

The Impact of Self-Perceived Burden on Loneliness in Stroke Patients: The Mediating Role of Rumination

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Background: Stroke outcomes are often measured through objective scales, which may neglect subtle cognitive changes and fail to capture patients' subjective experiences of recovery and quality of life. This study aimed to examine the interrelations among self-perceived burden, loneliness, and rumination in stroke survivors through the patient-reported outcomes and to provide theoretical insights and intervention strategies for improving psychological well-being and quality of life in stroke patients.

Methodology: Data from 1024 stroke patients who aged 18 years and above were prospectively collected in September 2022 in Zhengzhou, China. PROs included Self-Perceived Burden Scale, UCLA-Loneliness Scale, and Event-Related Rumination Inventory. Statistical methods employed included correlation analysis and mediation effect analysis.

Results: A total of 1024 participants completed this survey (90.9%), with 56.2% males and a mean age of 62.22 (SD = 13.60) years. Approximately 84.28% of stroke patients felt moderate loneliness. Self-perceived burden was positively correlated with rumination ($r = 0.516$, 95% CI [0.460, 0.574]) and loneliness ($r = 0.370$, 95% CI [0.307, 0.431]). Rumination was also positively associated with loneliness ($r = 0.493$, 95% CI [0.443, 0.541]). Both intrusive and deliberate rumination served as mediators in the relationship between SPB and loneliness ($b = 0.119$, 55.09%, $b = 0.031$, 14.35%, respectively).

Conclusion: Intrusive and deliberate rumination mediated the relationship between self-perceived burden and loneliness in stroke patients. Rumination in stroke patients should be emphasized as a modifiable factor to reduce loneliness and improve quality of life.

Plain Language Summary: Understanding how stroke patients' self-perceived burden (SPB) contributes to loneliness and the influencing of rumination between them could help improve their well-being and reduce negative outcomes. The focus was on exploring whether two types of rumination—intrusive and deliberate rumination—connect self-perceived burden to loneliness. Key findings showed that both intrusive and deliberate rumination played a role in connecting self-perceived burden with loneliness. Meanwhile, intrusive rumination has a stronger effect. This suggested that reducing repetitive negative thoughts, especially intrusive ones, and addressing more mental patterns in care plans might help lessen loneliness in stroke patients and improve their quality of life after stroke.

Keywords: stroke, self-perceived burden, loneliness, rumination, mediating effect

Introduction

Stroke represents a major global health challenge as it stands as a leading cause of death and long-term disability, characterized by its high incidence, substantial mortality rates, elevated recurrence, and a discernible trend toward

affecting individuals at increasingly younger ages.¹ Globally, stroke is the second leading cause of death. Data from the Global Burden of Disease Study (GBD) in 2019² indicated that the burden significantly increased (the number of people suffering strokes rose by 70.0%, stroke mortality increased by 43.0%, stroke prevalence went up by 102.0%, and DALYs increased by 143.0%) from 1990 to 2019. In China, the age-standardized prevalence rate of stroke was 1468.9/100,000 individuals, marking a 13.2% increase since 1990, which has the highest number of strokes in the world.² Furthermore, estimates from the National Center for Cardiovascular Diseases in China suggest that, as of 2021, approximately 13 million people in China have experienced a stroke,³ with about 75% of these survivors facing persistent functional impairments such as cognitive deficits, dysphagia, and motor dysfunction.⁴ These irreversible impairments profoundly reduce their quality of life, thereby posing a substantial burden on public health.⁵

Current findings in medical and psychological studies suggest that the repercussions of a stroke significantly transcend the physiological domain.⁶ Research indicates that stroke survivors frequently experience significant “feeling of being a burden to others”, a psychological state characterized by guilt, self-blame, and perceptions of being a “burden” to caregivers or society, due to increased dependency, role transitions, and uncertainty in recovery.⁷ Cousineau et al described this “feeling” as “self-perceived burden” (SPB) and defined it as

