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Impact of Stroke on Caregiver Burden and Quality of Life: A Cross-sectional Study at BMC Hospital, Quetta

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ABSTRACT

Background: Stroke imposes significant long-term disability, shifting substantial care responsibilities to informal family caregivers, often leading to considerable burden and reduced quality of life. This study aimed to assess caregiver burden and quality of life among caregivers of stroke patients in Quetta, Pakistan, and identify associated demographic, clinical, and social support factors. **Methods:** A cross-sectional, hospital-based quantitative study was conducted at Bolan Medical College Hospital, Quetta, involving 689 primary stroke caregivers. Data were collected using the Zarit Burden Interview (ZBI), the WHOQOL-BREF, the Barthel Index, the Mini-Mental State Examination (MMSE), and the Social Support Questionnaire (SSQ). Statistical analyses included descriptive statistics, Spearman's correlation, independent t-tests, one-way ANOVA, multiple linear regression, and binary logistic regression. **Results:** The mean ZBI score was 42.7±10.8, indicating moderate to high burden, while the mean WHOQOL-BREF score was 58.4±12.5, suggesting moderate quality of life. Higher caregiver burden was strongly negatively correlated with quality of life (ρ=−0.60,p<0.001) and social support (ρ= −0.56,p<0.001). Key predictors of increased burden included higher stroke severity (β= +0.41,p<0.001), more daily care hours, and lower patient functional and cognitive status. Female caregivers (OR = 1.89), those with low social support (OR = 2.74), longer caregiving time (>8 hrs/day), and low income (<20,000 PKR) were at significantly higher risk of high burden. **Conclusion:** Informal stroke caregivers in Quetta experience considerable burden with a negative impact on their quality of life, driven by patient dependency, caregiver characteristics, and socioeconomic factors. Enhanced social support is a critical protective factor. These findings underscore the urgent need for targeted interventions to support stroke caregivers in similar settings.

INTRODUCTION

Stroke remains a leading cause of long-term disability and mortality worldwide, imposing a substantial burden on healthcare systems and affected individuals[1-3]. In addition to the immediate medical challenges that stroke survivors encounter, the prolonged duration of the recovery process frequently requires ongoing care, which is primarily provided by informal caretakers, family members[4-6]. This shift in care responsibility from institutional settings to the home environment has increasingly highlighted the critical, yet often unacknowledged, role of these caregivers[7, 8].

Providing care for a stroke survivor, who may experience significant physical, cognitive, and emotional impairments, can be an immensely demanding and complex task[9-11]. This responsibility can lead to various adverse consequences for the caregiver, including psychological distress, physical health deterioration, social isolation, and financial strain, collectively termed "caregiver burden." Concurrently, the extensive demands of caregiving can profoundly impact the caregiver's overall quality of life (QoL)[12-14]. Despite the global recognition of stroke's impact, research specifically addressing caregiver burden and QoL, particularly in low- and middle-income countries like Pakistan, remains relatively scarce[15-17]. Cultural contexts, socioeconomic disparities, and healthcare infrastructure variations can significantly influence the caregiving experience, making localized studies essential.

In Quetta, Balochistan, a region with unique socio-economic and healthcare challenges, understanding the specific impact of stroke on caregivers is crucial for developing targeted support interventions[18]. This study aims to address this gap by investigating the extent of caregiver burden and its relationship with the quality of life among informal caregivers of stroke patients receiving care at Bolan Medical College (BMC) Hospital. Furthermore, it seeks to identify the demographic, clinical, and social support factors that predict both overall and

high levels of caregiver burden, thereby providing empirical evidence to inform public health strategies and clinical practice in the region.

