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Relationships between care burden, resilience, and depressive symptoms among the main family caregivers of stroke patients: A cross-sectional study

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Objectives: This study aims to explore the potential mediating role of resilience between care burden and depressive symptoms in family caregivers of stroke patients.

Methods: A cross-sectional study was conducted with a convenience sample involving 245 main family caregivers of stroke patients recruited from the neurology department of a Tertiary A hospital in China. Mediation analyses were conducted using the PROCESS macro (Model 4) for SPSS, applying the Bootstrap analysis with 5,000 samples and a 95% confidence interval.

Results: The results showed that with constant hemiplegia side, Barthel Index, education level, monthly income, care time per day, and living with patients in regression equations, the resilience partially mediated the correlation of care burden and depressive symptoms with a mediation effect ratio of 26.32%.

Conclusions: Resilience plays a mediating role in the correlation between care burden and depressive symptoms.

Impact: The findings indicated a protective effect of resilience in alleviating the negative influences of care burden on depressive symptoms, suggesting that resilience-training intervention may be developed to mitigate depressive symptoms of the main family caregivers of stroke patients.

KEYWORDS

care burden, resilience, depressive symptoms, stroke, family caregivers

Introduction

Stroke is one of the leading causes of adult disability and mortality globally (1, 2), particularly in China (3). Currently, stroke survivors have to cope with severe physical, cognitive, and emotional impairments. Indeed, over two-thirds of stroke survivors require assistance in daily life (4). However, due to the limited community health service,

and heavy economic burden, most patients choose to be rehabilitated at home with family caregivers providing care after discharge, and care is provided by family caregivers (5). Nevertheless, family caregivers are experiencing difficulties in employment, finance, sleeping, leisure activities (6), and social activities (7), resulting in degraded life quality, and physical and mental health (8, 9). The care burden involves physical, psychological, and social disruption related to the negative caring experience, which can be divided into objective and subjective components (10). It has been reported that 68.4% of the caregivers of stroke patients in China had a moderate burden and above burden (11), indicating that care burden is a severe issue for caregivers.

Family caregivers are facing huge financial burdens, social pressure, and mental distress (12). A previous study reported a high incidence of negative emotions in caregivers, including low satisfaction with leisure time (13), loss of happiness, loneliness, depression, and a sense of imprisonment (14). Indeed, 53.9% of the caregivers of stroke patients in China have varying degrees of depressive symptoms (11), which might be related to the care burden of family caregivers of stroke patients. Heavy burden leads to emotional exhaustion of caregivers and reduces their enthusiasm, thus affecting the quality of care provided (15). Previous studies showed that caregivers with depressive symptoms were more likely to increase the risk of patients' depressive symptoms (16) and even increased the odds of 6-month mortality of stroke survivors (17). However, some caregivers with care burdens do not experience depression, which emphasizes the essential role of protective factors, such as resilience. Resilience is defined as the ability to effectively adapt to trauma and/or adversity (18). Previous studies have shown that people with higher resilience would actively cope with adversity and rapidly adapt to changes (19, 20). Meanwhile, resilience partially mediates the correlation between negative life events and the mental health of caregivers of patients with advanced cancers (21) and diabetes (22). However, few studies have explicitly tested the mediating effects of resilience between care burden and depressive symptoms of family caregivers of stroke patients.

According to previous studies, care burden is correlated with depressive symptoms, and this correlation can be mediated by resilience. Therefore, it is assumed in this study that there is a correlation between care burden and depressive symptoms, and this relationship might be mediated by the resilience of family caregivers of stroke patients.

Materials and methods

Study design and participants

In this study, a cross-sectional study and a convenient sampling method were employed. The participants were

caregivers of patients admitted to the neurology department ward of a Tertiary A hospital in Shenyang, China during 6 January–20 July 2021. An ethical counsel permit (Ref. 402/2020 on 4 January 2021) was issued by the Medical Ethical Committee of the First Affiliated Hospital of China Medical University, and informed consent was obtained from all participants under the Helsinki Accords.