A multidimensional construct arising from the care recipient’s feelings of dependence and the resulting frustration and worry, which then may lead to negative feelings of guilt at being responsible for the caregiver’s hardship.⁸

McPherson discovered that 70.2% of stroke patients experience a moderate to high level of SPB.⁹ Social aging and lifestyle changes have amplified stroke risk factors in China over the past 30 years, leading to an increase in the SPB at the individual, familial, and societal levels.^{5,10–12} Concomitantly, substantial treatment expenses, reduced quality of life, and inadequate social support can result in significant mental strain and diminished confidence in disease management,^{13–15} both serving to intensify SPB and negatively influence rehabilitation outcomes, potentially increasing the risk of stroke recurrence.^{9,16} Furthermore, SPB may exacerbate loneliness, trapping patients in a vicious cycle of social withdrawal and emotional isolation. However, the intrinsic mechanisms underlying this psychological pathway remain inadequately elucidated.^{17,18} Rumination, particularly its two subtypes, intrusive rumination and deliberate rumination, may serve as critical mediators in this process.

Stroke patients, confronted with a challenging prognosis, high recurrence risk, and prolonged recovery, often engage in rumination, an ongoing cognitive process of self-reflection that can potentially foster personal growth after traumatic or significant life changes.^{19–21} Rumination is divided into intrusive rumination and deliberate rumination.²² According to the Response Styles Theory (RST), an individual’s initial response style (intrusive or deliberate) to stressors determines the trajectory of emotional outcomes.²³ Intrusive rumination, manifested as passive, repetitive focus on negative emotions and events, represents a rigid maladaptive response style. It may amplify catastrophic interpretations of SPB, exacerbating helplessness and social withdrawal, thereby directly intensifying loneliness. In contrast, deliberate rumination involves purposeful, goal-directed reflection, functioning as a problem-solving or meaning-making process.^{24,25} It may buffer the negative psycho-social effects of SPB through cognitive restructuring. Emotion Regulation Theory further posits that the impact of SPB on loneliness is not linear but exhibits differentiated effects mediated through two distinct rumination pathways.²⁶ Individuals’ adoption of either intrusive rumination or deliberate rumination strategies determines the efficacy of emotion regulation, ultimately leading to the exacerbation or alleviation of loneliness.

Loneliness, a subjective sensation characterized by feelings of isolation or a lack of companionship,²⁷ is a severe psychological issue affecting stroke patients, with 44% reporting feelings of loneliness.^{28,29} This is concerning, as studies have established a substantial correlation between loneliness and a greater risk for cardiovascular disease, further reinforcing its identification as a risk factor for stroke.^{30,31} The social withdrawal, aggressive behaviours, and suicidal ideation caused by loneliness can severely impair an individual’s social capabilities, ultimately reducing patients’ self-efficacy and their enthusiasm to participate in rehabilitation training, and delay functional recovery, even increase the risks of mortality and recurrence.^{32–35} While previous studies have documented the prevalence and consequences of SPB and loneliness, none have systematically investigated how different types of rumination mediate these associations. It is important to pay attention to and alleviate their loneliness to promote mental health and improve the rehabilitation effect

in the rehabilitation process of stroke patients. Moreover, existing research tends to treat rumination as a single construct, without distinguishing between its intrusive and deliberate forms. Therefore, this study addressed a critical gap in the literature by examining the mediating role of rumination in the relationship between SPB and loneliness among stroke patients, and put forward the following hypothesis: (1) there is a relationship between rumination, self-perceived burden, and loneliness; and (2) both intrusive rumination and deliberate rumination have mediating effects between self-perceived burden and loneliness. The theoretical framework is presented in Figure 1. The purpose of this study was to understand the distinctions between the two types of rumination and how they influence psychological adjustment, which is critical for optimizing intervention strategies for stroke patients, having practical implications for the development of targeted interventions to improve the psychological well-being of stroke survivors.

Materials and Methods

Design

A cross-sectional survey was conducted by using cluster sampling.

