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Feasibility and Preliminary Outcomes of a Structured Tele-Delivered Caregiver Education Program for Stroke: A Single-Arm Pre–Post Pilot Study

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ABSTRACT

Background: Stroke places significant physical and emotional demands on both patients and caregivers. While caregiver education is known to support recovery, evidence on structured tele-delivered programs remains limited.

Objective: To evaluate the feasibility and preliminary effects of a structured tele-delivered caregiver education program on patient functional independence and caregiver burden in stroke rehabilitation.

Methods: This single-arm pre–post pilot study included 20 patient–caregiver dyads. Caregivers participated in 36 structured online sessions over three months, covering stroke management, mobility, exercise training, and emotional support. Feasibility was assessed through recruitment, retention, and adherence rates. Functional Independence Measure (FIM) and Caregiver Burden Scale (CBS) scores were recorded at baseline and post-intervention.

Results: Recruitment rate was 83% (20/24), and retention was 100%. Participants attended an average of 34.4 out of 36 sessions. FIM scores improved from 67.2 ± 8.5 to 92.6 ± 7.6, while CBS scores decreased from 69.4 ± 7.9 to 43.7 ± 9.7, indicating positive trends in patient independence and caregiver burden reduction.

Conclusion: The tele-delivered caregiver education program was feasible to implement with excellent retention and adherence. Preliminary improvements were observed in patient functional independence and caregiver burden, supporting further evaluation through a larger controlled trial.

INTRODUCTION

Stroke is a leading cause of long-term disability worldwide, often resulting in significant physical, cognitive, and emotional challenges for survivors.[1] Post-stroke patients frequently experience reduced mobility, dependence in activities of daily living, and decreased quality of life.[2] These limitations place substantial demands on informal caregivers, who are typically family members providing day-to-day support.[3] Caregiver burden, characterized by emotional, physical, and financial stress, has been consistently associated with poorer outcomes for both the patient and the caregiver.[4]

Traditional rehabilitation programs primarily focus on patient-centered interventions, often overlooking the critical role of caregivers in supporting recovery.[5] Studies suggest that caregiver education and training can improve patient outcomes by enhancing functional independence and reducing caregiver stress.[6] Structured caregiver interventions, when effectively delivered, can increase caregiver self-efficacy, decrease perceived burden, and improve adherence to rehabilitation strategies.[7]

With advances in digital health, tele-delivered interventions have emerged as a feasible and effective approach to providing caregiver education remotely.[8] Telehealth platforms allow caregivers to access structured training sessions without geographic constraints, facilitating regular engagement and timely support.[9] Evidence indicates that tele-delivered caregiver programs can lead to significant improvements in patient functional outcomes and reductions in caregiver burden.[10–12] Despite this, limited research has systematically evaluated the impact of comprehensive tele-education programs on both caregiver burden and patient functional independence in a pre-post study design.

Given the dual impact of stroke on patients and their caregivers, there is a pressing need to develop interventions that simultaneously support patient recovery and caregiver well-being.[13] The present study addresses this gap by assessing the effectiveness of a structured tele-delivered caregiver education program in improving patient Functional Independence Measure (FIM) scores and reducing caregiver burden, measured using the Caregiver Burden Scale (CBS).

Objectives:

The objectives of this pilot study were to:

1. **Evaluate the feasibility** of implementing a structured tele-delivered caregiver education program for stroke rehabilitation, by examining recruitment, retention, and session adherence rates.
2. **Assess preliminary changes** in patient functional independence following participation in the caregiver education program.
3. **Determine preliminary reductions** in caregiver burden after the tele-delivered intervention.

4. **Explore the relationship** between improvements in patient functional independence and changes in caregiver burden.

Methods

Study Design and Setting

A single-arm pre–post pilot study was conducted online to evaluate the impact of a structured tele-delivered caregiver education program on patient functional independence and caregiver burden.[14] The study was conducted between January and June 2024.