Inclusion criteria

Patients: (1) the patients met the diagnostic criteria of the 4th National Cerebrovascular Disease (The 4th National Symposium on Cardiovascular Disease of the Chinese Medical Association, 1996). Classification of stroke was confirmed by brain computed tomography or magnetic resonance imaging; (2) the score of the Barthel Index ≤ 95 .

Family caregivers: (1) 18 years old and above; (2) spent the longest time with the patients per day; (3) unpaid for the care provided; (4) the care time was no <3 months; (5) voluntarily participate in this study.

Exclusion criteria

Family caregivers: (1) suffering from one or more stressful life events within the past 2 weeks (e.g., divorce, widowhood, and loss of job); (2) having a severe physical illness, such as malignancy and intellectual-psychiatric issues; (3) incomplete investigation due to communication or reading and writing obstacles.

Data collection

During January 2021–July 2021, 250 questionnaires were collected from the participants and 245 of them (valid response rate = 98%) were used for data analysis. Five questionnaires were excluded due to data missing. Data collection was completed by a trained researcher using a self-reported questionnaire. The researcher explained the aims of the study to participants and informed them that the collected data will be kept confidential, and that they had the right to refuse participation. If they agree to participate, they will sign a written informed consent. Questionnaires were completed independently by the participant and collected immediately. Additionally, any participant who wished to quit anytime during the study was allowed to do so.

Measurements

Demographic characteristics

The demographic data collected from the patients include gender, age, insurance, stroke subtypes, language barriers,

dysphagia, cognitive barriers and hemiplegia side. The demographic data collected from the caregivers include gender, age, education level, monthly income, employment status, relationship with the patient, total care duration, care time per day, and living with patients.

The Barthel Index (BI)

The Barthel Index (BI) was developed by Mahoney (23) in 1965 and has been widely employed to assess self-care activities including eating, bathing, grooming, dressing, using the toilet, transferring from bed to chair, walking, stair climbing, bowel control, and bladder control (23). It consists of 10 items and each item is supposed to be scored based on a 5-point Likert scale. The total score ranges from 0 (total dependence) to 100 (total independence), with 0–20 points defining total dependence, 21–60 defining severe dependence, 61–90 defining moderate dependence, 91–99 defining slight dependence, and 100 defining total independence (23, 24). The validity and reliability of this tool for use in the Chinese elderly population have been well-established (25). In this study, the Cronbach's alpha value was 0.87.

Zarit caregiver burden interview (ZBI)

The Chinese version of the ZBI scale (26), which was used to measure caregivers' perceived burden of providing informal care (27). The scale consists of 22-items assessing role strain and personal strain (28), and each item is supposed to be scored based on a 5-point Likert scale (0 = never, 1 = seldom, 2 = sometimes, 3 = often, and 4 = almost always) (29). The total score ranges from 0 to 88, with 0–20 points defining negligible or no load, 21–40 defining intermediate load, 41–60 defining large load, and 61–88 defining excessive load (30). The Chinese version of ZBI has satisfactory psychometric properties (31). In this study, the Cronbach's alpha value was 0.93.

Connor-Davidson resilience scale (CD-RISC)

The CD-RISC scale was originally developed by Connor and Davidson (32) and translated into Chinese by Yu and Zhang (33), is one of the most widely used scales to measure resilience. The scale consists of 25-items assessing tenacity, strength and optimism (33), and each item is supposed to be scored based on a 5-point Likert scale from 0 (not true at all) to 4 (true nearly all the time) (32). The total score ranges from 0 to 100 and the score is proportional to the resilience level (32). The Chinese version of CD-RISC exhibited good reliability and validity (34). In this study, the Cronbach's alpha value was 0.94.

