RESEARCH PAPER

Effect of Pharmacist Intervention on Quality of Life and Recurrence Rates in Stroke Patients: A Comparative Interventional Study from Southern India

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Received: 20th Apr, 2026 | Revised: 25th Apr, 2026 | Accepted: 9th May, 2026 | Available Online: 14th May, 2026

ABSTRACT

Introduction: Stroke is a leading cause of disability and mortality worldwide, with survivors often facing diminished Quality of Life (QoL) and high recurrence risk. The study aims to evaluate the effect of pharmacist-led interventions on quality of life and recurrence risk among patients with stroke in a tertiary-care hospital in Southern India.

Methods: A prospective, interventional comparative study was conducted with 112 stroke patients, randomly allocated into intervention (n=57) and control (n=55) groups. The intervention group (IG) received structured pharmacist counselling, medication education and reinforcement through developed and validated educational tools at discharge and follow-ups, while the control group (CG) received standard care. QoL was assessed during admission (Baseline), 2 months, and 4 months post discharge using Stroke Specific Quality of Life (SS-QOL) scale. Stroke recurrence, its associated risk factors and the patients' socioeconomic status were also recorded.

Results: At baseline and 2-months follow-up, no significant differences were observed between groups. By 4 months, the IG demonstrated significantly higher SS-QOL scores compared to controls (median 144 vs. 122; p=0.0003). Domain-specific analysis of SS-QOL scale showed improvements in energy, mood, cognition, family roles, productivity, vision, and upper extremity function. Socio-economic status was positively correlated with QoL (Spearman's rho = 0.300, p=0.001). Stroke recurrence was lower in IG (3.5%) compared to CG (9.1%), though not statistically significant (p=0.267).

Conclusion: Structured Pharmacist-led intervention significantly improved post-stroke quality of life, however did not have any significant effect on reducing recurrence. Incorporating pharmacists into multidisciplinary stroke care can enhance rehabilitation and long-term patient outcomes.

Keywords: Stroke, Quality of Life, Recurrence, Pharmacist, Educational Tools, Counselling.

How to cite this article: Rajmane P, Mudhol N, Desai H, Kamble S, Manjula G, Karoli S., Effect of Pharmacist Intervention on Quality of Life and Recurrence Rates in Stroke Patients: A Comparative Interventional Study from Southern India. Int J Drug Deliv Technol. 2026;16(44s): 477-487; DOI: 10.25258/ijddt.16.44s.50

INTRODUCTION

Stroke, also known as brain attack, happens when the brain's blood supply is either obstructed or when a blood vessel inside or on the brain's surface bursts. Strokes can occur either due to a clot blocking the brain's blood flow- ischemic stroke (IS), or due to rupture of a blood vessel, which disrupts blood flow, known as a hemorrhagic stroke (HS). A Transient Ischemic Attack (TIA), often called as a "mini-stroke," occurs when there is a temporary blockage and usually doesn't result in severe disability.[1]

It is amongst one of the leading causes of disability and globally ranks among the most common fatal health conditions. The World Stroke Organization's Global Stroke Fact Sheet-2025 provides comprehensive statistics highlighting its significant global impact.[2] In 2020, there were 12.2 million new stroke cases around the globe, leading to approximately 6.5 million deaths. At present, more than 100 million people have suffered a stroke, resulting in additional loss of 143 million healthy life years due to disability and early mortality. Importantly, 86% of stroke-related deaths take place in low and middle-income countries. Projections indicate that 1 in 4 individuals above the age of 25 will suffer a stroke during their lifetime, highlighting urgent need for effective prevention and treatment strategies.

According to a systematic review in The Indian Journal of Medical Research-August, 2017, the primitive stroke prevalence across various parts of India extended from 44.29 - 559 per 1,00,000 persons during the period of 1960 to 2015.[3] Due to limited data availability and absence of robust reporting systems, accurately assessing the epidemiology of stroke in India remains difficult.

