Received: 9 October 2023 | Revised: 24 July 2024 | Accepted: 15 August 2024

DOI: 10.1002/nop2.70020

EMPIRICAL RESEARCH QUANTITATIVE

NursingOpen Open Access WILEY

The relationships between quality of life with health literacy, social support and resilience in older stroke survivors: A structural equation model

Mei Chen[1] | Jinghong Li[2] | Chunyan Chen[1] | Qinghua Zhao[3] | Huanhuan Huang[3]

[1]Department of Nursing, Bishan Hospital of Chongqing (Bishan Hospital of Chongqing Medical University), Chongqing, China

[2]Department of Nursing, Chongqing Emergency Medical Center, Chongqing, China

[3]Department of Nursing, The First Affiliated Hospital of Chongqing Medical University, Chongqing, China

Correspondence
Qinghua Zhao and Huanhuan Huang, Department of Nursing, The First Affiliated Hospital of Chongqing Medical University, Chongqing, China.
Email: qh20063@163.com and hxuehao@126.com

Funding information
Medical Scientific Research Project of Bishan District, Grant/Award Number: BSKJ20210020; Youth scientific research innovation team project of Bishan Hospital of Chongqing, Grant/Award Number: BYKY-CX2023013

Abstract

Aim: To the determinants and the underlying mechanism of health literacy, social support, and resilience on the health-related quality of life (HRQoL) among older stroke survivors.

Design: A cross-sectional design was applied at four comprehensive hospitals in Chongqing via convenience sampling from January 2020 to June 2021.

Methods: Health literacy, social support, and resilience were designed as independent variables, and HRQoL was measured as a dependent variable. Structural equation modelling with the bootstrap method was used to test the hypotheses.

Results: The theoretically derived model exhibited a good fit (χ^2/df ratio = 2.830, GFI = 0.987, CFI = 0.978, RMSEA = 0.066). Health literacy ($\beta = 0.12$, $p < 0.05$) and social support ($\beta = 0.14$, $p < 0.05$) directly affect HRQoL. Resilience ($\beta = 0.40$, $p < 0.01$) also mediated the relationship between health literacy, social support, and HRQoL. The three variables explaining 29.0% of HRQoL variance.

Patient or Public Contribution: There was no direct patient or public involvement in the design, conduct, or reporting of this study. Participants were recruited through convenience sampling from four comprehensive hospitals in Chongqing, and their perspectives or contributions were not explicitly sought. The study focused on examining the determinants and underlying mechanism of health literacy, social support, and resilience on the health-related quality of life among older stroke survivors. Nonetheless, the findings of this research may inform the development of interventions aimed at improving the health-related quality of life in post-stroke older patients.

KEYWORDS
health literacy, health-related quality of life, nursing, older adults, resilience, social support, stroke

1 | INTRODUCTION

Globally, population aging is showing a clear trend, that is, the proportion of people aged 65 and over is increasing year by year (Tu et al., 2022). As the population ages, the incidence of stroke is also on the rise, especially among the older people (Wu et al., 2019). The incidence rate of stroke was between 78 and 134 per 100,000 population in the 40 to 49 years old age bracket, while increased to 943.2 per 100,000 population for those aged over 65 on 2019 (Ma et al., 2021). While survival remains a crucial determinant for this particular group, the health-related quality of life (HRQoL) after stroke is highly valued.

According to the World Health Organization, HRQoL refers to a multidimensional concept that assesses an individual's subjective perception of their physical, mental, and social well-being in relation to their health status or healthcare interventions (World Health Organization, 2012). By incorporating patients' perspectives and experiences, HRQoL assessment provides valuable insights for tailoring healthcare interventions, improving patient-centered care, and making informed decisions about healthcare resource allocation (Miguel et al., 2008). Thus, this field of research has become a priority, and continuous and combined efforts are warranted for the improvement of quality of life among poststroke patients by healthcare providers, patients, their families, and governments (Munce et al., 2017). However, despite the varied intervention options, a significant percentage of older stroke survivors reported poor HRQoL (Deb-Chatterji et al., 2022), and complex influencing factors are contributed to the low level of it.

Health literacy represents the mastery of tasks, which refer the ability of individuals to access and understand health information and apply it to maintain and promote their own health (Banbury et al., 2020). Previous research has shown a positive association between health literacy and HRQoL. Better health literacy helps patients make judgements and decisions concerning healthcare, disease prevention, and health promotion in their daily lives to maintain or improve quality of life over the course of life (Pham et al., 2022; Raddadi & Adib-Hajbaghery, 2022; Skoumalova et al., 2022). This ability to actively engage in health management may have a positive impact on the quality of life of older stroke survivors.

Social support means a sense of belonging and attachment with friends, families, or colleagues, including emotional and physical support (Langford et al., 1997). Studies have emphasized the importance of perceived social support on HRQoL (Alshraifeen et al., 2020; Singstad et al., 2021). Social support could provide emotional comfort and support to help older stroke survivors cope with psychological and physical challenges, thereby improving their life satisfaction.

Resilience, which could be viewed as a relatively stable psychological trait that enables individuals to respond to various stresses to maintain and promote healthy growth and a happy life (Davydov et al., 2010), also plays a vital role in the HRQoL. Geun et al. (2019) pointed out that improving patient resilience helps to achieve positive adjustment, particularly for patients with chronic diseases who focus on preventing complications and managing their disease.

