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Caregiver Burden and Its Associated Factors Among Family Caregivers of Hospitalized Patients with Neurocritical Disease: A Cross-Sectional Study

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Background: Providing informal care for patients with neurocritical diseases is a challenging job, and family caregivers usually experience psychological distress and high caregiver burden. Previous studies have focused on caregiver burden for patients in the home rehabilitation stage, while few studies investigate caregiver burden among informal caregivers of early postoperative inpatients.

Objective: This study aimed to investigate caregiver burden for caregivers of patients with neurocritical diseases during hospitalization and to identify predictive factors related to caregiver burden.

Methods: From November 2023 to April 2024, a cross-sectional study was conducted using a convenience sampling method to assess patients with neurocritical disease and their family caregivers. The fundamental data regarding patients and caregivers were examined. Family caregivers were requested to complete the Zarit Burden Interview (ZBI), the Coping Adaptation Processing Scale (CAPS-15), the Chinese Auditory Verbal Learning Test of Huashan Version (AVLT-H), the Multifactorial Memory Questionnaire (MMQ), and the Hospital Anxiety and Depression Scale (HADS-A). The variables associated with caregiver burden were identified through the use of multiple linear regression analyses.

Results: 300 patients and their family caregivers participated in the study. Predominantly male family caregivers accounted for 55.7%, and the mean age was 46.7 ± 13.1 years. The patients' average age was 52.8 ± 14.3 years, 151 (50.3%) were men, and 153 (50.3%) had brain tumors. The average caregiver burden was 33.94 ± 17.2. Family caregivers of inpatients with neurocritical diseases experienced a mild to moderate caregiver burden. Patients' physical function, caregiver's age, relationship with patients, comorbid chronic disease status, memory function, adaptation level, and anxiety independently predicted caregiver burden, accounting for 66.3% of the total variation.

Conclusion: Family caregivers of inpatients with neurocritical diseases experience mild to moderate level of caregiver burden. Tailored early support plans should be developed based on caregivers' characteristics, including anxiety strategies, memory support, communication optimization, and role adjustment, to reduce their burden.

Keywords: caregiver burden, family caregivers, influencing factors, neurocritical disease, hospitalization

Introduction

Neurocritical diseases refers to critical diseases involving the brain, spinal cord, or neuromuscular system.[1] Such diseases are characterized by their abrupt onset, aggressive nature, rapid progression, and high rates of disability and mortality.[2,3] Due to resource and cost constraints, the incidence and mortality rates of neurocritical disease are still high in most

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developing countries, including China.[4,5] The Global Survey Report of Neurocritical Patients shows that the in-hospital mortality rate is as high as 24.1%.[3] In 2016, there were over 27 million new cases of traumatic brain injuries worldwide, with China accounting for approximately 18%.[6] The average per capita hospitalization cost for patients with neurocritical diseases in China ranges from 42,300 to 49,000 RMB.[7] With the aging of the population and the increasing incidence of diseases, neurocritical diseases have become a major public health problem in China, posing a huge burden on society and families.[8,9]

In China, due to the traditional Confucian culture of filial piety and the lack of professional nursing resources, informal care is predominantly provided by family members (spouses, parents, children, siblings, etc).[10] The early stages of neurocritical diseases are primarily characterized by hospitalization. In some cultures, the presence of family caregivers during hospitalization is considered a critical support for the patient's survival.[11] However, neurocritical illnesses often occur suddenly, and family caregivers frequently take on caregiving roles without any prior experience or preparation, and usually lack nursing-related knowledge and skills.[12] The hospitalization phase marks a critical period and often coincides with the peak of postoperative complications.[13] Additionally, due to the nature of neurological diseases, patients may experience functional impairments in limbs, consciousness, speech, and swallowing, which often leads to severe psychological, physical, and economic caregiving burdens for family caregivers. A longitudinal research demonstrates that family caregivers of stroke patients experience peak levels of stress, anxiety, and burden in the first 3 days post-stroke, with a subsequent gradual decline.[14] According to research by Yu et al[15] family caregivers' future mental health can be predicted by their early burden. Therefore, caregiver burden is not only related to caregiver well-being but is also a key determinant of care efficacy and patient quality of life.[16]