METHODOLOGY

Study Design

This study utilized a cross-sectional, hospital-based quantitative research design to investigate the impact of stroke on caregiver burden and quality of life. Data were systematically collected from caregivers of stroke patients receiving treatment at Bolan Medical College (BMC) Hospital, Quetta, employing structured questionnaires and standardized scales. Ethical approval for the study was secured from the BMC Ethics Review Committee (Approval No: BMC/ERC/NEURO-2025/017). All participants provided written informed consent before their involvement. They were thoroughly briefed on the study's objectives, the confidentiality of their responses, the voluntary nature of their participation, and their unequivocal right to withdraw at any point without penalty

Study Population

The study population comprised primary caregivers of stroke patients who were either admitted to neurology wards or attending follow-up appointments at neurology outpatient departments. Inclusion criteria for caregivers mandated that they be 18 years or older, providing unpaid care to a stroke survivor for at least one month, capable of comprehending and responding to the questionnaire in Urdu, Pashto, or Balochi, and providing written informed consent. Exclusion criteria encompassed professional healthcare workers or paid caregivers, caregivers of patients with transient ischemic attacks (TIAs), individuals with diagnosed cognitive impairments or mental health disorders, and those unwilling to participate or who provided incomplete forms.

Sample Size and Sampling Technique

The target sample size was determined using Cochran's formula for cross-sectional studies, accounting for a 95% confidence interval, a 5% margin of error, and an anticipated moderate effect size, which yielded an initial estimate of 670 participants. To compensate for a projected non-response rate of approximately 3%, the final adjusted sample successfully included 689 caregivers who completed the interviews. A non-probability purposive sampling technique was employed, wherein caregivers meeting the established inclusion criteria were selected during the designated study period.

Data Collection Tools and Instruments

Data were gathered through a structured questionnaire that encompassed demographic information alongside several validated standardized instruments. Subjective caregiver burden was assessed using the Zarit Burden Interview (ZBI), a 22-item scale with scores ranging from 0 to 88, where higher scores signify greater burden[19]. This instrument was translated into Urdu and demonstrated validated reliability within the Pakistani context (Cronbach's $\alpha>0.85$). Health-related quality of life (QoL) was measured by the WHOQOL-BREF Questionnaire, which evaluates four domains: physical, psychological, social, and environmental[20]. Scores on this scale range from 0 to 100, with higher scores denoting superior QoL. The stroke patient's level of independence in activities of daily living (ADLs) was evaluated using the Barthel Index, scoring from 0 to 100, where higher scores indicate greater independence. Cognitive impairment in stroke survivors was assessed with the Mini-Mental State Examination (MMSE), a 0-30 point scale with education-level adjusted cut-offs[21]. Lastly, caregivers' perceived social support, encompassing family, friends, and community structures, was assessed using the Social Support Questionnaire (SSQ), where higher scores suggested stronger perceived social support[22].

Data Analysis Plan

All collected data were meticulously entered into SPSS version 26 and cross-validated through double entry to ensure accuracy. Descriptive statistics, including frequencies, means, standard deviations, medians, interquartile ranges (IQRs), and ranges, were used to summarize caregiver demographics and key study variables. For inferential statistics, normality of data distribution was assessed using the Shapiro-Wilk Test. Group comparisons were performed using the Independent t-test for two groups and One-Way ANOVA with post-hoc Tukey tests for multiple group comparisons. Spearman's rho was chosen for correlation analysis due to the non-normal distributions observed for several variables. Regression analyses included Multiple Linear Regression to identify predictors of overall caregiver burden and Binary Logistic Regression to determine factors associated with high caregiver burden (defined as a ZBI score ≥45). Model assumptions, such as multicollinearity, homoscedasticity, and residual normality, were rigorously verified. The level of statistical significance for all analyses was set at $p<0.05$.

RESULTS

Demographic and Clinical Characteristics

A total of 689 stroke caregivers participated in the study. The cohort was predominantly female (60.5%), with males constituting 39.5%. The mean age of caregivers was 42.8±11.3 years, ranging from 19 to 76 years. Regarding their relationship to the stroke survivor, 45.3% were sons or daughters, 29.8% were spouses, 13.2% were siblings, and 11.8% were other relatives or friends.

Socioeconomic assessment revealed that 40.3% of caregivers reported a monthly household income of less than 20,000 PKR. A substantial 42.8% fell into the 20,000–50,000 PKR income bracket, while only 16.8% reported an income exceeding 50,000 PKR.

On average, caregivers had been providing care for 10.4±5.7 months and dedicated an average of 8.9±3.7 hours per day to caregiving tasks. Clinically, 76% of the stroke patients had experienced ischemic strokes, and 24% had hemorrhagic strokes. Stroke severity, as determined by the Modified Rankin Scale (mRS), indicated that 45.2% of patients had moderate dependency, 34% had severe dependency, and 20.7% exhibited mild functional dependency. A comprehensive overview of these characteristics is provided in Table 1.

