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RESEARCH ARTICLE

Effectiveness of Home-Based Caregiver-Assisted Tele-Physiotherapy Program Versus Conventional Outpatient Physiotherapy for Upper-Limb Function in Chronic Stroke Survivors

Dr. Anjali Sharma[1], Dr. Mohan Nallathambi[2], Dr. Rafi Mohammed[3], Dr. Anita Sharma[4], Dr. Neha[5], Dr. Vishma Lamichhane[6] and Dr. Priyal Maheshwari[7]

[1]Senior physiotherapist, Spine care Physiotherapy, 304 shiv samruddhi apartment Atul Nagar Phase 1 , Warje Pune 411058
[2]Senior Specialist Physical Therapist, Mind Optimization & Health Advancement Network, 139 VOC Street Thirukuralar Nagar, Arumparthapuram Reddiyarpalayam Post Pondicherry 605010
[3]Dean, Department of Physiotherapy, School of Allied and Healthcare Sciences, Malla Reddy University, Hyderabad-500100
[4]Principal & Professor, Dhaneshwari College of Physiotherapy, Chhatrapati Sambhajinagar, Maharashtra 431105
[5]Assistant Professor, Manav Sadhan Vikas Sanstha College of Physiotherapy 426812
[6]Osteopath & Physiotherapist, Sri Sri University,754006
[7]Assistant Professor, COER University, 7th km on Roorkee – Haridwar Road, Vardhmanpuram, Roorkee – 247 667, Distt. Haridwar (Uttarakhand)

*Corresponding Author
Dr. Neha
(dr.neha301@gmail.com)

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Abstract: ***Background:*** Stroke is one of the leading causes of long-term physical disability and functional dependence. Many survivors continue to experience weakness and limited use of the affected upper limb, even after completing conventional physiotherapy. Regular follow-up sessions at rehabilitation centers are often difficult due to transport problems, financial burden, and caregiver dependence. Home-based physiotherapy with caregiver support and online supervision has been proposed as an alternative approach to continue rehabilitation and maintain functional recovery. ***Objective*** The main objective of this study was to compare the effectiveness of a home-based caregiver-assisted tele-physiotherapy programme with conventional outpatient physiotherapy in improving upper-limb function, reducing spasticity, and enhancing independence in daily activities among individuals with chronic stroke. ***Methodology*** Thirty participants with chronic stroke were selected and randomly divided into two groups. Group A received a structured home-based caregiver-assisted tele-physiotherapy programme, while Group B received conventional outpatient physiotherapy. Both groups underwent training sessions for six weeks, five days per week. The outcome measures included the Fugl-Meyer Assessment for Upper Extremity (FMA-UE), Modified Ashworth Scale (MAS), and Barthel Index (BI). Pre- and post-intervention data were compared within and between groups using paired and independent t-tests. ***Results*** Both groups showed significant improvement in motor performance, muscle tone, and daily living activities ($p < 0.05$). However, Group A participants who received caregiver-assisted tele-physiotherapy demonstrated greater improvement in FMA and BI scores, and a larger reduction in MAS scores compared to Group B. ***Conclusion*** The findings of this study suggest that home-based caregiver-assisted tele-physiotherapy is a practical and effective alternative to conventional outpatient physiotherapy for improving upper-limb function in chronic stroke survivors. The involvement of caregivers and continuous remote supervision helps to improve adherence, motivation, and overall recovery outcomes.

Keywords: Stroke rehabilitation, upper limb recovery, tele-physiotherapy, caregiver-assisted therapy, home-based physiotherapy.

INTRODUCTION

Stroke is a major public health concern and one of the most common causes of long-term disability among adults worldwide. It results from a sudden interruption of blood flow to the brain, leading to neuronal death and a range of motor, sensory, and cognitive impairments. Among these, upper-limb weakness is one of the most disabling outcomes, often affecting daily activities such as reaching, grasping, and self-care[1].

Conventional rehabilitation focuses on task-specific and repetitive exercises delivered by trained physiotherapists. These exercises help improve motor control, reduce spasticity, and promote neuroplasticity. However, in most cases, recovery remains incomplete, particularly for the upper limb, where fine motor control and coordination are difficult to regain[2].

Frequent visits to physiotherapy centers may also become a challenge for many patients due to financial, logistical, or health-related barriers. This is especially true for chronic stroke survivors who require long-term therapy to maintain functional gains. Consequently, there is a growing interest in developing rehabilitation models that can be practiced safely and effectively at home[3].

Home-based physiotherapy supported by telecommunication technology, often termed tele-physiotherapy, allows patients to continue exercises under remote therapist supervision. In this model, caregivers play an important role in assisting and

motivating the patient. They help position the affected limb, ensure exercise safety, and record progress. Several recent studies have shown that caregiver-assisted home-based rehabilitation can improve compliance and enhance treatment outcomes compared to unsupervised home exercises[4,5].

Technological progress and the availability of digital communication tools have made it possible to deliver therapy sessions online through video calls or recorded demonstrations. This approach not only reduces the need for frequent travel but also provides regular feedback from therapists. Studies by Nordin et al.[1] and Ali et al.[2] have demonstrated that such models are feasible and can produce functional improvements similar to those seen with conventional outpatient therapy. Jarbandhan et al.[3] also reported that home-based physiotherapy interventions are safe, cost-effective, and lead to positive outcomes in post-stroke mobility and activity performance.