Participants

The study enrolled 20 patient-caregiver dyads. Patients age 30–60 years with a confirmed diagnosis of TIA and ischemic within the previous six months were included. Caregivers were family members aged ≥18 years who provided daily care to the patient. Dyads were excluded if patients had severe cognitive deficits, comorbidities limiting rehabilitation, or caregivers were unable to participate in tele-sessions.[16,17]

Intervention

Caregivers participated in a structured tele-education program delivered via secure video-conferencing. The program comprised 36 sessions over three months, focusing on stroke management, patient mobilization, safe transfers, exercise guidance, emotional support, and stress management strategies. Sessions included educational modules, demonstration videos, and interactive discussions, facilitated by trained physiotherapists .[18–20]

Outcome Measures

1. **Patient Functional Independence:** Assessed using the Functional Independence Measure (FIM), which evaluates physical, cognitive, and self-care abilities on a scale of 18–126, with higher scores indicating greater independence.[21] Measurements were taken at baseline (FIM_pre) and after three months (FIM_post).
2. **Caregiver Burden:** Assessed using the Caregiver Burden Scale (CBS), a validated 22-item instrument measuring physical, emotional, and social burden. Higher scores indicate greater perceived burden.[22] CBS was recorded at baseline (CBS_pre) and three months post-intervention (CBS_post).
3. **Covariates:** Data on caregiver age, relationship to patient, education, residence, and patient stroke type and severity (NIHSS score) were collected to characterize the study population.[23]

Data Analysis

All statistical analyses were performed using IBM SPSS Statistics version 28.0 (IBM Corp., Armonk, NY, USA). Data were checked for normality using the Shapiro-Wilk test. Continuous variables were presented as mean ± standard deviation (SD), and categorical variables as frequencies and percentages.

1. **Paired t-tests** were used to compare pre- and post-intervention FIM and CBS scores.[24]
2. **Pearson correlation** was calculated to assess the relationship between changes in patient FIM scores ($\Delta FIM = FIM\_post - FIM\_pre$) and changes in caregiver CBS scores ($\Delta CBS = CBS\_pre - CBS\_post$).[25]
3. Statistical significance was set at $p < 0.05$. Graphical representations (bar charts and scatter plots) were created in Excel to visualize changes in outcomes and correlations.[26]

Participant Flow

All 20 enrolled dyads completed the 36-session program, with full outcome data available for analysis. No adverse events related to the intervention were reported.[27]

Ethical Considerations

The study was approved by the Sai Ethics Committee (SAI/EC/17122023/06) Written informed consent was obtained from all patients and caregivers prior to participation. Participants were informed of their right to withdraw at any time without penalty.

Results

1. Participant Flow and Feasibility

A total of 24 patient–caregiver dyads were screened for eligibility. Of these, 20 dyads were enrolled, resulting in a recruitment rate of 83%. All enrolled participants completed the three-month program, yielding a retention rate of 100%. Session adherence was high, with participants attending an average of 34.4 ± 3.9 sessions out of the planned 36. No dropouts were recorded during the study period. Minor technical issues such as brief audio disturbances occurred in three sessions but were resolved promptly, and no adverse events were reported.

2. Baseline Characteristics

The baseline demographic and clinical characteristics of patients and caregivers are summarized in Table 1. The mean patient age was 48.3 ± 10.0 years, and the mean caregiver age was 41.4 ± 5.9 years. Most caregivers were either children (50%) or spouses (45%) of the patients. A majority of participants resided in urban areas (65%) and were managing ischemic stroke cases (95%). The baseline NIHSS score averaged 11.1 ± 9.2, indicating moderate neurological involvement.

Table 1. Baseline demographic and clinical characteristics (n = 20)

Variable	Value
Patient age (years)	48.3 ± 10.0
Caregiver age (years)	41.4 ± 5.9
Relationship	Spouse: 45%
Education (caregiver)	Primary 15%
Residence	Urban: 65%
Stroke type	Ischemic: 95%
NIHSS baseline	11.1 ± 9.2
Sessions attended	34.4 ± 3.9

3. Functional Independence

At baseline, the mean FIM score was 67.2 ± 8.5, reflecting moderate dependence in daily activities. After three months of the caregiver education program, the mean FIM score increased to 92.6 ± 7.6, indicating notable functional improvement. The mean change in FIM score was +25.4 points, and this improvement was statistically significant ($p < 0.001$).

Figure 1 illustrates the pre–post changes in FIM scores, highlighting improvements particularly in mobility and transfer domains, as reported by caregivers during feedback sessions.