Self-determination theory (SDT) is developed by Edward Deci and Richard Ryan in the 1980s, is a widely recognized theoretical framework in the field of psychology that aims to explain human motivation and well-being (Deci & Ryan, 1985). According to Wehmeyer (2001), self-determination is defined as 'acting as the primary causal agent in one's life and making choices and decisions regarding one's quality of life free from undue external influence or interference'. In a broad sense, a correlation may exist between self-determination and quality of life by definition. Besides, SDT has been extensively applied to quality of life in the health filed, such as in cancer patients (Hull et al., 2016), chronic disease patients (Sebire et al., 2018), and older adults (Tang et al., 2020). Therefore, SDT may provide a new theoretical lens on the HRQoL determinants among older stroke survivors for us.

Findings from previous studies suggest that health literacy, social support, and resilience have a direct or indirect impact on the quality of life of older stroke survivors, while the determinants and the underlying mechanism are not well explored. Thus, this study aimed to develop a hypothetical model involving the above factors of HRQoL and current literature based on SDT, and test the hypotheses using structural equation modelling (SEM).

2 | METHODOLOGY

2.1 | Design

A cross-sectional design was applied at four comprehensive hospitals in Chongqing. This study is reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (von Elm et al., 2014).

2.2 | Participants recruitment

Convenience sampling was used from January 2020 to June 2021, and all patients in the cerebrovascular departments and neurology departments of each hospital were included in this study. The inclusion criteria were: (a) aged 60 or older; (b) diagnosed with a first stroke; and (c) informed and willing to participate. The exclusion criteria were (a) functionally impaired elderly with severe mental illness, or cognitive dysfunction; (b) inability to communicate verbally or complete the questionnaires; and (c) complications with serious impairment of vital organ function or other serious diseases (such as malignant tumours).

2.3 | Sample size

Based on the sample size estimation method for the structural equation model (SEM) analysis, the sample size should be 10–20 times the questionnaire variables (Kirkwood & Sterne, 2010).

2.4 | Study variables

2.4.1 | Health literacy

Health literacy was assessed using the 25-item Stroke Knowledge Questionnaire (SKQ) developed by Wan et al. (2014). The SKQ comprises 10 dimensions: physical activity, nutrition, adherence to a low-salt diet, medication adherence, blood pressure check-ups, knowledge of stroke risk factors, awareness of stroke warning symptoms, understanding of prehospital delay, smoking cessation, and moderation of alcohol consumption. Each item offers three response options, with 'Yes' scored as 1 and 'Uncertain' or 'No' scored as 0. A cumulative total score is calculated across the 10 dimensions, with higher scores indicating greater health literacy related to stroke. The Cronbach's α coefficient for the total score in this study was 0.88, suggesting good reliability of this measurement tool.

2.4.2 | Social support

Social support was assessed using the 10-item Social Support Rating Scale (SSRS) developed by Xiao (1994). The SSRS comprises three dimensions: objective support, subjective support, and utilization of social support. Each item is rated on a four-point Likert scale. The total score ranges from 12 to 66, with scores of 22 or lower indicating a low level of support, scores between 23 and 44 indicating a moderate level, and scores between 45 and 66 indicating a high level of support. The SSRS is a widely used tool for assessing social support in China (Huang et al., 2019; Jiang et al., 2021), and in the current study, the Cronbach's α coefficient for the entire scale was 0.92, indicating high internal consistency.

2.4.3 | Resilience

Resilience was assessed using the 10-item Connor-Davidson Resilience Scale (CD-RISC-10) developed by Campbell-Sills and Stein (2007). The scale was translated into Chinese by Wang et al. (2010) and demonstrated good reliability among Chinese adults aged 60 years and older (Meng et al., 2019). Each item is rated on a five-point Likert scale, with 0 indicating 'not true at all' and 4 indicating 'true nearly all the time'. The total score ranges from 0 to 40, with higher scores indicating higher levels of psychological resilience. In this study, the Cronbach's α coefficient for the entire scale was 0.94, indicating strong internal consistency.

2.4.4 | HRQoL

HRQoL in this study was assessed using the 5-level EuroQol Five Dimensions questionnaire (EQ-5D-5L) developed by Rabin and de Charro (2001). The EQ-5D-5L is a widely utilized measure of HRQoL, validated across various countries and languages, facilitating comparisons across different settings. As a generic HRQoL measure, it offers a comprehensive view of participants' overall quality of life beyond their specific stroke conditions. Its ease of administration and short completion time make it particularly suitable for research involving older adults with potential attention and cognitive limitations.

The EQ-5D-5L assesses the quality of health states across dimensions such as mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, along with an overall health rating using a vertical, hash-marked, 40-cm visual analogue scale (VAS). Each dimension comprises five response levels, and the VAS score ranges from 0 to 100. The utility score, calculated based on the Chinese value set (Luo et al., 2017) following EQ-5D-5L guidelines, ranges from −0.391 to 1. A score of 1 indicates full health, 0 represents death, and −0.391 signifies a state deemed worse than death. In this study, the Cronbach's α coefficient for the entire EQ-5D-5L scale was 0.90, indicating strong internal consistency.