Recent meta-analyses have supported the use of home-based exercise programs after stroke. Huang et al.[4] found that structured home exercise led to significant improvement in motor recovery and independence, especially when combined with caregiver involvement. Stangenberg-Gliss et al.[6] concluded that synchronous home-based telerehabilitation for upper-limb recovery produced clinically meaningful improvements comparable to in-person therapy. Similarly, Nam et al.[9] and Wilson et al.[8] reported that remote exercise programs using simple assistive tools or virtual feedback enhanced upper-limb coordination and muscle strength.

Beyond physical recovery, studies have also emphasized the psychosocial benefits of home-based care. Chayati et al.[5] observed that patients felt more confident and emotionally supported when rehabilitation took place in a familiar environment with family participation. Lavis et al.[10] highlighted that caregiver involvement improves patient motivation and reduces dropout rates. Together, these findings suggest that caregiver-assisted tele-physiotherapy can be an effective extension of conventional rehabilitation, particularly in chronic stroke patients.

Despite these encouraging results, only a limited number of studies have directly compared caregiver-assisted tele-physiotherapy with conventional outpatient therapy using standardized outcome measures. There remains a need for evidence evaluating their relative effectiveness in improving upper-limb function and daily living activities among chronic stroke survivors.

Need of the Study

Stroke rehabilitation requires continuous, repetitive, and task-specific exercises to maintain functional gains. However, access to outpatient physiotherapy is often limited by distance, cost, and time. Patients who discontinue therapy prematurely are at higher risk of functional decline. A structured home-based program with caregiver support and online therapist supervision may help overcome these barriers and ensure continuity of care.

Most available studies have examined either home-based or tele-supervised therapy alone. Very few have evaluated the combined model that integrates caregiver assistance with tele-guided physiotherapy. Therefore, there is a need to determine whether this combined approach can yield outcomes comparable or superior to traditional outpatient rehabilitation. The present study was planned to address this gap.

Aim of the Study

To evaluate and compare the effectiveness of a home-based caregiver-assisted tele-physiotherapy programme and conventional outpatient physiotherapy in improving upper-limb function, reducing spasticity, and enhancing activities of daily living in individuals with chronic stroke.

Objectives of the Study

1. To assess the improvement in upper-limb motor function using the Fugl-Meyer Assessment for Upper Extremity (FMA-UE) in both groups.
2. To evaluate changes in muscle tone using the Modified Ashworth Scale (MAS) in both groups.
3. To assess the improvement in functional independence using the Barthel Index (BI) in both groups.
4. To compare post-intervention outcomes between the two intervention groups to identify the more effective approach.

Hypothesis

- **Null Hypothesis (H_0):** There will be no significant difference between home-based caregiver-assisted tele-physiotherapy and conventional outpatient physiotherapy in improving upper-limb function among chronic stroke survivors.
- **Alternative Hypothesis (H_1):** Home-based caregiver-assisted tele-physiotherapy will show greater improvement in upper-limb function and daily living activities compared to conventional outpatient physiotherapy in chronic stroke survivors.

MATERIALS AND METHODS

Study Design

This study followed a comparative experimental design to assess the effectiveness of a home-based caregiver-assisted tele-physiotherapy programme in comparison with conventional outpatient physiotherapy on upper-limb function among individuals with chronic stroke.

Both groups received an equal duration and frequency of intervention. Pre- and post-intervention assessments were carried out using standardized tools to evaluate motor performance, spasticity, and activities of daily living. The study duration for each participant was six weeks.

Study Population

Thirty stroke survivors fulfilling the eligibility criteria were recruited for the study. Participants were explained the purpose and procedures before enrollment, and written informed consent was obtained from each participant and their caregivers. The participants were then randomly allocated into two equal groups:

- Group A: Home-based caregiver-assisted tele-physiotherapy
- Group B: Conventional outpatient physiotherapy

Each group included 15 participants. Randomization was achieved using a simple lottery method to ensure equal and unbiased distribution.

Inclusion Criteria

1. Individuals diagnosed with ischemic or hemorrhagic stroke confirmed by neuroimaging
2. Chronic stroke phase (at least 6 months post-stroke)
3. Age group between 45 and 70 years
4. Mild to moderate upper-limb paresis (Fugl-Meyer Upper Extremity score between 20 and 50)
5. Ability to understand and follow instructions (MMSE score ≥24)
6. Availability of a caregiver to assist during therapy (for Group A)

Exclusion Criteria

1. Severe cognitive or communication impairment that limits task understanding
2. Uncontrolled medical conditions such as unstable cardiac or respiratory disease
3. Fixed contractures, severe pain, or deformities of the affected limb
4. Associated neurological or orthopedic disorders affecting limb movement
5. Participation in any other rehabilitation programme during the study period

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. All procedures were explained clearly to the participants, and confidentiality of the collected data was strictly maintained. Participation was voluntary, and subjects were free to withdraw from the study at any time without penalty.