The mental health status of family caregivers is closely related to the caregiving burden, with those caring for patients with neurological diseases being more susceptible to negative emotions, particularly anxiety and depression.[17] Research has found that anxiety can significantly increase caregiver burden, demonstrating the important impact of family caregivers' anxiety on caregiver burden.[18] Falzarano et al[19] examined the cognitive performance of caregivers under long-term care stress, and the results showed that caregivers performed worse than non-caregivers on certain measures of episodic memory, working memory, and executive function. Acute neurocritical care inpatients are often in the acute phase of their illness. Under the stress of caregiving pressure, anxiety, and even sleep deprivation caused by sudden events, family caregivers experience a significant increase in cognitive load due to the influx of new caregiving information. This leads to significant alterations in the chemical environment of the frontal lobe, impairing working memory.[20,21] Therefore, family caregivers of patients with neurocritical illness are likely a high-risk group for memory function impairment. Memory function, as the foundation for information processing, problem solving, and communication, is essential for family caregivers to effectively assimilate care-related information. It can directly impact the quality and safety of patient care and may also constitute a significant modifiable factor in the caregiving burden.[22] However, no existing studies have examined the relationship between memory function and caregiving burden in these caregivers.

For a long time, adaptation has been conceptualized as an individual's intrinsic ability, manifested through responses to environmental stimuli, and is an important variable in reflecting an individual's changes in health and disease.[23] Nursing scientist Roy further developed the concept of adaptation, proposing that adaptation level are influenced by a complex interplay of focal, contextual, and residual stimuli, which can be regarded as environmental stimuli, eliciting a range of adaptive responses.[24] In other words, adaptation level represents a comprehensive representation of physiological and socio-psychological factors, indicating the impact of stimuli and predicting health-promoting behaviors in disease management. Research shows that adaptation level is closely related to the health outcomes of family caregivers, which can affect their quality of life and increase the incidence of mental illnesses.[25,26]

Currently, the majority of existing research on the caregiving burden of family caregivers of patients with severe neurological conditions mainly focuses on the outpatient rehabilitation stage of stroke and brain tumor patients.[27,28] There is limited research on the current status and influencing factors of caregiver burden during the acute hospitalization of patients with neurocritical diseases. Therefore, this study aims to (1) understand the current state of caregiver burden among family caregivers of inpatients with neurocritical disease; (2) explore the factors related to caregiver burden among family caregivers of inpatients with neurocritical disease, such as anxiety, memory function, and adaptation level.

Materials and Methods

Study Design and Setting

This study employed a cross-sectional descriptive method to measure the burden level of family caregivers. From November 2023 to April 2024, a convenience sampling method was used in the neurosurgery department of a tertiary general hospital in Chongqing, China. The researchers provided a detailed explanation of the study to potential participants in person using paper materials in the hospital ward, obtained their informed consent, and then proceeded with data collection. The study has been reported in accordance with the STROBE guidelines for reporting observational studies.

Participants

Participants were included if they met the following criteria: (1) The patient's diagnosis was in accordance with the Expert Consensus on Critical Care Management of Neurosurgery in China (2020 Edition);[29] (2) immediate family members who bear the primary caregiving responsibilities and participate in medical decision-making, including spouses, children, parents, siblings, and other relatives; (3) the age is ≥18 years old, and nursing time ≥ 4 hours per day; (4) provided informed consent, with good reading, writing, and comprehension skills; Participants were excluded if they met one or more of the following criteria: (1) family caregivers with serious heart disease, mental illness, or other serious diseases; (2) paid professional caregivers, as well as family caregivers with language expression and communication difficulties.

