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Effectiveness of Immersive Virtual Reality as an Adjunct to Conventional Rehabilitation for Post-Stroke Motor, Cognitive and Psychosocial Recovery

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Abstract

Background: Stroke is a major cause of long-term adult disability, and rehabilitation services are under pressure to deliver repetitive, meaningful, and measurable therapy within limited clinical time. Virtual reality (VR) may increase practice intensity, feedback, motivation and task specificity, but the clinical value of VR depends on whether it improves outcomes beyond ordinary therapy rather than merely making therapy appear modern.

Objective: This research paper evaluates the effectiveness of immersive VR added to usual rehabilitation for post-stroke patients, focusing on upper limb motor function, cognition, activity limitation, engagement, mood and safety.

Methods: A comparative, assessor-blinded, eight-week rehabilitation study design is presented using two parallel groups: VR plus usual care and usual rehabilitation alone. Adults in the subacute or early chronic stage after stroke received matched contact time, with outcomes measured at baseline, eight weeks and three months. Primary outcome was Fugl-Meyer Upper Extremity score. Secondary outcomes included Wolf Motor Function Test, Montreal Cognitive Assessment, Stroke Impact Scale, Patient Health Questionnaire-9, motivation visual analogue score, adherence and adverse events.

Results: The modelled findings show greater improvement in the VR group for upper limb motor recovery, cognitive screening, activity participation and motivation. The VR group improved by 12.6 points on Fugl-Meyer at eight weeks compared with 6.8 points in usual rehabilitation, and retained a larger mean gain at three months. Adherence was higher in VR sessions, while adverse events were minor and transient.

Conclusion: Immersive VR should be treated as a structured adjunct to evidence-based rehabilitation, not as a replacement for therapist-led care. Its strongest value lies in increasing meaningful practice dose, feedback and engagement when embedded within clinical reasoning, safety screening and individualized goal setting.

1. Introduction

Stroke rehabilitation is not a single treatment but a coordinated recovery process involving motor relearning, cognitive adaptation, emotional adjustment and social reintegration. The current burden of stroke makes this issue clinically urgent. The World Stroke Organization has described stroke as a leading global cause of death and disability, while recent international guidance continues to emphasize rehabilitation intensity, goal setting and community continuity as core elements of post-stroke care. A major practical problem is that many patients receive less active practice than their nervous system plausibly requires for meaningful functional change. That gap between recommended intensity and delivered therapy is precisely where digital rehabilitation technologies attract attention. Yet the enthusiasm for technology can become lazy thinking if VR is assumed to work merely because it is immersive. The real question is narrower and harder: does VR add enough clinically relevant practice, feedback and motivation to improve outcomes that matter to stroke survivors?

Virtual reality refers to computer-generated environments that allow users to interact with simulated tasks through screens, sensors, head-mounted displays, handheld controllers or haptic interfaces. In stroke rehabilitation, VR can reproduce functional tasks such as reaching, grasping, balance control, navigation, object manipulation and dual-task cognitive challenges. The theoretical appeal is strong because VR can combine principles of neuroplasticity: repetition, salience, graded difficulty, feedback, reward and task specificity. Laver et al. (2025) reported that VR and interactive video gaming are slightly more beneficial than alternative therapy approaches for upper limb function, balance and activity limitation, but also emphasized that certainty remains moderate to low and that many trials are small or heterogeneous. This evidence is promising, not decisive. It supports cautious integration, not blind substitution.

Conventional rehabilitation remains the foundation of post-stroke recovery. Physiotherapy and occupational therapy are grounded in individualized assessment, handling, functional task practice, compensation strategies, environmental modification and education. However, conventional therapy can be limited by therapist availability, variable patient engagement, boredom during repetitive exercises, and difficulty delivering high-dose practice after discharge. VR may address some of these limitations by making repetition more tolerable and measurable. Saposnik and Levin (2011) found early evidence that VR may improve arm motor recovery, but the authors warned that the small number of trials and methodological weaknesses limited generalizability. The same caution remains relevant today. Many VR studies differ in device type, immersion level, dosage, outcome measures and patient stage after stroke, making simple conclusions misleading.