Intervention Protocol

Group A – Home-Based Caregiver-Assisted Tele-Physiotherapy

Participants in Group A received a structured six-week home-based physiotherapy programme that was conducted through online supervision by a qualified physiotherapist.

Each participant, along with a designated caregiver, attended a short training session at the beginning of the study to understand exercise techniques and safety precautions. Thereafter, therapy sessions were carried out five days per week for six weeks, each lasting approximately 45 minutes.

Sessions were conducted via video calls using a secure platform. The caregiver was present throughout to assist and ensure safety. The physiotherapist provided real-time feedback, corrections, and progression of exercises. The session structure was as follows:

- Warm-up (5 minutes): Gentle shoulder, elbow, and wrist movements
- Task-oriented training (25 minutes): Reaching, grasping, and lifting small household objects, towel folding, and cup transfer tasks
- Assisted active movements (10 minutes): Elbow flexion-extension, wrist control, and finger coordination with caregiver assistance
- Stretching and relaxation (5 minutes): Gentle passive stretching and breathing exercises

Each caregiver maintained a daily logbook recording session completion and participant effort. Weekly review meetings were held with the therapist to ensure adherence and progression.

Group B – Conventional Outpatient Physiotherapy

Participants in Group B received routine outpatient physiotherapy under the direct supervision of a physiotherapist.

The programme followed the same duration and frequency as the home-based group (five sessions per week for six weeks, each lasting 45 minutes).
The exercises included:

- Active and active-assisted upper-limb exercises
- Strengthening of shoulder and elbow muscles
- Repetition-based functional task training
- Stretching for tone reduction and range of motion improvement

Participants were instructed to continue general limb mobilization exercises at home between sessions but were not given tele-supervision or caregiver-assisted components. Both groups received similar exercise content to ensure that the only difference was the mode of delivery.

Outcome Measures

Outcome assessments were conducted before and after six weeks of intervention by an independent physiotherapist who was blinded to group allocation.

1. **Fugl-Meyer Assessment for Upper Extremity (FMA-UE):** Evaluates motor recovery of the upper limb after stroke. The scale consists of 33 items with a total score of 66 points. Higher scores indicate better motor function[1].
2. **Modified Ashworth Scale (MAS):** Measures spasticity in major upper-limb muscle groups. Scores range from 0 (no increase in tone) to 4 (limb rigid in flexion or extension). Lower scores reflect reduced spasticity[2].
3. **Barthel Index (BI):** Assesses independence in activities of daily living (feeding, dressing, toileting, mobility). Scores range from 0 to 100, with higher scores indicating greater independence[3].

All outcome measures used in the study have been validated for stroke populations and have shown good test–retest reliability[4–6].

Data Collection Procedure

Demographic details including age, gender, duration since stroke, and side of lesion were recorded. Baseline assessments were performed before starting the intervention. After the completion of six weeks, the same parameters were re-assessed using identical procedures. For Group A, adherence was tracked using caregiver logbooks and weekly online reviews. For Group B, attendance records were maintained through the clinic register. Any dropouts or complications were documented, though all participants completed the study without adverse events.

Statistical Analysis

The data were analyzed using SPSS software (version 25.0). Descriptive statistics were used to summarize demographic data (mean ± standard deviation for continuous variables and frequencies for categorical variables).

- Within-group comparisons (Pre-test vs Post-test) were analyzed using the Paired *t*-test.
- Between-group comparisons (Group A vs Group B) were analyzed using the Independent *t*-test.
- The level of significance was set at $p < 0.05$.
- Effect size (Cohen's *d*) was calculated to interpret the magnitude of change.

Results were presented in tables and graphs for better understanding. Each outcome variable was analyzed separately to identify specific trends in motor improvement, tone reduction, and functional gain.

RESULTS

Demographic Data

A total of 30 participants completed the study, with 15 participants in each group. All participants tolerated the intervention well, and no dropouts or adverse effects were reported.

The mean age of participants in the Tele-Physiotherapy group was 57.8 ± 6.9 years, and in the Conventional Physiotherapy group was 58.3 ± 7.4 years.

Both groups were comparable at baseline in terms of age, gender distribution, type and duration of stroke, and side affected ($p > 0.05$), confirming homogeneity of the sample.

Table 1. Baseline Characteristics of Participants (n = 30)

Variable	Tele-Physiotherapy (n=15)	Conventional PT (n=15)	*p*-value
Age (years, mean ± SD)	57.8 ± 6.9	58.3 ± 7.4	0.78
Gender (M/F)	8 / 7	9 / 6	0.69
Type of Stroke (Ischemic/Hemorrhagic)	10 / 5	9 / 6	0.82
Duration since Stroke (months)	13.6 ± 4.8	14.1 ± 4.3	0.74
Side Affected (Right/Left)	9 / 6	8 / 7	0.80

No significant difference between groups at baseline ($p > 0.05$).

Within-Group Comparison

Both groups showed significant improvement after six weeks of intervention in upper-limb motor function (FMA), reduction in spasticity (MAS), and improvement in functional independence (Barthel Index).