Center for epidemiological survey depression scale (CES-D)

The Chinese version of the CES-D scale was designed to evaluate the depressive symptoms and risk of disorder in a non-psychiatric person (35). The scale consists of 20-items assessing depressed feelings, somatic complaints, positive feelings and international relationships, and each item is supposed to be scored based on a 4-point Likert scale from 0 (rarely or none of the time) to 3 (most of the time) (35). The total score ranges from 0 to 60 and a score ≥ 16 indicates an elevated level of depressive symptoms (35). Additionally, a score of 16–23 and ≥ 24 were classified as moderate and severe depressive symptomatology (36). The Chinese version of CES-D has been widely used in China with good reliability and validity (37). In this study, the Cronbach's alpha value was 0.95.

Statistical analysis

Statistical analyses were conducted utilizing SPSS version 26.0. Normal distribution tests were verified by using Kolmogorov-Smirnov and Shapiro-Wilk statistics. Continuous variables were presented as mean \pm standard deviation (SD), whereas classification variables were presented as frequency and percentages (%). Independent sample *t*-test or single-factor variance was conducted to identify differences in depressive symptoms concerning the characteristics of caregivers and stroke survivors. Pearson's correlation analysis was employed to explore the correlation between care burden, resilience, and depressive symptoms. The mediation model was analyzed using Model 4 in the PROCESS Marco (38) version 3.3 with 5,000 iteration bootstrapping to measure the indirect effect and 95% confidence intervals (CI) were estimated. Parameters of indirect effects were considered statistically significant when the 95% CI did not include 0 (39). Hemiplegia side, education level, monthly income, living with patients, care time per day, and the BI score were included as covariates since these variables exhibited significant differences in depressive symptoms and were significantly associated with depressive symptoms. A two-sided $p < 0.05$ was considered statistically significant.

Results

Sociodemographic characteristics

As shown in Table 1, stroke survivors ranged have ages from 34 to 89 years old (mean = 64.09, *SD* = 9.66), 66.53% of them were males and 90.20% of them needed help for daily activities. Of the caregivers aged 27–80 years old (mean = 59.05, *SD* = 1.00), 78.78% of them were females and 75.10% of them were the spouse of the patient. 20.00, 67.35, and 12.65% has a total score (BI) of 0–60, 61–90, and 91–99, respectively.

TABLE 1 Descriptive statistics for demographic characteristics and differences in depressive symptoms (*N* = 245).

Variable	<i>N</i>	%	Depressive symptoms	
			<i>M</i> ± <i>SD</i>	<i>F</i> or <i>t</i> (<i>P</i>)
Patients				
Gender				1.398 (0.163)
Male	163	66.53	22.96 ± 10.21	
Female	82	33.47	21.10 ± 9.01	
Age (years)				1.796 (0.149)
<55	45	18.37	23.71 ± 11.45	
55–64	70	28.57	23.79 ± 9.42	
65–74	105	42.86	21.46 ± 9.71	
≥75	24	9.80	19.48 ± 7.74	
Health insurance				−0.781 (0.436)
Yes	232	94.69	22.22 ± 9.94	
No	12	4.90	24.50 ± 7.79	
Stroke subtypes				1.210 (0.300)
Ischemic stroke	204	83.33	22.40 ± 10.14	
Hemorrhagic stroke	18	7.35	24.72 ± 8.24	
Both	23	9.39	20.00 ± 8.06	
Language barriers				1.776 (0.184)
Yes	77	31.43	23.31 ± 10.22	
No	168	68.57	21.89 ± 9.67	
Dysphagia				1.960 (0.163)
Yes	23	9.39	26.30 ± 8.44	
No	222	90.61	21.92 ± 9.91	
Cognitive barriers				0.422 (0.517)
Yes	10	4.08	21.40 ± 9.24	
No	235	95.92	22.37 ± 9.89	
Hemiplegia side				2.991 (<0.050)
None	11	4.49	20.64 ± 10.24	
Left	108	44.08	21.22 ± 9.14	
Right	74	30.20	21.72 ± 10.34	
Both	52	21.22	25.88 ± 9.91	
Total scores (BI)				8.882 (<0.001)
0–60	49	20.00	27.47 ± 10.84	
61–90	165	67.35	21.05 ± 9.48	
91–99	31	12.65	21.03 ± 7.42	
Caregivers				
Gender				−0.752 (0.453)
Males	52	21.22	21.42 ± 8.82	
Females	193	78.78	22.58 ± 10.11	
Age				0.231 (0.875)
<55	83	33.88	21.96 ± 9.59	
55–64	77	31.43	22.36 ± 9.50	
65–74	71	28.98	23.00 ± 10.89	
≥75	14	5.71	21.00 ± 8.21	
Education status				8.641 (<0.001)
Primary school at most	50	20.41	27.08 ± 10.46	