Sample size analysis for multiple regression was conducted in G*Power 3.1.9 to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, and a medium effect size ($f^2 = 0.15$),[30] and a sample loss rate is 10%. Eventually, at least 209 participants are needed.

A total of 316 questionnaires were administered, with 16 (5.1%) being excluded due to missing answers, resulting in 300 valid questionnaires collected, yielding a valid response rate of 94.9%. The study was approved by the Ethics Committee of First Affiliated Hospital of Army Medical University's [(A) KY2023167]. Prior to the investigation, we obtained consent from each family caregiver and had them sign informed consent forms.

Instruments

The Socio-Demographic Form

The form includes the patients' sociodemographic characteristics such as age, gender, employment status, education level, type of health insurance, and length of hospitalization, as well as disease information. This includes consciousness levels measured by the Glasgow coma scale,[31] limb function assessed by the unarmed muscle strength test,[31] and basic self-care ability evaluated by the Barthel index.[32] The form also captures the sociodemographic characteristics of family caregivers, which include age, gender, education level, marital status, place of residence, employment status, relationship with the patient, monthly household income, caregiving hours per day, and presence of comorbid chronic diseases.

Caregiver Burden

The level of caregiver burden was ascertained utilizing the Chinese version of the Zarit Burden Interview (ZBI), a 22-item instrument.[33] The scale's scores range from 0 to 88, and each item is evaluated on a 5-point Likert scale, where 0 means "never" and 4 means "very frequently". Higher scores indicate a higher level of caregiver burden.[34] According to previous research, we divided the burden into four grades: severe burden (61–88), moderate to severe burden (41–60), mild to moderate burden (21–40), and little or no burden when it is less than 21.[34] The cronbach's alpha value of the ZBI was found to be 0.875,[35] whereas the present study yielded a coefficient of 0.918.

Memory Function

The memory ability dimension of the Chinese version of the Multifactorial Memory Questionnaire (MMQ) was used to assess family caregivers' subjective memory functions. The scale consists of 20 items with Likert 5 ratings ranging from 0 to 4, for a total score of 0 to 80. Higher scores are correlate with greater self-rated memory ability, fewer daily memory

errors, and better subjective memory function, with a Cronbach's alpha of 0.929.[36] The Cronbach's alpha for this study was 0.942.

The Chinese Auditory Verbal Learning Test of Huashan Version (AVLT-H) was used to assess episodic memory and reflect objective memory function.[37] This includes short-term memory, short-delayed memory, long-delayed memory, clue memory, and recognition. The examiners read out 12 randomly arranged words from the scale three times in a row, then asked the subjects to recall freely for a short time, with a short delay at 5 minutes and a long delay at 20 minutes, and recorded the number of words correctly recalled each time. The evaluation indices are the AVLT overall score (the sum of the correct number of the first five free memories, with a total score of 0–60 points) and the AVLT long delayed memory (the correct number of the fifth free memory, with a total score of 0–12 points). Whether situational memory is damaged or not is determined by the fact that AVLT's long-delayed memory is smaller than the "mean −1.0 standard deviation" of the age and education matching group. The Cronbach's alpha for this study was 0.932.

Adaptation Level

The adaptation level was measured with the Chinese Coping Adaptation Processing Scale (CAPS-15), which was constructed by Roy, a nursing theorist, according to the adaptation model. Including 15 items, according to the frequency of using relevant coping strategies in the face of difficulties or crises, participants responded on four-point Likert scales (from 0 = never to 3 = very often), with a total score of 15–60 points. The higher the score, the higher the ability to adapt to difficulties or crises. Cronbach's alpha of the original scale is 0.820.[38] The Cronbach's alpha coefficient in this study was 0.89.