2.5 | Data collection

Potentially eligible patients were identified by nurses in the cerebrovascular departments and neurology departments by reviewing their medical records. Upon discharge, detailed instructions were provided to the patients, elucidating the significance of the subsequent follow-up and the questionnaire survey they would be participating in. It was ensured that all patients were fully informed that their participation was voluntary and that consent could be withdrawn at any time.

On the day of the follow-up, typically scheduled for the first week of the third month post-discharge, patients were invited to a tranquil meeting room where they were subjected to a face-to-face survey conducted by five trained investigators. These investigators comprised two graduate students specializing in geriatric nursing and three registered nurses, all of whom had been meticulously trained to engage with the patients in a manner that was respectful and empathetic. For physically dysfunctional participants, the investigators read the items and completed the questionnaire according to the patient's or care's responses and verified the authenticity of the responses at the end of the survey.

2.6 | Data analysis

SAS version 9.4 (StataCorp LLC, TX, USA) was used for data analysis. Descriptive statistics were employed to present the characteristics of the participants, including social- and disease-related information, and scores from the four questionnaires. Following visual inspection of the Quantile–Quantile (QQ) plots, Pearson correlation was used to examine correlations between variables. Prior to model analysis, multicollinearity among independent variables was assessed by calculating the Variance Inflation Factor (VIF). The results revealed VIF values below 3 for all variables, indicating no significant multicollinearity issues.

SEM was conducted using Amos version 24.0 (IBM SPSS, Chicago, IL, USA) with model parameter estimation performed using the maximum likelihood method. The model was adjusted based on modification indices. Good model fit criteria included a ratio of chi-square to degrees of freedom less than 5.0, a Goodness-of-Fit Index (GFI) greater than 0.90. Regarding the Root Mean Square Error of Approximation (RMSEA), values below 0.06 indicated acceptable fit, while values below 0.08 denoted mediocre fit. For the Goodness-of-Fit Index (GFI), values above 0.90 indicated acceptable fit, while values exceeding 0.97 signified excellent fit (Hopper et al., 2008; Hu & Bentler, 1999). The bias-corrected percentile bootstrap method (with 5000 resamples) was used to calculate 95% confidence intervals for the total effect, direct effect, and indirect effect. All p values were two-tailed, with statistical significance set at $p<0.05$.

2.7 | Ethical consideration

Approval was obtained from the REDACTED's ethics committee (approval number: REDACTED). All written informed consents to take part in the research were obtained from participants or their carers.

3 | RESULTS

3.1 | Demographic and clinical characteristics

The study included a total of 422 participants in the final analysis. The majority were male (194, 59.51%) and had a primary school education or below (223, 68.40%). Economic income varied, with 134 (41.10%) earning between 1000 and 2999 yuan more per month.

In terms of stroke classification, cerebral infarction was the most common type (286, 87.73%), followed by cerebral haemorrhage (34, 10.43%), and cerebral infarction combined with haemorrhage (6, 1.84%). The length of hospitalization was significantly associated with the EQ-5D-5L scores, with 98 (30.06%) hospitalized for 1 week or less, 110 (33.74%) for 2 weeks, 84 (25.77%) for 3 weeks and 34 (10.43%) for four weeks or more. The Barthel Index indicated varying degrees of dependence among the participants (Collin et al., 1988). A significant proportion (171, 52.45%) was moderately dependent (score 41–60). Fortunately, 211 (64.72%) and 204 (62.58%) partially understanding of stroke pathogenesis and sequelae. Compliance with doctor's advice was also noted, with 206 (63.19%) always following the advice, 71 (21.78%) usually following, and 49 (15.03%) sometimes following. As presented in Table 1.

3.2 | Levels and association of variables

The results of the levels and association of participants' health literacy, social support, resilience, and HRQoL are shown in Table 2. The mean score for health literacy was 12.10 ± 5.92. The mean scores for the three dimensions of social support were 8.33 ± 2.27, 21.64 ± 3.99s, and 6.95 ± 2.05, respectively. The level of resilience, with a mean score of 23.70 ± 7.67. The overall score for EQ-5D-5L was 0.67 ± 0.33. The results also implied that HRQoL was positively significantly linked to health literacy ($r=0.110$, $p<0.05$) and social support ($r=0.176$, $p<0.001$), and resilience ($r=0.499$, $p<0.001$). Interestingly, HRQoL positively associated with subjective social support ($r=0.221$, $p<0.001$), usage of social support ($r=0.171$, $p<0.001$), while not significantly linked with $p>0.05$.

3.3 | Structural equation modelling

Based on the results of the correlation analysis, the final SEM among health literacy, social support, resilience, and HRQoL in older adults after stroke was shown in Figure 1. The model-fit indices were as follows: χ^2/df ratio = 2.830, GFI = 0.987, CFI = 0.978, RMSEA = 0.066, indicating that the model had a good fit. The results implied that Health literacy ($\beta=0.14$, $p<0.05$) and social support ($\beta=0.12$, $p<0.05$) directly affect HRQoL, and indirectly through resilience ($\beta=0.40$, $p<0.05$) (Table 3). Three variables explained 29.0% of HRQoL variance.

4 | DISCUSSION

To the best of our knowledge, our study is the first to explore the impact mechanism and path of potential factors on HRQoL among older adults after the first incident stroke. Our findings would supply new references and benefit poststroke rehabilitation and clinical management in the future.

