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Caregiver Burden and Associated Factors Among Informal Caregivers of Hospitalized Elderly Patients in China: A Latent Profile Analysis

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Background: Caregiver burden is a critical issue in healthcare, particularly among informal caregivers of hospitalized elderly patients, as it can significantly impact both the caregivers' well-being and the quality of patient care.
Objective: This study aims to identify the latent profiles of caregiver burden among informal caregivers of hospitalized elderly patients and the factors associated with caregiver burden.
Methods: 506 pairs of hospitalized elderly patients and their informal caregivers were interviewed using the Sociodemographic questionnaire, Caregiver Burden Inventory, Perceived Social Support Scale, Generalized Anxiety Disorder, and Barthel Index. Latent profile analysis identified caregiver burden profiles, and multinomial logistic regression determined associated factors.
Results: The caregiver burden was classified into three profiles: low (49.01%), moderate (41.90%), and high (9.09%). Individual caregiver factors (older age, high economic stress, poor self-rated health, poor caregiving ability and profound anxiety) and situational factors (inadequate social support, and caring for patients with limited ADL) were associated with high level of caregiver burden (*P*<0.05).
Conclusion: These three profiles of caregiver burden in the study showed different characteristics in different dimensions of caregiver burden. These findings provide a basis for developing targeted interventions to alleviate the burden and enhance care quality.

Keywords: informal caregivers, hospitalized elderly patients, caregiver burden, latent profile analysis, cross-sectional study

Introduction

As life expectancy grows, the percentage of elderly adults in the general population continues to rise steadily.[1] The World Health Organization (WHO) projects that by 2030, 22% of the world's population will be 60 years of age or older, and by 2050, there will be 2.1 billion individuals over the age of 60 worldwide.[2] In recent years, the prevalence of chronic illness among older adults has been increasing worldwide, driven by conditions such as cardiovascular disease, diabetes, and Alzheimer's disease,[3,4] and the incidence of disability in the elderly has also been rising.[5] In China, elderly patients aged 60 years or above made up 42.0% of hospitalized patients until 2021.[6] This trend has led to an increased demand for hospitalization.[7] The associated caregiver burden has thus emerged as a significant social issue necessitating urgent attention.

Informal caregivers are individuals who provide unpaid support and medical attention to those with illnesses, disabilities, injuries, or chronic conditions.[8] They play a crucial role in delivering primary bedside care to patients both before and during hospitalization. Globally, there is a shortage of caregivers,[9] amplifying the reliance on these individuals. While nurses primarily execute medical treatments as prescribed, elderly hospitalized patients require caregivers who provide them with comprehensive physical, psychological, and economic support.[10] The responsibility of care is shifted to the informal caregivers. In China, family members assume the main responsibility in caring for elderly hospitalized patients.[11] A long-

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term intervention trial for Alzheimer's disease reported that caregiving has a positive effect on personal growth and the caregiver-patient relationship.[12] However, caregiving also brings substantial changes to caregivers' lives, impacting their daily routines and personal responsibilities.[13] Many caregivers face unpreparedness for their roles, leading to conflicts with personal lives, professional development, and familial obligations.[14,15] The limited caregiving ability, changing social roles, and long hours of caregiving make caregivers' quality of life decline, creating stress and burden.[16]

Caregiver burden is defined by Zarit as " The subjective feelings and negative impacts that caregivers experience in caring for their patients in physical, psychological, economic, and social terms."[17] Previous studies indicated that a majority of caregivers endure mild and moderate levels of burden.[18–20] Physical manifestations of this burden commonly include sleep disturbances, fatigue, pain, and weight fluctuations.[21–23] Beyond these tangible challenges, caregivers also face emotional and psychological strains such as anxiety, depression, and social isolation,[10,24] which can detrimentally affect both the caregiver's ability to provide optimal care and the patient's prognosis.[25] These effects often persist even after caregiving ends. Additionally, caregiver burden is associated with increased healthcare utilization.[26] In China, when patients are diagnosed with severe illnesses, the majority of caregivers opt to conceal the diagnosis from the patients to prevent increasing their psychological burden. However, this practice may inadvertently increase the psychological burden on the caregivers.[27] Moreover, influenced by the traditional Chinese family concept, patients often have a strong dependency on their families, and treatment decisions are largely made by family caregivers. The greater the responsibility, the greater the burden.[28] Previous studies had investigated the factors of caregiver burden had focused on caregiver and patient characteristics, such as Sociodemographic, care-related, disease-related, social and psychological factors.[29,30] Conducting burden assessments and offering supportive services are crucial steps toward enhancing caregivers' capabilities and quality of life while mitigating their physical and mental stress.[31] Therefore, improving the caregiver experience not only enhances care quality for hospitalized elderly patients but also carries significant policy implications in our aging society.