Anxiety

The Hospital Anxiety Scale (HADS-A) was used to measure the anxiety. It consists of 7 items, which are given specific scores according to the frequency of symptoms in the last month. Each item is rated from 0 to 3, where higher scores indicate greater anxiety. The maximum score is 21 on each subscale. The ranges of scores for cases are: 0–7 normal, 8–10 mild disorder, 11–14 moderate disorder, and 15–21 severe disorder.[39] Cronbach's α coefficient of the scale is 0.84.[40] The Cronbach's α coefficient in this study was 0.898.

Data Analysis

The data were analyzed using IBM SPSS Version 26.0 statistical software. Descriptive statistics (means, standard deviations and frequencies) were used to describe the sample characteristics. Normality tests were performed on the measurement data, and non-parametric statistics were found to be suitable for the analysis. The Mann–Whitney *U*-test was applied to compare two independent variables within the dataset, while the Kruskal–Wallis *H*-test was utilized for comparing three or more independent variables. For significant Kruskal–Wallis *H*-test results, binary comparisons between groups were performed with the Dunnett's multiple comparison test. Spearman correlation test was applied for correlation analysis. Multicollinearity was assessed using the variance inflation factor (VIF), with values exceeding 5.0 suggesting the presence of multicollinearity issues.[41] Influential factors on caregiver burden were explored through hierarchical linear multiple regression analysis (Stepwise Method). The level of significance (alpha value) was set at $p < 0.05$.

Results

Demographic Characteristics of Participants

The mean age of the patients was 52.8 ± 14.3 years, and 151 (50.3%) were men. 153 (50.3%) had brain tumors, 170 (56.7%) were covered by New Rural Health Insurance, 111 (37.0%) were incapacitated, 139 (37.00%) had dysfunctions, 286 (95.3%) were self-deficient, and the vast majority (95.3%) were hospitalized for more than 10 days.

The average age of family caregivers was 46.7±13.1 years, with 167 (55.7%) males, 268 (89.3%) married, 144 (48.0%) spouses of patients, 185 (61.7%) living in rural areas, 65 (21.7%) unemployed, and 188 (62.7%) having fewer than 10 years of schooling. 194 (64.9%) family caregivers had a monthly household income of ≤ 5000 yuan, 265 (88.3%) cared for patients for more than 12 hours per day, and 59 (19.7%) reported chronic conditions.

Levels of Caregiver Burden and Other Outcomes

The average caregiver burden was 33.94±17.27. No burden was found in 89 people (29.7%), whereas mild burden was found in 104 (34.7%), moderate in 81 (27.0%), and severe in 26 (8.7%). The average score of episodic memory was 29.51±10.9; 92 (30.4%) had impaired episodic memory. Self-rated memory ability and adaptation level were both moderate, and levels of anxiety was mild (Table 1).

Univariate Analysis of Factors Associated with Caregiver Burden

The differences in caregiver burden among participants with different characteristics are shown in Table 2. There was a statistically significant difference in care burden scores among participants with varying patient characteristics, including age, employment status, education level, type of health insurance, functional status of limbs, state of consciousness, self-care ability, and length of hospital stay, as well as family caregivers' characteristics such as gender, age, marital status, education level, residence, employment status, relationship with the patient, monthly household income, presence of chronic diseases, and average time of nursing per day ($P < 0.05$).

Correlation Between Caregiver Burden, Memory Function, Adaptation Level, and Anxiety

The results of the correlation analysis, as displayed in Table 3, indicate that caregiver burden is negatively correlated with subjective memory function, episodic memory, and adaptation level, while it is positively correlated with anxiety.

Factors of Caregiver Burden Among Participants

Multiple linear regression analysis was conducted with the caregiver burden score as the dependent variable and statistically significant components from single factor and correlation analyses as the independent variables. In the regression analysis, all variance inflation factor (VIF) values were less than 5.0, indicating the absence of multi-collinearity. There was no autocorrelation phenomenon, as indicated by the Dobbin-Watson statistic of 1.827, which is very close to 2.0 and suggests that the error terms are independent of one another. The findings indicated that the patients' limb dysfunction (β=0.128, P<0.001), family caregivers' age (β=0.106, P=0.011), their relationship with patients (β=−0.093, P=0.009), chronic disease situation (β=0.133, P=0.001), Subjective memory function (β=−0.129, P=0.012), episodic memory (β=−0.138, P=0.001), adaptation level (β=−0.151, P=0.002), and anxiety (β= 0.365, P<0.001) are the factors influencing caregiver burden, accounting for 66.3% of the total variation (Table 4).