(Continued)

TABLE 1 (Continued)

Variable	<i>N</i>	%	Depressive symptoms	
			<i>M</i> ± <i>SD</i>	<i>F</i> or <i>t</i> (<i>P</i>)
Junior high school	80	32.65	23.63 ± 9.42	
High school/technical school	80	32.65	19.71 ± 8.19	
College and above	35	14.29	18.60 ± 10.42	
Monthly income (RMB, yuan)				10.811 (<0.001)
<2,500	58	23.67	27.93 ± 10.14	
2,500–3,500	93	37.96	21.72 ± 8.76	
3,500–4,500	70	28.57	20.33 ± 9.17	
>4,500	24	9.80	17.04 ± 9.61	
Working status				4.489 (<0.050)
Employed	91	37.14	22.54 ± 9.60	
Unemployed	60	24.49	25.10 ± 10.87	
Retired	93	37.96	20.32 ± 8.99	
Relationship with patient				5.843 (<0.001)
Spouse	184	75.10	22.55 ± 9.58	
Offspring	52	21.22	20.31 ± 9.48	
Parents	5	2.04	38.60 ± 10.90	
Sibling	4	1.63	18.50 ± 7.94	
Duration of care time (month)				0.677 (0.567)
3–6	89	36.33	21.34 ± 9.68	
6–12	45	18.37	22.58 ± 8.50	
12–36	52	21.22	22.31 ± 9.96	
>36	59	24.08	23.68 ± 10.96	
Care time per day (hours)				7.086 (<0.001)
<4	102	41.63	19.30 ± 7.54	
4–8	98	40.00	23.53 ± 10.16	
8–16	34	13.88	26.21 ± 11.79	
>16	11	4.49	27.82 ± 11.75	
Living with patients				2.407 (<0.050)
Yes	232	94.69	22.69 ± 9.78	
No	13	5.31	16.00 ± 9.22	

SD, standard deviation; BI, the Barthel Index.

Descriptive and correlative analysis

The average scores of care burden, resilience, and depressive symptoms of caregivers were 43.89 ± 13.40, 55.68 ± 11.01, and 22.33 ± 9.85, respectively. 72.65% of the caregivers had depressive symptoms. The results of Pearson’s correlation analysis revealed that care burden was positively associated with depressive symptoms (*r* = 0.58, *p* < 0.01). Additionally, resilience was negatively associated with care burden (*r* = −0.26,

TABLE 2 Means, standard deviations, and correlations among variables.

Variable	<i>M</i> ± <i>SD</i>	1	2	3
1. Care burden	43.89 ± 13.40	–		
2. Resilience	55.68 ± 11.01	–0.26**	–	
3. Depressive symptoms	22.33 ± 9.85	0.58**	–0.70**	–

** $p < 0.01$.

$p < 0.01$) and depressive symptoms ($r = -0.70$, $p < 0.01$), as shown in Table 2.

Mediating effect of resilience

To verify the proposed hypothesis conceptual model, Model 4 of Hayes' PROCESS macro was applied to establish three regression models (see Table 3 and Figure 1). After controlling the hemiplegia side, BI score, education level, monthly income, care time per day, and living with patients, the care burden was positively associated with depressive symptoms ($\beta = 0.51$, $p < 0.001$). After adding resilience, the positive association between care burden and depressive symptoms remained significant ($\beta = 0.38$, $p < 0.001$), while resilience was negatively correlated with care burden ($\beta = -0.21$, $p < 0.01$) and depressive symptoms ($\beta = -0.64$, $p < 0.001$).

