

# IMPACT OF TELEHEALTH ON PHYSICAL FUNCTION AND QUALITY OF LIFE IN STROKE

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## Abstract

**Background:** Stroke is one of the most prime and prevalent root-cause of 70% disability which ultimately reduces quality of life of the Patient, so 90% of survivors prefers home treatment due to many social, economic, personal, cultural factors.<sup>1</sup> Education, exercise and social support are the primary components which are frequently given by using video-conferencing system, which is known as home-based telehealth program. All the education about how to use TR system is demonstrated by a skilled therapist or by therapy-aide in order to improve or increase patient's physical function.<sup>2</sup>

**Objective:** The basic purpose of this review was to provide efficient knowledge about impact of telehealth on physical function and quality of life in stroke patients.

**Methods:** We searched Pedro, Pub Med, Medline, and CINAHL databases from 1, January 2010 to July 28,2021 by using following keywords: “Telehealth stroke,” “telerehabilitation for stroke rehabilitation,” “Telehealth stroke physical function” and quality of life. Our inclusion criteria comprised of only randomized controlled trial studies which involved an intervention group that undergo any tele-health or tele-rehabilitation therapy for stroke patients while compared with a control or usual care group.

**Results:** Almost, out of 36 screened papers,9 articles with total 582 participants met criteria and were taken in this systematic review. Six studies evaluated the effect of tele-rehabilitation on physical function and functional outcomes. On the other hand, 3 studies assessed its impact on quality of life in stroke survivors. Tele-health provides improvement in recovery of motor function, quality of life and relief of caregiver burden with depression in stroke individuals. 3 studies out of 9 included studies showed significant difference in control and intervention groups in favor of tele-health while remaining studies suggested non-significant differences.

**Conclusion:** This updated review gives evidence that telehealth of all approaches have either better or equal effects on physical function and quality of life compared with usual care or conventional rehabilitation.

**Key words:** Tele-health, Poststroke, Physical function, Quality of life, Motor function, Tele-rehabilitation, Randomized controlled trial

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## INTRODUCTION

TR is a new emerging type of rehabilitation service in which people takes their treatment protocols at home. Moreover, this therapy gives equal distribution of results in stroke survivors.<sup>3,4</sup> However, number of stroke survivors has been increased over years due to usage of advanced and modified medical technology with probably 13 million survivors in China. Stroke patients mostly have reduced motor activity of the body, main aim of the therapy is to reduce dependency of these patients on the caregivers and involving them to participate in community in one or otherway.<sup>5</sup> TR is a best and alternative way of supervising patients by therapist when frequent face-face interactions are not possible than remote rehabilitation is provided to patients by tele-health.<sup>6</sup>

One method of TR is by use of robot-assisted device, allows repetitive, task-oriented activities in order to enhance functional, routine activities and QOL of patient.<sup>7</sup> Homebased TR is a type of rehabilitation method in which clinicians operate telecommunication devices like telephone, videophone and audio-video conference in order to supply of different rehabilitation therapies, judgment and assistance for disabled/incapacitate persons at home for better recovery of stroke survivors.<sup>8,9</sup>

An RCT conducted in 2017 by Chen J et al., to check the validity of TR in stroke survivors. This RCT done in order to check either relief of burden of caregiver could be possible by providing TR to patients or not. Furthermore, effect on physical function of the stroke survivors was also checked. Total 97 individuals were gets enrolled in this study, out of which 54 individuals were randomized into control and HTR groups. Both groups received physical exercises including Bo

bath and Proprioceptive neuromuscular facilitation (PNF) and (ETNS). According to conclusion of this study, TR might be another or alternative resource of treatment and could lower the burden from the caregivers.<sup>8</sup>

## Methods

Databases of Pedro, Pub Med, Medline, and CINAHL from January 01, 2010 to July 28, 2021 were searched by using following keywords: "Telehealth stroke," "telerehabilitation for stroke rehabilitation," "Telehealth stroke physical function" and quality of life. A systematic search methodology was employed and selection process was studied meticulously.