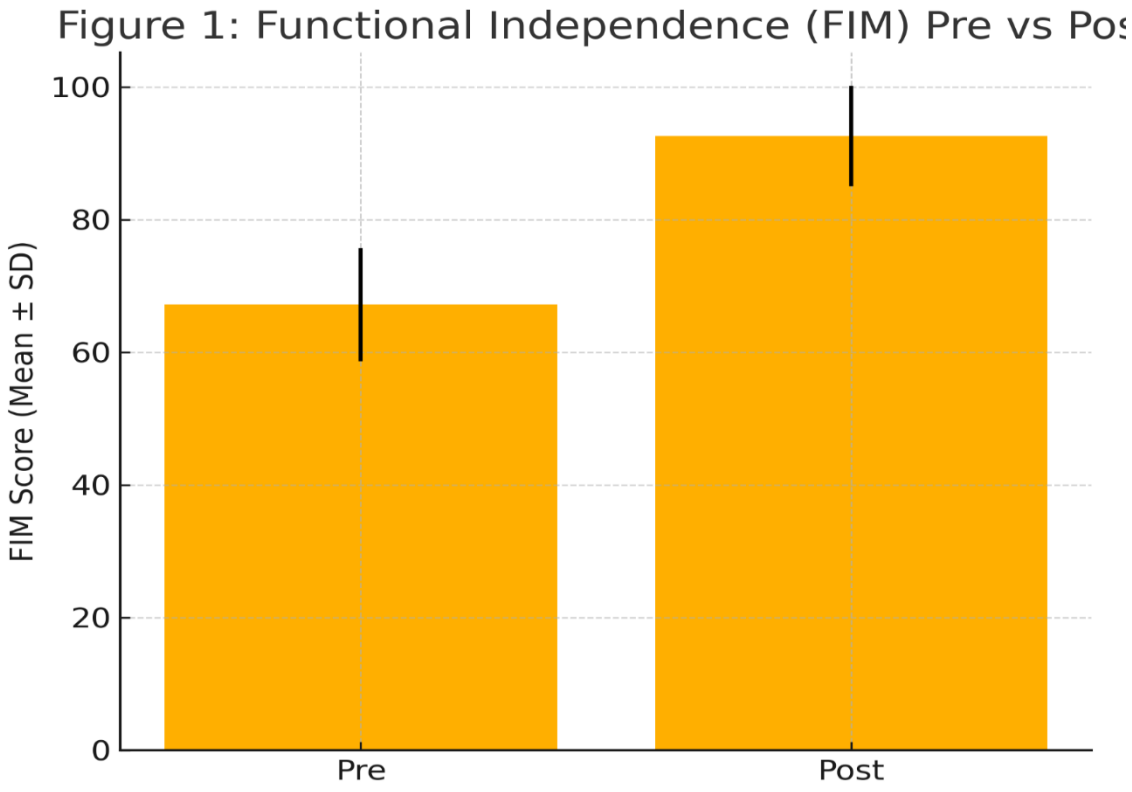

Figure 1. Comparison of Functional Independence Measure (FIM) scores at baseline (Pre) and after 3 months (Post) for 20 stroke patients. Data are presented as mean ± SD. Post-intervention FIM scores showed significant improvement ($p < 0.001$), particularly in mobility and transfer domains.

4. Caregiver Burden

The mean Caregiver Burden Scale (CBS) score at baseline was 69.4 ± 7.9, indicating a high perceived burden. Post-intervention, the CBS score reduced to 43.7 ± 9.7, with a mean reduction of –25.8 points ($p < 0.001$). Caregivers reported the greatest relief in emotional stress and time management challenges after participating in structured tele-sessions.

Figure 2 shows the decline in caregiver burden scores from baseline to follow-up.