Then, bootstrapping was executed to determine the statistical significance of the mediating effect of resilience. We adopted the method of random sampling to extract 5000 Bootstrap samples from the original data ($N = 245$). The results demonstrated that the total effect of care burden on depressive symptoms was 0.38 [95% CI (0.29–0.46)], with the direct effect and the indirect effect being 0.28 [95% CI (0.22–0.35)] and 0.10 [95% CI (0.04–0.16)], respectively. The 95% CI did not contain 0, indicating that resilience played a mediating role in the correlation of care burden and depressive symptoms, with a mediating contribution rate of 26.32% (0.10/0.38), as shown in Table 4.

Discussion

The study aims to clarify the correlation between care burden and depressive symptoms by using the Kumpfer's resilience model. First, the mean score of depressive symptoms was 22.33 ± 9.85 , which was higher than that reported in previous studies using the same tool for caregivers of patients with other diseases, including dementia (40) and cancer (41). The difference can be attributed to stroke-related disabilities and long disease duration (42), which poses a heavy burden on caregivers of stroke patients.

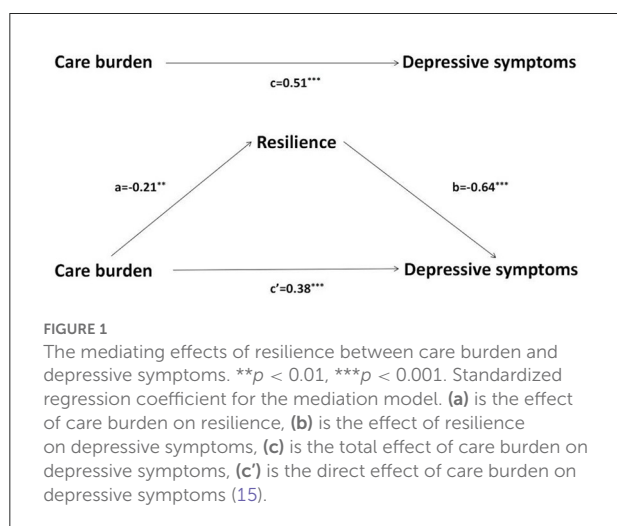
As the period of data collection in this study coincided with the COVID-19 pandemic, the incidence of depressive symptoms (72.65%) among caregivers was different from those in previous studies (40–71%) (43, 44). The uncertainty induced by the epidemic would increase the psychological pressure [e.g., infection risk (45), unemployment, financial insecurity (46)] on everyone, including caregivers enrolled in this study. Specifically, the decrease of social interaction could have a negative impact on mental health, since caregivers' life and normal rest may get irregular due to restrictions on outdoor activities (47). COVID-19-related financial distress and work impairment were also associated with higher symptom levels of depression (48). A recent study (49) showed that 78.5% of caregivers of children with kidney diseases reported depressive symptoms during the pandemic, which was 32.8–48.3% higher than those in previous studies (50, 51). Meanwhile, the incidence of subjective depressive symptoms increased from 5.9 to 60% among caregivers of patients with dementia (52). On the other hand, patient caring is more challenging due to the restriction of hospitalizations and the complicated admissions process during the pandemic (53). Another recent study reported a 40% drop in stroke admissions (54), and it complained that strict measures due to the pandemic can lead to increased anxiety and distress (55).