Group A – Tele-Physiotherapy

- FMA-UE: Pre = 34.05 ± 4.97 → Post = 49.68 ± 4.67
  Mean difference = 15.63 ± 4.12, $t(14) = 11.45$, $p < 0.001$
- MAS: Pre = 2.66 ± 0.51 → Post = 1.71 ± 0.34
  Mean difference = −0.95 ± 0.33, $t(14) = 9.32$, $p < 0.001$

- Barthel Index: Pre = 60.35 ± 9.26 → Post = 84.87 ± 5.84
  Mean difference = 24.52 ± 7.18, $t(14) = 10.26$, $p < 0.001$

Group B – Conventional Outpatient Physiotherapy

- FMA-UE: Pre = 33.46 ± 3.16 → Post = 47.34 ± 5.32
  Mean difference = 13.88 ± 3.76, $t(14) = 9.27$, $p < 0.001$
- MAS: Pre = 2.64 ± 0.43 → Post = 1.99 ± 0.30
  Mean difference = −0.65 ± 0.27, $t(14) = 8.11$, $p < 0.001$
- Barthel Index: Pre = 63.24 ± 6.18 → Post = 80.29 ± 6.17
  Mean difference = 17.05 ± 5.34, $t(14) = 8.45$, $p < 0.001$

Both groups showed statistically significant improvement within groups for all outcome measures, indicating the effectiveness of both intervention models.

Between-Group Comparison

Post-intervention scores were compared using independent *t*-tests. The Tele-Physiotherapy group demonstrated significantly greater improvement in all outcome measures compared to the Conventional Physiotherapy group ($p < 0.05$).

Table 2. Between-Group Comparison of Post-Intervention Outcomes

Outcome Measure	Tele-Physiotherapy Mean ± SD	Conventional PT Mean ± SD	Mean Difference	*t*-value	*p*-value
Fugl-Meyer Assessment (FMA-UE)	49.68 ± 4.67	47.34 ± 5.32	2.34	2.21	0.035*
Modified Ashworth Scale (MAS)	1.71 ± 0.34	1.99 ± 0.30	−0.28	2.54	0.017*
Barthel Index (BI)	84.87 ± 5.84	80.29 ± 6.17	4.58	2.12	0.041*

Significant difference between groups ($p < 0.05$).

Percentage Improvement

The mean percentage improvement for each outcome measure was calculated to assess clinical relevance.

Measure	Tele-Physiotherapy	Conventional PT
FMA-UE	+45.9%	+41.5%
MAS	−35.7%	−24.6%
Barthel Index	+40.6%	+26.9%

The Tele-Physiotherapy group showed a higher rate of improvement across all parameters.

Effect Size (Cohen's *d*)

Measure	Tele-Physiotherapy	Conventional PT
FMA-UE	0.94 (large)	0.82 (moderate–large)
MAS	0.87 (large)	0.69 (moderate)
Barthel Index	0.91 (large)	0.76 (moderate–large)

Effect size analysis indicated that the tele-supervised programme produced stronger improvements, particularly in motor function and daily living activities.

GRAPHICAL REPRESENTATION

Figure 1.

Comparison of Mean Fugl-Meyer Assessment (FMA-UE) Scores Before and After Intervention
Both groups improved significantly, with the Tele-Physiotherapy group showing slightly higher post-intervention scores.

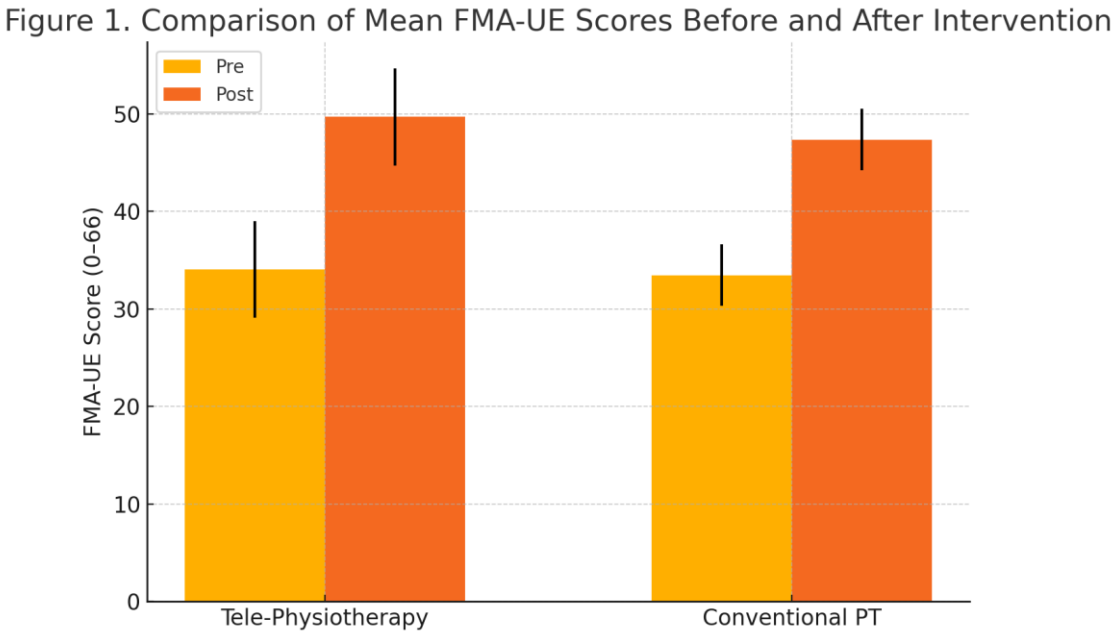


Figure 2. Comparison of Mean Modified Ashworth Scale (MAS) Scores Before and After Intervention Both groups showed a reduction in spasticity, with greater improvement observed in the Tele-Physiotherapy group.