Stroke management encompasses acute intervention, secondary prevention, and rehabilitation. Timely and evidence-based treatments are crucial for optimizing patient outcomes. Intravenous recombinant tissue plasminogen activator (rtPA), if given within 4.5 hours of the onset of symptoms, remains a cornerstone in treating acute IS. Guidelines from the American Heart Association/American Stroke Association (AHA/ASA) outline detailed recommendations for early stroke management.[4]

Post-stroke, secondary prevention strategies are vital to reduce recurrence risk. The AHA/ASA-2021 guidelines emphasize individualized management plans, including antithrombotic therapy, blood pressure control, lipid management, diabetes management, lifestyle modifications, and when appropriate, carotid artery interventions.

Comprehensive rehabilitation is essential for functional recovery post-stroke. The 2016-guidelines provide a synopsis of best clinical practices in stroke rehabilitation, highlighting the importance of interdisciplinary approaches tailored to individual patient needs. [5]

Stroke recurrence is a significant concern in cerebrovascular disease, with approximately 25-30% of stroke survivors experiencing a recurrent stroke within five years. Recurrent strokes often result in higher mortality, increased disability, and greater healthcare burdens compared to initial stroke episodes.

Stroke survivors face substantial risks of recurrence, and enduring physical, cognitive, and emotional impairments can significantly diminish Quality of Life (QoL). Clinical pharmacist-led secondary prevention interventions comprising tailored counselling, medication reconciliation, and optimization of antithrombotic, antihypertensive, and lipid-lowering therapies, are critical in mitigating these risks and enhancing adherence. A randomized trial found that patients receiving pharmacist-delivered pharmaceutical care had significantly greater medication adherence and higher Stroke Specific Quality of Life (SS-QOL) scores (mean 184.9 vs 166.0; $p < 0.001$), along with reduced stroke recurrence (2.2 % vs 10.6 %; $p = 0.044$) compared to usual care. [6] Another study demonstrated improved adherence and SS-QOL domains of energy and productivity through pharmacist education following first-ever stroke. [7] While the value of extended pharmacist-led intervention has been recognized in various chronic disease states, limited research has investigated its specific implementation and efficacy in the immediate post-stroke phase. Data related to the Indian healthcare setting remains scarce.

Hence, this study aims to assess the effect of structured pharmacist intervention in improving the QoL of patients with stroke, and reducing the incidence of a recurrent stroke. A secondary objective is to investigate the potential influence of patients' Socioeconomic Status (SES) on their subsequent QoL outcomes.

METHODS

Study design: The study was a Comparative Interventional Study carried out at a tertiary care teaching hospital in Southern India. This was a single-center, parallel-group randomized study with 1:1 allocation ratio achieved through computer-generated random numbers. It was approved by the institute's ethics committee (KLECOPBGMEC/D006-2024). This study was not prospectively registered in a clinical trial registry.

Selection and Description of Participants: Patients admitted to the Neuro-medicine, General Medicine, and Cardiology wards were screened for eligibility based on specific inclusion and exclusion criteria. Eligible participants were adults aged 18 years or older who had been diagnosed with a cerebrovascular event, including Cerebrovascular Accident (CVA), Intra-cerebral Haemorrhage (ICH), TIA, or IS. Patients were excluded if they were pregnant or lactating, terminally ill, cognitively impaired, discharged to hospice, long-term care facilities, or nursing homes, or if they were participating in another clinical trial. Individuals who declined to provide informed consent were also excluded from the study.

As this was an exploratory study, formal sample size calculation was not carried out. Sample size was determined based on patient admissions during the study period. 145 patients were screened for eligibility out of which 123 participants were enrolled and randomly allocated into two groups with near equal distribution to Control Group (CG) and Intervention Group (IG). Due written informed consent was obtained. 7 patients from CG and 4 patients from IG were lost to follow up. 55 patients in the CG and 57 patients in IG respectively, (total-112) were considered for the final analysis. (Figure 1) Randomization was carried out using computer-generated random numbers. Allocation concealment was not implemented. At baseline assessment (during hospital admission), data were collected for all participants using a structured case report form. Information included demographic characteristics (age, gender), clinical details (primary diagnosis, comorbidities), socio-economic details (education, qualification and average monthly income) and medication profiles (number and type of prescribed drugs). Baseline QoL was assessed for both groups using the SS-QOL Scale.

