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"OPTIMIZING RECOVERY AFTER STROKE: OUTPATIENT VERSUS HOME-BASED REHABILITATION IN PATIENTS AT RISK FOR POOR OUTCOMES"

Dr. Zahoor Ahmad[*1]
[*1]Assistant Professor The University of Haripur
[*1]drzahoor@upoh.edu.pk

Dr. sumayya[2]
[2]Lecturer University of Swabi
[2]drsumayya95@gmail.com

Author Details

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Corresponding E-mails & Authors*:
Dr. Zahoor Ahmad

Abstract

Aim of the Study: *To compare the effectiveness of outpatient physiotherapy versus structured home-based rehabilitation in improving functional and clinical outcomes among patients at risk of poor recovery after stroke.*

Objectives of the Study: *To evaluate changes in functional independence, balance, gait speed and patient-reported recovery over four months, to document adherence, safety and feasibility of both rehabilitation models and to describe and standardize detailed treatment protocols for each setting.*

Methodology: *A randomized controlled trial was conducted at Health & Wellness Physio Rehab Center. Forty-two patients (21 per group) within 2 weeks to 6 months post-stroke and identified as at risk of poor outcome were randomized to receive either outpatient physiotherapy (60-minute sessions, three times per week for 16 weeks) or a structured home-based program (daily self-practice with one supervised session per week). Primary outcome was changed in Functional Independence Measure (FIM); secondary outcomes included Berg Balance Scale, 10-Meter Walk Test, Stroke Impact Scale, upper limb function and mood. Assessments were performed at baseline and four months by blinded assessors.*

Results: *At four months, the outpatient group showed a mean FIM gain of 25.37 ± 8.72 versus 16.51 ± 10.02 in the home-based group ($p = 0.004$). Balance improvement (Berg Balance Scale) was also greater in the outpatient group (10.27 ± 4.20 vs. 6.13 ± 5.16; $p = 0.007$). Gait speed increased more in the outpatient group but did not reach significance ($p = 0.066$). Stroke Impact Scale scores improved by 19.50 ± 8.50 in the outpatient group compared with 10.41 ± 10.42 in the home group ($p = 0.003$). Adherence was higher in the outpatient group; adverse events were minor and similar between groups.*

Conclusion: *Outpatient physiotherapy delivered at high supervised intensity produced significantly greater gains in functional independence, balance and patient-reported recovery compared with a structured home-based*

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program in patients at risk of poor post-stroke outcomes. Home-based rehabilitation remains a valuable alternative when outpatient therapy is not feasible but may yield smaller improvements in this high-risk group.

INTRODUCTION

Stroke is a leading cause of adult disability worldwide and rehabilitation intensity and setting influence long-term outcomes. Patients identified as at risk of poor outcomes for example those with severe initial deficits, comorbidities, limited social support, or socioeconomic barriers require rehabilitation models that maximize recovery potential while remaining feasible and acceptable [1,2]. Outpatient physiotherapy offers frequent supervised, high-intensity, therapist-led interventions that can deliver progressive task-specific training, manual therapy, and device-assisted practice [3–6]. Home-based rehabilitation models aim to increase accessibility, reduce travel burden, and promote self-management, often with periodic therapist visits or telehealth support [7–10]. Previous trials and systematic reviews have reported mixed findings: some show equivalent outcomes between home programs and center-based therapy for selected patients [11–14], while others report better gains with higher supervised intensity [15–18]. Evidence gaps remain about which model yields superior functional gains for patients specifically at risk of poor outcomes, and which protocol elements (frequency, dose, exercise specifics) are critical [19–22]. This study was designed to compare OP versus structured HB in such patients, using standardized outcome measures over a four-month period, and to provide detailed treatment protocols clinicians can replicate.

The primary objective was to compare functional improvement (FIM change) at four months between OP and HB in patients at risk of poor outcomes after stroke. The secondary objective was to compare balance (Berg Balance Scale), gait speed (10-m walk test), patient-reported recovery (Stroke Impact Scale), upper limb function (Fugl-Meyer Upper Extremity or WMFT), and mood (PHQ-9) between groups; to describe adherence, adverse events, and feasibility.

Understanding which rehabilitation model offers superior outcomes for patients at risk of poor recovery is therefore essential for clinical decision-making and health policy. Moreover, many studies provide limited detail on the exact exercise protocols, making replication difficult. Precise information on exercise types, intensity, repetitions and progression is needed so clinicians can implement evidence-based programs in their own settings.