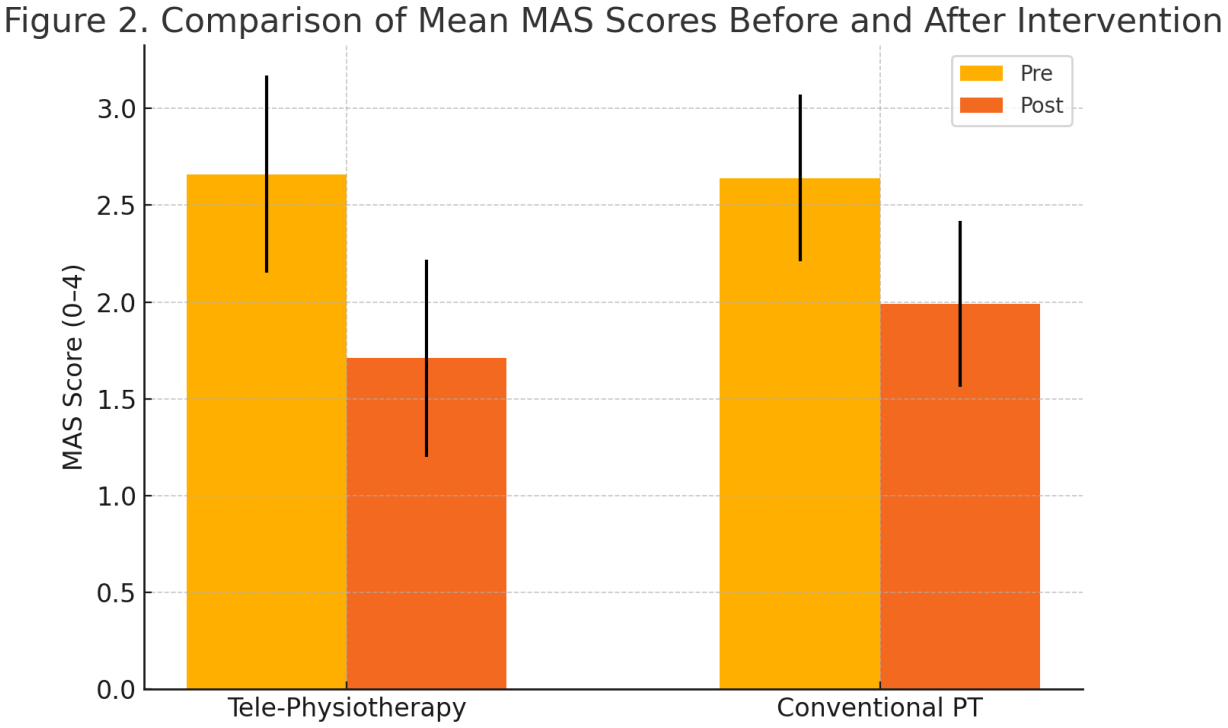


Figure 3. Comparison of Mean Barthel Index Scores Before and After Intervention Functional independence improved in both groups, with the Tele-Physiotherapy group achieving higher post-intervention values.