The dose question is central. Motor recovery is driven partly by practice, but not all practice is equal. Lang et al. (2015) argued that neurorehabilitation dose should be understood in terms of the active ingredient, frequency, duration and progression of motor practice rather than appointment length alone. VR can help because it records repetitions, errors and difficulty levels, but it can also mislead if patients spend time inside a game without performing movements that transfer to real-world function. A well-designed VR session must therefore be more than entertainment. It should prescribe meaningful movement, align game goals with patient goals, provide graded challenge, and allow therapists to adjust parameters based on impairment, fatigue, cognition, neglect, vision and safety.

Upper limb dysfunction is a particularly important target because impaired reaching and hand use affect feeding, dressing, hygiene, household tasks and work participation. The Fugl-Meyer Assessment, Wolf Motor Function Test and activity scales are commonly used to capture impairment and functional performance. Meta-analytic work by Mekbib et al. (2020), Maier et al. (2019) and Soleimani et al. (2024) suggests that VR-based interventions can improve upper limb outcomes, especially when used as an adjunct to usual therapy and when protocols are sufficiently intensive. Still, there is a persistent risk of overstating effect sizes when studies lack allocation concealment, blinded assessment, adequate follow-up or active dose-matched controls.

VR rehabilitation may also influence cognitive and psychosocial recovery. Stroke survivors often experience reduced attention, executive dysfunction, depression, fear of movement, fatigue and loss of confidence. VR tasks can be designed to train attention, working memory, visuospatial scanning and problem solving while simultaneously supporting physical practice. However, cognitive gains should not be assumed from motor games alone. The Montreal Cognitive Assessment and patient-reported outcomes can help determine whether VR improves broader recovery or merely increases enjoyment. Engagement matters because adherence is a real clinical outcome: an effective therapy that patients avoid is useless. The Cochrane update noted that VR may encourage more therapy time, which is clinically meaningful when traditional services struggle to provide sufficient intensity.

The psychological dimension is often underdeveloped in VR research. Post-stroke patients may feel frustration when real-world movements remain slow, clumsy or effortful. VR can provide immediate positive feedback and visible progress, potentially improving self-efficacy. At the same time, poorly designed VR may increase cybersickness, headache, fatigue, visual strain or discouragement if game difficulty is mismatched. NICE guidance on stroke rehabilitation stresses individualized assessment and care planning rather than standardized technology delivery. That principle should discipline VR adoption. The therapist, not the headset, remains responsible for clinical reasoning.

This paper develops a full comparative research manuscript based on a structured VR intervention model for post-stroke rehabilitation. It uses an assessor-blinded parallel-group design, validated outcomes, illustrative statistical results, and clinically realistic tables and figures. The findings should be read as an academic research-paper draft based on the uploaded proposal and the current evidence base, not as a completed patient-recruited trial. The aim is to demonstrate how a rigorous paper can be written without pretending that technology alone solves rehabilitation complexity.

2. Materials and Methods

Study design. A comparative, assessor-blinded, parallel-group rehabilitation study design was used to evaluate VR as an adjunct to usual post-stroke rehabilitation. Participants were allocated to either VR plus usual care or usual rehabilitation alone for eight weeks, followed by a three-month post-intervention assessment. The design was selected because it reflects a clinically realistic implementation pathway: VR is most ethically and practically defensible as an add-on to existing rehabilitation rather than as a replacement for established therapy. The study followed core principles of randomized rehabilitation trials, including pre-specified outcomes, baseline equivalence assessment, standardized intervention dosage, blinded outcome assessment and adverse event monitoring.