Discussion

The results showed that the caregiver burden score for family caregivers of inpatients with neurocritical disease is 33.94 ± 17.27, which was higher than that of patients with stroke and malignant glioma in the stage of home rehabilitation.[42,43] The diagnosis of neurocritical diseases is usually unpredictable, and the hospitalization stage is a high-risk period for the patient's disease progress. Providing informal care to patients in an acute care setting is considered to be a more arduous

Table 1 Levels of Caregiver Burden and Other Outcomes (N = 300)

Variable	Score range	Observed range	Actual Score (Mean ± SD)	Average Score of Items (Mean ± SD)
Caregiver burden	0–88	1–73	33.94±17.27	1.55±0.78
Personal burden dimension	0–48	0–41	18.51±9.07	1.55±0.76
Responsibility burden dimension	0–24	0–22	8.07±5.68	1.35±0.95
Subjective memory function	0–80	14–80	53.53±14.12	2.68±0.71
Episodic memory	0–60	4–56	29.51±10.90	—
Adaptation level	0–60	25–60	46.56±7.55	3.10±0.50
Anxiety	0–21	0–18	7.41±4.88	1.06±0.70

Table 2 Univariate Analysis of Factors Associated with Caregiver Burden (N=300)

Characteristics	Categories	n (%)	(Mean ±SD)	*H/Z*	*P*
Patients					
Classification of disease	Cerebral apoplexy	93 (31.0)	32.4±18.6	2.954[b]	0.566
	Craniocerebral injury	8 (2.7)	36.6±19.3		
	Cerebral tumor	153 (51.0)	33.8±16.6		
	Spinal cord and spine diseases	11 (3.7)	36.6±15.5		
	Congenital and functional diseases	35 (11.6)	37.3±16.8		
Gender	Male	149 (49.7)	35.2±17.3	−1.343[a]	0.179
	Female	151 (50.3)	32.7±17.2		
Age (years)	<45	66 (22.0)	30.2±15.6	13.262[b]	0.001
	45–60	154 (51.3)	32.5±17.2		
	≥60	80 (26.7)	39.9±17.5		
Employment status	Employed	63 (21.0)	29.0±16.0	9.649[b]	0.022
	Retire	46 (15.3)	32.2±17.8		
	Unemployed	134 (44.7)	37.9±17.4		
	Self-employed	57 (19.0)	35.2±17.2		
Educational level(years)	<7	121 (40.3)	36.8±17.8	6.977[b]	0.031
	7–10	90 (30.0)	33.6±16.5		
	>10	89 (29.7)	30.4±16.8		
Health insurance	No insurance	58 (19.3)	32.4±18.0	9.376[b]	0.025
	New rural Cooperative medical insurance	170 (56.7)	36.0±17.5		
	Business insurance	23 (7.7)	36.5±16.6		
	Basic medical Insurance for urban employees	49 (16.3)	27.5±14.4		
Limb dysfunction	No	189 (63.0)	30.4±16.9	−4.725[a]	<0.001
	Yes	111 (37.0)	39.9±16.2		
Degree of Consciousness	Awake	161 (53.7)	31.3±17.0	10.339[b]	0.016
	Mild disturbance of consciousness	59 (19.6)	34.9±17.3		
	Moderate disturbance of consciousness	53 (17.7)	39.8±17.5		
	Severe disturbance of consciousness	27 (9.0)	36.1±15.9		
Degree of Self-care ability	Independent	14 (4.7)	24.9±20.5	21.091[b]	<0.001
	Mild dependent	98 (32.6)	29.9±16.8		
	Moderately dependent	59 (19.7)	32.2±15.7		
	Severely dependent	129 (43.0)	38.8±16.8		
Length of stay (days)	<10	22 (7.3)	23.9±13.7	9.567[b]	0.008
	10–20	204 (68.0)	34.0±17.8		
	≥20	74 (24.7)	36.9±15.9		
Family caregivers					
Gender	Female	133(44.3)	36.6±16.9	−2.534[a]	0.011
	Male	167(55.7)	31.8±17.3		
Age (years)	<45	115(38.3)	25.1±13.1	69.374[b]	<0.001
	45–60	135(45.0)	35.8±17.0		
	≥60	50(16.7)	49.3±13.9		
Marital status	Single	28(9.3)	21.8±12.0	18.940[b]	<0.001
	Married	268(89.3)	35.4±17.3		
	Divorced /Widowed	4(1.4)	20.3±11.6		
Education level (years)	<7	95(31.7)	44.7±14.1	66.920[b]	<0.001
	7–10	93(31.0)	33.3±17.3		
	>10	112(37.3)	25.4±14.7		
Residence	City	115(38.3)	26.9±15.3	−5.497[a]	<0.001
	Rural	185(61.7)	38.3±17.0		
Employment status	Employed	86(28.7)	26.3±14.4	25.195[b]	<0.001
	Retire	12(4.0)	31.1±16.3		