Participants

The investigation carried out in September 2022, utilized a whole-cluster sampling technique to conduct a cross-sectional questionnaire survey among stroke inpatients at the neurology departments of five tertiary-grade A hospitals within Henan Province. These hospitals were selected based on their geographic distribution and patient volume to ensure regional representation. The inclusion criteria were as follows: (1) adherence to the diagnostic standards specified by the 2019 “Chinese Clinical Management Guidelines for Cerebrovascular Diseases”,³⁶ confirmed through MRI or CT scans; (2) aged 18 years and above with a stable clinical condition; (3) informed and willing participation in the study with clear consciousness and communication capabilities; (4) proficiency of using smartphones by either the patient or their caregivers. The exclusion criteria included: (1) individuals with major somatic diseases such as malignant tumors that hindered self-care; (2) individuals who had a diagnosis of psychiatric disease; (3) individuals engaging in other research studies concurrently with this investigation. A total of 1126 questionnaires were distributed, with 1024 valid responses collected, resulting in an effective response rate of 90.9%.

Data Collection

Following the acquisition of consent and collaboration from the administration of five hospitals, the investigators utilized the Questionnaire Star platform for the dissemination and retrieval of surveys. The research team transmitted the survey link to rigorously trained researchers, who employed a standardized script to elaborate on the study’s objectives to patients meeting the inclusion and exclusion criteria. They informed them of key points regarding the completion of the questionnaire and secured informed consent before distributing the questionnaire for completion. Respondents were encouraged to finish and submit within 30 minutes to ensure the authenticity and integrity of the data.

In cases where patients or their family members were unable to complete the questionnaire due to literacy or cognitive impairments, interviewers systematically inquired about the survey items and filled them out on the patient’s

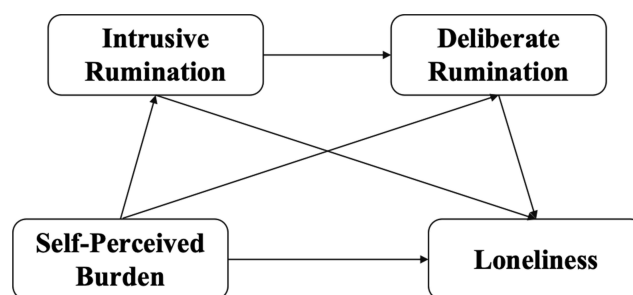


Figure 1 Hypothesis theoretical model of mediation.

behalf based on their responses. To ensure survey completeness, all questions were made compulsory, and the survey was limited to one response per IP address.

Tools

Demographic and Clinical Characteristics

The questionnaire assessing demographic and clinical characteristics was developed by researchers, drawing upon an extensive review of the literature. It encompassed variables such as age, gender, employment status, place of residence, marital status, whether the participant lives alone, average monthly family income, type of stroke, and presence of a family history of stroke.

Self-Perceived Burden Scale

The self-perceived burden was assessed using the abbreviated version of Self-Perceived Burden Scale (SPBS).⁸ The SPBS is designed to quantify patients' subjective sense of being a burden to others, encompassing physical, emotional, and economic dimensions. This scale is composed of 10 items across three domains. Each item utilizes a 5-point Likert scale, which ranges from 1 ("none of the time") to 5 ("all of the time"). The total score ranges from 10 to 50, where higher scores signify a more profound sense of perceived burden. For analytical purposes, the total score is stratified into four ordinal categories reflecting the burden's severity: none (10–19), mild (20–29), moderate (30–39), and severe (40–50). The Chinese version of the SPBS has demonstrated satisfactory content validity and internal consistency reliability within a population of Chinese cancer patients.³⁷ The Cronbach's α was 0.923 in the current study.

UCLA-Loneliness Scale

The UCLA-Loneliness Scale³⁸ is a widely adopted questionnaire for assessing self-reported feelings of loneliness. The scale consists of 20 items, with 10 positively and 10 negatively worded statements, each of which is rated on a 4-point Likert scale (1 = "never", 2 = "rarely", 3 = "sometimes", 4 = "often"). The total score is obtained by summing all items, which ranges from 20 to 80. Notably, scores for nine of the positively worded items are reversed before being summed. Higher scores correspond to increased levels of loneliness. The internal consistency was acceptable among this sample (Cronbach's $\alpha = 0.824$).