Most previous studies have focused on individuals with specific illnesses, such as cancer,[27] stroke[10,32] and Parkinson,[33–36] there remains a notable gap in understanding the comprehensive burden experienced by caregivers of elderly patients. Moreover, much of the existing literature has concentrated on family caregivers, with limited attention given to caregivers of hospitalized patients. In addition, many studies used scale total scores to directly determine the extent of caregiver burden, ignoring the variation caused by individual differences. Latent profile analysis (LPA) is a person-centered method to explain the relationships among indicators of external continuous variables through latent categorical variables, which makes up the drawbacks of traditional categorical methods.[37] LPA categorizes study subjects into different populations based on differences in exogenous variables and analyzes the differences in relevant indicators between different profiles and the characteristics of different groups.[38] It effectively identifies high-risk profiles that should be targeted for prevention, thereby providing a reliable basis for the development of targeted intervention programs. To date, there have been no reports of applying LPA to the study of caregiver burden among informal caregivers of hospitalized elderly patients in China. In this study, LPA was used to identify subgroup of caregiver burden among informal caregivers of hospitalized elderly patients in China and to explore the associated factors of caregiver burden in different potential profiles.

The aim of this study was used LPA to identify different burden profiles of informal caregivers and their specific characteristics, and explore the relationships between Sociodemographic characteristics, social and psychological variables with different caregiver burden profiles, as well as provide a reference for policy development, and can help to further support and improve the development of caregiver training programs and the provision of mental health treatment. Also, it improves hospitals to integrate caregiver support as an integral part of patient care, creating a supportive environment to alleviate the physical and mental burden and improve the quality of life.

Materials and Methods

Study Design, Settings and Participants

This cross-sectional study was conducted among hospitalized elderly patients and their informal caregivers from April to June 2024 in Xinxiang City, Henan Province, China. We employed a stratified random sampling method to recruit participants from hospitalized patients in secondary and tertiary hospitals. Specifically, we identified all Secondary and

Tertiary hospitals in Xinxiang and assigned a unique number to each. We selected two hospitals from each level using a random number table Next, we recruited patients and their caregivers through convenience sampling according to the following inclusion criteria.

Inclusion criteria for the caregivers were (1) age≥18, (2) primary caregiver with a non-employment relationship, and (3) signed informed consent and voluntary participation. Exclusion criteria were (1) presence of severe psychiatric disorders, (2) speech, reading, or writing impairment, and (3) experience major traumatic events in the past 3 months (eg, bereavement, accidents).

According to Kendall's guidelines, since the sample size should be 10 to 20 times the number of variables, this study included 21 variables, at least 420 cases should be included, and considering the 20% sample loss rate, the estimated sample size is 252 to 504 cases.

Ultimately, 512 pairs of hospitalized elderly patients and their informal caregivers were enrolled in the survey. 6 pairs were excluded for the following reasons: 2 pairs did not complete the questionnaire, 3 pairs withdrew consent after starting the survey, and 1 pair's responses contained inconsistencies, affecting the validity of the data. After exclusions, 506 patient-caregiver dyads provided informed consent and completed the questionnaire survey.

Data Collection

Information on informal caregivers and hospitalized elderly was collected by the researchers through face-to-face interviews. Researchers contacted the patient's attending physician or nurses to assess whether they met any exclusion criteria and obtain permission to contact the patient and his/her caregiver. Then, the purpose of the study and the procedures were explained to the participants. After obtaining informed consent, questionnaires were administered to elderly hospitalized patients and their caregivers. The questionnaires included: Sociodemographic questionnaire, Caregiver Burden Inventory, Perceived Social Support Scale, 7-item Generalized Anxiety Disorder Scale, and Barthel Index, which lasted approximately 20 min. Following the survey, the questionnaire was carefully checked, and any errors or ambiguities were promptly confirmed by the participants. Therefore, in the current manuscript, no missing data is reported. During the data entry phase, we used double data entry and cross-validation techniques to minimize errors.

Measures

Sociodemographic Questionnaire

A Sociodemographic questionnaire designed by the researcher was used to investigate the Sociodemographic characteristics of informal caregivers and hospitalized elderly patients. The Sociodemographic questionnaire includes: gender, age, marital status, place of residence, education, income level, self-rated health (poor, general, healthy), social relationship with the patient, financial stress (no at all, almost not, general, some, severe), care hours per day and caregiving ability (very poor, poor, general, good, very good) of informal caregivers; gender, age, marital status, education and length of hospitalization of the hospitalized elderly patients. Self-rated health was categorized as a categorical variable, while financial stress and caregiving ability were treated as continuous variables in the analysis.