The present study was designed to address these gaps. We conducted a randomized controlled trial at the Health & Wellness Physio Rehab Center comparing a high-intensity, supervised outpatient physiotherapy program to a structured home-based rehabilitation program in patients identified as at risk of poor outcomes after stroke. We carefully documented both interventions, including session frequency, duration, repetitions and sets, and monitored functional, balance, and patient-reported outcomes over a four-month period. By focusing on a high-risk group and providing detailed protocols, this study aims to offer practical evidence to guide rehabilitation planning and resource allocation in similar clinical contexts.

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METHODS

Study design and setting

This was a parallel group randomized controlled trial conducted at Health & Wellness Physio Rehab Center between [start date] and [end date], total study duration 4 months per participant. The center's institutional review board approved the study, and written informed consent was obtained from all participants.

Participants

Sample size and recruitment

A convenience sample of 42 participants was recruited and randomized 1:1 to OP (n = 21) or HB (n = 21). Sample size (42) was selected to provide preliminary comparative data and to be feasible at the center within the study period.

Inclusion criteria

- Age 18–85 years.
- Diagnosis of first or recurrent ischemic or hemorrhagic stroke confirmed by imaging.
- Time since stroke: 2 weeks to 6 months (subacute to early chronic window).
- At risk of poor outcome defined by at least one of: baseline FIM ≤ 75, Berg Balance Scale ≤ 40, moderate to severe paresis (Fugl-Meyer upper limb ≤ 45), living alone or limited caregiver support, or two or more major medical comorbidities. These criteria were used to enrich the sample for higher risk of poor recovery [1,2].
- Medically stable and cleared for physiotherapy.
- Ability to follow simple two-step commands (to allow engagement in rehab).

Exclusion criteria

- Severe cognitive impairment (MMSE < 18) precluding participation.
- Uncontrolled cardiovascular disease or unstable medical illness.
- Progressive neurological disease other than stroke.
- Severe musculoskeletal problems limiting participation (e.g., unstable fracture).
- Enrollment in another intensive rehabilitation trial.
- Residence outside the center's home visit catchment area (for HB safety/feasibility).

Participants were randomized by computer-generated blocks (block size 4) into OP or HB. Allocation was concealed in opaque sealed envelopes opened after baseline assessment. Outcome assessors were blinded to group allocation. Therapists and participants could not be blinded due to the nature of the interventions. Both arms received rehabilitation organized around motor relearning, task specificity, progressive loading, balance and gait training, and upper limb retraining where relevant. The core difference was the delivery model: supervised outpatient sessions versus a structured home program with weekly therapist supervision and telephonic support. Both protocols specified exercise progressions, repetitions, sets, and session durations to allow reproducibility.

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Outpatient physiotherapy protocol (OP)
Setting: Health & Wellness Physio Rehab Center clinic.
Dose: 60 minutes per session, 3 sessions per week, for 16 weeks (4 months) = 48 sessions total.
Therapist: Licensed physiotherapist with stroke rehab experience (1:1).
Components and exact prescription (examples for typical participant):

1. **Warm-up (5–8 min)**
   - Active range of motion and gentle mobilization of affected limbs; 2 sets of 10 repetitions per major joint.
   -
2. **Task-specific lower limb & gait training (25–30 min)**
   - Sit-to-stand practice: 3 sets of 8–12 repetitions, progress via reduced assistance or added load.
   - Repetitive stepping and weight-shift drills: 4 sets of 20 steps per set.
   - Treadmill training (when indicated) with body-weight support initially: 20 minutes, intervals of 5 min work / 2 min rest; target cumulative stepping time 12–16 min per session; speed progressed aiming for 10% increase weekly as tolerated.
   - Overground gait training: 10 minutes of focused gait tasks (turns, obstacle negotiation), repeated 4–6 task trials per session.

3. **Balance training (10–12 min, can overlap with gait)**
   - Static standing progression: 3 sets x 30–60 seconds (narrow base, foam surface).
   - Dynamic balance: reaching tasks, tandem walking, single-leg support (as tolerated): 3 sets of 6–10 repetitions per task.
   - Reactive balance (perturbation training): 6–8 perturbations per session if safe.

4. **Upper limb task practice (10–15 min)**
   - Repetitive reaching and grasp tasks: 3 sets of 10–20 repetitions targeting functional tasks (reaching, grasp-release).
   - Constraint-induced movement principles for eligible patients: structured repetitive practice 30 min/day, 5 days/week, integrated into session and home assignment.
   - Functional electrical stimulation (FES) may be applied for ankle dorsiflexion or wrist extension: parameters 35–50 Hz, 250 μs pulse width, on:off 10s:20s for 10–15 minutes.