Event-Related Rumination Inventory

The Event-Related Rumination Inventory (ERRI) was developed as a revision to the Rumination Scale³⁹ by Cann et al.²² This instrument comprises 2 subscales: intrusive rumination ("I thought about the event when I didn't mean to") and deliberate rumination ("I decided to think about the experience to try and make sense out of what happened"), each containing 10 items. Responses on the ERRI are measured using a 4-point Likert scale, where higher scores indicate elevated levels of rumination. Dong et al⁴⁰ translated and tested it, and the findings from their study indicated that the Chinese version of the ERRI exhibits acceptable internal consistency, as evidenced by a Cronbach's α coefficient of 0.92. The Cronbach's α was 0.967 in the current study.

Ethical Considerations

Ethical approval for this study was granted by the Ethics Committee of the First Affiliated Hospital of Zhengzhou University (Ethic review number: 2022-KY-1168001). Informed consent was obtained from all participants, who were briefed on the study's objectives. The research has strictly adhered to the ethical principles outlined in the Declaration of Helsinki. To safeguard participants' privacy and human rights, data were collected anonymously.

Data Analysis

The data were analyzed using the SPSS 26.0 and AMOS 28.0 for the Windows software. The sociodemographic characteristics of the participants and other related variables were analyzed using descriptive statistics, which included the computation of frequencies, percentages, means, standard deviations, and the range of scores. Structural Equation Modeling (SEM) was employed to construct a theoretical model, which allows for the estimation of complex relationships between observed and latent variables, including direct and indirect effects, using a combination of factor analysis

and regression analysis methods.⁴¹ Mediation effects were examined using the Bootstrap technique, which resamples the data to generate an empirical distribution of indirect effects and estimate their significance, providing more accurate results for small sample sizes. The number of resamples was set at 5000 to establish a 95% confidence interval. Statistical significance was inferred at a P-value threshold of less than 0.05.

Results

Characteristics of the Participants

A total of 1024 stroke patients were included in this study and the mean age of the patients was (62.22 ± 13.60) years old. The details of the participants are described in Table 1.

This study found that stroke patients had an average loneliness score of (49.05 ± 7.95), SPB score of (28.69 ± 8.32), and rumination score of (45.42 ± 12.63), as detailed in Table 2. Among the surveyed individuals, 12.79% reported mild loneliness, 84.28% felt moderate loneliness, and overall, the level of loneliness was considered moderate. A very small portion of respondents indicated no SPB, while the proportions of patients with mild, moderate, and severe SPB were 33.30%, 38.18%, and 8.30%, respectively. Moreover, the overall score for rumination was below average. Correlation analysis of the three variables, as shown in Table 2, indicated that loneliness was positively correlated with SPB and rumination and that intrusive and deliberate rumination were also positively correlated ($P < 0.01$).

Common Method Bias Test

To assess potential common method bias, Harman's single-factor test was employed, which involves performing an exploratory factor analysis (EFA) on all items from the SPBS, C-ERRI, and UCLA Scale. This method examines whether

Table 1 Demographic and Clinical Characteristics of the Stroke Patients (N = 1024)

Factors	Group	N	%
Age	18-29	19	1.9
	30-39	46	4.5
	40-49	100	9.8
	50-59	243	23.7
	60-69	294	28.7
	70-79	232	22.6
	≥80	90	8.8
Gender	Male	575	56.2
	Female	449	43.8
Highest educational qualification	Primary school or below	421	41.1
	Middle school	330	32.2
	Senior high school	140	13.7
	Undergraduate college or above	133	13.0
Marital status	Unmarried	41	4.0
	Married	877	85.6
	Divorced	14	1.4
	Widowed	92	9.0
Live alone	Yes	120	11.7
	No	904	88.3
Monthly income (RMB)	<3000	529	51.6
	3000–5000	422	41.2
	5000–10,000	62	6.1
	>10,000	11	1.1
Type of stroke	Ischemic stroke	842	82.2
	Haemorrhagic stroke	182	17.8
Family history of stroke	Have	156	15.2
	No	868	84.8