Outcomes: The primary outcome was change in overall SS-QOL score from admission to the last follow-up at 4 months. Secondary outcomes included stroke recurrence within 4 months and association between SES and QoL.

Control Group (Standard Care): Participants in the CG received standard discharge care, consisting of routine instructions provided by physicians or nursing staff where no structured pharmacist counselling or follow-up intervention was given. During Follow-Up 1 (FU1-at 2 months from baseline) patients were contacted to reassess QoL using the SS-QOL scale, and information regarding readmissions or emergency visits was documented. During Follow-Up 2 (FU2-at 4 months from baseline assessment) a second reassessment was carried out via telephone using SS-QOL scale. No additional intervention was provided, as patients continued to receive standard care only.

Intervention Group: IG received comprehensive structured pharmacist-led care, beginning at their hospital stay and continuing upon discharge. This intervention consisted of one-on-one counselling sessions, which were conducted in a private, quiet counselling room for approximately 15-25 minutes, using a semi-structured script to ensure uniformity. The counselling was patient-centred and tailored to the individual's literacy and concerns, covering key domains such as understanding stroke and recurrence risk, detailed medication education (purpose, dosing, adverse effects, and adherence), lifestyle and behavioural modification (diet, activity, smoking cessation), and emotional/cognitive support. Customized educational materials in the form of information leaflets, and verbal guidance were provided in the patient's vernacular language-either English, Marathi, Kannada, or Hindi, with telephone support available for clarification post-discharge.

Follow-up was structured over two time points: at two months from baseline data collection (FU1), where patients were reassessed using the SS-QOL scale. Reinforcement counselling and additional intervention focused on adherence and secondary prevention if needed. The counselling sessions also actively involved caregivers, educating family members on recognizing warning signs and supporting medication adherence. FU2, at four months from baseline was conducted via telephone, during which QoL was reassessed, and further educational reinforcement was offered as necessary. Due to the nature of the intervention, blinding of investigating-pharmacists and participants was not feasible. Outcome-assessment was based on patient-reported measures. The statistician was blinded.

Statistical analysis was carried out using the IBM - SPSS Statistics software Version 20. The data obtained was not normally distributed, as assessed by the Kolmogorov-Smirnov test, and hence non-parametric tests were used for the subsequent analyses. Intergroup analyses were carried using the Mann-Whitney U test, whereas intragroup comparisons were analysed using the Friedman test. Additionally, the Chi-Square test was used to analyse categorical variables.

RESULTS

Analysis was performed only with the patients that completed follow-up. Overall patient age ranged from 20-80 years, with the highest frequency found in 50-69 age bracket. In CG, the 60-69 age group represented 27.2%, while in IG, 50-59 age group made up 26.31%, representing the highest frequencies in control and intervention groups respectively. No patients in the age group of 20-29 years were included in CG whereas only one patient was younger than 30 years in IG. (Table-1)

A higher proportion of male patients was observed in both groups: 61.81% (34) in control and 64.91% (37) in the IG. Female representation was 38.18% (21) and 35.08% (20) in CG and IG, respectively. (Table-1)

At baseline and FU1, there were no statistically significant differences in median SS-QOL scores between groups ($p > 0.05$), indicating similar starting points. By FU2, IG showed significantly higher SS-QOL scores (median = 144 vs 122 in control; p=0.0003). Friedman test confirmed statistically significant improvements in both groups over time, but IG experienced greater magnitude of change. (Table-2)

There was no major improvement in Energy levels of the patients post 2 months of enrolment in the study. However, there was a statistically relevant difference (p-value=0.001) in energy levels of patients in IG after 4 months (FU2), suggesting enhanced vitality in IG.