Caregiver Burden Inventory (CBI)

The ZBI was used to measure caregiver burden. The scale originally developed by Novak and Guest,[39] the Chinese version was translated and revised by Yue Peng with a Cronbach's α was 0.92.[40] It consists of 24 items organized into five dimensions: time-dependence burden, developmental burden, physical burden, social burden, and emotional burden. Responses are rated on a 5-point Likert scale where 0 indicates "not at all descriptive" and 4 indicates "very descriptive", total scores range from 0 to 96, with higher scores indicating more severe caregiver burden.

Perceived Social Support Scale (PSSS)

Caregivers' social support was measured using the PSSS, which was established by Zimet,[41] consists of 12 questions spanning three dimensions: family support, friend support and other support. The scale was based on a 7-point Likert scale, with 1 indicating strongly disagree and 7 indicating strongly agree. Total scores range from 12 to 84, with higher values indicating stronger perceived social support. The Chinese version of the PSSS was interpreted and validated with a Cronbach's α of 0 0.91.[42]

7-Item Generalized Anxiety Disorder Scale (GAD-7)

Anxiety was assessed using the Chinese version of 7-item Generalized Anxiety Disorder Scale (GAD-7),[43] with a Cronbach's α of 0.93. It is based on the diagnostic criteria for generalized anxiety disorder of the DSM-IV, developed in 2006 by Spitzer to screen and monitor anxiety intensity.[44] It comprises 7 items rated on a 4-point Likert scale ranging from "not at all" to "nearly every day", with a score of 0 to 3. Total scores vary between 0 and 21, with higher scores indicating more severe anxiety symptoms.

Barthel Index (BI)

The levels of activity of daily living (ADL) were measured using the Barthel index (BI) in this study.[45] It includes 10 items: self-care (bathing, grooming, bladder management, bowel management, dressing, feeding, and toilet use) and mobility (transfers, ascending and descending stairs, and walking). Total scores range from 0 to 100, with higher scores indicating better functional independence in elderly patients. A Chinese version was recently constructed and verified with a Cronbach's α of 0.90.[46]

Data Analysis

This study used Mplus 8.3 to identify profiles of caregiver burden and IBM SPSS 25.0 to explore associated factors. Before data analysis, a Harman single-factor test was conducted. The results of the rotated principal component analysis showed that nine factors had eigenvalues >1, with the first component accounting for 23.32%, which did not exceed the critical threshold of 40%, indicating no significant common method bias.

The data was analyzed in three sections. To begin, descriptive statistics were applied to all variables to better understand participant characteristics. For non-normally distributed continuous variables, we utilized the median with interquartile range (*IQR*). Categorical variables were presented as frequencies and proportions. Secondly, LPA was used to identify latent profiles of caregiver burden. Model fit was evaluated using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample-size adjusted BIC (aBIC), where lower values indicate better fit. Entropy was used to assess the accuracy of model classification, with values closer to 1 indicating higher accuracy. The Lo-Mendell-Rubin (LMR) and Bootstrapped Likelihood Ratio Test (BLRT) were used to determine the optimal number of classes, with *P*-values <0.05 indicating that a k-class model fit better than a k-1 class model. Thirdly, exploring associated factors in different caregiver burden profiles. Kruskal–Wallis *H*-tests and chi-square tests were used to examine differences in Sociodemographic characteristics among subgroups. Multivariable logistic regression analyzed factors associated with different levels of caregiver burden, with *P*-values <0.05 considered statistically significant.

Result

The Sociodemographic Characteristics

In this study, 512 questionnaires were distributed and 506 questionnaires were valid, with a valid recovery rate of 98.82%. Table 1 presents the Sociodemographic characteristics. Among 506 informal caregivers, the majority were female (55.9%), aged 31 to 45 years (39.1%). Most were married (89.3%) and lived in rural areas (57.1%). The predominant education was junior (39.1%), and 41.7% had a monthly income of less than 3000 yuan. 68.6% of caregivers perceived themselves to be in relatively good health, with 45.8% needing to care for patients for more than 16 hours per day. Among the 506 hospitalized elderly patients, 50.8% were female. The age group primarily ranged from 60 to 69 years (49.4%), and most were married (86.4%). The majority had an elementary and lower school education (45.3%) and stayed in the hospital for less than one week (57.1%). Table 2 showed that the caregiver burden inventory medians were 37.00 and IQR was 26.00–48.00, other scales were: GAD-7 (2.00, 0.00–7.00), PSSS (66.00, 56.00–72.00), and BI (80.00, 50.00–100.00).