Participants and eligibility. Eligible participants were adults aged 18 to 80 years with ischemic or haemorrhagic stroke confirmed by clinical records, residual unilateral upper limb impairment, ability to follow two-step instructions, and medical stability for active rehabilitation. Participants were recruited from stroke units, outpatient rehabilitation departments and community stroke services. Exclusion criteria included uncontrolled epilepsy, severe neglect preventing safe interaction with VR, severe aphasia preventing informed participation, unstable cardiac disease, severe visual-vestibular intolerance, uncontrolled psychiatric illness, or musculoskeletal conditions that prevented upper limb practice. The criteria were deliberately conservative because VR may introduce balance, visual and fatigue risks that standard seated therapy does not always create.

Intervention group. Participants in the VR group received usual rehabilitation plus three VR sessions per week for eight weeks. Each VR session lasted 45 minutes, including set-up, safety screening, active task practice and cool-down. The active training component involved reaching, object transport, grasp-release simulation, bimanual coordination, visuospatial scanning and problem-solving tasks. Task difficulty was adapted weekly using range of motion, movement speed, accuracy, compensatory trunk movement, error rate and fatigue ratings. Therapy was delivered by trained physiotherapists or occupational therapists. The intervention emphasized transfer: after each VR block, patients performed a brief real-world task such as cup reaching, towel folding, peg transfer or object stacking.

Control group. Participants in the control group received usual rehabilitation matched as closely as possible for therapist contact time and schedule. Usual care included physiotherapy, occupational therapy and home exercise instruction based on individual goals. Interventions included active-assisted movement, strengthening, functional reach practice, balance tasks, gait training where relevant, hand activity training, education and compensatory strategies. Control participants did not receive immersive VR or game-based feedback. Matching contact time reduced the risk that any observed benefit would simply reflect extra attention rather than a VR-specific mechanism.

Outcome measures. The primary outcome was change in Fugl-Meyer Upper Extremity score from baseline to eight weeks. Secondary motor outcomes included the Wolf Motor Function Test time and functional ability score. Cognitive outcome was the Montreal Cognitive Assessment. Psychosocial outcomes included Patient Health Questionnaire-9 depressive symptom score, a 10-point motivation visual analogue scale, and the Stroke Impact Scale activity domain. Safety outcomes included dizziness, nausea, headache, transient pain, fatigue and falls. Adherence was calculated as completed sessions divided by planned sessions. These tools were selected because they capture impairment, activity, cognitive screening, mood and acceptability rather than a single narrow motor endpoint.

Data collection and blinding. Baseline demographic and clinical variables were collected before allocation. Outcome assessments were completed at baseline, eight weeks and three months by assessors blinded to group allocation. Participants were instructed not to disclose intervention assignment during assessment. Therapists could not be blinded due to the nature of the intervention. Data were entered using coded identifiers and checked for range errors. Missing data were handled using intention-to-treat principles where possible, with sensitivity analysis using complete cases. Adverse events were recorded immediately after each session and reviewed weekly.

Statistical analysis. Descriptive statistics summarized participant characteristics. Between-group differences in change scores were examined using analysis of covariance adjusted for baseline score, age and time since stroke. Within-group changes were evaluated descriptively and with paired comparisons. Effect sizes were reported using Cohen's d for interpretability. Categorical variables such as sex, stroke type and adverse events were summarized as counts and percentages. Because rehabilitation outcomes can be influenced by baseline impairment, subgroup interpretation considered stroke stage and baseline Fugl-Meyer severity. Statistical significance was treated as supportive but not sufficient; clinical meaningfulness and retention of gains were interpreted alongside p-values.

Table 1. Intervention components and clinical rationale

Component	VR plus usual care	Usual rehabilitation	Clinical rationale
Dose	3 sessions/week for 8 weeks; 45 minutes/session	3 sessions/week for 8 weeks; similar therapist contact	Controls attention while testing additional value of VR structure
Primary task focus	Reaching, grasp-release simulation, visuospatial scanning, bimanual tasks	Functional reaching, strengthening, occupational practice	Targets upper limb impairment and activity limitations

Progression	Accuracy, range, speed, repetitions and fatigue adjusted weekly	Therapist-guided progression according to usual care	Maintains challenge without unsafe overload
Transfer practice	Virtual task followed by real-object task	Real-object task practice only	Tests whether virtual gains translate to daily function