Descriptive Statistics of Key Study Variables

The mean Zarit Burden Interview (ZBI) score was 42.7±10.8, suggesting a moderate to high level of caregiver burden within the study population. The World Health Organization Quality of Life-BREF (WHOQOL-BREF) score, assessing caregivers' quality of life (QoL), had a mean of 58.4±12.5, indicative of moderate life satisfaction. Patients' functional status, measured by the Barthel Index, averaged 53.1±21.7, while cognitive function (Mini-Mental State Examination, MMSE) showed a mean of 22.3±4.1, reflecting mild cognitive impairment in the majority of cases. The mean Social Support Questionnaire (SSQ) score among caregivers was 3.5±1.2, pointing to a moderate perception of social support. These descriptive statistics are summarized in Table 2.

Correlation Analysis

Spearman's correlation analysis, as detailed in Table 3, revealed several statistically significant relationships among the key study variables. A moderate to strong negative correlation was observed between the ZBI burden score and perceived social support ($\rho=-0.56, p<0.001$), indicating that higher social support was associated with lower caregiver burden. Likewise, a moderate inverse relationship existed between the ZBI score and the Barthel Index ($\rho=-0.51, p<0.001$), as well as between the ZBI score and MMSE cognitive function ($\rho=-0.39, p<0.001$). These findings suggest that higher patient functional and cognitive impairment are associated with increased caregiver burden. Conversely, a moderate positive correlation was found between the ZBI score and daily care hours ($\rho=+0.34, p<0.001$), demonstrating that more time spent on caregiving tasks correlated with higher perceived burden. Crucially, ZBI burden scores were strongly negatively correlated with WHOQOL-BREF Quality of Life scores ($\rho=-0.60, p<0.001$). This significant inverse relationship underscores that higher caregiver burden is directly associated with poorer quality of life for the caregivers. These correlational findings emphasize the interconnectedness of patient functional status, cognitive impairment, social support, and daily care demands in shaping the caregiving experience and its impact on caregiver well-being.

Group Comparison: Caregiver Burden by Stroke Type

An independent t-test was conducted to compare caregiver burden between those caring for hemorrhagic stroke patients and those caring for ischemic stroke patients. The results, presented in Table 4, indicated a statistically significant difference ($t=3.49, p<0.001$). Caregivers of hemorrhagic stroke patients reported significantly higher burden (mean ZBI = 45.3±11.6) compared to caregivers of ischemic stroke patients (mean ZBI = 41.9±10.2). This finding suggests that stroke type is a meaningful factor influencing the intensity of caregiving stress.

Quality of Life Differences by Income (ANOVA Analysis)

A one-way ANOVA was performed to investigate potential differences in caregiver Quality of Life (QoL) across various income levels. As shown in Table 5, the analysis revealed a significant main effect of income group on WHOQOL-BREF scores ($F=18.4, p<0.001$). Post-hoc Tukey's tests were conducted to identify specific group differences. Caregivers reporting a monthly household income of less than 20,000 PKR exhibited significantly lower QoL (mean = 53.1±11.4) compared to those in the 20,000–50,000 PKR group (mean = 59.5±12.0) and the $> PKR 50,000 group (mean = 65.7±13.2). These results highlight a clear socio-economic gradient in caregiver well-being, with lower income levels correlating with reduced quality of life.

Multiple Linear Regression: Predictors of Caregiver Burden

A multiple linear regression model was constructed with the ZBI score as the dependent variable. The independent variables included were stroke severity (mRS), daily care hours, social support score, MMSE score, and Barthel Index score. The model was statistically significant ($F=64.2, p<0.001$) and accounted for 48% of the variance in caregiver burden (Adjusted $R2=0.48$), as detailed in Table 6.

The strongest positive predictor of caregiver burden was stroke severity ($\beta=+0.41, p<0.001$), indicating that as the impact of the stroke increased, caregiver burden also significantly rose. Conversely, higher social support was identified as a significant protective factor, leading to a reduction in burden ($\beta=-0.34, p<0.001$). Furthermore, better cognitive status (MMSE) and improved functional status (Barthel Index) of the stroke patient were also significantly associated with reduced caregiver burden. These findings underscore the multifactorial nature of caregiver burden, influenced by both patient-related and caregiver-related factors.