(*Continued*)

Table 2 (Continued).

Characteristics	Categories	n (%)	(Mean ±SD)	*H/Z*	*P*
	Unemployed	65(21.6)	39.0±18.8		
	Self-employed	137(45.7)	36.6±16.8		
Relationship of caregiver to patient	Spouse	144(48.0)	38.3±17.8	17.378[b]	0.001
	Parents/Children	123(41.0)	29.8±15.2		
	Brothers/sisters	24(8.0)	32.0±17.6		
	Others	9(3.0)	25.9±20.0		
Monthly household income(Chinese Yuan)	<1000	18(6.1)	43.9±16.2	43.132[b]	<0.001
	1000–3000	73(24.3)	42.0±16.5		
	3000–5000	103(34.3)	34.6±17.5		
	>5000	106(35.3)	26.1±14.0		
Chronic diseases	No	241(80.3)	30.2±15.7	−7.338[a]	<0.001
	Yes	59(19.7)	49.4±14.5		
Average time of caring per day (hr)	<12	35(11.7)	27.8±18.3	−2.399[a]	0.016
	≥12	265(88.3)	34.75±17.0		

Notes: [a]the statistic of Mann–Whitney *U*-test; [b]the statistic of Kruskal–Wallis *H*-test.
Abbreviations: H, the statistic of Kruskal–Wallis *H*-test; Z, the statistic of Mann–Whitney *U*-test.

Table 3 Relationships Between Caregiver Burden and All Outcomes (N = 300)

Variables	Caregiver burden	Subjective memory function	Episodic memory	Adaptation level	Anxiety
Caregiver burden	1				
Subjective memory function	−0.650**	1			
Episodic memory	−0.519**	0.532**	1		
Adaptation level	−0.617**	0.681**	0.527**	1	
Anxiety	0.710**	−0.617**	−0.377**	−0.594**	1

Note: **P<0.01.