Enhanced perception regarding their Family Roles was reported in patients in IG as compared to CG during the FU2 (p-value=0.003), potentially highlighting the effect of the pharmacist's involvement in the care given to the patients. No significant difference was observed in the linguistic (speech) abilities of the patients in either group, within a span of 4 months. Although, numerically there was an improvement with respect to mobility in both the groups overtime, a statistically relevant difference was not observed between the groups.

Patients in IG reported heightened mood levels during FU2, as compared to that of CG (p-value=0.001). Difference with respect to traits such as irritability, patience and overall personality changes was not observed between both the groups.

In the self-care domain, a statistically significant difference was observed between groups at baseline. This baseline imbalance is likely due to chance-variation during randomization, as has been reported in previous RCTs with moderate sample sizes. At subsequent follow-ups (2 and 4 months), no significant differences were noted.

Much improvement in terms of the social aspects of the patients' life could not be observed in either of the groups throughout the period of the study. Although, not much difference was observed in the thinking of patients in both the groups during FU1, a marked increase occurred by FU2 (p-value=0.001), signifying better concentration and ability to remember things in IG.

Both groups saw an improvement in terms of upper extremity function overtime, however a statistically significant difference between the groups was observed only at FU2. Higher median values provided evidence of better upper extremity function in IG. (Control-12; Intervention-15; p-value=0.005).

Patients in IG reported improved vision and fewer challenges with respect to sight by FU2 (p-value=0.001)

No significant difference was observed in productivity of patients between the two groups up until FU1. However, during FU2, a statistically significant difference was reported and considering the median values, patients in IG were found to be more productive as compared to the ones in CG. (Table 3)

A moderate, positive correlation was observed between SES, as measured by the Kuppuswamy Scale, and overall SS-QOL scores (Spearman's rho=0.300, p=0.001). The Kruskal-Wallis test also indicated significant differences in SS-QOL across SES categories (H=15.636, df=4, p=0.004). These findings align with existing literature suggesting that post-stroke quality of life is strongly influenced by social determinants. (Table 4)

Though stroke recurrence was numerically lower in the intervention group at 3.5% (2) compared to the control group at 9.09% (5), the difference was not statistically significant (p=0.267). (Table 5)

Both, the control and intervention groups demonstrated similar prevalence of major stroke risk factors. There was a 63.63% (35) and 66.66% (38) prevalence of hypertension in the control and intervention groups respectively. Type-II diabetes mellitus prevailed in about 25(45.45%) patients in control and 20 (35.08%) patients in intervention group. 9 (16.36%) patients in CG and 13(22.80%) in IG had a history of Myocardial infarction (MI). 15(27.27%) patients in CG and 20(35.08) patients in IG were found to have some form of Peripheral Arterial Disease (PAD). Prevalence of smoking habit was higher in the IG at 14(24.56%) as compared to 8(14.54%) in CG. 7 (12.72%) patients in control group and 6(10.52%) in intervention group suffered from other cardiovascular events. (Table 5.)

Table 1: Demographic details including Age and Gender distribution of patients in both groups

Demographic	**Control Group**	**Intervention Group**	

Parameter							
Age (in Years)	**n (%)**	**Male**	**Female**	**n (%)**	**Male**	**Female**	**Total**
20-29	0 (0 %)	0	0	1(1.75 %)	1	0	1
30-39	8 (14.50 %)	6	2	4 (7.01%)	4	0	12
40-49	10 (18.10 %)	7	3	12 (21.05 %)	9	3	22
50-59	13 (23.60 %)	12	1	15 (26.31 %)	10	5	28
60-69	15 (27.20 %)	6	9	13 (22.80 %)	9	4	28
70-79	8 (14.50 %)	3	5	12 (21.05 %)	4	8	20
>80	1 (1.80%)	0	1	0 (0 %)	0	0	1
Total	**55**	34 (61.81 %)	21 (38.18 %)	**57**	37 (64.91 %)	20 (35.08 %)	**112**

Table 2: Application of *Mann-Whitney U Test & Friedman Test* for Comparison of SS-QOL Scores between Control and Intervention Groups.