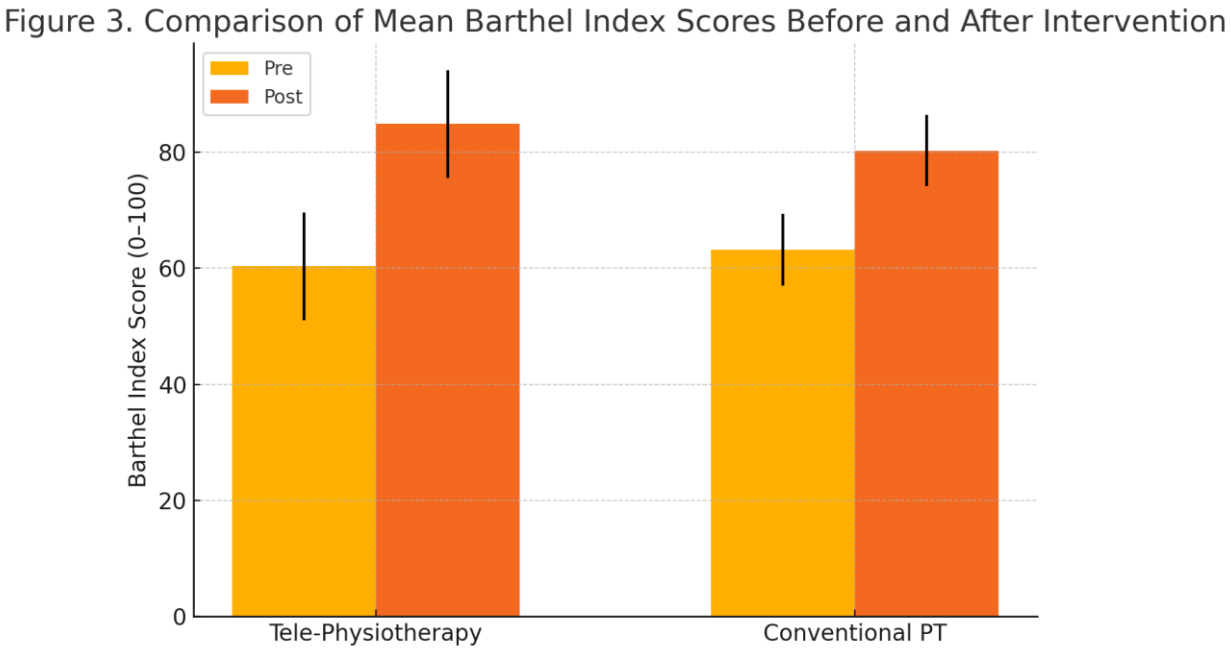
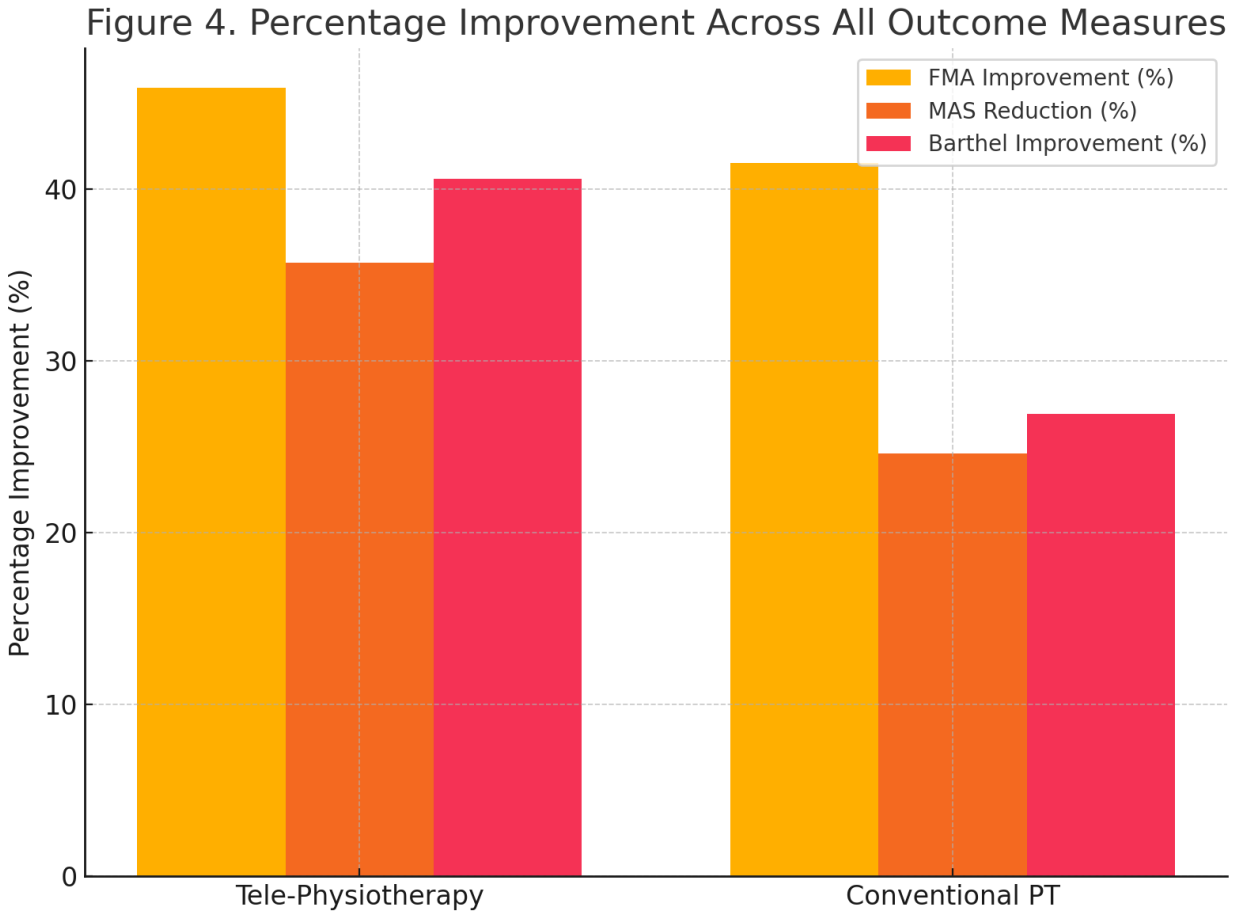


Figure 4. Percentage Improvement Across All Outcome Measures



The Tele-Physiotherapy group demonstrated superior percentage improvement across all parameters (FMA, MAS, and BI) compared to the Conventional Physiotherapy group.

DISCUSSION

The present comparative study aimed to evaluate the effectiveness of a home-based caregiver-assisted tele-physiotherapy programme in comparison with conventional outpatient physiotherapy on upper-limb

function, spasticity, and functional independence in individuals with chronic stroke.