Binary Logistic Regression: Predicting High Caregiver Burden

A binary logistic regression model was employed to identify factors predicting high caregiver burden (defined as ZBI ≥45). The results, presented in Table 7, indicated that several variables were significant predictors of high burden: low social support (Odds Ratio [OR] = 2.74, $p<0.001$), female gender of the caregiver (OR = 1.89, $p=0.003$), higher stroke severity (OR = 1.51 per point on mRS, $p<0.001$), longer daily caregiving time (>8 hours/day) (OR = 1.68, $p=0.005$), and low income (<20,000 PKR) (OR = 2.12, $p<0.001$). The model demonstrated good fit (Hosmer–Lemeshow $p=0.44$) and explained 36% of the variance in high caregiver burden (Nagelkerke $R2=0.36$). These findings are crucial for identifying caregivers at heightened risk of experiencing severe burden and for developing targeted interventions.

Table 1

Demographic and Clinical Characteristics of Stroke Caregivers (N = 689)

Variable	Category	Frequency (n)	Percentage (%)
Caregiver Gender	Male	272	39.5%
	Female	417	60.5%
Age (years)	Mean ± SD	42.8 ± 11.3	–
Relationship to Patient	Spouse	205	29.8%
	Son/Daughter	312	45.3%
	Sibling	91	13.2%
	Other	81	11.8%
Monthly Income (PKR)	< 20,000	278	40.3%

	20,000–50,000	295	42.8%
	> 50,000	116	16.8%
Duration of Care (months)	Median (IQR)	10 (6–15)	–
Daily Caregiving (hours)	Mean ± SD	8.9 ± 3.7	–
Type of Stroke	Ischemic	524	76.0%
	Hemorrhagic	165	24.0%
Stroke Severity (mRS)	Mild (0–2)	143	20.7%
	Moderate (3)	312	45.2%
	Severe (4–5)	234	34.0%

Table 2
Descriptive Statistics for Key Continuous Variables

Variable	Mean ± SD	Median (IQR)	Min–Max
Zarit Burden Interview (ZBI)	42.7 ± 10.8	44 (35–50)	12–69
WHOQOL-BREF (Overall QoL)	58.4 ± 12.5	59 (50–68)	23–93
Barthel Index (patient ADL)	53.1 ± 21.7	55 (35–70)	5–95
Social Support (SSQ score)	3.5 ± 1.2	3.8 (2.5–4.6)	0–6
MMSE (patient cognition)	22.3 ± 4.1	23 (20–25)	10–30

Table 3
Correlation Analysis (Spearman's rho)

Variable Pair	ρ (rho)	p-value	Interpretation
Barthel Index vs ZBI	-0.51	<0.001	Moderate negative correlation
MMSE Score vs ZBI	-0.39	<0.001	Moderate negative correlation
Social Support vs ZBI	-0.56	<0.001	Strong negative correlation
Daily Hours Caring vs ZBI	+0.34	<0.001	Moderate positive correlation
Income Level vs WHOQOL-BREF	+0.41	<0.001	Moderate positive correlation
ZBI vs WHOQOL-BREF	-0.60	<0.001	Strong inverse relationship

Table 4
Group Comparison – Caregiver Burden by Stroke Type

Stroke Type	Mean ZBI Score ± SD	n	t-score	p-value
Ischemic	41.9 ± 10.2	524		
Hemorrhagic	45.3 ± 11.6	165	3.49	<0.001

Table 5
Multiple Linear Regression for Predicting Caregiver Burden (ZBI Score)

Predictor Variable	β (Beta)	Std. Error	t-value	p-value
Patient mRS (stroke severity)	+3.27	0.37	8.84	<0.001
Daily care hours	+1.12	0.18	6.22	<0.001
Social Support (SSQ score)	-4.29	0.74	-5.80	<0.001
Cognition (MMSE score)	-0.95	0.22	-4.32	<0.001
Functional Status (Barthel)	-0.17	0.06	-2.83	0.005
Constant	52.41	4.26	12.30	<0.001