Table 1 Profiles Differences in Sociodemographic Characteristics of Caregiver and Hospitalized Elderly Patients (n = 506)

Variable	**n (%)**	**C1 n (%)**	**C2 n (%)**	**C3 n (%)**	***χ2/H***	***p-value***
Caregivers						
Gender					0.691[a]	0.708
Male	223(44.1)	105(42.3)	96(45.3)	22(47.8)		
Female	283(55.9)	143(57.7)	116(54.7)	24(52.2)		
Age (years)					12.938[a]	0.044
Below 30	37(7.3)	26(10.5)	13(6.1)	1(2.2)		
31–45	195(38.5)	102(41.1)	75(35.4)	18(39.1)		
46–60	185(36.6)	90(36.3)	77(36.3)	18(39.1)		
61 and below	86(17.0)	30(12.1)	47(22.2)	9(19.6)		
Marital Status					1.122[a]	0.571
Unmarried	54(10.7)	29(11.7)	22(10.4)	3(6.5)		
Married	452(89.3)	219(88.3)	190(89.6)	43(93.5)		
Place of residence					0.861[a]	0.930
Rural	289(57.1)	141(56.9)	122(57.5)	26(56.5)		
Semirural	102(20.2)	53(21.4)	39(18.4)	10(21.7)		
Urban	115(22.7)	54(21.8)	51(24.1)	10(21.7)		
Education					4.027[a]	0.673
Elementary and below	71(14.0)	31(12.5)	35(16.5)	5(10.9)		
Junior	198(39.1)	100(40.3)	81(38.2)	17(37.0)		
High	129(25.5)	59(23.8)	55(25.9)	15(32.6)		
University and above	108(21.3)	58(23.4)	41(19.3)	9(19.6)		
Income Level(yuan)					0.599[a]	0.200
Below 3000	211(41.7)	91(36.7)	96(45.3)	24(52.2)		
3000–4999	186(36.8)	97(39.1)	75(35.4)	14(30.4)		
Above 5000	109(21.5)	60(24.2)	41(19.3)	8(17.4)		
Self-rated Health					25.697[a]	0.000
Poor	25(4.9)	9(3.6)	7(3.3)	9(19.6)		
General	134(26.5)	59(23.8)	62(29.2)	13(28.3)		
Healthy	347(68.6)	180(72.6)	143(67.5)	24(52.2)		
Social Relationship					14.555[a]	0.068
Spouse	104(20.6)	39(15.7)	54(25.5)	11(23.9)		
Child	307(60.7)	166(66.9)	118(55.7)	23(50.0)		
Sibling	12(2.4)	6(2.4)	5(2.4)	1(2.2)		
Daughter /Son -in-law	39(7.7)	13(5.2)	20(9.4)	6(13.0)		
Other	44(8.7)	24(9.7)	15(7.1)	5(10.9)		
Financial Stress					66.454[b]	0.000
No at all	58(11.5)	45(18.1)	12(5.7)	1(2.2)		
Almost not	115(22.7)	76(30.6)	36(17.0)	3(6.5)		
General	107(21.1)	51(20.6)	47(22.2)	9(19.6)		
Some	148(29.2)	59(23.8)	75(35.4)	14(30.4)		
Severe	78(15.4)	17(6.9)	42(19.8)	19(41.3)		
Caregiving Daily Time(hours)					8.411[a]	0.078
Less than 8	171(33.8)	98(39.5)	61(28.8)	12(26.1)		
8–16	103(20.4)	49(19.8)	46(21.7)	8(17.4)		
More than 16	232(45.8)	101(40.7)	105(49.5)	26(56.5)		
Caregiving Ability					36.067[b]	0.000
Very poor	16(3.2)	2(0.8)	8(3.8)	6(13.0)		
Poor	47(9.3)	14(5.6)	24(11.3)	9(19.6)		
General	104(20.6)	38(15.3)	52(24.5)	14(30.4)		
Good	206(40.7)	114(46.0)	81(38.2)	11(23.9)		
Very good	133(26.3)	80(32.3)	47(22.2)	6(13.0)		

(*Continued*)

Table 1 (Continued).

Variable	n (%)	C1 n (%)	C2 n (%)	C3 n (%)	*χ2/H*	*p-value*
Patients						
Gender					1.580[a]	0.454
Male	249(49.2)	127(51.2)	103(48.6)	19(41.3)		
Female	257(50.8)	121(48.8)	109(51.4)	27(58.7)		
Age(years)					1.280[a]	0.865
Below 69	209(41.3)	101(40.7)	86(40.6)	22(47.8)		
70–79	225(44.5)	111(44.8)	97(45.8)	17(37.0)		
Above 80	72(14.2)	36(14.5)	29(13.7)	7(15.2)		
Marital Status					0.121[a]	0.941
Unmarried	69(13.6)	33(13.3)	29(13.7)	7(15.2)		
Married	437(86.4)	215(86.7)	183(86.3)	39(84.8)		
Education					2.584[a]	0.859
Elementary and below	229(45.3)	108(43.5)	102(48.1)	19(41.3)		
Junior	173(34.2)	84(33.9)	72(34.0)	17(37.0)		
High	79(15.6)	44(17.7)	28(13.2)	7(15.2)		
University and above	25(4.9)	12(4.8)	10(4.7)	3(6.5)		
Length of Hospitalization					11.241[a]	0.024
<1 week	289(57.1)	151(60.9)	120(56.6)	18(39.1)		
1 ~ 2 weeks	131(25.9)	62(25.0)	56(26.4)	13(28.3)		
>2 weeks	86(17.0)	35(14.1)	36(17.0)	15(32.6)		

Note: C1 is the low caregiver burden group; C2 is the moderate caregiver burden group; C3 is the high caregiver burden group; [a]chi-square tests; [b]Kruskal–Wallis tests.