5. **Strengthening (8–10 min)**
   - Progressive resistance exercises for major muscle groups: 3 sets x 8–12 reps at 60–80% of 1RM equivalent using therabands, ankle weights, or machines; progressed every 1–2 weeks.

6. **Cool down and education (5 min)**
    - Home safety advice, prevention of falls, medication and skin care education.
    - Repetitions and sets are recorded each session. Therapists increased difficulty every 7–10 days based on performance (increase resistance, reduce assistance, increase speed, add dual tasks).

Adherence & monitoring

- Attendance logged; adverse events recorded. Weekly multidisciplinary case meeting to adjust programs.

Home-based rehabilitation protocol (HB)

Setting: Patient's home with weekly supervised therapist visit at the clinic or home visit (depending on safety) plus telephonic support twice weekly.

Dose: Daily home exercises aiming 45 minutes per day, totaling approximately 5–6 days/week, plus one 60-minute supervised therapist contact per week for 16 weeks. Expected total supervised contact: 16 sessions; total prescribed practice dose roughly matched by expected daily home practice.

Components and prescription (detailed, written and demonstrated at first supervised session):

1. **Warm-up (5 min)**
    - Active ROM and light marching in place; 2 sets x 10 reps.

2. **Task practice (20–25 min daily)**
    - Sit-to-stand: 3 sets x 8–12 reps, performed twice daily.
    - Repetitive stepping and block practice: 3 sets x 20 steps, once daily.
    - Overground walking practice: 10–15 minutes' walk broken into intervals, with specific cueing for symmetry.

3. **Balance tasks (7–10 min daily)**
    - Static balance holds: 3 x 30–60 seconds; dynamic reaching 3 x 8–10 reps.

4. **Upper limb practice (10–15 min daily)**
    - Reaching and task practice: 3 sets x 10–20 reps targeted to functional tasks such as lifting a cup, retrieving object from shelf.
    - If eligible, constraint principles: target 20–30 min of affected limb use daily.

5. **Strengthening (3–5 min)**
    - 2–3 exercises, 2 sets x 10–12 reps with theraband or household items.

6. **Education and safety**
    - Fall risk management, caregiver training, written exercise manual and logbook.

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Supervision and progression

- Weekly supervised session (60 minutes) to progress exercises, check technique, and adjust difficulty.
- Twice weekly phone check-ins to troubleshoot barriers, reinforce adherence, and record adverse events.

Outcome measures and assessment schedule

Baseline and four-month assessments by blinded assessor included:

- Functional Independence Measure (FIM): primary outcome.
- Berg Balance Scale (BBS).
- 10-Meter Walk Test (10MWT) — comfortable speed.
- Stroke Impact Scale (SIS) overall score.
- Fugl-Meyer Assessment upper extremity (when applicable).
- PHQ-9 for mood/depression.
- Adherence (logged sessions or minutes of practice).
- Adverse events (falls, medical complications).

Statistical analysis

Data were analyzed per intention-to-treat. Continuous variables are presented as mean ± standard deviation (SD). Between-group comparisons used independent t-tests (or Mann-Whitney U if not normally distributed). Categorical variables used chi-square tests. A two-tailed $p < 0.05$ was considered statistically significant. Effect sizes (Cohen's d) were calculated for main outcomes.

Results

Forty-two participants were randomized (OP n = 21, HB n = 21). Baseline demographic and clinical characteristics were similar between groups: mean age 63.2 ± 9.8 years, 55% male, mean time since stroke 6.8 ± 3.1 weeks, baseline FIM 62.4 ± 9.3, baseline BBS 29.1 ± 7.8. There were no significant between-group baseline differences (all $p > 0.2$). Two participants (one in each group) lost follow-up due to relocation; their primary outcome data were included using last observation carried forward. Outpatient group improved mean FIM by 25.37 ± 8.72 points at four months compared with baseline. Home-based group improved by 16.51 ± 10.02 points. The between-group difference was statistically significant (mean difference 8.86 points; independent t-test $p = 0.004$), favoring OP. Effect size was moderate to large (Cohen's $d \approx 0.9$) indicating clinically meaningful superiority of OP for functional independence in this sample. Balance (Berg Balance Scale): OP mean change 10.27 ± 4.20 points versus HB 6.13 ± 5.16 points. Between-group difference $p = 0.007$, favoring OP. Gait speed (10MWT): OP means speed improvement 0.300 ± 0.125 m/s versus HB 0.223 ± 0.140 m/s; $p = 0.066$ (trend favoring OP but not statistically significant). Stroke Impact Scale (SIS): OP means change 19.50 ± 8.50 versus HB 10.41 ± 10.42; between-group $p = 0.003$, favoring OP. Upper limb function (Fugl-Meyer/WMFT subset): OP showed greater mean gains, but small subgroup numbers limited statistical power. Mood (PHQ-9): Both groups showed modest improvements with no significant difference.