In this study, we found a close correlations between health literacy and HRQoL. A systematic review (Kanejima et al., 2022) revealed that not only in stroke patients but also in patients with cardiovascular diseases, low health literacy is significantly associated with decreased HRQoL, increased mortality, and hospital readmission. A potential explanation may be patients with higher levels of health literacy are better equipped to manage their health conditions, engage in shared decision-making, and access necessary care (Dewalt et al., 2004). For older stroke survivors, this can result in better health outcomes and an improved quality of life.

Our results also showed that social support may have a positive effect on HRQoL, similar to previous studies (Kim et al., 2021). Clinical health workers have noticed that stroke is not only a challenge to survivors but also to their families; that is, families have to be 'caregivers' and may be unprepared to address the process of rehabilitation or disabilities of the patient (Ramos-Lima et al., 2018). Thus, psychosocial resources such as social networks within a cultural context must be considered (Harms et al., 2019), especially filial piety, which is highlighted in Chinese culture.

Interestingly, we found that health literacy and social support could also affect HRQoL through resilience, which implied that

TABLE 1 Demographic and clinical characteristics of participants ($N = 422$).

Variables	*N* (%)	EQ-5D-5L	*F*-value	*p*-value
Age				
60–69	102 (31.29)	0.71 ± 0.34	1.073	0.343
70–79	136 (41.72)	0.66 ± 0.32		
≥80	88 (26.99)	0.64 ± 0.34		
Sex				
Male	194 (59.51)	0.66 ± 0.33	−0.52	0.603
Female	132 (40.49)	0.68 ± 0.33		
Marital status				
Married	250 (76.69)	0.68 ± 0.32	0.157	0.855
Divorced or unmarried	9 (2.76)	0.63 ± 0.39		
Widowed	67 (20.55)	0.66 ± 0.36		
Education level				
Primary school or below	223 (68.40)	0.66 ± 0.32	0.675	0.510
Junior school	67 (20.55)	0.71 ± 0.38		
High school or above	36 (11.04)	0.68 ± 0.31		
Economic income per month (¥)				
<1000	126 (38.65)	0.64 ± 0.31	1.003	0.392
1000–2999	134 (41.10)	0.67 ± 0.34		
3000–4999	53 (16.26)	0.74 ± 0.37		
≥5000	13 (3.99)	0.65 ± 0.33		
Stroke classification				
Infarction	286 (87.73)	0.66 ± 0.34	3.335	0.037
Haemorrhage	34 (10.43)	0.79 ± 0.19[c]		
Infarction combined with haemorrhage	6 (1.84)	0.47 ± 0.41[b]		
Length of hospitalized (week)				
≤1	98 (30.06)	0.74 ± 0.3	10.671	<0.001
2	110 (33.74)	0.71 ± 0.34		
3	84 (25.77)	0.65 ± 0.27		
≥4	34 (10.43)	0.40 ± 0.40		
Barthel index				
Very severely depended (≤20)	36 (11.04)	0.08 ± 0.29	125.477	<0.001
Severely depended (21–40)	59 (18.10)	0.51 ± 0.26		
Mid depended (41–60)	171 (52.45)	0.76 ± 0.23		
Slightly depended (≥60)	60 (18.40)	0.93 ± 0.11		
Understanding of stroke pathogenesis				
Fully understood	19 (5.83)	0.81 ± 0.26	3.095	0.047
Partially understood	211 (64.72)	0.68 ± 0.31		
Not understood at all	96 (29.45)	0.62 ± 0.39		
Understanding of stroke sequelae				
Fully understood	6 (1.84)	0.89 ± 0.17	1.989	0.138
Partially understood	204 (62.58)	0.68 ± 0.31		
Not understood at all	116 (35.58)	0.64 ± 0.37		
Compliance with doctor's advice				
Always follow	206 (63.19)	0.67 ± 0.31	0.64	0.528
Usually follow	71 (21.78)	0.64 ± 0.39		
Sometimes follow	49 (15.03)	0.71 ± 0.35		

Abbreviation: EQ-5D-5L, *5-level EuroQol five dimensions questionnaire*.

TABLE 2 Levels and association of participants' health literacy, social support, resilience, and HRQoL ($N = 422$).

Variables	Mean ± SD	1	2	3	4	5	6	7
1. Health literacy	12.10 ± 5.92	1						
2. Social support-objective	8.33 ± 2.27	0.020	1					
3. Social support-subjective	21.64 ± 3.99	0.191***	0.516***	1				
4. Social support-usage	6.95 ± 2.05	0.251***	0.312***	0.467***	1			
5. Overall social support	36.93 ± 6.72	0.197***	0.739***	0.911***	0.688***	1		
6. Resilience	23.70 ± 7.67	0.239***	−0.028	0.280***	0.233***	0.228***	1	
7. EQ-5D-5L	0.67 ± 0.33	0.110*	−0.022	0.221***	0.171***	0.176***	0.499***	1

Abbreviation: *EQ-5D-5L*, *5-level EuroQol five dimensions questionnaire*.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