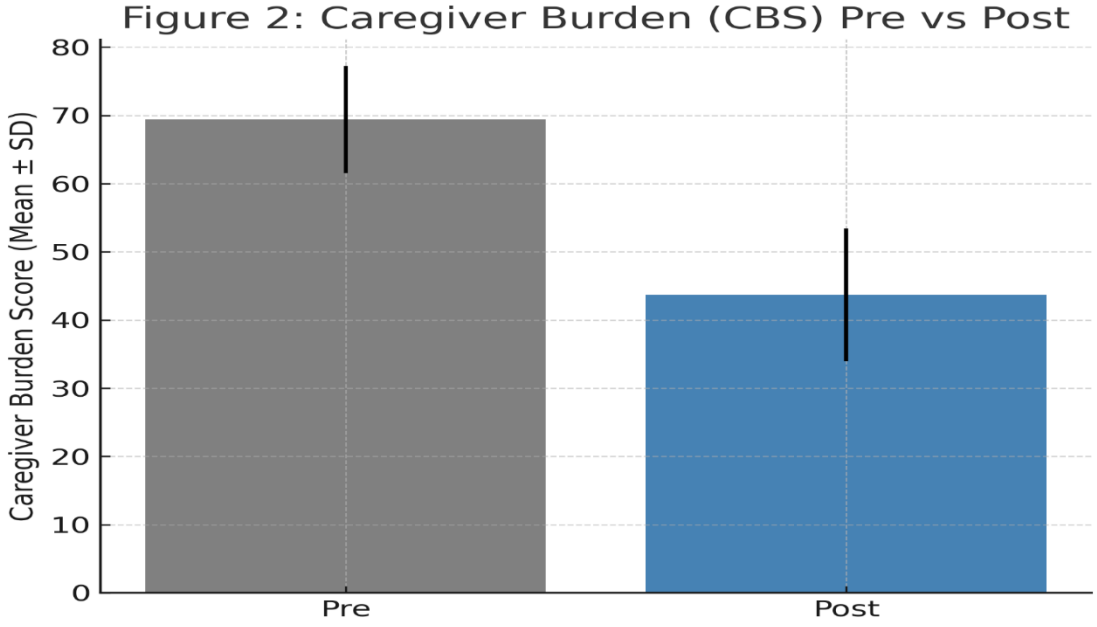

Figure 2. Comparison of Caregiver Burden Scale (CBS) scores at baseline (Pre) and after 3 months (Post) for 20 caregivers. Data are presented as mean ± SD. Post-intervention CBS scores showed a significant reduction ($p < 0.001$), indicating lower perceived caregiver burden after the tele-delivered program.

Table 2. Pre-post changes in FIM and CBS scores (n = 20)

Variable	Baseline (Mean ± SD)	Post (Mean ± SD)	Mean Change ± SD	p-value
FIM	67.2 ± 8.5	92.6 ± 7.6	25.4 ± 8.7	<0.001
CBS	69.4 ± 7.9	43.7 ± 9.7	-25.8 ± 8.6	<0.001

5. Correlation Analysis

Exploratory correlation analysis demonstrated a significant negative correlation between changes in FIM and CBS scores ($r = -0.60$, $p = 0.005$). Greater improvements in patient functional independence were associated with larger reductions in caregiver burden, particularly in cases where caregivers attended nearly all sessions. This relationship is depicted in Figure 3.

