Appraisal of Fiscal Burden and Patient Centered Outcomes in Stroke-A Cost of Illness Analysis

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ABSTRACT
Appraisal of Fiscal Burden and Patient-Centred Outcomes in Stroke ; A Cost of Illness Analysis Stroke (Stroke/CVA) is the second most common cause of death and the third cause of morbidity in the world with a share of 7.6% of all deaths and 5.9% of all DALYs. Besides being a disease, Stroke is also a huge economic problem that not only impacts the patients but also families, health systems, and even nations, especially developing nations like India. To understand and analyze the cost burden as well as the effect on the quality of life of Stroke patients based on whether or not they are beneficiaries of any Social Security Scheme, the Cost of Illness methodology was utilized for the assessment. Prospective Observational study was conducted in Sathiram Medical College and General Hospital, Nandyal, Andhra Pradesh over 6 months period (September 2025 to February 2026). During this duration, a total of 300 stroke patients (208 ischemic & 92 haemorrhagic strokes) were selected from neurology department of the above-mentioned hospital following ethical clearance from the Institute Ethics Committee. Mann Whitney U test was used to compare the costs of SSC and Non-SSC stroke patients while Spearman Correlation test was used to analyze the association between Total cost and SS-QOL scores. Majority of the subjects (65%) were male aged. The mean total cost for non-SSC patients was significantly greater at INR 82,094.89 compared to the SSC group with an average cost of INR 50,740.83. Additionally, all costs involved such as hospitalisation, laboratory fees, medicine cost, transport fee, food cost, and income loss were statistically significantly different between both groups ($P<0.05$). The results of SS-QOL assessment indicated that the most intact domain was mood with a mean score of 32.98, while the least intact domains were work/ productivity (12.42), family roles (17.34), and personality (17.34). There was a positive correlation between total cost and SS-QOL ($r = 0.15$, $p= 0.011$), meaning that the greater the cost incurred by the patient, the better the quality-of-life outcome. Stroke places a heavy economic strain on the affected individuals, particularly those who do not have social security cover. The quality of life is severely affected in several ways including physically, cognitively, and socially. Social security insurance assists

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INTRODUCTION

The cerebrovascular accident (CVA), which is commonly termed as the stroke, is one of the most destructive conditions afflicting humanity. To define broadly, CVA is characterized by blood supply impairment due to ischemia, which is due to thrombosis or embolism, while hemorrhage is as a result of a ruptured blood vessel. This event triggers brain network disturbance, brain neuronal injury, and inflammation, hence brain dysfunction [1]. As far as deaths go, stroke is considered the second cause of death and the third cause of disability in the world. It results in up to 7.6% of mortalities and 5.9% of Disability-Adjusted Life Years (DALYs). In addition, stroke is regarded as the cause of disability, avoidable impairment, and vascular dementia cognitive decline. [2,3] Some of the non-modifiable risk factors of stroke include increasing age, gender, and heredity. On the other hand, modifiable risk factors include high blood pressure, diabetes, smoking, overweightness, atrial fibrillation, high levels of cholesterol, alcohol intake, lack of exercise, and carotid stenosis. Smoking can cause stroke twice as likely as diabetes, whose incidence is thrice that of stroke. [4]There are three main types of stroke. The first type is ischemic stroke, which accounts for the largest proportion, approximately 87%, of all instances. It involves the formation of blood clots in the brain arteries. Hemorrhagic stroke results from the rupture of blood vessels, and it can lead to complications such as an aneurysm and arteriovenous malformation. Mini-stroke, or Transient Ischemic Attack (TIA), involves the temporary formation of blood clots that eventually disintegrate without causing damage. [5] Two main types of hemorrhagic stroke include intracranial hemorrhage (ICH) and subarachnoid hemorrhage (SAH). Patients of hemorrhagic stroke may present symptoms such as headache, elevated blood pressure, vomiting, and focal neurological disorders. [6] Symptoms of stroke include numbness in the limbs, facial drooping, problems with speech, vertigo, visual impairment, and cognitive problems. [7] Stroke physiologically arises when neuronal cells fail to receive adequate oxygen and glucose supplies. A stroke can become more severe due to the presence of plaques on brain blood vessels and vessel fragility due to sustained hypertension or amyloid angiopathy. [8]A well-tested 49-item measure named the Stroke-Specific Quality of Life scale (SS-QOL) was chosen in the study to assess the outcomes from patients' perspectives and their quality of life after stroke. [9,10]