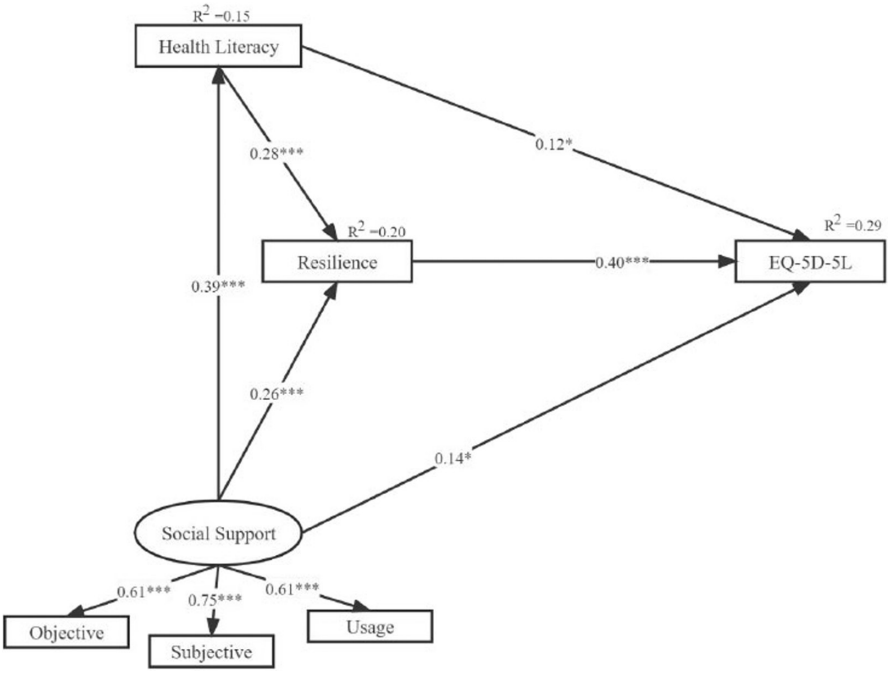

FIGURE 1 Structural equation model of health literacy, social support and resilience on the health-related quality of life among older stroke survivors. *$p<0.05$, ***$p<0.001$.

TABLE 3 Direct and indirect (mediation) effects of health literacy, social support, resilience on HRQoL ($N = 422$).

Variables	Total effects (95% CI)	*p*	Direct effects (95% CI)	*p*	Indirect effects (95% CI)	*p*	Indirect effect size (%)
Health literacy	0.33 (0.21, 0.44)	<0.001	0.14 (0.02, 0.26)	0.026	0.19 (0.14, 0.25)	<0.001	57.58%
Social support	0.24 (0.13, 0.33)	0.001	0.12 (0.02, 0.22)	0.019	0.11 (0.07, 0.16)	<0.001	45.83%
Resilience	0.4 (0.32, 0.47)	0.001	0.4 (0.32, 0.47)	0.001	—	—	

resilience is the key factor associated with HRQoL among first-stroke older adults (Liu et al., 2019). More social support and a high level of health literacy could promote the development of resilience through acquisition of favourable external environmental conditions and thereby a greater sense of perceived HRQoL (Ong et al., 2018; Searle et al., 2017). Similar results have also been observed in cancer patients by our team (Zhang et al., 2017), and this relation could be partly interpreted according to the SDT.

According to SDT, HRQoL is primarily driven by three fundamental psychological needs: autonomy, competence, and relatedness. Although resilience is not typically categorized as a form of autonomy within the framework of SDT, both autonomy and resilience are important for individual well-being. Autonomy focuses more on individuals' self-directedness and decision-making, whereas resilience emphasizes individuals' ability to cope with and recover from adversity. Health literacy could contribute to a

sense of competence in managing one's health, it is a broader concept that encompasses not only the skills and knowledge but also the understanding and application of health-related information. Therefore, it is more closely associated with autonomy (in terms of making informed decisions) and, to some extent, relatedness (as it affects interpersonal interactions related to health). Social support involves the presence of interpersonal connections, such as family, friends, or community members, who provide emotional, informational, or instrumental assistance. These supportive relationships fulfil the need for connection and belonging, promoting a sense of relatedness, which could be categorized as a form of relatedness.

The positive associations between HRQoL and health literacy, social support, and resilience suggest that interventions aimed at improving these factors may lead to better HRQoL outcomes for older stroke survivors. For instance, health literacy interventions could involve education programs aimed at enhancing patients' understanding of their conditions and the importance of self-management in improving their health. Social support programs could involve connecting patients with community resources, such as support groups or volunteer organizations, to help them build social networks and gain emotional and practical support. In addition, compared with social support and health literacy, resilience is a modifiable psychological factor that can be enhanced by effective interventions (Kong et al., 2021). Thus, our study emphasized the importance of developing resilience target care strategies for improving the wellbeing and perceived HRQoL of stroke patients (Liu et al., 2021; Zhang et al., 2020). Resilience can be developed through various methods, such as cognitive-behavioural therapy (Love et al., 2019), and may help patients cope with the challenges of chronic illness and improve their overall well-being.

This study is not without its limitations. First, the sample was exclusively drawn from four hospitals in western China, potentially constraining the generalizability of our findings to broader populations and healthcare settings. This geographical confinement may impede the external validity of the results. Second, the reliance on self-reported data introduces potential biases, notably social desirability bias, which could introduce inaccuracies in the responses. Furthermore, the cross-sectional design of the study prevents the establishment of causal relationships. Consequently, we can only infer associations based on the data collected at a singular time point, representing a substantial constraint.