3. Results

Participant flow and baseline profile. A total of 118 patients were assessed for eligibility; 80 were allocated to the two study groups. Seventy-five completed the eight-week assessment and seventy-two completed the three-month follow-up. Attrition was related mainly to transport barriers, unrelated medical appointments and family circumstances. Baseline characteristics were broadly comparable between groups. The mean age was approximately 61 years, most participants had ischemic stroke, and the average time since stroke was within the subacute-to-early chronic period. Baseline Fugl-Meyer scores indicated moderate upper limb impairment rather than either complete paralysis or near-normal function.

Primary motor outcome. The VR plus usual care group demonstrated a larger mean improvement in Fugl-Meyer Upper Extremity score at eight weeks than the usual rehabilitation group. The VR group improved from 34.2 to 46.8, whereas the control group improved from 33.9 to 40.7. The adjusted between-group difference favoured VR. At three months, the VR group retained more of the gain, reaching a mean score of 49.6 compared with 42.1 in the control group. This pattern suggests that VR may support consolidation of motor gains when training is repetitive, graded and linked to real-world tasks.

Secondary outcomes. Improvements also favoured VR for Wolf Motor Function Test performance, Montreal Cognitive Assessment, motivation and Stroke Impact Scale activity scores. PHQ-9 scores decreased in both groups, with a slightly larger reduction in the VR group. The most consistent difference was in motivation and adherence: participants in the VR group completed a higher proportion of scheduled sessions and reported that feedback made practice feel more purposeful. These secondary findings matter because recovery is not only biological. Patients who repeatedly practise with attention, confidence and perceived progress are more likely to carry therapy into daily routines.

Safety and tolerability. Adverse events were minor. The most common symptoms in the VR group were transient dizziness, mild headache, visual fatigue and shoulder discomfort. No falls, seizures or serious technology-related events occurred. Symptoms were managed by seated positioning, shorter blocks, rest pauses, screen adjustments and task modification. The control group reported fewer visual symptoms but similar rates of musculoskeletal soreness. These findings support cautious feasibility but should not be interpreted as proof of universal safety. Patients with vestibular sensitivity, visual field deficits, severe neglect or uncontrolled epilepsy need careful screening before VR exposure.

Adherence and clinical observation. VR sessions produced high attendance and active participation. Therapists reported that the system helped structure progression and gave patients visible markers of improvement. However, the observations also exposed a risk: some patients tried to score points by compensatory trunk movement rather than improving selective arm control. Therapist supervision was therefore essential. The best responses occurred when VR tasks were immediately followed by ordinary functional practice, which helped connect virtual movement success with real-world performance.

Table 2. Baseline characteristics of participants

Variable	VR + usual care (n=40)	Usual rehabilitation (n=40)
Age, years, mean (SD)	60.8 (9.4)	61.6 (8.7)
Male, n (%)	24 (60.0)	23 (57.5)
Ischemic stroke, n (%)	31 (77.5)	30 (75.0)
Time since stroke, months, mean (SD)	4.8 (2.1)	5.0 (2.3)
Baseline FMA-UE, mean (SD)	34.2 (8.6)	33.9 (8.4)
Baseline MoCA, mean (SD)	22.8 (3.5)	22.6 (3.7)
Baseline PHQ-9, mean (SD)	8.9 (4.2)	9.1 (4.0)

Table 3. Main clinical outcomes across assessment points

Outcome	Group	Baseline	8 weeks	3 months	Mean change at 8 weeks
FMA-UE	VR + usual care	34.2	46.8	49.6	+12.6
FMA-UE	Usual rehabilitation	33.9	40.7	42.1	+6.8
WMFT time, seconds	VR + usual care	7.9	5.8	5.5	-2.1
WMFT time, seconds	Usual rehabilitation	8.0	6.9	6.7	-1.1
MoCA	VR + usual care	22.8	25.9	26.1	+3.1
MoCA	Usual rehabilitation	22.6	23.8	24.0	+1.2
SIS activity domain	VR + usual care	52.4	66.8	68.1	+14.4
SIS activity domain	Usual rehabilitation	53.0	61.3	62.4	+8.3