MATERIALS AND METHODS

A Prospective Observational Study was conducted at Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, For Six Months of September 2025- February 2026, After Obtaining the Approval from the Institutional Ethical Committee. The Participants Were 300 Patients With Both Ischemic Stroke And Hemorrhagic Stroke In The Unit Of Neurology Department Of SRMC&GH. The Study Involved Who Provided with Informed Consent Form, Clinically Diagnosed with Complete Medical Records, Including Hospitalization and Follow-up Details and Exclusion Criteria Who Patients Unwilling to Participate Patients with Incomplete Interview Data, or had incomplete interview data, incomplete records, and billing information, were excluded. Economic Burden and Quality of Life by using the SQOL scale was Assessed by using the Statistical analysis. The analysis Of Economic Burden Was Conducted by Using Mann Whitney U test and for SSQOL scale Was Conducted by using the Spearsman correlation analysis to Assess the fiscal burden and patient centered outcomes In Stroke Patients. The Results were Analyzed and Proportionally Tabulated

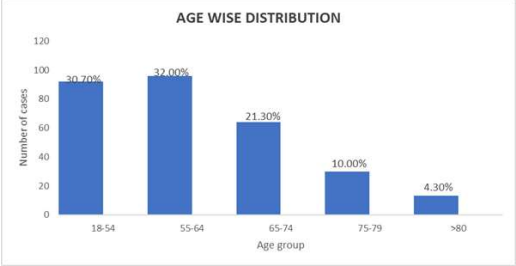
RESULTS

In This Prospective Observational Study Of 300 Stroke Patients, The Participants Were Assigned To 208 Patients with Ischemic Stroke And 92 Patients with Hemorrhagic Stroke For "**Appraising the fiscal burden and Patient centered outcomes- A cost illness analysis"**. in depth information was obtained, including patient history, clinical findings, laboratory results, and economic cost. The results indicate there is high economic burden for patient without social security schemes than for patients with social security schemes. Throughout the study period, we accrued information on patients with stroke. Aged The majority of patients were in the 55–64 years age group (32.0%), followed by the 18–54 years group (30.7%), the 65–74 years group (21.3%), the 75–79 years group (10.0%), and those above 80 years (4.3%)%.**[see table 1 Figure 1]**, whereas from the reference, Pooled meta-analysis showing 75.2% of strokes in India occur above age 50; male preponderance 64.5% **(Joseph, Jaison et al., Jan-June 2024)**

Table 1: Age Wise Distribution

Figure 1: Age Wise Distribution

Age wise distribution	No. of cases	Percentage (%)
18-54	92	30.70%
55-64	96	32.00%
65-74	64	21.30%
75-79	30	10.00%
>80	13	4.30%

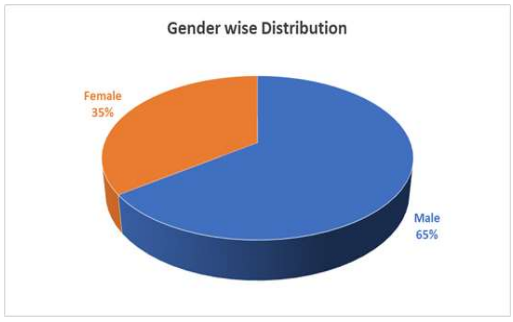


In 300 cases, the gender wise distribution was 195 patients (65%) were male and 105 (35%) were female. The male preponderance observed is consistent with the well-documented higher stroke risk among men compared to women in the adult age group. ***[see table 2 Figure 2]***, Male preponderance (64.5%) confirmed in Indian meta-analysis. (**Joseph, Jaison etal. jan-june-2024)**

Table 2: Gender Wise Distribution

Figure 2: Gender Wise Distribution

Gender	No .of cases	Percentage%
Male	195	65.22%
Female	105	34.78%

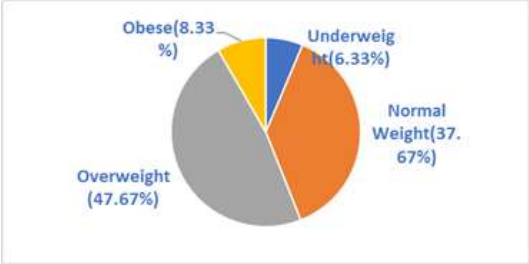


In 300 cases the distribution of BMI was majority of stroke patients were overweight (BMI 25–30), accounting for 47.67% of cases, followed by normal weight (37.67%), obese (8.33%), and underweight (2.67%). This highlights the overweight as a significant contributor to stroke risk in our study population ***[see table 3 Figure 3]***, Overweight and obesity independently associated with stroke risk**. (strazzullo P, D'Elia,2010)**