Despite these limitations, our study holds significant value. The findings provide a snapshot of the relationships between health literacy, social support, resilience, and the quality of life among older stroke survivors, which is a relatively under-researched area. Our data contribute to the body of knowledge by highlighting the importance of these factors in the post-stroke recovery process. Furthermore, the insights gained from this study can inform future research designs, potentially leading to more robust studies that address the limitations identified here. The practical implications of our findings for healthcare providers and policymakers in terms of enhancing support systems for stroke survivors are noteworthy. By identifying areas where interventions may be most effective, our study can serve as a foundation for developing targeted strategies to improve the quality of life for this vulnerable population.

5 | CONCLUSION

Health literacy, social support, or resilience directly or indirectly affected post-stroke older patients' HRQoL. the health caregivers and families should provide effective health education and enough social support to develop patients' resilience to improve their HRQoL. In addition, resilience could be enhanced by empowering health literacy and providing social support.

ACKNOWLEDGEMENTS

The authors thank the patient and the patient's family.

FUNDING INFORMATION

This work was supported by the Science and Technology Bureau Livelihood Project of Bishan District (BSKJ20210020).

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Huanhuan Huang https://orcid.org/0000-0003-0845-7526

REFERENCES

Alshraifeen, A., Al-Rawashdeh, S., Alnuaimi, K., Alzoubi, F., Tanash, M., Ashour, A., Al-Hawamdih, S., & Al-Ghabeesh, S. (2020). Social support predicted quality of life in people receiving haemodialysis treatment: A cross-sectional survey. *Nursing Open*, *7*(5), 1517–1525. https://doi.org/10.1002/nop2.533

Banbury, A., Nancarrow, S., Dart, J., Gray, L., Dodson, S., Osborne, R., & Parkinson, L. (2020). Adding value to remote monitoring: Co-design of a health literacy intervention for older people with chronic disease delivered by telehealth—the telehealth literacy project. *Patient Education and Counseling*, *103*(3), 597–606. https://doi.org/10.1016/j.pec.2019.10.005

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the Connor-davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress*, *20*(6), 1019–1028. https://doi.org/10.1002/jts.20271

Collin, C., Wade, D. T., Davies, S., & Horne, V. T. (1988). The Barthel ADL index: A reliability study. *International Disability Studies*, *10*(2), 61–63. https://doi.org/10.3109/09638288809164103

Davydov, D. M., Stewart, R., Ritchie, K. A., & Chaudieu, I. (2010). Resilience and mental health. *Clinical Psychology Review*, *30*(5), 479–495. https://doi.org/10.1016/j.cpr.2010.03.003

Deb-Chatterji, M., Pinho, J., Flottmann, F., Meyer, L., Broocks, G., Brekenfeld, C., Reich, A., Fiehler, J., Gerloff, C., Thomalla, G., & Investigators, G. S. R.-E. T. (2022). Health-related quality of life after thrombectomy in young-onset versus older stroke patients: A

multicenter analysis. *Journal of Neurointerventional Surgery*, *14*(11), 1145–1150. https://doi.org/10.1136/neurintsurg-2021-017991

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior* (1st ed.). Springer. https://doi.org/10.1007/978-1-4899-2271-7

Dewalt, D. A., Berkman, N. D., Sheridan, S., Lohr, K. N., & Pignone, M. P. (2004). Literacy and health outcomes: A systematic review of the literature. *Journal of General Internal Medicine*, *19*(12), 1228–1239. https://doi.org/10.1111/j.1525-1497.2004.40153.x

Harms, C. A., Cohen, L., Pooley, J. A., Chambers, S. K., Galvão, D. A., & Newton, R. U. (2019). Quality of life and psychological distress in cancer survivors: The role of psycho-social resources for resilience. *Psycho-Oncology*, *28*(2), 271–277. https://doi.org/10.1002/pon.4934

Hopper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modeling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods*, *6*, 53–60.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55. https://doi.org/10.1080/10705519909540118

Huang, Y., Luo, D., Chen, X., Zhang, D., Huang, Z., & Xiao, S. (2019). Role of psychosocial status in predicting health-related quality of life at 1-year follow-up among newly diagnosed people living with HIV. *PLoS One*, *14*(10), e0224322. https://doi.org/10.1371/journal.pone.0224322

Hull, S. J., Abril, E. P., Shah, D. V., Choi, M., Chih, M.-Y., Kim, S. C., Namkoong, K., McTavish, F., & Gustafson, D. H. (2016). Self-determination theory and computer-mediated support: Modeling effects on breast cancer patient's quality-of-life. *Health Communication*, *31*(10), 1205–1214. https://doi.org/10.1080/10410236.2015.1048422

Jiang, F., Xiao, Y., Dong, H., Liu, S., Guo, F., Gong, Z., Xiao, S., Shen, M., Zhou, Q., & Li, J. (2021). Sleep quality in medical staffs during the outbreak of coronavirus disease 2019 in China: A web-based cross-sectional study. *Frontiers in Psychiatry*, *12*, 630330. https://doi.org/10.3389/fpsyt.2021.630330

Kanejima, Y., Shimogai, T., Kitamura, M., Ishihara, K., & Izawa, K. P. (2022). Impact of health literacy in patients with cardiovascular diseases: A systematic review and meta-analysis. *Patient Education and Counseling*, *105*(7), 1793–1800. https://doi.org/10.1016/j.pec.2021.11.021

Kim, G. M., Lim, J. Y., Kim, E. J., & Park, S.-M. (2019). Resilience of patients with chronic diseases: A systematic review. *Health & Social Care in the Community*, *27*(4), 797–807. https://doi.org/10.1111/hsc.12620

Kim, S. R., Yoo, S.-H., Kim, H. Y., & Kim, G.-G. (2021). Predictive model for quality of life in patients 1 year after first stroke. *Journal of Cardiovascular Nursing*, *36*(5), E60–E70. https://doi.org/10.1097/JCN.0000000000000814

Kirkwood, B. R., & Sterne, J. A. (2010). *Essential medical statistics*. John Wiley & Sons.