Table 6
Logistic Regression – Predicting High vs Low Burden

Predictor	Odds Ratio (OR)	95% CI	p-value
Female caregiver	1.89	1.24 – 2.86	0.003
Stroke severity (per mRS pt)	1.51	1.26 – 1.81	<0.001
Low social support	2.74	1.88 – 4.00	<0.001
Daily hours > 8	1.68	1.19 – 2.38	0.005
Income < 20,000	2.12	1.44 – 3.12	<0.001

DISCUSSION

This study investigated the impact of stroke on caregiver burden and quality of life among informal caregivers at Bolan Medical College (BMC) Hospital, Quetta, providing crucial insights into the challenges faced by this often-overlooked population in a low- and middle-income country context. The findings underscore the significant burden experienced by stroke caregivers and its detrimental effect on their quality of life, highlighting several key determinants.

Our results indicate a moderate to high level of caregiver burden (mean ZBI = 42.7±10.8) and a moderate quality of life (mean WHOQOL-BREF = 58.4±12.5) among the surveyed caregivers. This finding aligns with global literature demonstrating that informal caregivers of stroke survivors frequently experience substantial psychological, physical, and financial strain due to their caregiving responsibilities [23, 24]. The strong negative correlation observed between ZBI scores and WHOQOL-BREF scores ($\rho=-0.60, p<0.001$) is particularly noteworthy, reinforcing the well-established inverse relationship between increased burden and diminished quality of life [25]. This suggests that efforts to mitigate caregiver burden are paramount for improving their overall well-being.

The study identified several significant predictors of caregiver burden. Patient-related factors, such as higher stroke severity (mRS) and poorer functional (Barthel Index) and cognitive (MMSE) status, were significantly associated with increased caregiver burden. This is consistent with previous research indicating that higher dependency levels in care recipients necessitate more intensive care, leading to greater caregiver strain [26, 27]. Furthermore, caregivers of hemorrhagic stroke patients experienced significantly higher burden compared to those caring for ischemic stroke patients, possibly reflecting the often more acute onset and severe initial neurological deficits associated with hemorrhagic strokes [28]. The positive correlation between daily care hours and caregiver burden further emphasizes that the sheer time commitment required for caregiving directly contributes to the perceived load [29].

Crucially, caregiver-related factors also played a significant role. Our findings revealed a strong negative correlation between social support and caregiver burden ($\rho=-0.56, p<0.001$), identifying it as a potent protective factor against burden. This highlights the importance of social networks and community support systems in buffering the adverse effects of caregiving, a consistent theme in caregiving research [30]. The binary logistic regression model further reinforced this, identifying low social support as a major predictor of high caregiver burden (OR = 2.74). Female caregivers were also found to

be at a higher risk of experiencing high burden (OR = 1.89), consistent with global trends where women disproportionately assume caregiving roles and report higher levels of burden [9][31]. Socioeconomic status emerged as a critical determinant of caregiver QoL, with lower-income caregivers reporting significantly poorer QoL. This "socio-economic gradient" points to the compounding challenges faced by financially disadvantaged families in providing care, likely due to limited access to resources, external support, or coping mechanisms [32].

While this study provides valuable insights, it is not without limitations. Its cross-sectional design precludes the establishment of cause-and-effect relationships; longitudinal studies would be beneficial to track changes in burden and QoL over time. The reliance on a single hospital setting in Quetta may limit the generalizability of findings to other regions or healthcare contexts. Additionally, while standardized scales were used, potential biases related to self-report or cultural nuances in interpreting questions cannot be entirely ruled out. Future research could explore the effectiveness of specific interventions, such as psycho-educational programs or support groups, tailored to the unique cultural and socioeconomic context of Balochistan, and investigate the long-term trajectories of caregiver burden and QoL.

CONCLUSION

This study at Bolan Medical College Hospital, Quetta, confirms that informal stroke caregivers face a significant burden, negatively impacting their quality of life. Key factors contributing to this burden include the patient's stroke severity and functional/cognitive dependency, as well as the caregiver's gender, daily caregiving time, and socioeconomic status. Crucially, strong social support acts as a vital protective factor against this burden. These findings emphasize the urgent need for targeted interventions and support programs in regions like Balochistan to alleviate caregiver burden and enhance the well-being of families affected by stroke.

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