Table 2 Profiles Differences in GAD-7, PSSS, BI of Caregiver and Hospitalized Elderly Patients (n = 506)

Variable	Median (IQR)	C1 Median (IQR)	C2 Median (IQR)	C3 Median (IQR)	*H*	*p-value*
GAD-7	2.00(0.00,7.00)	1.00(0.00,5.00)	4.00(0.25,9.00)	8.00(0.75,13.25)	46.906	0.000
PSSS	66.00(56.00,72.00)	68.00(58.00,74.00)	65.00(55.00,72.00)	55.00(47.75,66.75)	18.518	0.000
BI	80.00(50.00,100.00)	90.00(65.00,100.00)	70.00(26.25,100.00)	67.50(30.00,100.00)	24.381	0.000

Note: C1 is the low caregiver burden group; C2 is the moderate caregiver burden group; C3 is the high caregiver burden group; GAD-7 is the 7-item generalized anxiety disorder scale; PSSS is perceived social support scale; BI is Barthel index.

Latent Profile Analysis (LPA)

Table 3 presented fit indices for one to four latent profile models. The models began with one profile and progressively increased to identify the optimal structure. The three-profile model was considered the optimal model for the overall comparison. The determination was based on model fit indicators. For the three-profile model, AIC, BIC, and aBIC showed significant decreases compared to the two-profile model, and both LMRA (*P*=0.0064) and BLRT (*P*=0.0071)

Table 3 Latent Profile Analysis of Caregiver Burden with Model Fit Results (n = 506)

Model	AIC	BIC	aBIC	LMR *P* value	BLRT *P* value	Entropy	Category probability
1	18,680.937	18,723.203	18,691.462				100
2	18,141.416	18,141.416	18,158.255	0.0001	0.0001	0.906	84.00/16.00
3	17,850.464	17,943.447	17,873.617	0.0064	0.0071	0.812	49.01/41.90/9.09
4	17,715.172	17,833.513	17,744.637	0.311	0.319	0.841	14.23/25.69/49.80/10.18

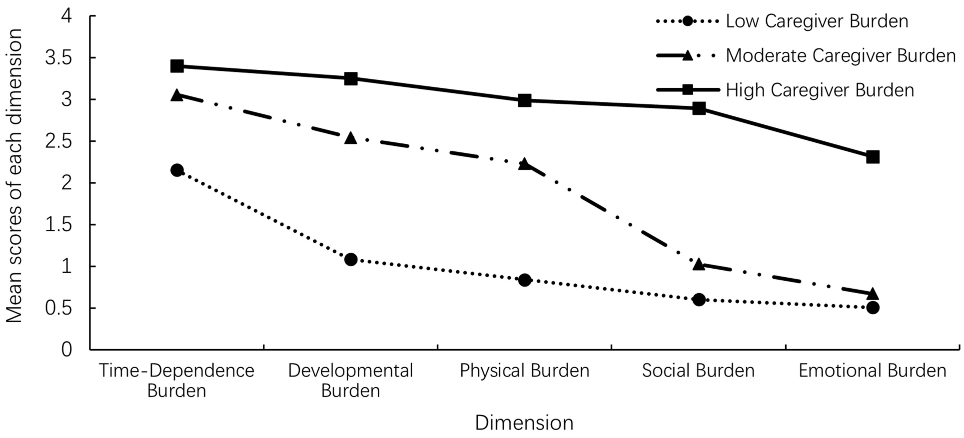

Figure 1 Mean scores of each dimension in the three classes.

were statistically significant. While AIC, BIC, and aBIC slightly decreased for the four-profile model, LMR and BLRT did not reach significance.

Figure 1 reflected the mean values of the three profiles of caregiver burden levels in terms of the scores of each dimension. In Class 1, all five dimensions of CBI scores were relatively low, named the "Low Caregiver Burden Group", comprising 248 cases (49.01%). In Class 2, the dimension score between Class 1 and 3, named the "Moderate Caregiver Burden Group", with 212 cases (41.90%). Class 3 had the highest scores across all dimensions, named the "High Caregiver Burden Group", with 46 cases (9.09%).