There were statistically significant differences in the hemiplegia side, the BI and education, monthly income, working status, correlation with patients, care time per day, and living with patients among the depressive symptoms of the caregivers. Similar to previous studies (11, 16), depressive symptoms are associated with the severity of functional disability of the patients as they are more likely to rely on caregivers for support and care (56). Meanwhile, caregivers with a higher education level tend to experience fewer depressive symptoms, which may be attributed to better ways to insight into illness and seek help (57). The study has shown that unemployment and low income are risk factors for depressive symptoms as limited economic resources, substantial uncertainty and income volatility expose them to physical and mental stress (58). Additionally, the length of care time was proportional to depression. This may be attributed to the fact that a long care time would let to more disruptions in daily life, causing increased stress levels (59). In some studies, parental caregivers exhibited more depressive symptoms compared with spousal caregivers as they are more vulnerable due to physical limitations (60) and prone to have negative emotions related to the future they had envisioned for the child [e.g., care for the child after their death (61)]. Nevertheless, some studies stated that spouses exhibited more depressive symptoms (62, 63), which may be attributed to the fact that spousal caregivers tend to be overwhelmed by conflicting demands such as work, children, and household chores (5). The result indicates that healthcare workers should focus on spousal and parental caregivers

TABLE 3 Mediating effect of resilience between care burden and depressive symptoms.

Controls	Model 1 (resilience)			Model 2 (depressive symptoms)			Model 3 (depressive symptoms)		
	β	SE	t	β	SE	t	β	SE	t
Hemiplegia side	0.04	0.70	0.65	0.06	0.60	1.13	0.08	0.44	2.12*
The Barthel Index	-0.17	1.38	-2.37**	0.06	1.17	0.96	-0.04	0.88	-0.84
Education level	0.03	0.87	0.40	-0.03	0.74	-0.47	-0.01	0.55	-0.27
Monthly income	0.48	0.90	6.31***	-0.21	0.76	-2.89**	0.10	0.61	1.68
Care time per day	-0.17	0.92	-2.38	0.09	0.78	1.32	-0.02	0.59	-0.37
Living with patients	-0.10	2.72	-1.88	-0.04	2.30	-0.75	-0.11	1.72	-2.69**
Independence variable									
Care burden	-0.21	0.05	-3.37**	0.51	0.04	8.82***	0.38	0.03	8.63***
Mediator									
Resilience							-0.64	0.04	-13.93***
R ²	0.33			0.40			0.67		
F	16.91***			22.67***			60.25***		

*p < 0.05, **p < 0.01, ***p < 0.001. Bootstrap sample size = 5,000. β , standardized coefficients; SE, Standard Error; t, t-test value; F, F-test value; R², explanatory power.



with low income, low education, unemployment, living with patients and long-term care in future work, and develop appropriate interventions to reduce depressive symptoms and improve the life quality of both stroke patient and his/her family caregivers.

Notably, the results of the present study showed that there is a statistically significant and inverse relationship between care burden and depressive symptoms in family caregivers. Our findings support previous research (64, 65) suggesting that caregivers who score high care burden have also high depression. Despite these similar findings in the literature, we don't see a ready explanation for this association. In future research we need to further examine the dynamic mechanisms between care burden and depressive symptoms

TABLE 4 Bootstrap analysis of mediation effect significance test (N = 245).

Effect	Effect	SE	95% CI	
			LLCL	ULCL
Total effect	0.38	0.04	0.29	0.46
Direct effect	0.28	0.03	0.22	0.35
Indirect effect	0.10	0.03	0.04	0.16

Bootstrap sample size = 5,000. SE, Standard Error; CI, Confidence Interval; LLCL, Lower Limit Confidence Interval; ULCL, Upper Limit Confidence Interval.

of caregivers. Also, our results showed that resilience could partly mediate the relationship between care burden and depressive symptoms. This is consistent with previous studies that examined resilience as a possible mediator (66), including in the context of COVID-19 research (67). One possible explanation may be that people with a lower level of resilience tend to negatively confront adversity in unhealthy ways, such as mood disturbances, persisting fatigue, and sleep changes (68). Specifically, the psychobiological mechanisms underlying resilience has shown that resilience had a relation to neurochemical, neuropeptide, and hormonal when the response to stressful things (69, 70), people with higher resilience tend to reduce psychobiological allostatic load, and balance neural systems, which could maintain normal psychological function and thus can confront stress actively (71). Besides, individuals with higher resilience are better at coping with stressful events, they tend to make active attempts to adjust the relationship between the environment and individuals, make full use of various resources, and achieve a good state

of adaptation (72, 73). Therefore, resilience seemed to be one of the possible mechanisms to resist mental disorders who exposed to care burden, which confirmed Kumpfer's resilience model.