Table 2 Descriptive Statistics and Correlation Analysis Among Variables (N = 1024)

Variables	Range of Score	Mean (SD)	Pearson Correlation Coefficient				
			(1)	(2)	(3)	(4)	(5)
(1) Self-perceived burden	10-50	28.69 (8.32)	I				
(2) Loneliness	20-80	49.05 (7.95)	0.370**	I			
(3) Rumination	20-80	45.42 (12.63)	0.516**	0.493**	I		
(4) Intrusive rumination	10-40	22.38 (6.71)	0.476**	0.471**	0.952**	I	
(5) Deliberate rumination	10-40	23.04 (6.57)	0.507**	0.467**	0.950**	0.809**	I

Note: **P < 0.01.

a single factor accounts for most of the variance, which could indicate that method biases influence the results.⁴² The results indicated that there were six factors with eigenvalues greater than 1 in the unrotated principal component analysis, accounting for 63.522% of the variance, which is below the threshold for significant common method bias.

Mediating Effects of Intrusive Rumination and Deliberate Rumination

The mediating effects of intrusive and deliberate rumination on the relationship between SPB and loneliness are shown in Table 3, with the final path model in Figure 2. The results indicate that the final path model exhibited acceptable fit indices, as detailed in Table 4. The total effect of SPB on loneliness was significant ($b = 0.383$). The direct effect was 0.167, accounting for 43.60% of the total effect, while the mediating effect was 0.216, representing 56.40%. Within the mediating effect, both intrusive and deliberate rumination significantly mediated the relationship between SPB and loneliness, accounting for 55.09% and 14.35% of the mediating effect, respectively. Additionally, the chain mediation from intrusive rumination to deliberate rumination was also significant, constituting 30.55% of the total mediating effect.

Discussion

The present study investigated the current status of SPB, rumination, and loneliness among stroke patients and explored the mediating roles among these variables. The results revealed that SPB, rumination, and loneliness were significantly correlated. Furthermore, both intrusive and deliberate rumination served as significant mediators in the relationship

Table 3 Mediating Effects of Intrusive Rumination and Deliberate Rumination on the Relationships Between SPB and Loneliness (N = 1024)

Model Pathway	Point Estimate	Product of Coefficients		Bootstrap			
				Bias-Corrected 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
Total effects							
SPB→Loneliness	0.383	0.034	11.265	0.314	0.446	0.315	0.448
Direct effects							
SPB→Loneliness	0.167	0.038	4.395	0.090	0.239	0.091	0.240
Indirect effects							
Total Indirect Effects	0.216	0.021	10.286	0.175	0.259	0.175	0.259
SPB→IR→Loneliness	0.119	0.022	5.409	0.078	0.165	0.077	0.163
SPB→DR→Loneliness	0.031	0.009	3.444	0.015	0.051	0.014	0.049
SPB→IR→DR→Loneliness	0.066	0.018	3.667	0.033	0.102	0.033	0.101

Note: Bootstrap replicates = 5000.

Abbreviations: SPB, Self-perceived burden; IR, Intrusive rumination; DR, Deliberate rumination.

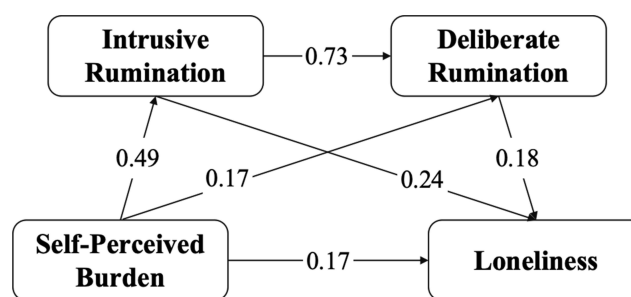


Figure 2 Results of the final path model (N = 1024).

between SPB and loneliness. Additionally, the findings also supported that the mediating effect of intrusive rumination was stronger than that of deliberate rumination in this context.