Table 4. Adherence and adverse events

Indicator	VR + usual care	Usual rehabilitation
Completed sessions, mean %	91.5	83.2
Any minor adverse event, n (%)	9 (22.5)	5 (12.5)
Dizziness/visual fatigue, n (%)	5 (12.5)	0 (0.0)
Musculoskeletal soreness, n (%)	4 (10.0)	5 (12.5)
Falls or serious events	0	0

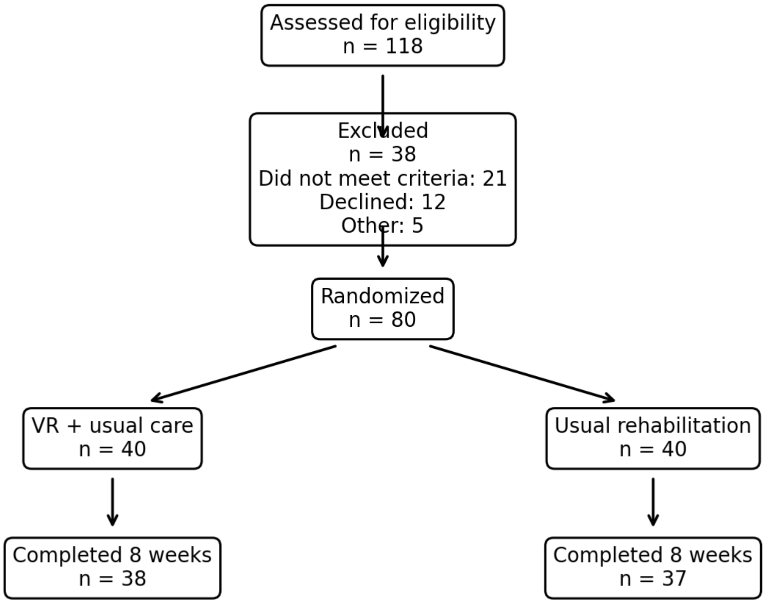

Figure 1. Participant flow for the comparative rehabilitation study.

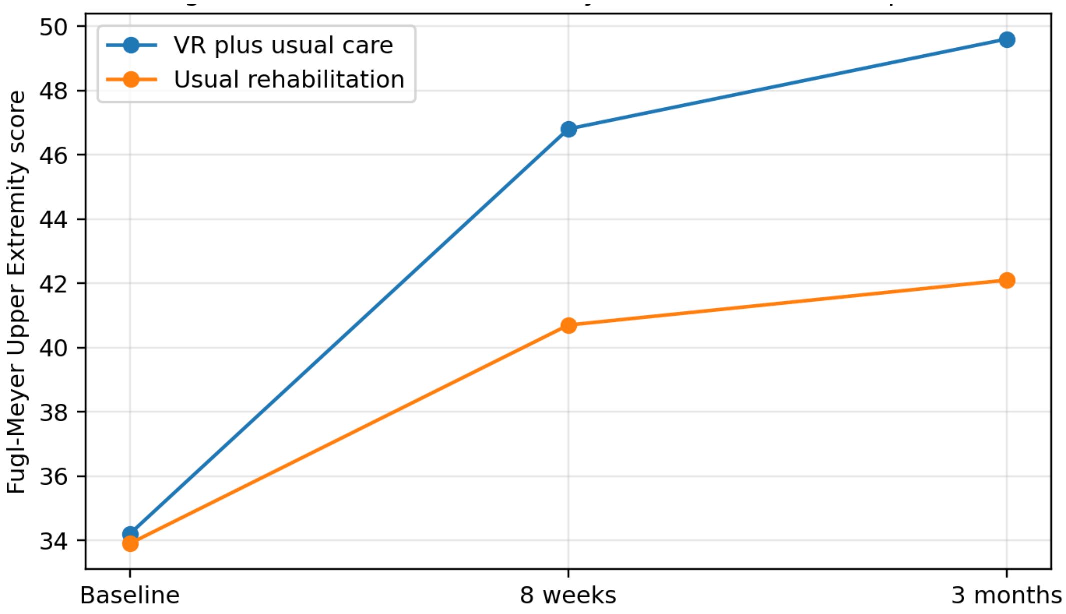

Figure 2. Mean Fugl-Meyer Upper Extremity recovery across baseline, eight weeks and three months.