Associated Factors of Latent Profiles of Caregiver Burden

Tables 1 and 2 showed the Sociodemographic, psychological, and social characteristics were conducted in the three profiles and Preliminary analysis showed that the different potential profiles in terms of caregiver age, self-rated health, caregiving ability, financial stress, length of hospitalization, anxiety, and social support to perform activities of daily living were statistically significant (*P*-value < 0.05). Then, the factors that were statistically significant in the univariate analysis were used as independent variables, and Class 1 was used as the reference group for the multivariate logistic regression analysis. Table 4 shows the results of the multivariate logistic regression model between the different profiles.

Table 4 Logistic Regression of Different Caregiver Burden Profiles (n = 506)

Class	Associated factors	B	SE	Wald	p-value	OR	95% CI
C1 VS C2	Age ≤30	−1.219	0.454	7.218	0.007	0.296	0.121,0.719
	31≤ Age ≤45	−0.897	0.314	8.16	0.004	0.408	0.220,0.755
	Caregiving ability	−0.235	0.119	3.882	0.049	0.791	0.626,0.999
	Financial stress	0.449	0.09	24.683	0.000	1.566	1.312,1.870
	GAD-7	0.072	0.023	10.134	0.001	1.075	1.028,1.124
	BI	−0.008	0.004	5.554	0.018	0.992	0.985,0.999
C1 VS C3	Financial stress	0.794	0.18	19.506	0.000	2.211	1.555,3.145
	Caregiving ability	−0.68	0.199	11.665	0.001	0.507	0.343,0.748
	GAD-7	0.078	0.035	5.149	0.023	1.082	1.011,1.157
	PSSS	−0.043	0.016	7.559	0.006	0.958	0.929,0.988
C2 VS C3	Financial stress	0.345	0.175	3.875	0.049	1.412	1.001,1.990
	Caregiving ability	−0.446	0.187	5.678	0.017	0.640	0.444,0.924
	Self-rated health poor	1.618	0.632	6.552	0.010	5.042	1.461,17.400
	PSSS	−0.041	0.015	7.684	0.006	0.960	0.932,0.988

Note: C1 is the low caregiver burden group; C2 is the moderate caregiver burden group; C3 is the high caregiver burden group; GAD-7 is the 7-item generalized anxiety disorder scale; PSSS is perceived social support scale; BI is Barthel index.

Caregiver age, self-rated health, financial stress, caregiving ability, anxiety, and social support were found to be associated factors of caregiver burden (P-value < 0.05). Specifically, compared to caregivers aged ≥61 years, age ≤30 (*OR* = 0.296, *95% CI*: 0.121, 0.719) and 31 ≤ age ≤45 (*OR* = 0.408, *95% CI*: 0.220, 0.755) were more likely to be assigned to Class 1 than Class 2. Caregivers with high financial stress (*OR* = 1.566, *95% CI*: 1.312, 1.870), weak caregiving ability (*OR* = 0.791, *95% CI*: 0.626, 0.999), high anxiety (*OR*= 1.075, *95% CI*: 1.028, 1.124), and low ADLs for the patient (*OR*=0.992, *95% CI*: 0.985, 0.999) compared to Class 1 were more likely to be assigned to Class 2. When compared with patients in Class 1, caregivers in Class 3 were likely to have high financial stress (*OR* = 2.211, *95% CI*: 1.555, 3.145), weak caregiving ability (*OR* = 0.507, *95% CI*: 0.343, 0.748), deep anxiety (*OR* = 1.082, *95% CI*: 1.011, 1.157), and inadequate social support (*OR* = 0.958, *95% CI*: 0.929, 0.988). Caregivers with high financial stress (*OR* = 1.412, *95% CI*: 1.001, 1.990), weak caregiving ability (*OR* = 0.640, *95% CI*: 0.444, 0.924), inadequate social support (*OR* = 0.960, *95% CI*: 0.932, 0.988), and poor self-rated health (*OR* = 5.042, *95% CI*: 1.461, 17.400) caregivers were more likely to be assigned in Class 3 than Class 2.

Discussion

This study is one of the first to use LPA to determine the caregiver burden profile of informal caregivers of elderly hospitalized patients in China. The study aimed to identify potential profiles of caregiver burden among hospitalized elderly patients based on the mean scores of different dimensions of their caregiver burden. It also compares and analyzes the potentially influential factors of different profiles, such as Sociodemographic characteristics, social and psychological factors, to add to the current literature related to caregiver burden among hospitalized elderly patients.