Kong, L.-N., Zhu, W.-F., Hu, P., & Yao, H.-Y. (2021). Perceived social support, resilience and health self-efficacy among migrant older adults: A moderated mediation analysis. *Geriatric Nursing*, *42*(6), 1577–1582. https://doi.org/10.1016/j.gerinurse.2021.10.021

Langford, C. P., Bowsher, J., Maloney, J. P., & Lillis, P. P. (1997). Social support: A conceptual analysis. *Journal of Advanced Nursing*, *25*(1), 95–100. https://doi.org/10.1046/j.1365-2648.1997.1997025095.x

Liu, Z., Zhou, X., Zhang, W., & Zhou, L. (2019). Factors associated with quality of life early after ischemic stroke: The role of resilience. *Topics in Stroke Rehabilitation*, *26*(5), 335–341. https://doi.org/10.1080/10749357.2019.1600285

Liu, Z., Zhou, X., Zhang, W., & Zhou, L. (2021). Resilience is an independent correlate of the course of quality of life in patients with first-ever ischemic stroke. *International Psychogeriatrics*, *33*(6), 567–575. https://doi.org/10.1017/S1041610220000587

Love, M. F., Sharrief, A., Chaoul, A., Savitz, S., & Beauchamp, J. E. S. (2019). Mind-body interventions, psychological stressors, and quality of life in stroke survivors. *Stroke*, *50*(2), 434–440. https://doi.org/10.1161/STROKEAHA.118.021150

Luo, N., Liu, G., Li, M., Guan, H., Jin, X., & Rand-Hendriksen, K. (2017). Estimating an EQ-5D-5L value set for China. *Value in Health*, *20*(4), 662–669. https://doi.org/10.1016/j.jval.2016.11.016

Ma, Q., Li, R., Wang, L., Yin, P., Wang, Y., Yan, C., Ren, Y., Qian, Z., Vaughn, M. G., McMillin, S. E., Hay, S. I., Naghavi, M., Cai, M., Wang, C., Zhang, Z., Zhou, M., Lin, H., & Yang, Y. (2021). Temporal trend and attributable risk factors of stroke burden in China, 1990–2019: An analysis for the global burden of disease study 2019. *The Lancet. Public Health*, *6*(12), e897–e906. https://doi.org/10.1016/S2468-2667(21)00228-0

Meng, M., He, J., Guan, Y., Zhao, H., Yi, J., Yao, S., & Li, L. (2019). Factorial invariance of the 10-item Connor-Davidson resilience scale across gender among Chinese elders. *Frontiers in Psychology*, *10*, 1237. https://doi.org/10.3389/fpsyg.2019.01237

Miguel, R. S., López-González, A. M., Sanchez-Iriso, E., Mar, J., & Cabasés, J. M. (2008). Measuring health-related quality of life in drug clinical trials: Is it given due importance? *Pharmacy World & Science*, *30*(2), 154–160. https://doi.org/10.1007/s11096-007-9152-9

Munce, S. E. P., Perrier, L., Shin, S., Adhihetty, C., Pitzul, K., Nelson, M. L. A., & Bayley, M. T. (2017). Strategies to improve the quality of life of persons post-stroke: Protocol of a systematic review. *Systematic Reviews*, *6*(1), 184. https://doi.org/10.1186/s13643-017-0579-3

Ong, H. L., Vaingankar, J. A., Abdin, E., Sambasivam, R., Fauziana, R., Tan, M.-E., Chong, S. A., Goveas, R. R., Chiam, P. C., & Subramaniam, M. (2018). Resilience and burden in caregivers of older adults: Moderating and mediating effects of perceived social support. *BMC Psychiatry*, *18*, 27. https://doi.org/10.1186/s12888-018-1616-z

Pham, T. T. M., Vu, M.-T., Luong, T. C., Pham, K. M., Nguyen, L. T. K., Nguyen, M. H., Do, B. N., Nguyen, H. C., Tran, T. V., Nguyen, T. T. P., Le, H. P., Tran, C. Q., Nguyen, K. T., Yang, S.-H., Hu, C.-J., Bai, C.-H., & Duong, T. V. (2022). Negative impact of comorbidity on health-related quality of life among patients with stroke as modified by good diet quality. *Frontiers in Medicine*, *9*, 836027. https://doi.org/10.3389/fmed.2022.836027

Rabin, R., & de Charro, F. (2001). EQ-5D: A measure of health status from the EuroQol group. *Annals of Medicine*, *33*(5), 337–343. https://doi.org/10.3109/07853890109002087