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Adherence were higher in OP for supervised session attendance (mean attended sessions 45/48 = 93.8%). HB group reported median daily practice of 38 minutes (interquartile range 28–45), with supervised contact attendance 14/16 visits (87.5%). Adverse events were minor and similar between groups: 5 falls without serious injury (3 OP, 2 HB), and 3 transient cardiac symptoms leading to temporary pause in therapy (1 OP, 2 HB). No deaths or major complications were related to interventions. Patients with higher baseline caregiver support had better adherence to HB and smaller between-group differences. Participants with severe baseline deficits derived relatively greater absolute gain from OP compared to HB.

Table 1: Showing the Baseline Demographic and Clinical Characteristics of Participants

Variable	Outpatient Group (n = 21)	Home-Based Group (n = 21)	p-value
Age (years), mean (SD)	63.1 (9.8)	63.4 (10.2)	0.92
Male, n (%)	12 (57%)	11 (52%)	0.77
Time since stroke (weeks), mean (SD)	6.9 (3.1)	6.7 (3.2)	0.88
Baseline FIM score, mean (SD)	62.5 (9.3)	62.3 (9.5)	0.95
Baseline Berg Balance Scale, mean (SD)	29.3 (7.8)	29.0 (7.6)	0.83

Table 2: Showing the Primary and Secondary Outcome Changes from Baseline to 4 Months for Outpatient and Home-Based Rehabilitation Groups

Outcome Measure	Outpatient Group (Mean ± SD)	Home-Based Group (Mean ± SD)	Mean Difference (95% CI)	p-value
Functional Independence Measure (FIM) change	25.37 ± 8.72	16.51 ± 10.02	8.86 (3.0–14.7)	0.004
Berg Balance Scale change	10.27 ± 4.20	6.13 ± 5.16	4.14 (1.2–7.0)	0.007
10-Meter Walk Test (m/s) change	0.300 ± 0.125	0.223 ± 0.140	0.077 (−0.005–0.159)	0.066
Stroke Impact Scale change	19.50 ± 8.50	10.41 ± 10.42	9.09 (3.3–14.8)	0.003

DISCUSSION

In this randomized sample of 42 patients at risk of poor post-stroke outcomes, outpatient physiotherapy consisting of high-dose, supervised sessions produced significantly greater gains in functional independence, balance, and patient-reported recovery at four months compared with a structured home-based program with weekly supervision. Gait speed showed a favorable trend for OP but did not reach conventional significance.

These findings echo prior literature suggesting supervised higher-intensity, task-specific training yields larger functional gains, particularly for patients with greater baseline impairment or limited support [3,15,16,23]. The larger effect sizes for FIM and SIS suggest that the supervised dose, immediate therapist feedback, and ability to progress difficulty in OP may be important mechanisms. Home programs remain valuable when access is limited or for maintenance, but in this at-risk group HB produced smaller improvements despite structured content and weekly supervision [7,11,12]. For patients identified as at risk of poor outcomes, clinicians should consider prioritizing outpatient supervised therapy when feasible and safe. When OP is not accessible, structured HB with frequent remote monitoring, caregiver training, and periodic hands-on progression may be an acceptable alternative but may yield smaller gains. Programs should record dose precisely (minutes of active practice) and tailor progression. Strengths include randomized design, blinded outcome assessment, and detailed, replicable intervention protocols. Limitations are small sample size, single-center setting, and limited long-term follow-up beyond four months. The sample may not generalize to populations with very severe cognitive impairment or to those living in remote areas where home models require different supports.

Future research

Larger multicenter trials should confirm these findings, explore hybrid models (early OP transitioning to HB with telehealth), and identify which subgroups derive equivalent benefit from HB. Cost-effectiveness and patient preference studies are also needed.

CONCLUSIONS

In this 4-month randomized study at Health & Wellness Physio Rehab Center, outpatient physiotherapy produced larger improvements in functional independence, balance, and patient-reported recovery than a structured home-based rehabilitation program in patients at risk of poor outcomes after stroke. Home-based programs remain important when OP is not feasible, but for high-risk patients' clinician-supervised OP should be prioritized where possible.

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