Data collection time period	**Control Group**	**Intervention Group**	**p-value**
	Median ± IQR	**Median ± IQR**	
Baseline	104.00 ± 44.00	108.00 ± 41.50	0.6729
1st Follow Up	100.00 ± 29.00	107.00 ± 32.00	0.4969
2nd Follow Up	122.00 ± 30.00	144.00 ± 32.00	0.0003*
Improvement within groups over time	<0.05**	<0.05**	

**<0.05 Significance is obtained by Mann-Whitney U Test*

***<0.05 Significance is obtained by Friedman Test*

Table 3: Application of *Mann-Whitney U Test* to Analyse the Domains of the Stroke Specific Quality of Life scale.

Domain	**Study Groups**		
Energy	**Control Group**	**Intervention Group**	**p-value**
	Median ± IQR	**Median ± IQR**	
Baseline	6.00 ± 3.00	6.00 ± 4.00	0.596
1st Follow Up	6.00 ± 4.00	6.00 ± 4.00	0.749
2nd Follow Up	8.00 ± 3.00	9.00 ± 3.50	0.001*
Family Roles			
Baseline	6.00 ± 2.00	6.00 ± 3.50	0.064
1st Follow Up	6.00 ± 1.00	6.00 ± 2.50	0.107
2nd Follow Up	7.00 ± 3.00	8.00 ± 3.00	0.003*
Language			
Baseline	10.00 ± 9.00	10.00 ± 8.00	0.671
1st Follow Up	10.00 ± 9.00	10.00 ± 6.00	0.103
2nd Follow Up	10.00 ± 9.00	10.00 ± 6.00	0.103
Mobility			
Baseline	12.00 ± 9.00	12.00 ± 10.50	0.135

1st Follow Up	12.00 ± 5.00	12.00 ± 9.00	0.474
2nd Follow Up	15.00 ± 6.00	15.00 ± 9.50	0.056
Mood			
Baseline	10.00 ± 3.00	11.00 ± 5.00	0.635
1st Follow Up	10.00 ± 3.00	11.00 ± 4.00	0.464
2nd Follow Up	13.00 ± 6.00	15.00 ± 3.00	0.001 *
Personality			
Baseline	8.00 ± 3.00	7.00 ± 5.00	0.672
1st Follow Up	8.00 ± 3.00	8.00 ± 3.00	0.579
2nd Follow Up	9.00 ± 4.00	9.00 ± 3.00	0.057
Self -Care			
Baseline	10.00 ± 5.00	10.00 ± 5.50	0.002 *
1st Follow Up	11.00 ± 4.00	10.00 ± 6.00	0.255
2nd Follow Up	13.00 ± 5.00	14.00 ± 6.50	0.190
Social Roles			
Baseline	11.00 ± 5.00	11.00 ± 7.50	0.726
1st Follow Up	11.00 ± 5.00	11.00 ± 5.00	0.852
2nd Follow Up	11.00 ± 5.00	11.00 ± 5.00	0.852
Thinking			
Baseline	7.00 ± 3.00	8.00 ± 4.00	0.568
1st Follow Up	7.00 ± 3.00	7.00 ± 3.00	0.467
2nd Follow Up	9.00 ± 3.00	11.00 ± 3.00	0.001 *
Upper Extremity Function			
Baseline	10.00 ± 6.00	10.00 ± 6.00	0.148
1st Follow Up	10.00 ± 6.00	10.00 ± 4.00	0.482
2nd Follow Up	12.00 ± 6.00	15.00 ± 5.50	0.005 *
Vision			
Baseline	9.00 ± 3.00	8.00 ± 4.50	0.958
1st Follow Up	9.00 ± 4.00	9.00 ± 3.50	0.882
2nd Follow Up	9.00 ± 3.00	12.00 ± 3.00	0.001 *
Work/ Productivity			
Baseline	6.00 ± 4.00	6.00 ± 3.00	0.073
1st Follow Up	6.00 ± 5.00	6.00 ± 2.00	0.519
2nd Follow Up	7.00 ± 3.00	9.00 ± 2.00	<0.05 *

**<0.05 Significance is obtained by Mann-Whitney U Test*

Table 4: Socio-economic status and its corelation with quality of life (SS-QOL scores).