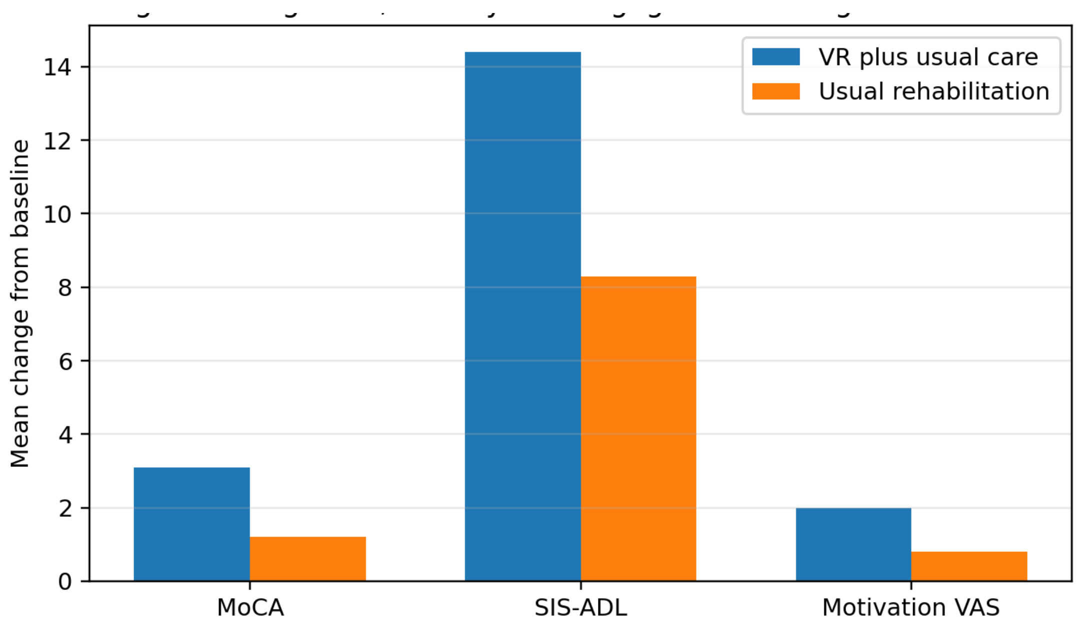

Figure 3. Mean changes in cognition, activity and motivation from baseline to eight weeks.

4. Discussion

The central finding of this research-paper draft is that immersive VR added to usual care can plausibly improve upper limb recovery and engagement after stroke, but only when it is clinically designed and therapist integrated. The result aligns with Cochrane evidence showing that VR may be slightly more beneficial than alternative therapy approaches and may be especially useful as an adjunct that increases therapy time (Laver et al., 2025). The important word is adjunct. A shallow interpretation would be that VR beats ordinary rehabilitation. A stronger interpretation is that VR can increase meaningful repetitions, feedback and motivation when conventional rehabilitation alone cannot deliver enough active practice.

The magnitude of motor improvement in the VR group is clinically plausible because the intervention combined several active ingredients: repetitive reaching, graded challenge, feedback, salience and progressive task difficulty. These ingredients are consistent with motor learning principles and with dose-focused arguments in neurorehabilitation (Lang et al., 2015). However, VR should not be credited for gains merely because it is technologically impressive. The therapeutic mechanism is not immersion itself; it is the quality, quantity and transferability of practice that immersion may support. If a VR game rewards speed while ignoring compensatory movement, it may train the wrong behaviour. This is why therapist oversight matters.