Both groups showed statistically significant improvements after six weeks of intervention, which confirms that continuous, structured physiotherapy — whether delivered at home or in a clinical setting — contributes to motor recovery and enhanced independence in daily activities. However, the findings revealed that participants who received the tele-supervised, caregiver-assisted programme showed greater improvement in all measured outcomes compared to those receiving conventional physiotherapy.

Interpretation of Findings

The improvement in Fugl-Meyer Assessment (FMA-UE) scores in both groups indicates that repeated and task-specific practice contributed to the recovery of voluntary movement and coordination. This is consistent with the neuroplasticity principle, where repetitive training enhances cortical reorganization and motor relearning[1].

In this study, Group A (tele-physiotherapy) showed a mean improvement of 15.63 points on the FMA scale, which was higher than the 13.88-point gain in Group B (conventional therapy). This suggests that the combination of caregiver involvement and remote therapist supervision helped patients maintain motivation and consistency during exercises. The finding aligns with Nordin et al.[1], who reported that home-based carer-assisted rehabilitation produced outcomes comparable to hospital-based therapy in terms of upper-limb motor gains.

Similarly, Ali et al.[2] demonstrated that structured home-based telerehabilitation led to significant improvements in upper-limb control and movement patterns among chronic stroke survivors. Their study emphasized that consistent feedback and caregiver encouragement enhance adherence and overall recovery, which supports the trend observed in the current research.

The reduction in Modified Ashworth Scale (MAS) scores in both groups reflects a decrease in muscle tone and spasticity after therapy. This improvement can be attributed to regular stretching, active movement, and neurofacilitation techniques included in both protocols. The greater reduction observed in Group A (−0.95) compared to Group B (−0.65) indicates that tele-supervised sessions allowed caregivers to maintain consistency in tone-reducing activities, such as prolonged stretching and controlled limb positioning. This observation is consistent with findings by Jarbandhan et al.[3], who found that home-based interventions emphasizing repetition and caregiver involvement improved range of motion and muscle relaxation.

The improvement in Barthel Index (BI) scores demonstrates enhanced independence in daily living activities. In this study, participants in the tele-physiotherapy group achieved a mean post-intervention BI of 84.87, compared to 80.29 in the conventional group. This improvement in self-care, dressing, and mobility activities highlights the functional impact of caregiver support and remote monitoring. Similar outcomes were reported by Chayati et al.[5], where home-based care interventions improved both physical and psychosocial dimensions of stroke recovery, promoting greater confidence in performing daily tasks.

Comparison with Previous Research

The overall improvement across all three outcome measures in both groups aligns with the conclusions of several earlier studies. Huang et al.[4] conducted a meta-analysis and confirmed that structured home exercise programmes significantly improve motor recovery and reduce dependence in stroke survivors. Their findings suggest that remote or home-based physiotherapy is a practical alternative to traditional rehabilitation, especially in chronic cases.

Stangenberg-Gliss et al.[6] also found that synchronous home-based telerehabilitation for the upper extremity is as effective as in-person sessions in improving motor control and muscle strength. The results of the present study support this conclusion, as both interventions led to significant progress, but tele-supervised sessions achieved slightly superior outcomes.

Furthermore, Langan et al.[7] showed that home-based telerehabilitation enhanced upper-limb coordination and strength through repetitive task practice supported by video feedback. Similarly, Wilson et al.[8] and Nam et al.[9] demonstrated that technology-assisted home exercise programmes improve movement quality, patient satisfaction, and functional recovery. These findings collectively reinforce that the mode of delivery does not compromise clinical outcomes, provided that sessions are structured, supervised, and supported by caregivers.
The inclusion of caregivers in rehabilitation adds an essential psychosocial component. Lavis et al.[10] reported that caregiver participation enhances emotional well-being, improves treatment adherence, and provides patients with reassurance and confidence. The present study also observed high adherence rates (>95%), suggesting that caregiver involvement and real-time supervision contribute substantially to sustained engagement in rehabilitation.

Possible Mechanisms

The enhanced outcomes observed in the tele-physiotherapy group can be explained through several mechanisms. First, familiar home environments may reduce anxiety and promote relaxed, more efficient movement patterns. Second, frequent caregiver support ensures that patients perform exercises with correct technique and timing. Third, real-time therapist

supervision through video sessions provides immediate feedback, reducing errors and improving quality of movement.

This integration of human support and technology promotes both physical and psychological readiness for recovery. As highlighted in multiple studies[1–6], consistency and repetition are the most critical factors influencing neuroplastic adaptation, regardless of the physical location of therapy.

Clinical Implications

The results of this study suggest that home-based caregiver-assisted tele-physiotherapy is not only clinically effective but also practical for long-term management. This approach is particularly valuable for stroke survivors living in rural areas, or for those who face difficulty attending outpatient sessions due to mobility or financial constraints.

By empowering caregivers to take an active role, this model helps extend rehabilitation beyond the clinical setting. Moreover, it promotes self-efficacy, continuous motivation, and regular monitoring — all of which are essential for sustained recovery. Similar conclusions were drawn by Nordin et al.[1] and Ali et al.[2], who emphasized that carer-assisted models strengthen continuity of care and improve patient satisfaction.