Socio-economic Class	N (%)	Spearman Correlation		Kruskal–Wallis		
		Spearman rho	p-Value	H	df	p-Value
Lower Class	8 (7.14%)	0.300	0.001	15.636	4	0.004
Upper Lower Class	32 (28.57%)					
Lower Middle Class	48 (42.85%)					
Upper Middle Class	18 (16.07%)					
Upper Class	6 (5.35%)					

Table 5. Distribution of risk factors and stroke recurrence in control and intervention groups.

Risk Factor	Control Group (N = 55)	Intervention Group (N = 57)	p-value
Hypertension	35 (63.63%)	38 (66.66%)	0.843
Diabetes Mellitus	25 (45.45%)	20 (35.08%)	0.336
Myocardial Infarction	9 (16.36%)	13 (22.80%)	0.478
Peripheral artery disease	15 (27.27%)	20 (35.08%)	0.419
Smoking	8 (14.54%)	14 (24.56%)	0.236
Other Cardiovascular Events	7 (12.72%)	6 (10.52%)	0.774
Incidence of Recurrent Stroke among study groups respectively (Control & Intervention)			
Recurrent Stroke	5 (9.09%)	2 (3.50%)	0.267

Figure 1: CONSORT flow diagram of participant enrolment, randomization, follow-up and analysis in the study.

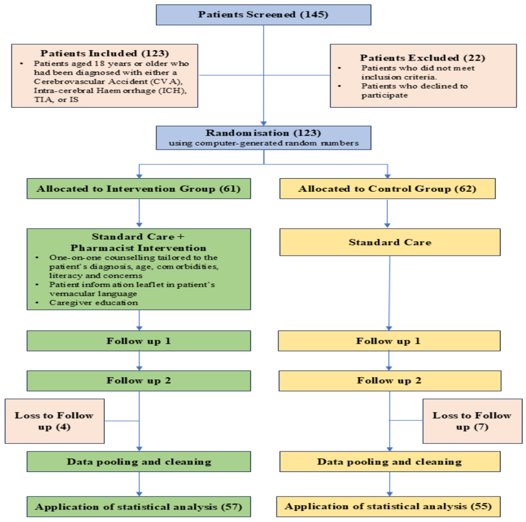

Figure 1: Flow Diagram Describing the Study Details.

DISCUSSION

In the present study, 112 patients were enrolled and randomized in control (n=55) and intervention (n=57) groups. Age-wise, the highest proportion of participants fell within the 50–69 years range, consistent with data reported by the Global Burden of Disease Study which identifies increased stroke prevalence starting from the fifth-decade of life.[9] Most ischemic stroke patients in Indian tertiary care centers belonged to 50–70 years age group and had multiple modifiable risk factors including hypertension and diabetes.

The gender distribution showed higher proportion of males in both groups (61.8% in control vs. 64.9% in intervention), aligning with known epidemiological trends highlighted through a study conducted by Bushnell C. et.al.[8] where consistently lower incidence of stroke in women was observed as compared to men, particularly between ages 45-84, across a 25-year period. Incidence of stroke tends to be higher in men than in women, especially during younger and middle-ages, largely due to earlier accumulation of vascular risk factors in men such as hypertension, smoking and dyslipidaemia. Protective effects of oestrogen in pre-menopausal women, which improve endothelial function and delay atherosclerosis also contribute to lesser occurrences in women.[10]