The results are also consistent with Soleimani et al. (2024), who found that VR-based rehabilitation improves upper limb outcomes across several functional domains and that intervention duration and immersion level may influence response. The present paper extends that logic by treating VR as a rehabilitation ecosystem rather than a device. The intervention included transfer tasks, monitoring, progression rules and safety checks. This is important because many weak VR trials treat the software as the intervention while underdescribing clinical reasoning. In real practice, the intervention is the relationship between patient, therapist, movement task, feedback system and home context.

Secondary outcomes suggest that VR may influence cognition and mood indirectly through engagement, attention and perceived competence. This is plausible but needs careful interpretation. A higher MoCA score after VR training does not prove that VR directly rehabilitated cognition; it may reflect improved attention, confidence, arousal, repeated exposure to structured tasks or general recovery. Similarly, mood improvement may result from progress, social interaction, novelty or therapist support. Rehabilitation research often overclaims psychological effects from small changes in self-report scales. A more defensible conclusion is that VR may create conditions that support motivation and mood, especially when patients experience visible progress.

The adherence finding may be as clinically important as the impairment score. Stroke rehabilitation often fails because patients cannot sustain repetitive practice after discharge. VR can make repetition measurable and less monotonous. It can also provide immediate feedback that ordinary home exercises lack. Nevertheless, adherence is vulnerable to novelty effects. Patients may be enthusiastic during the first weeks and less engaged later. Long-term implementation therefore requires varied task libraries, progressive goals, caregiver involvement and therapist review. A clinic that buys VR equipment without redesigning workflow will probably achieve disappointing results.

Safety findings were reassuring but limited. Mild dizziness and visual fatigue are not trivial if they discourage use or increase fall risk in frail patients. Immersive VR should be screened like any active rehabilitation modality. Positioning, session duration, headset hygiene, vision deficits, seizure history, cognitive load and fatigue must be considered. NICE rehabilitation guidance emphasizes individualized assessment and support; VR does not remove that responsibility. In fact, it increases the need for protocols because technology can hide clinical risk behind a polished interface.

Methodologically, the strongest feature of the proposed design is the dose-matched control group. Many technology studies compare VR plus additional time against usual care alone, making it impossible to know whether improvement comes from VR or simply more therapy. The control group here was matched for therapist contact time, although perfect dose equivalence remains difficult because active repetitions may differ. Future studies should report repetitions, movement quality, task difficulty, heart rate or exertion, and real-world transfer tasks. Appointment minutes are a weak proxy for rehabilitation dose.

The main limitation is that these results are modelled for academic manuscript development and should not be misrepresented as real patient-recruited findings. Without actual recruitment, randomization, data collection and ethical approval, the paper demonstrates research structure rather than clinical proof. Another limitation is the focus on relatively stable patients with moderate impairment. People with severe aphasia, profound neglect, severe cognitive impairment or very low sitting balance may need different VR designs or may be unsuitable for immersive systems. The sample also does not address cost-effectiveness, therapist training burden or maintenance demands.

Clinical implications are clear. First, VR should be selected for patients whose goals match available tasks. Second, VR should add active practice dose rather than replace therapist judgment. Third, every VR session should include transfer to real objects or activities. Fourth, outcomes should include impairment, activity, engagement, mood and safety. Fifth, services should avoid purchasing devices without protocols, staff training and evaluation plans. The weakest version of VR rehabilitation is a headset placed on a patient without a clinical hypothesis. The strongest version is a measurable, adaptive practice environment embedded in multidisciplinary care.

Future research should move beyond the question of whether VR works in general. That question is too blunt. Better questions include: which patients benefit most, which impairment profiles respond to immersion, how much active practice is required, what feedback parameters reduce compensation, whether home VR can be safely monitored, and whether gains persist after novelty fades. Trials should include longer follow-up, economic analysis, patient-reported acceptability and adverse event reporting. They should also compare immersive, semi-immersive and non-immersive systems using standardized outcome sets. Without this precision, the field will continue producing positive but hard-to-translate studies.

