental adaptation, and impaired comprehension of medical information, all of which may be consequences of cognitive dysfunction [51]. Therefore, the development of a discharge planning system led by multidisciplinary collaborative teams is essential. In clinical practice, standardized cognitive assessment tools—such as the MoCA and MMSE—should be employed in conjunction with measures of daily functional ability, such as the Activities of Daily Living (ADL) scale, to quantify patients' functional status. Based on these assessments, stepwise and tailored intervention programs should be designed. Compensatory cognitive strategies may include the use of external memory aids to support cognitive functioning, while structured health education interventions—such as visual medication reminder systems—can enhance patients' understanding of medical information [52, 53]. It is also important to address the negative effects of emotional disorders on cognitive rehabilitation. Psychological support and cognitive behavioral therapy should be integrated into routine nursing care [54]. Intervention strategies should be continuously refined through periodic reassessment, forming an iterative "assessment–intervention–feedback" management cycle. Ultimately,

this approach aims to improve patients' RHD and mitigate their risk of social isolation.

Although this study provides some insights into RHD and its relationship with social isolation in patients with PSCI, it has several limitations. The sample size of this study may be small and cannot fully represent all patients with PSCI. This study was designed as a cross-sectional study and the causal relationship could not be determined. Although a significant correlation between RHD and social isolation was found, it is not certain whether improvements in RHD directly lead to a reduction in social isolation. Although some confounding variables were controlled for in this study, other potential factors may influence the results, such as socioeconomic status, the family support system and mental health status. These factors have not been completely ruled out, which may have affected the results of the study.

Future research we consider expanding the sample size and conducting multi-center collaborations to enhance the generalizability and reliability of the findings, and to facilitate their application across different countries or regions. Future research in culturally diverse settings should incorporate regionspecific social determinants, implement localized interventions, and develop discharge planning protocols tailored to the demographic and cultural characteristics of each region. Longitudinal studies can be conducted to track the long-term data of patients after discharge to better explore the causal relationship between RHD and social isolation. Specific interventions for patients with PSCI, such as pre-discharge education, family support programs, and community resource provision, should be designed and evaluated, and the effectiveness of these interventions in improving patients' RHD and reducing social isolation should be evaluated.

Conclusion

This study revealed that the RHD of patients with PSCI is at a medium level, and the main factors affecting RHD include family annual income, residence and the MoCA score. Correlation analysis revealed a significant correlation between stroke severity, cognitive impairment severity, RHD and social isolation after discharge. These findings suggest that improving patients' RHD may help reduce social isolation and provide direction for optimizing post-stroke rehabilitation management. In clinical practice, more social and family support should be provided to PSCI patients to promote their social integration and quality of life.

Supplementary Information

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Supplementary Material 1

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Author contributions
L.G. led the design, statistical analysis and manuscript writing of this study. Q.S. participated in the experimental design and manuscript writing. L.C. provided important help in the experimental investigation and data extraction. S.D. provides important support in both statistical analysis and graphical visualization. Q.J. guided the entire process of this study, put forward valuable suggestions and helped write the manuscripts.

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Data availability
The authors affirm that the methods used in the data analyses are suitably applied to their data within their study design and context. The dataset analyzed in this study is not public, but can be obtained from the corresponding author according to reasonable requirements.

Declarations

Ethics approval and consent to participate
This study was ethically approved by the Ethics Review Committee of The First Hospital of Jiaxing (Reference No. 2023-LY-364). All procedures involving human participants were performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments. Informed consent was obtained from all individual participants included in the study. Written consent forms were signed by participants prior to data collection.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

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