At baseline, most patients in both groups reported low QoL (CG–104.00 $\pm$ 44.00 vs IG-108.00 $\pm$ 41.50). By FU2, QoL significantly improved in IG, where the median score reported in CG and IG were 122.00 $\pm$ 30.00 and 144.00 $\pm$ 32.00, respectively, accounting for better improvements in patients who received additional interventions from clinical pharmacists. These findings resonate with a study conducted by Cengiz, K.N. et.al.[6], which showed that pharmacist-driven stroke education and medication review improved post-stroke QoL scores significantly across domains ($p<0.001$). The Friedman test in our study further confirmed within-group improvements over time ($p < 0.05$), highlighting the long-term benefit of even short-term pharmacist contact. Similarly, during a Quality Improvement Project conducted by E. Coughlan-Siam et.al., pharmacist-led interventions were shown to significantly enhance care through a patient-centred approach, with structured pharmacist input, and was found to be essential to improve clinical outcomes.[11]

While a meta-analysis by Ellis et.al. found limited evidence supporting stroke liaison worker interventions across all patient and caregiver groups, it highlighted significant benefits for patients with mild to moderate disability.[12] The study underscored that emotional and cognitive recovery after stroke is strongly influenced by psychoeducation and caregiver involvement, domains in which pharmacists can make a meaningful contribution. Domain-specific analysis of the SS-QOL scale in our study revealed statistically significant improvements in the Energy, Mood, Thinking, Vision, Upper Extremity Function, Family Roles, and Productivity domains in IG, particularly by FU2. This indicates that targeted pharmacist interventions not only improved overall QoL but also had a positive influence on cognitive, emotional, and physical recovery aspects.

However, domains such as Language, Personality, and Social Roles did not show statistically significant group differences. This may suggest that while some domains respond well to pharmacist support, others may require multidisciplinary or more specialized interventions. In the Self-care domain a statistically significant difference was observed between groups at baseline. This baseline imbalance is likely due to chance variation during randomization, as has been reported in previous RCTs with moderate sample sizes. At subsequent follow-ups, no significant differences were noted. This may be explained by the natural recovery process post-stroke and a possible ceiling effect in self-care activities, whereby most patients regained functional independence irrespective of group allocation. Thus, baseline difference in Self-care scores should be interpreted with caution, as it does not represent true effect of the intervention.

A recent systematic-review and meta-analysis encompassing global studies found that lower SES, as indicated by education, income, or occupation, was consistently associated with poorer health-related quality of life (HRQoL) among stroke survivors, regardless of which SES indicator was used.[13] The pooled effect sizes were moderate (standardised mean difference ~ –0.36), reinforcing our observation that SES exerts a meaningful influence on post-stroke HRQoL. SES has been shown to predict long-term physical recovery. For instance, one study by Wolf S. et.al. found that patients with higher pre-stroke SES had significantly higher odds (OR > 17) of motor recovery and improved self-reported physical health post-rehabilitation.[14] Although much of the literature has focused on overall HRQoL or functional outcomes, our findings contribute further insight by using the SS-QOL instrument and capturing individual-level SES via the composite Modified Kuppuswamy scale.[15] This strengthens the evidence that social disadvantage is a determinant of worse QoL following stroke. Education and occupation influence a person's ability to understand and manage their health, navigate the healthcare system, and adhere to treatment plans, all of which affect recovery and QoL.[16] Findings of the current study demonstrate a relationship between higher SES potentially leading to better QoL in post stroke patients.