Although family caregivers are often critical to maintain the patients' health, there has been little emphasis on how clinicians should relate to family caregivers (74). Caregivers become "the invisible patient" and often feel tense and upset (74). Hence there is a need to undertake necessary precautions to protect their health. Among patients, a handful of resilience-based interventions have shown promising results for outcomes such as resilience, stress, and anxiety (75, 76). However, there are few published recommendations for conducting intervention trials with stroke caregivers. Some recent studies suggests that a strength-oriented psychoeducational program can reduce depressive symptoms and improved life changes for caregivers (77), as well as the assessment of the risk factors of depressive symptoms (78). The current study suggests that we should assess the situation of care burden and depressive symptoms of caregivers, screen for its main influencing factors, and take effective programs such as social and financial support (79), increased post-traumatic, better patient-caregiver relationships, growth improvement in the competence and self-esteem of caregivers (80). In addition, resilience plays an important role for caregivers' mental health also means it is possible to alleviate the depressive symptoms of caregivers by promoting the level of resilience. Specifically, social support is one of the important sources for the development of resilience, which may ultimately help lessen depressive symptoms (81). Self-compassion and mindfulness training are also related to higher resilience (82). Moreover, some research has shown that love for family, feeling responsible toward the family (83), ability to analyze the current situation, and capability to establish relationships (84) are some of the motivations for resilience. In addition to the aforementioned approach, Overall, the sources of strength can provide intervention targets for promoting resilience and care burden, and thus alleviate the depressive symptoms. Insufficient evidence is available to show that psychoeducational interventions should be implemented in the families of stroke survivors.

There are some limitations in our study to be considered. Firstly, this study is a cross-sectional study, and it is difficult to determine the causal connections between the variables. Therefore, future studies can use longitudinal research to explore the causal relationship between variables. Secondly, we used a self-rating questionnaire for screening for depressive symptoms instead of a clinical diagnosis from psychiatrists. Irrespective, the instrument is a validated depressive symptoms screening tool. Thirdly, our study focused only on the association between care burden, resilience, and depressive symptoms. Further investigation

needs to be taken into consideration to explore other social psychology and emotional predictors for the level of depressive symptoms in caregivers of stroke survivors, such as society, family environment factors, and so on. Finally, the COVID-19 level of psychological distress in the current sample has not been assessed, the results must be interpreted with caution. However, in large samples, the current study adds valuable information to incipient efforts to understand care burden and its consequences for family caregivers of patients with stroke, it can help to provide first insights into the research field and help to define directions for the future.

Conclusions

The correlation of care burden, resilience and depressive symptoms in the main family caregivers of stroke patients was explored. The results showed a severe mental health burden on the main family caregivers, especially spousal and parental caregivers, of stroke patients. The self-care ability of patients and conditions of caregivers (e.g., education, income, employment, relationship with the patient, care time per day, and living with patients) were had a direct correlation with depressive symptoms. Care burden was positively correlated with depressive symptoms, while the mediating effect of resilience helps to alleviate depressive symptoms of caregivers with high care burden. This study facilitates understanding and prompt assessment of mental health of the main family caregivers of stroke patients, and the development of resilience-promoting measures in the health care system.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical counsel permit (Approval number: 402/2020) was approved by the Medical Ethical Committee of the First Affiliated Hospital of China Medical University, and informed consent was received from each participant. All procedures performed in the study involving human participants were in accordance with the ethical standards of the hospital, the National Research Committee, and the 1964 Helsinki Declaration (as revised in Brazil 2013).

Author contributions

LF and JZ conceptualized and designed the study. LF collected the data and prepared Figure 1 and Tables 1–4. LF and MD analyzed the data. JZ reviewed the analyses. LF, WF, and MD drafted the initial version of the manuscript. All authors contributed to revising, editing, and finalizing the manuscript. All authors have read and agreed to the published version of the manuscript.

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