In this study, the proportion of stroke patients whose SPB is moderate to high reached 83.30%, notably exceeding the 70.2% reported by McPherson et al⁹ in 2010. While the mean SPB scores in this study were similar to the acute and one-month post-stroke figures in Wei et al's longitudinal study,⁴³ the high SPB may also be influenced by factors such as persistent functional impairments and the increased survival rates of stroke patients. More compelling factors include the growing prevalence of chronic conditions such as hypertension and diabetes, which increase stroke risk in the elderly.⁴⁴ Furthermore, cultural differences may influence the way SPB is perceived and expressed. In some Western cultures, the focus may be on individual independence, and self-reliance may lead to more pronounced feelings of guilt and helplessness when stroke survivors cannot perform daily activities independently. In contrast, Chinese culture, with its emphasis on family interconnectedness and filial piety, may place greater pressure on caregivers, resulting in a different experience of burden. For example, a Chinese study by Ren et al highlighted that many Chinese stroke patients felt a heightened sense of burden due to dependency on family members, which was compounded by financial stress and the role strain experienced by family caregivers.⁴⁵ Additionally, the impact of the COVID-19 pandemic has resulted in increased treatment costs, while economic resources have diminished, thereby further intensifying patients' sense of burden.⁴⁶ This study also found that the level of ruminative reflection among patients was generally below average (score of 45.42 ± 12.63), consistent with the findings by Kelly et al,⁴⁷ suggesting that rumination may not be as prominent a concern as other psychosocial challenges posed by stroke. Moreover, stroke patients experience a high level of loneliness, which aligns with the findings of Byrne et al in Wales.²⁸ Severe loneliness could be associated with post-stroke functional disabilities, decreased social engagement, and changes in interpersonal relationships, all of which might elicit psychological and emotional issues. Therefore, addressing loneliness in post-stroke patients is crucial to improving their overall well-being and quality of life.

Consistent with previous studies,^{29,48,49} this research found a positive correlation between SPB and loneliness in stroke patients. Those with greater SPB tend to experience higher levels of loneliness. Many stroke patients, facing various degrees of functional impairments, often perceive themselves as imposing a significant burden on their caregivers in terms of financial, emotional, and time-related aspects.⁷ This can lead to guilt and diminished self-worth, potentially causing isolation and thereby exacerbating loneliness.⁵⁰ Furthermore, strokes often compel individuals to adopt new, typically more passive roles, thereby altering their identities within the family and community. This transformation can exacerbate the loneliness experienced by those who perceive themselves as burden bearers within their new roles.

Table 4 Fitting Indicators and Evaluation Criteria

Fit Index	χ^2 /df	RMSEA	GFI	AGFI	NFI	IFI	CFI
Index value	1.404	0.020	0.997	0.991	0.998	0.999	0.999
Evaluation criteria	1-3	<0.05	>0.90	>0.90	>0.90	>0.90	>0.90

Abbreviations: χ^2 /df, Chi-square/degree of freedom; RMSEA, root mean square error of approximation; GFI, goodness-of-fit index; AGFI, adjusted-goodness-of-fit index; NFI, normed fit index; IFI, incremental fit index; CFI, comparative fit index.