According to the results of LPA, the caregiver burden of hospitalized elderly patients was divided into three profiles: "low caregiver burden" (49.01%), "moderate caregiver burden" (41.90%), and "high caregiver burden" (9.09%). This indicates significant variability in caregiver burden among informal caregivers of hospitalized elderly patients in China. The total caregiver burden score was 37.00 (26.00–48.00) in this study, with nearly one-tenth of informal caregivers having high caregiver burden, with a total burden score slightly higher than in previous studies.[18,19] Elderly patients in hospitals often experience complex, recurring conditions and prolonged hospital stays, which exacerbate caregivers' physical and psychological strain. Figure 1 showed that time-dependent burden was the highest score of the five dimensions, which was consistent with the study by Zeliha Tulek.[47] This is attributed to the frequent care requirements of elderly patients, including bathing, eating, repositioning and medication administration, demanding substantial time and energy from caregivers. Furthermore, caregivers sometimes juggle extra family duties such as childcare and domestic chores, which adds to their time limits and stress in meeting caring expectations on time. The study's lowest score was for emotional stress. This conclusion might have been influenced by traditional Eastern culture, which views caring as a responsibility and virtue,[48] leading caregivers to hide negative feelings.[49] Therefore, it is important to recognize the heavy caregiving burden of caregivers for hospitalized elderly patients and implement measures to improve caregiving, helping to share the time costs. New technologies such as emergency response systems and mobile monitors can be utilized to age-proof the medical environment, reducing the burden on caregivers, allowing them to have time for their activities.[50] Promoting novel nursing models such as "unaccompanied wards" and "respite care" is an efficient way to offer caregivers a break and reduce stress.

The results of this study showed that the caregiver burden of hospitalized elderly patients was predicted by the caregiver's sociodemographic (age, financial stress, caregiving ability, self-rated health), social support, anxiety, and ADL of hospitalized elderly patients.

Firstly, Caregivers under the age of 30 and between the ages of 31 and 45 are more likely to belong to the "low caregiver burden group." Previous research has also confirmed the positive association between age and caregiver burden.[30] Younger caregivers typically have higher learning and adaptation capacity, and adapt more quickly to caregiving tasks and new situations. Conversely, older caregivers typically have greater family responsibilities and may lack familiarity with information technology, often experience heightened caregiving burdens and feelings of helplessness when managing healthcare activities.

Secondly, this study showed that high financial stress was a predictor of the high caregiver burden group. Previous research has shown that financial stress is positively associated with caregiver burden.[51] Caregivers often face the decision to reduce work hours or quit their jobs to provide long-term care, resulting in reduced income and increased caregiving costs. Moreover, financial constraints can increase caregivers' anxiety and stress,[52] they worry about covering caregiving expenses and securing their future financial stability. This ongoing psychological stress may affect caregivers' health and well-being. Long-term care insurance assists patients and their families in mitigating the financial risks associated with illness and in easing their economic burden, and special funds can provide economic assistance or subsidies to eligible caregivers, such as caregiver allowances and medical expense reductions, to alleviate the financial burden on caregivers.

Thirdly, this study suggested that inadequate caregiving ability is more likely to be in the "high caregiver burden group" than the "low caregiver burden group" and the "moderate caregiver burden group", which is consistent with previous research.[53] Effective caregiving ability not only enhances the quality of life and promotes recovery of patients, but also improves the ability to live autonomously.[54] Conversely, caregivers may experience heightened mental health risks if they perceive the care demands to exceed their abilities. Providing emergency care skills training and resource support such as information booklets and online resources can help caregivers enhance their caregiving abilities, provide higher quality care services, and also contribute to the recovery of patients.

Lastly, caregivers reporting poor self-rated health were associated factors of the high caregiver burden group compared to healthy caregivers. Previous research indicated that caregivers with chronic disease comorbidities report more severe caregiver burdens than those without chronic disease.[21] When caregivers experience sub-health, they may face conflicts between the needs of the patient and the care provided by the caregiver, the caregivers cannot timely meet the needs of the patients, and gradually produce a certain psychological deviation in the caregivers.[29] Similarly, in the study by Aleksandra Kudlicka,[55] burden of care leads to poor health perception and poor quality of life for caregivers. To improve the health of caregivers, they need to maintain adequate sleep. Therefore, providing caregiver beds and a comfortable care environment is helpful. Additionally, caregivers can adopt relaxation techniques such as meditation or mindfulness practices to ease their minds and promote mental health.

Perceived social support and anxiety were the associated factors of different caregiver burden profiles. Regarding perceived social support, the findings showed that inadequate social support was more likely to be in the moderate and high caregiver burden groups than in the high caregiver burden group, consistent with previous research.[49] The experience of increased stress among caregivers may be partially related to decreased social support from other family members after the initial crisis.[56] Support and assistance from friends, family, and community can help the caregiver share daily caregiving responsibilities and lessen stress and anxiety at work, providing them more flexibility to adjust to changing roles. Establishing a family-centered model of collaborative care can encourage other family members to share the caregiving tasks, and building a support groups platform can make caregivers to help each other, share experiences and provide emotional support.