According to findings of the current study, both groups exhibited a broadly similar prevalence of key IS risk factors, demonstrating a balanced baseline risk profile between the arms. Hypertension was highly prevalent in both cohorts- 63.6% in controls and 66.7% in the IG, consistent with prior studies identifying hypertension as the dominant modifiable risk factor for all ischemic stroke subtypes.[17] [18] Type-II diabetes mellitus affected 45.5% patients of CG and 35.1% of IG. This confirms that diabetes remains a significant contributor to stroke risk, as reported through studies by Sarfo FS et.al. (adjusted odds ratio-3.44)[17], and Ntaios G. et.al.[19], where 19.8% out of 5412 stroke patients had diabetes. Another study by Wei LM et.al. showed that diabetic patients had significantly higher risk of lacunar infarction than nondiabetic patients (47.8% *vs.* 30.5%; P=0.045) reinforcing the findings of our study.[20] History of MI was present in 16.4% of controls and 22.8% of intervention participants, while PAD was seen in 27.3% vs. 35.1%, respectively. These atherosclerotic comorbidities are known to reflect systemic vascular disease burden and are more commonly associated with large-artery atherosclerotic stroke pathology as can be inferred from a study by Lee Nedkoff et.al.[21] The prevalence of smoking was higher in IG (24.6%) versus controls (14.5%). Smoking is a well-documented risk factor across both small-vessel and large-artery stroke aetiologies as reported through a study by Yan Shi et.al.[17] Other cardiovascular events were similar (12.7% in controls vs. 10.5% in intervention), indicating no major differences in additional vascular risk exposures.

In a study conducted by Jennifer Andres et.al., the combined primary outcome, including readmission for stroke/TIA, MI, or newly diagnosed PAD was significantly lower in the SPC (Pharmacist-run Stroke Prevention Clinic) group compared to the subjects in control (p-value=0.013).[22] The SPRINT India Trial -2023, a multicentre RCT evaluated a semi-interactive stroke prevention package (SPP) delivered via videos, SMS, and written materials in 429 patients post-stroke or TIA from 31 hospitals across India.[23] While the primary composite outcome (recurrent stroke, MI, or death) did not differ significantly between intervention and control groups, the SPP group showed significant improvements in secondary outcomes, including better medication adherence, reduced alcohol intake, and higher follow-up rates.

The present study observed a lower recurrence rate in the intervention group (3.5%) compared to the control (9.09%), though not statistically significant (p=0.267). The study was limited due to single-center patient enrollment and short follow up duration. The modest sample size may have limited the ability to detect statistically significant differences in stroke recurrence. However, this trend indicates that even brief pharmacist-led interventions, focused on medication adherence, risk factor education, and lifestyle counselling can positively impact outcomes. The positive impact of behavioural interventions may diminish over time if not reinforced. To ensure sustained benefits, it is essential to investigate the optimal frequency and duration of the pharmacist interventions. Future studies should also explore whether tailoring the timing and intensity of these interventions to individual patient needs could enhance long-term benefits. This can be accomplished through dedicated pharmacist-driven stroke prevention programs.

CONCLUSION

This study highlights the critical role of clinical pharmacists and their involvement in improving the QoL of stroke survivors through structured education, medication review, and adherence support, particularly in a resource strained country like India, where integration of clinical pharmacy services is still evolving. Beyond reinforcing the importance of established risk factors such as hypertension and diabetes, the findings emphasize that SES significantly influences recovery trajectories, underscoring the need for tailored post-stroke care strategies. Although recurrence rates did not reach statistical significance, the favourable trend suggests that pharmacist-led interventions can positively shape both clinical and patient-reported outcomes. Future research should focus on optimizing the timing, frequency, and delivery of such interventions with a bigger and more diverse population and longer follow-up duration, to ensure their sustained impact, and on embedding pharmacist-driven stroke prevention programs like Stroke Prevention Clinics within multidisciplinary models of care, to maximize long-term benefits.

AUTHOR CONTRIBUTIONS

- **Conceptualization and Study Design:** Dr. Pradnya Rajmane, Dr. Nehal Mudhol, Dr. Harani Desai, Dr. Shreya Kamble, Dr. Satish Karoli
- **Data Collection:** Dr. Pradnya Rajmane, Dr. Nehal Mudhol, Dr. Harani Desai, Dr. Shreya Kamble
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FUNDING INFORMATION: There was no external funding for this work.

CONFLICT OF INTEREST STATEMENT: The authors declare no conflicts of interest related to this study.

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