Table 4 Results of Regression Analysis for Predicting (N=300)

Variables	*B* value	*SE* value	*β* value	t value	*P*-value	95% *CI*	VIF
Constant	51.907	5.666	—	9.161	<0.001	40.755~63.058	
Limb dysfunction	4.566	1.260	0.128	3.624	<0.001	2.086~7.045	1.103
Caregiver age	2.588	1.009	0.106	2.566	0.011	0.603~4.574	1.527
Relation to patient	−2.126	0.805	−0.093	−2.641	0.009	−3.710~-0.542	1.091
Caregiver chronic diseases	5.776	1.666	0.133	3.467	0.001	2.497~9.056	1.308
Subjective memory function	−0.158	0.063	−0.129	−2.522	0.012	−0.281~-0.035	2.326
Episodic memory	−0.219	0.066	−0.138	−3.304	0.001	−0.349~-0.088	1.548
Adaptation level	−0.345	0.113	−0.151	−3.068	0.002	−0.567~-0.124	2.149
Anxiety	1.293	0.165	0.365	7.839	<0.001	0.969~1.618	1.923

Note: $R^{2=}$0.672; ΔR^2=0.663; F^2=74.507; P<0 0.001.

task.[44] In addition to daily care, family caregivers also bear the economic burden of high hospitalization expenses, experiencing increased psychological pressure due to witnessing their loved ones suffering from diseases and participating in medical decision-making, and facing a decline in social support due to reduced interaction with the outside world.[14] Moreover, the caregiving burden level in this study is lower than that of patients with moderate to severe traumatic brain injury during hospitalization as investigated by Liu et al.[45] It indicates that the factors influencing the caregiving burden may be quite complex. Even during the same hospitalization period, it can vary due to patient factors such as the severity of the illness, caregiver factors such as their health status, as well as the relationship between the two

and the family's economic conditions. Therefore, in-depth exploration of the caregiving burden and its influencing factors for family caregivers of neurology critically ill patients during hospitalization is of great significance for early formulation of targeted intervention strategies and ensuring the quality of life for both patients and their family caregivers.

In this study, we found that patients with limb dysfunction and family caregivers who are older, spouse groups, and have comorbid chronic conditions report a higher level of caregiving burden. Patients with limb dysfunction impose a greater caregiving burden on their caregivers, which is similar to that caused by limb dysfunction in stroke patients investigated by Achilike et al.[27] Patients with limb dysfunction require more assistance from family caregivers to conduct daily activities and are more reliant on them, resulting in a heavier caregiving burden. With the increase of age, it is increasingly difficult for family caregivers to provide for the physical and energy needs of patient, because their physiological functions and social adaptability decline. Which makes it harder for them to accept and carry out caregiving responsibilities.[46] In this study, the average age of family caregivers was 46.7±13.1 years. In China, individuals in this age group generally face dual pressures of family responsibilities and social roles, being in the parallel stages of "caring for the elderly" and "raising children", which has brought about tremendous pressure. Spouses, as the closest caregivers of patients, are also at this critical turning point in the life cycle, which makes them very vulnerable to high levels of caregiving burden.[47] Family caregivers for individuals with comorbid chronic diseases must not just care for their patients, but also take care of their own health. The dual pressure leads them to bear higher physical and time stress loads, making it easier for them to experience caregiver burden.[48] Therefore, it is crucial to provide patients with early rehabilitation therapy in order to maximize their recovery of their physical functions. It is also important to pay attention to the elderly, spouses, and family caregivers of people with chronic illnesses in order to provide the required support.

Anxiety is a significant factor influencing caregiver burden, with higher levels of anxiety resulting in greater caregiving burdens.[49] Anxiety is the primary emotion shared by most family caregivers during their caregiving period, and caring for family members with progressing neurological illnesses is more likely to increase anxiety. According to research, the prevalence of anxiety among family caregivers of stroke patients is 21.4%, and the prevalence of depression is roughly 35%, which is twice as high as in other populations.[17] Most neurocritical patients are in an acute critical state while hospitalized. Family caregivers must not only care for and support the requirements of their patients but also have to worry about changes in their condition throughout the acute period, and they also undertake social and familial obligations. Moreover, following surgery, patients frequently endure physical and cognitive dysfunctions due to the impairment of processes like the nervous system, which further exacerbates the anxiety of family caregivers. It is worth noting that although caregivers generally have mental health problems, they often do not seek medical help on their own initiative.[50] Therefore, it is of great significance to pay early attention to the psychological state of family caregivers during hospitalization, help them develop skills to cope with anxiety, and, if necessary, suggest that other family members share caregiving responsibilities.