Table 3: BMI Wise Distribution

BMI	No. of patients	Percentage%
Under weight(<18.5)	8	2.67%
Normal weight(18.5-24.5)	113	37.67%
Over weight (25-30)	143	47.67%
Obese (>30)	25	8.33%

Figure 3: BMI Wise Distribution

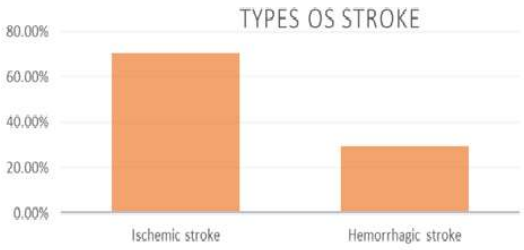


Ischemic stroke was the predominant type, accounting for 212 patients (70.6%), while hemorrhagic stroke was present in 88 patients (29.3%). ***[see table 4 Figure 4]***, whereas the reference shows that Ischemic stroke ~62–68% of all strokes globally; hemorrhagic ~25–28%. **(GBD 2019 Stroke Collaborations 2021)**

Table 4: Types of Strokes

Type of stroke	No. of cases	Percentage %
Ischemic	212	70.60%
Haemorrhagic	88	29.30%

Figure 4: Types of Strokes



A Mann-Whitney U test was used to compare the mean cost for stroke patients those with coverage schemes (SSC) and without coverage schemes(paid), for hospitalization it shows that the difference between SSC and PAID with respect to the dependent variable was statistically significant, U = 9739.00, n1 = 150, n2 = 150 p = .045. Thus, null hypothesis was rejected, with respect to laboratory the dependent variable was statistically significant, U = 5970.50, n1 = 150, n2 = 150 p = <.001. Thus, the null hypothesis was rejected, with respect to cost of drugs the dependent variable was statistically significant, U = 7917.00, n1 = 150, n2 = 150 p = <.001. Thus, the null hypothesis was rejected, cost of stay the dependent variable was statistically significant, U = 7119.00, n1 = 150, n2 = 150 p = <.001. Thus, the null hypothesis was rejected, with respect to cost of travel the dependent variable was statistically significant, U = 8480.50, n1 = 150, n2 = 150 p = <.001. Thus, the null hypothesis was rejected, cost of food items the dependent variable was statistically significant, U = 1364.00, n1 = 150, n2 = 150 p = <.001. Thus, the null hypothesis was rejected. Wages lost by patient the dependent variable was statistically significant, U = 9449.50, n1 = 150, n2 = 150 p = .017. Thus, the null hypothesis was rejected, wages lost by caregivers the dependent variable was statistically significant, U = 9158.50, n1 = 150, n2 = 150 p = .005. Thus, the null hypothesis was rejected. ***[see table 5 Figure 5]*** The average direct cost was INR 12727.21 [95% C.I.8658.50–16795.92] in the beneficiary, whereas INR 33900 [95%] C.I., 25495.17–42304.83] in patients who are not recipients. There was a notable 4isparity between the beneficiary's indirect cost and patients who are not beneficiaries (P < 0.01). The average indirect cost was Beneficiary: INR 12414.75 [95% C.I., 9691.13–15138.37]and the amount was INR 16460 [95% C.I. 13044.81–19875.19] in stroke patients in western Rajasthan who are not eligible for benefits. There was no discernible change in the beneficiary's indirect costs. and non-recipient (P = 0.06) Beneficiary-status study participants spent 40.75% on medical30.32% of acute stroke care's non-medical costs, which makes up 72.33% of their monthly earnings. **(Divya Goswami et al, (2020)**

Table 5: Pharmacoeconomics evaluation

Direct medical cost	**SSC (mean)**	**Paid(mean)**
Cost of hospitalization	4741.63	6610.13
Cost of laboratory	18303.46	30220
Cost of drugs	19084.33	35259.90
Direct non-medical cost		
Cost of stay	1184	732.66
Cost of travel	726	859.2
Cost of food items	631.8	1707.73
Indirect cost		
Wages lost by patient	2974.6	5548.6
Wages lost by caregivers	2154.6	3102.3
Total cost	50740.83	82094.89