Raddadi, Y., & Adib-Hajbaghery, M. (2022). Health literacy and quality of life in Iranian persons with COPD. *Heart & Lung: The Journal of Critical Care*, *54*, 61–67. https://doi.org/10.1016/j.hrtlng.2022.02.009

Ramos-Lima, M. J. M., Brasileiro, I. d. C., de Lima, T. L., & Braga-Neto, P. (2018). Quality of life after stroke: Impact of clinical and sociodemographic factors. *Clinics*, *73*, e418. https://doi.org/10.6061/clinics/2017/e418

Searle, A., Neville, P., & Waylen, A. (2017). Psychological growth and well-being in individuals born with cleft: An application of self-determination theory. *Psychology & Health*, *32*(4), 459–482. https://doi.org/10.1080/08870446.2016.1275630

Sebire, S. J., Toumpakari, Z., Turner, K. M., Cooper, A. R., Page, A. S., Malpass, A., & Andrews, R. C. (2018). "I've made this my lifestyle now": A prospective qualitative study of motivation for lifestyle change among people with newly diagnosed type two diabetes mellitus. *BMC Public Health*, *18*(1), 204. https://doi.org/10.1186/s12889-018-5114-5

Singstad, M. T., Wallander, J. L., Greger, H. K., Lydersen, S., & Kayed, N. S. (2021). Perceived social support and quality of life among adolescents in residential youth care: A cross-sectional study. *Health and Quality of Life Outcomes*, *19*(1), 29. https://doi.org/10.1186/s12955-021-01676-1

Skoumalova, I., Madarasova Geckova, A., Rosenberger, J., Majernikova, M., Kolarcik, P., Klein, D., de Winter, A. F., van Dijk, J. P., & Reijneveld,

S. A. (2022). Health literacy and change in health-related quality of life in dialysed patients. *International Journal of Environmental Research and Public Health*, *19*(2), 620. https://doi.org/10.3390/ijerph19020620

Tang, M., Wang, D., & Guerrien, A. (2020). A systematic review and meta-analysis on basic psychological need satisfaction, motivation, and well-being in later life: Contributions of self-determination theory. *PsyCh Journal*, *9*(1), 5–33. https://doi.org/10.1002/pchj.293

Tu, W.-J., Zeng, X., & Liu, Q. (2022). Aging tsunami coming: The main finding from China's seventh national population census. *Aging Clinical and Experimental Research*, *34*(5), 1159–1163. https://doi.org/10.1007/s40520-021-02017-4

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P., & Initiative, S. T. R. O. B. E. (2014). The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. *International Journal of Surgery (London, England)*, *12*(12), 1495–1499. https://doi.org/10.1016/j.ijsu.2014.07.013

Wan, L.-H., Zhao, J., Zhang, X.-P., Deng, S.-F., Li, L., He, S.-Z., & Ruan, H.-F. (2014). Stroke prevention knowledge and prestroke health behaviors among hypertensive stroke patients in mainland China. *The Journal of Cardiovascular Nursing*, *29*(2), E1–E9. https://doi.org/10.1097/JCN.0b013e31827f0ab5

Wang, L., Shi, Z., Zhang, Y., & Zhang, Z. (2010). Psychometric properties of the 10-item Connor-Davidson resilience scale in Chinese earthquake victims. *Psychiatry and Clinical Neurosciences*, *64*(5), 499–504. https://doi.org/10.1111/j.1440-1819.2010.02130.x

Wehmeyer, M. L. (2001). Self-determination and mental retardation. In *International review of research in mental retardation* (Vol. *24*, pp. 1–48). Academic Press. https://doi.org/10.1016/S0074-7750(01)80004-5

World Health Organization. (2012). The World Health Organization Quality of Life (WHOQOL). https://www.who.int/publications-detail-redirect/WHO-HIS-HSI-Rev.2012.03

Wu, S., Wu, B., Liu, M., Chen, Z., Wang, W., Anderson, C. S., Sandercock, P., Wang, Y., Huang, Y., Cui, L., Pu, C., Jia, J., Zhang, T., Liu, X., Zhang, S., Xie, P., Fan, D., Ji, X., Wong, K.-S. L., … Zhang, S. (2019). Stroke in China: Advances and challenges in epidemiology, prevention, and management. *The Lancet Neurology*, *18*(4), 394–405. https://doi.org/10.1016/S1474-4422(18)30500-3

Xiao, S. (1994). Theoretical basis and research application of social support rating scale. *Journal of Clinical Psychological Medicine*, *02*, 98–100.

Zhang, H., Zhao, Q., Cao, P., & Ren, G. (2017). Resilience and quality of life: Exploring the mediator role of social support in patients with breast cancer. *Medical Science Monitor*, *23*, 5969–5979. https://doi.org/10.12659/msm.907730

Zhang, W., Liu, Z., Zhou, X., & Zhou, L. (2020). Resilience among stroke survivors: A cohort study of the first 6 months. *Journal of Advanced Nursing*, *76*(2), 504–513. https://doi.org/10.1111/jan.14247

How to cite this article: Chen, M., Li, J., Chen, C., Zhao, Q., & Huang, H. (2024). The relationships between quality of life with health literacy, social support and resilience in older stroke survivors: A structural equation model. *Nursing Open*, *11*, e70020. https://doi.org/10.1002/nop2.70020