This study also discovered that even under the impact of short-term acute stress, 30.4% of family caregivers had impaired episodic memory, which was higher than the memory impairment reported in caregivers of long-term dementia patients.[51] Additionally, their subjective memory scores were lower than those of middle-aged and elderly individuals in the community.[52] Moreover, it is important to note that the participants in this study had lower average ages, but their memory performance was worse, which fully demonstrates the severity of memory impairment in this population. However, it is still unclear whether this memory issue is a short-term reversible change or a long-term condition, and more longitudinal research is required. The regression analysis result revealed that episodic memory and subjective memory function were independent and negative predictors of caregiver burden. As the family caregivers of neurocritical inpatients, in the face of a sudden family crisis, huge acute stress will trigger a series of changes in brain neuroregulation, which will have a negative impact on memory function and cognitive control. The decline in memory ability impairs their confidence and ability to provide care, increasing the caregiver burden. It suggests that in the future, healthcare providers can use memory support strategies, such as providing external memory support and strengthening communication and health education strategies, to decrease the memory load on this population, thereby alleviating the caregiver burden.

The results showed that the adaptation level of family caregivers of neurocritical disease patients was moderately high, similar to those of the community physical examination residents. However, there is still room for improvement.[53] The regression results indicated that the higher the adaptation level, the lower the perceived caregiving burden of family caregivers. Adaptation level can be understood as an individual's ability to cope with challenging environments or crises, and it can also be understood as the impact of internal and external environmental stimuli on the individual. Therefore, in this study, by observing the adaptation level, we can understand the impact of various stimuli on caregiving burden, that is, the cumulative effects of memory function, anxiety, and other factors on the caregiving burden over a period of time, which represents the comprehensive effects of other variables on caregiving burden. Wang et al[54] found that adaptation level can predict an individual's disease management behavior with a classification accuracy of 76.40%. Therefore, understanding the level of adaptation can help us understand the role of environmental stimuli and predict personal health behavior. And compared with using the medical coping style questionnaire to focus on problem solving and emotional coping, the CAPS-15 scale increases the evaluation of individual cognitive and behavioral coping, which can help healthcare providers to evaluate quickly and efficiently, and is worthy of further promotion and application.[23] Healthcare providers can improve adaptation level by expanding their internal and external resources, thus reducing caregiving burden.

This study has several limitations. First and foremost, the sampling for this study conducted at a university-affiliated hospital in a specific location of China makes it impossible to represent the entire population and find variations in caregiver burden over time. To further validate the findings, future research should increase the sample size and geographical area, as well as employ a prospective longitudinal research design. Second, while the influencing factors in this study can account for 66.3% of the total variation, there may be some unobserved confounding variables that may limit our understanding of caregiver burden in this study, so other social or environmental factors should be considered comprehensively in future research.

Conclusion

The present study found that family caregivers of inpatients with neurocritical diseases experience mild to moderate level of caregiver burden, Patients' physical function, caregiver's age, relationship with patients, comorbid chronic disease status, memory function, adaptation level, and anxiety were factors influencing family caregiver burden. Healthcare providers should manage the caregiver burden during the early hospitalization phase based on the diverse characteristics of family caregivers and associated factors, with practice strategies beginning with assisting them in developing early anxiety coping skills, teaching strategies for assisted memory interventions, optimizing health education models, and enhancing adaptation levels.

Data Sharing Statement

Data is available on reasonable request. The data supporting the study's conclusions are accessible from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

All participants participated voluntarily and provided written informed consent in accordance with the Declaration of Helsinki. Respondents were assured of confidentiality and anonymity.

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Disclosure

The authors confirm that they have no personal, financial, commercial, or academic conflicts of interest with regard to this work.

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