Regarding psychological aspects, the study findings indicated that caregivers who experienced high levels of anxiety were more likely to belong to the moderate caregiver burden group and the high caregiver burden group, with caregivers in the high caregiver burden group having the highest levels of anxiety. In a study of Parkinson's caregivers by Shuai Liu, a positive correlation was also found between anxiety level and caregiving burden.[57] The reason for this may be that high-anxiety caregivers may often feel tense, restless, and fearful, making it more difficult for them to handle caregiving tasks effectively.[58] At the same time, anxiety may lead to avoidance of social activities, make it difficult for the caregiver to interact with others, and even cause them to feel isolated and lost, thus affecting their social functioning and quality of life.[59] Psychoeducation was an effective intervention against anxiety. Providing psychoeducation can help caregivers strengthen and maintain their perceived self-confidence in care provision and care recipient symptom management, which can directly reduce anxiety about their caregiving responsibilities.[60] Additionally, establish a psychological hotline or counseling center to offer regular psychological assessments and interventions for caregivers.

ADL also was the associated factor of caregiver burden in different profiles. The results of this study showed that caregivers of patients with low BI were more likely to fall into the moderate caregiver burden group compared to the low caregiver burden group. In a study of informal caregivers of stroke survivors with moderate-to-severe functional disability were 3.7 times more likely than caregivers of stroke survivors with no functional disability to have a low-to-moderate caregiver burden.[61] Caregivers of patients with low BI often require more time and effort from caregivers, which may result in caregivers often having less time to themselves.[62]

Limitations

This study has several limitations. First, the study was conducted only in Xinxiang, Henan Province, China. Samples from more cities should be considered in the future. Second, the majority of the questionnaires were self-reported, which might contribute to self-report bias. Further research should evaluate caregiver burden from both subjective and objective perspectives. Third, the sample size of the high caregiver burden group in this study was small, which may weaken the credibility of the results of the multifactor logistics. Fourth, this is a cross-sectional study, which does not prove causality between variables. Longitudinal studies are needed to investigate causal relationships between variables. Finally, there are limited associated factors included in the study and a limited explanation of the impact of different caregiver burden profiles. More relevant factors need to be included for more in-depth studies in the future.

Implications and Recommendations

To our knowledge, this study makes an important first attempt to characterize profiles of burden in a special group that caregivers of hospitalized elderly patients, and reveal the associated factors of the profiles of caregiver burden in China. There are three profiles of caregiver burden in the study which show different characteristics in different dimensions of caregiver burden.

Based on our results, several recommendations can be considered. Specifically, there is an absence of identifying and explaining the profiles of caregiver burden in caregivers of hospitalized elderly patients currently. Medical staff can distinguish different profiles and further identify the characteristics of different profiles in different dimensions by characterizing the level of caregiver burden to better implement intervention according to profiles.

The second recommendation is to provide social interventions as early as possible according to the profiles of caregivers of hospitalized elderly patients. The results of this study showed that more than half of the caregivers were in the status of moderate and high burden. They could be physically and mentally exhausted from having to devote a lot of time and effort to the patient’s treatment. Therefore, nurses should pay more attention to them. Healthcare practitioners can offer caregivers pertinent information and skill training, such as first aid knowledge, effective caregiving techniques, and communication skills. Giving caregivers resources and support, such as information pamphlets, assistive tools, and caregiving equipment, and establishing support groups to allow them to share coping mechanisms, support one another, and exchange experiences and feelings with other caregivers. If needed, they should also offer mental health services and emotional support. Government and social welfare assistance should be actively sought when they face significant financial burden, and long-term care insurance can be established to reduce financial strain.

Conclusion

The caregiver burden for older hospitalized patients was categorized into three profiles: low caregiver burden group, moderate caregiver burden group, and high caregiver burden group. More than half of caregivers are in the moderate and high caregiver burden group. In clinical work, we should focus on older caregivers, in poor health, with high economic stress, weak caregiving ability, deep anxiety, and inadequate social support, caring for patients with low ADL, and comprehensively assessing and monitoring the burden of caregivers. Healthcare professionals should develop targeted and individualized interventions to reduce the burden of caregivers, such as implementing respite care, establishing support groups, conducting psychological education, providing nursing skills training, and improving the long-term care insurance system, which can help guide future clinical practice to provide better support and care for elderly patients and their caregivers, promoting patient recovery.

Ethics Approval and Consent to Participate

The study was approved by the ethics committee of Xinxiang Medical University (No. XYLL-20230736). Written informed consent was obtained from all of the patients and their informal caregivers. The research stuck to the tenets of the Declaration of Helsinki.

Consent for Publication

Participants in the study were informed and provided informed consent for publication.

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Disclosure

The authors declare that they have no competing interests.

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