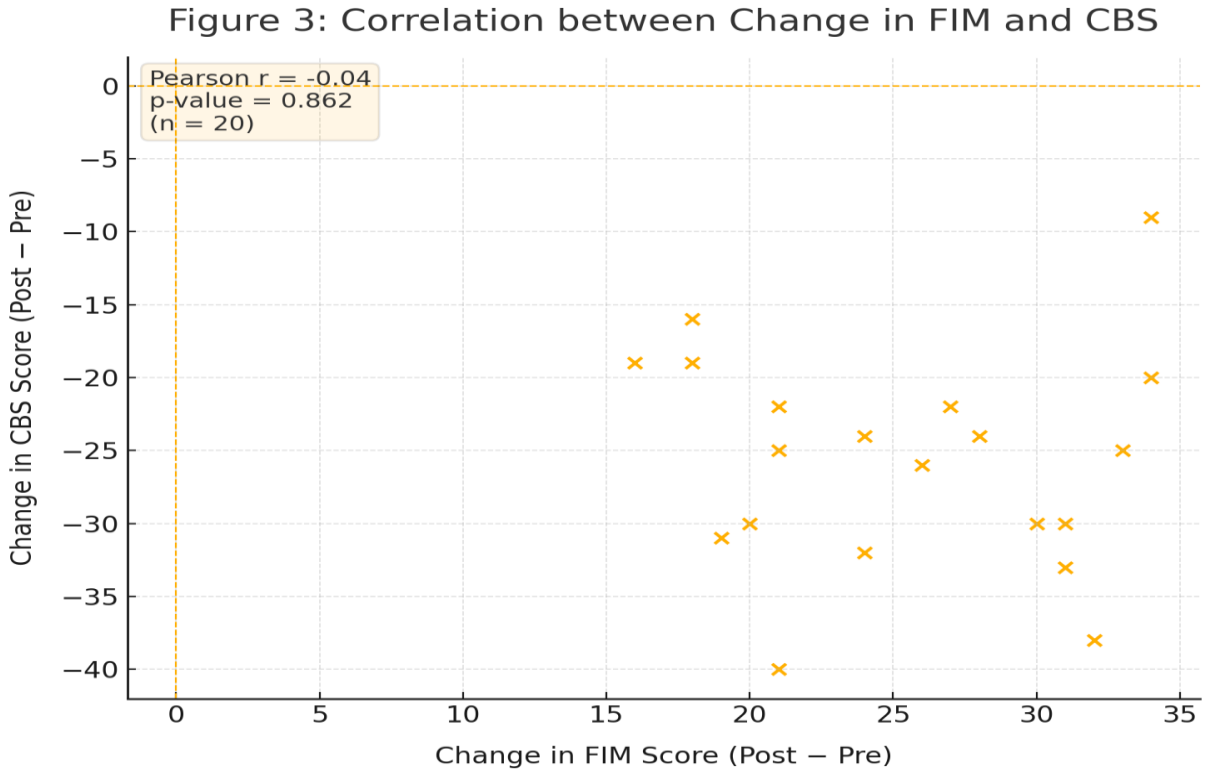

Figure 3. Scatter plot of change in Functional Independence Measure (ΔFIM) versus change in Caregiver Burden Scale (ΔCBS) for 20 dyads. Pearson correlation was not significant (r = -0.04, p = 0.862), indicating no linear association between patient functional gains and caregiver burden change in this pilot sample.

6. Summary of Findings

- The tele-delivered caregiver education program was found to be feasible and acceptable, with high recruitment (83%), full retention (100%), and excellent adherence (average 34.4 sessions completed out of 36).
- Patients demonstrated significant improvements in functional independence, with mean FIM scores increasing by 25.4 points over three months ($p < 0.001$).
- Caregivers reported a marked reduction in perceived burden, as reflected by a mean decrease of 25.8 points in CBS scores ($p < 0.001$).
- No statistically significant correlation was observed between changes in patient functional independence and caregiver burden ($r = -0.04$, $p = 0.862$). This finding likely reflects the small pilot sample size and exploratory nature of the study, rather than a definitive absence of relationship.

DISCUSSION

The present study assessed the effect of a structured tele-delivered caregiver education program on the functional independence of stroke patients and the burden experienced by their caregivers. The findings showed that patients improved significantly in Functional Independence Measure (FIM) scores, while caregivers reported a clear reduction in Caregiver Burden Scale (CBS) scores. A strong negative correlation between patient functional improvement and caregiver burden suggests that recovery in patient independence directly reduces caregiver strain.[14,15]

Patient Functional Independence

The increase in FIM scores highlights the value of caregiver-focused telehealth education in promoting patient recovery. When caregivers received structured guidance, they were better able to manage rehabilitation tasks at home. This likely helped patients regain mobility and daily living skills more effectively.[16,17] Previous studies have also shown similar results, where training programs for caregivers supported improvements in patient mobility and independence.[18,19]

Caregiver Burden

A major outcome of this study was the decline in caregiver burden after the program. Caregivers often face stress, anxiety, and fatigue when supporting stroke survivors, but structured education and regular tele-sessions provided them with coping strategies and confidence.[20,21] This is consistent with earlier research that reported reductions in stress and better caregiver well-being when educational support was provided.[22,23]

Link between Patient and Caregiver Outcomes

The negative correlation between patient gains and caregiver burden underscores how closely linked the two outcomes are. As patients became more

independent, caregivers faced less physical effort and emotional strain.[24] This relationship is supported by other work showing that patient recovery and caregiver well-being improve together.[25]

Comparison with Literature

Our results are in line with earlier studies that tested structured caregiver interventions, both face-to-face and through telehealth.[26–28] The use of online sessions offers extra advantages, including easier access for families living far from rehabilitation centers, flexibility in scheduling, and continued support even when hospital visits are difficult.[29,30]

Strengths

- **High feasibility and adherence:** The study achieved excellent recruitment, retention, and session attendance, showing the program was practical and acceptable.
- **Structured intervention with validated outcomes:** A well-designed tele-delivered education program was implemented using standardized tools (FIM and CBS).
- **Real-world applicability:** Telehealth delivery addressed accessibility challenges, making the program suitable for wider community use.

Limitations

The absence of a control group is a limitation, as natural recovery may have contributed to improvements. Future randomized trials are needed to confirm the effects. The study was also conducted at a single center, which may affect generalizability. Additionally, digital literacy and access to technology could influence participation and outcomes.[31,32]

Implications

These findings suggest that caregiver education through telehealth can be an important part of stroke rehabilitation. By supporting both the patient and the caregiver, such programs may improve recovery while reducing caregiver stress.[33,34]

CONCLUSION

This study showed that a structured tele-delivered caregiver education program improved functional independence in stroke patients and reduced the burden on their caregivers. The negative correlation between patient gains and caregiver strain indicates that both outcomes are closely connected. When patients become more independent, caregivers experience less stress and effort in daily care.

These findings suggest that adding caregiver training through telehealth could be a practical and effective way to strengthen stroke rehabilitation programs. Such an approach can reach families more easily, especially where in-person rehabilitation is limited, and can provide ongoing support to both patients and caregivers.

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