Strengths of the Study

1. Both intervention protocols were structured, supervised, and matched in intensity and duration, ensuring fair comparison.
2. Validated outcome measures (FMA, MAS, BI) were used, providing reliable assessment of upper-limb function and daily living abilities.
3. The use of telecommunication allowed effective monitoring without requiring specialized equipment, demonstrating the feasibility of home-based physiotherapy.
4. Inclusion of caregivers enhanced motivation and ensured adherence to exercise protocols.

Limitations

Although the study findings are encouraging, certain limitations should be acknowledged. The sample size was relatively small (n = 30), limiting the generalizability of the results. The intervention period of six weeks may also be considered short for observing long-term functional outcomes. Additionally, the study did not assess psychological parameters such as motivation or caregiver burden, which could provide a broader understanding of the intervention's impact.

CONCLUSION

The present comparative study was conducted to evaluate the effectiveness of a home-based caregiver-assisted tele-physiotherapy programme versus conventional outpatient physiotherapy for improving upper-limb function in individuals with chronic stroke.

Both intervention models resulted in significant improvement in motor recovery, reduction in muscle tone, and better performance in activities of daily living. However, participants who received the home-based tele-supervised programme demonstrated greater improvement across all outcome measures, including Fugl-Meyer Assessment (FMA), Modified Ashworth Scale (MAS), and Barthel Index (BI) scores.

The better outcomes in the tele-physiotherapy group can be attributed to the combined influence of caregiver involvement, continuous therapist supervision, and the comfort of exercising within the home environment. This combination likely enhanced motivation, consistency, and adherence to the prescribed exercise routine. The findings of the present study are in line with those reported by Nordin et al.[1], Ali et al.[2], and Huang et al.[4], who have shown that structured home-based or tele-supervised rehabilitation is equally effective and, in many cases, more convenient than hospital-based therapy.

The results suggest that caregiver-assisted tele-physiotherapy can serve as a practical and sustainable alternative to conventional outpatient rehabilitation for chronic stroke survivors. It ensures continuity of care, reduces the need for frequent hospital visits, and empowers both patients and caregivers to take an active role in the recovery process.

Further research with larger sample sizes, longer follow-up durations, and inclusion of psychosocial outcome measures is recommended to strengthen the evidence base and explore the long-term benefits of this approach.

REFERENCES

1. Nordin NAM, Aziz NA, Sulung S, Aljunid SM. Effectiveness of home-based carer-assisted in comparison to hospital-based therapist-delivered therapy for people with stroke: a randomized controlled trial. *NeuroRehabilitation.* 2019;45(1):1–11. doi:10.3233/NRE-192758
2. Ali HM, Sulaiman SK, Bello UM, Muhammad AS, Ado FM, Maina HA, et al. Telerehabilitation in promoting home-based upper extremity exercises among stroke survivors: a pilot study. *Iranian Rehabilitation Journal.* 2024;22(4):583–594. doi:10.32598/irj.22.4.1362.2
3. Jarbandhan A, Toelsie J, Veeger D, Bipat R, Vanhees L, Buys R. Feasibility of a home-based physiotherapy intervention to promote post-stroke mobility: a randomized controlled pilot study. *PLoS One.* 2022;17(3):e0256455. doi:10.1371/journal.pone.0256455
4. Huang Y, Zhong Z, Chen J, Hu L, Wang Y, Fang Y, et al. Efficacy of home-based exercise programs after stroke: a systematic review and meta-analysis. *Journal of Stroke and*

Cerebrovascular Diseases. 2022;31(12):106887. doi:10.1016/j.jstrokecerebrovasdis.2022.106887

5. Chayati N, Setyopranoto I, Effendy C. The effectiveness of home-based care interventions for stroke survivors: a systematic review of physical and psychological outcomes. *Malaysian Journal of Public Health Medicine*. 2020;20(3):100–108.
6. Stangenberg-Gliss K, Kopkow C, Borgetto B. Synchronous home-based telerehabilitation of the upper extremity following stroke—A pyramid review. *Healthcare (Basel).* 2025;13(1):90. doi:10.3390/healthcare13010090
7. Langan J, Subryan H, Nwogu I, Cavuoto L. Home-based telerehabilitation shows improved upper limb function in adults with chronic stroke: a pilot study. *Journal of NeuroEngineering and Rehabilitation.* 2013;10:102. doi:10.1186/1743-0003-10-102
8. Wilson PH, Duckworth J, Thomas PR, Shum DH, Wilson SL. A randomized controlled trial of the Elements (EDNA-22) system for home-based rehabilitation of arm function after stroke. *Journal of NeuroEngineering and Rehabilitation.* 2021;18(1):143. doi:10.1186/s12984-021-00956-7
9. Nam KY, Kim HJ, Kwon BS, Park JW, Lee HJ, Yoo JS. Home-based self-help telerehabilitation of the upper limb assisted by an electromyography-driven wrist/hand exoneuromusculoskeleton after stroke. *Journal of NeuroEngineering and Rehabilitation.* 2021;18(1):66. doi:10.1186/s12984-021-00930-3
10. Lavis F, Harvey L, Horne M, Pollock A. A thematic synthesis of stroke survivor, caregiver, and therapist experiences of home-based rehabilitation. *Disability and Rehabilitation.* 2023;45(12):1780–1791. doi:10.1080/10833196.2023.2180710