Additionally, cognitive and communicative barriers make it challenging for patients to express their needs and thoughts, leading to further self-isolation and intensified loneliness.⁵¹

This study provides evidence for the mediating role of both intrusive and deliberate rumination in the relationship between self-perceived burden (SPB) and loneliness in stroke patients. Facing a range of functional impairments, stroke patients may engage in repetitive contemplation of their limitations and adversities as they adapt to altered lifestyles.⁵² The persistent remembrance of their stroke, health worries, and fear of the future can weaken their emotional stability, contributing to anxiety, depression, and loneliness. This usually results in social withdrawal and reduced social interaction, further underpinning loneliness.⁵³ These findings are consistent with the Response Styles Theory, suggesting that individuals who engage in more passive, repetitive thinking are more likely to experience increased loneliness and psychological distress. Some patients quickly shift their focus to deliberate ruminations—constructive thoughts on rehabilitation and prevention of stroke recurrence. Yet, without effective support, even these ruminations can become burdensome and lead to a negative cycle that deepens loneliness. Moreover, the positive correlation between intrusive and deliberate rumination observed among stroke patients aligns with past research findings.^{43,54} Patients may transition from intrusive to deliberate ruminations in the hope of finding solutions but may be frustrated by the inability to identify satisfactory outcomes due to psychological or physiological constraints.⁵⁵ When stroke patients perceive a high SPB, they may oscillate between both states of rumination, with acute phases likely favoring intrusive rumination and subsequent recognition of the detrimental cycle of negativity prompting a shift toward deliberate rumination. The frustration from failure of deliberate rumination can lead to an increase in intrusive rumination, deepening SPB, continuing to impact emotional states and recovery progress, thus enhancing loneliness and isolation.

As anticipated, a chain-mediated effect exists between intrusive and deliberate ruminative reflection among stroke patients, linking SPB loneliness. In other words, SPB may provoke intrusive rumination, leading to deliberate rumination, and ultimately exacerbating loneliness. The study also found that intrusive rumination has a stronger mediating role between SPB and loneliness, likely due to its inherently negative nature. Furthermore, face-saving is significant to many Chinese people, and stroke patients may conceal negative emotions to preserve their face, as stroke patients might suppress negative emotions to preserve their dignity, thereby intensifying intrusive rumination and loneliness. The findings suggest that psychological interventions emphasizing the reduction of intrusive thoughts and support for deliberate rumination are vital for stroke patients. Therapeutic strategies, such as cognitive-behavioral therapy, psychosocial support, and proactive rehabilitation, can break the cycle of negative rumination, alleviate emotional burdens, promote positive adaptation, and reduce loneliness. The provision of such support is crucial for the psychological well-being of stroke patients.

Conclusions

In conclusion, both intrusive and deliberate rumination were found to play a mediating role in the relationship between the self-perceived burden and loneliness, with intrusive rumination having a stronger effect. This underscores the importance for health-care professionals to closely assess stroke patients' rumination in clinical practice, particularly implementing measures to reduce patients' intrusive rumination, such as cognitive-behavioral therapy. By enhancing patients' social interaction and improving overall psychological well-being, the quality of life can be elevated.

Nevertheless, several limitations must be acknowledged. Firstly, the study's cross-sectional design restricts the ability to infer causal relationships. Future research should employ a longitudinal design to explore the interactive relationships among these variables over time. Secondly, the exclusion of participants with diagnosed psychiatric disorders, such as depression, may have led to an underrepresentation of individuals with post-stroke depression (PSD) or post-traumatic stress disorder (PTSD), both of which are common and often underdiagnosed in stroke patients. These conditions are frequently associated with rumination, and their exclusion might have resulted in the underestimation of rumination's role in mediating the relationship between self-perceived burden (SPB) and loneliness. Future studies should include these populations and consider depression and PTSD as additional variables to better understand the full psychological impact of stroke and its interaction with rumination.

Data Sharing Statement

The data used to support the findings of this study are available from the corresponding author (Yanjin Liu, liuyanjin0409@163.com) or first author (Xinxin Zhou, zhouxinxin_1212@163.com).

Ethics Approval and Informed Consent

Ethical approval for this study was granted by the Ethics Committee of the First Affiliated Hospital of Zhengzhou University (Ethic review number: 2022-KY-1168001). Informed consent was obtained from all participants, who were briefed on the study's objectives. The research has strictly adhered to the ethical principles outlined in the Declaration of Helsinki. To safeguard participants' privacy and human rights, data were collected anonymously.

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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

The authors stated that they have no conflicts of interest in this work.

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