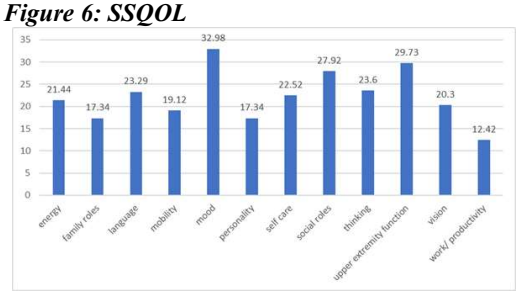
The Stroke-Specific Quality of Life (SSQOL) scale data demonstrate variable recovery patterns across different domains in stroke patients. The highest mean score is observed in mood (32.98), similarly, upper extremity function (29.73) and social roles (27.92) indicate moderate functional independence, especially in arm use and social participation. Language (23.29), thinking (23.6), and self-care (22.52) reflect moderate impairment, meaning patients retain some cognitive and daily living abilities but are not fully independent.

Lower scores in mobility (19.12) and energy (21.44) highlight persistent physical limitations and fatigue, which can restrict daily activities. The lowest scores are found in family roles (17.34) and personality (17.34), indicating that stroke significantly affects interpersonal relationships, social identity, and role fulfilment within the family. Overall, the data suggest that while emotional health is relatively preserved, physical and social domains remain substantially impacted, emphasizing the need for comprehensive rehabilitation ***[see table 6 figure 6]***. The reference describes that the post -stroke depression affects-33% of survivors; the mood domain reflects emotional burden. **(Hackett ML et al., (2005)**

Table 6: SSQOL

SSQOL scale	Mean score
Energy	21.44
Family roles	17.34
Language	23.29
Mobility	19.12
Mood	32.98
Personality	17.34
Self care	22.52
Social roles	27.92
Thinking	23.6
Upper extremity function	29.73
Vision	20.3
Work /productivity	12.42

Figure 6: SSQOL



A Spearsmann correlation test is used to compare the total cost of stroke patients for both ischemic and hemorrhagic ,and their health related qualify of life by using the SSQOL scale .the finding shows that there is significant statistical positive correlation between the cost and SSQOL scale, r(298)=0.15,p=0.011this implies that there is high correlation between the total cost and SSQOL score for the stroke patients.***[see table 7 &Figure 7)***no significantly HRQOL difference between socioeconomic groups; functional outcome primary determinant.**(Kim AS et al., (2011)**

Table 7: Correlation between total cost & SSQOL Scale

	r	P	95% CI
TOTAL COST and SSQOL	0.15	.011	[0.03, 0.26]

DISCUSSION

In a 2025 , prospective observational study , assessed the appraisal of fiscal burden & patient centered outcomes on stroke – a cost of illness analysis; collected both ischemic & hemorrhagic stroke cases and analyzed that there were majority of 55-64 years of age (32.0%) and those were males (65.22%),based on BMI there were overweight (25-30) accounting the more risk factor for occurrence of stroke, use of herbal medications in pre- stroke patients leads to an increase in factor for stroke re-occurrence; the majority of stroke patients were currently employed (182 cases,60.7%), followed by retire persons, in occupation field and length of stay of majority of patients in study is 5-7 days(151 patients,50.3%).From an economic perspective, a stroke imposed a substantial financial burden, particularly among patients without social security coverage. Direct medical costs, especially drugs and laboratory investigations, constituted the largest share. However, despite differences in expenditure, quality of life outcomes were comparable between insured and non-insured groups, suggesting that clinical factors such as severity and timely management play a more crucial role than financial status alone. The SS-QOL domain analysis further revealed that while mood was relatively preserved (mean 32.98), work/productivity (12.42), family roles (17.34), and personality (17.34) were severely impacted, underscoring that quality of life is multidimensional and cannot be reduced to economic factors alone similarly reported that functional outcome, rather than socioeconomic status, remains the primary determinant of health-related quality of life post-stroke.

CONCLUSION

Stroke imposes a significant fiscal burden, especially on patients without social security coverage (mean INR 82,094 vs. INR 50,740 for SSC beneficiaries). All cost components were significantly higher in the non-SSC group ($p < 0.05$). Quality of life was most impaired in work/productivity, family roles, and personality domains, while mood remained relatively preserved. A weak but significant low positive correlation existed between total cost and SS-QOL scores ($r = 0.15$, $p = 0.011$). Social security schemes are vital in reducing out-of-pocket expenditure, and comprehensive rehabilitation addressing both economic and patient-centred outcomes is essential in stroke management.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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