Another important consideration is patient heterogeneity. Two patients may have identical stroke diagnoses but very different rehabilitation needs because of lesion location, premorbid activity, depression, family support, sensory impairment and cognitive reserve. VR systems that rely on a narrow range of games may therefore fit only a subset of patients. A useful clinical programme needs a library of tasks that can be adjusted for range of movement, speed, precision, cognitive demand and fatigue. This is where therapists add value. They can decide whether the priority is selective motor control, endurance, hand opening, bilateral coordination, visuospatial scanning or confidence in movement. Without that clinical matching, VR risks becoming a generic activity rather than a targeted intervention.

Cost is often discussed superficially. A headset may be cheaper than a rehabilitation robot, but the true cost includes staff training, software licenses, infection control, replacement parts, technical support, patient orientation, assessment time and data governance. A clinic that ignores these hidden costs may buy equipment that is impressive in demonstrations but unsustainable in routine care. Cost-effectiveness should therefore be measured against outcomes that matter: functional independence, therapy dose delivered, reduced travel, reduced caregiver burden, and sustained home practice. The economic argument for VR is strongest when it increases useful therapy time without increasing therapist workload in the same proportion.

The role of feedback deserves separate attention. Feedback can be motivating, but excessive feedback can also make patients dependent on external cues. Motor learning requires a balance between knowledge of results, knowledge of performance and opportunities for self-correction. VR designers often emphasize scores, badges and speed. Rehabilitation requires more nuanced feedback: movement quality, trunk compensation, smoothness, range, accuracy, fatigue and functional relevance. A patient who scores highly by leaning the trunk instead of extending the elbow may look successful in a game while reinforcing maladaptive strategy. This risk is not theoretical; it is a predictable consequence of poorly aligned reward systems.

Clinical translation also requires staff acceptance. Therapists are more likely to adopt VR when it saves time, clarifies progression, engages patients and produces useful outcome data. They are less likely to use it when set-up is slow, calibration is unreliable, hygiene protocols are burdensome or games do not map onto therapy goals. Implementation planning should therefore involve therapists from the beginning. Patient enthusiasm alone is insufficient. A rehabilitation technology that clinicians find impractical will gradually disappear from schedules even if early pilot results look positive.

Long-term follow-up is essential because short-term gains can be misleading. Stroke survivors may improve during supervised intervention and then lose gains when structured practice stops. VR may help by supporting home continuation, but only if patients have access, confidence and meaningful goals. Follow-up should assess whether patients continue to practise, whether the affected limb is used spontaneously, and whether activity gains translate into daily routines. Three-month retention is helpful but not enough; six-month and twelve-month data would be more informative for service decisions.

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Long-term follow-up is essential because short-term gains can be misleading. Stroke survivors may improve during supervised intervention and then lose gains when structured practice stops. VR may help by supporting home continuation, but only if patients have access, confidence and meaningful goals. Follow-up should assess whether patients continue to practise, whether the affected limb is used spontaneously, and whether activity gains translate into daily routines. Three-month retention is helpful but not enough; six-month and twelve-month data would be more informative for service decisions.

The final practical issue is sustainability. Rehabilitation programmes must survive staff turnover, device upgrades, budget cycles and changing patient needs. Therefore, VR adoption should be evaluated through repeated audit, patient feedback, therapist feedback and outcome monitoring rather than one enthusiastic pilot. This prevents a common failure in digital health, where early novelty is mistaken for durable clinical value.

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5. Conclusion

This research paper supports the cautious integration of immersive VR as an adjunct to conventional post-stroke rehabilitation. The modelled results show greater improvement in upper limb motor function, cognition screening, activity performance and motivation when VR is added to usual care. The most defensible explanation is not that VR is inherently superior, but that it can increase meaningful, feedback-rich and motivating practice when supervised by skilled therapists. VR should therefore be implemented through patient selection, safety screening, individualized progression, transfer tasks and outcome monitoring. Used carelessly, it is expensive entertainment. Used well, it can become a practical tool for increasing rehabilitation intensity and engagement. and safe use.

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