### Selection Criteria:

Selection criteria was done by designing a PICO format (Population, Intervention, Control, Outcome) with comprehensive inclusion and exclusion criteria.

### Inclusion Criteria

Eligibility for inclusion is as follows:

- The design of studies included must be Randomized controlled trial (RCT) assessing interventions based on telehealth (TR) with its effect on physical function or Quality of Life in patients diagnosed combining with ischemic/hemorrhagic, acute/sub-acute/chronic stroke with age  $\geq 18$
- Studies must have at least one outcome measure of physical function or quality of life

- Studies involving patients with ability to transfer independently from sit to stand in the presence of a caregiver while performing task
- Time period of studies from year 2010 to year 2021
- All included studies must be written in English language with available full text

### **Exclusion Criteria**

Literature reviews, meta-analysis, pilot studies, case studies, prevalent studies were excluded from this review. All the studies other than randomized controlled trials were excluded. Language restrictions were imposed on inclusion of articles. Only articles written in English language were included in this review. Studies having Pedro rating less than 3 and patients with underlying pathology like dementia, CVS problems were excluded. Studies having patients with cooperation difficulties and patients while using certain drugs or medicines were excluded. The Preferred Reporting Item for Systematic Reviews and Meta-analysis (PRISMA) statement was followed for the systematic review.

**Assessment of risk bias:** Quality of included articles was assessed by using Pedro scale, articles with Pedro score above 3 were included in this review. This scale has 11 parts: eligibility criteria, random allocation, concealed allocation, baseline comparability, blind subjects, blind therapists, blind assessor, adequate follow-up and intention-to-treat analysis, group comparison, point estimation with variability.

### **Outcome Measures**

Common outcome measures used to assess outcomes after telehealth interventions included Stroke Impact Scale (SIS)<sup>10,11</sup>, Functional Independence Measure (FIM)<sup>9,12</sup>, Fugl-Meyer Motor

Function Assessment (FMA)<sup>1,13</sup>, Stroke-Specific Quality of Life (SS-QOL), Modified Barthel Index (MBI)<sup>14,15</sup> were used.

## Results

Almost, out of 36 screened papers, 9 articles with total 582 participants met criteria and were taken in this systematic review. All the added articles were randomized controlled trials. All the studies other than RCT's were not included in this review. All the participants in included studies or articles were randomly allocated into intervention or control group. The outcomes as physical function and QOL were assessed by the impact of TH in stroke survivors.

Six studies evaluated the effect of tele-rehabilitation on physical function and functional outcomes.<sup>8,10,15</sup> On the other hand, 3 studies assessed its impact on quality of life in stroke survivors.<sup>1,16,17</sup> The duration of treatment in case of physical function and quality of life varied from 20 minutes to 2hr. The duration of treatment ranged from 4 weeks to 12 months.

Quality assessment of the researches were ranging from good (five studies) to fair (four studies) with a mean Pedro scoring of 7.3 out of 9. However, all studies included in this study revealed positive impact of TH in the evaluated results. Similarly, the outcomes showed evidence for physical function and QOL while using TR in comparison with HEP or no intervention. Meta-analysis was considered inappropriate because of clinical heterogeneity of all included studies. In general, all included studies in this review reported the improvements in physical function and quality of life by applying tele-health intervention strategy for stroke survivors.

**Table 1.** Description of articles initially included by PRISMA methodology

Author/ year	Objective	Population	Intervention	Tele- rehabilitati on technology device	Duration of Interventio n	Outcome measures	Results
Saywell et al, 2021 <sup>10</sup>	To check whether ACTIVE improved or increased physical function in comparison with usual care in post-stroke	Total 95 <b>ACTIVE group:</b> n=47 <b>usual care:</b> n=48	Intervention group (IG): ACTIVE training versus usual care in control group	telephone and text messages	12 months	Stroke impact scale (SIS), step test, EQ-5D	Two groups manifested significant difference, ACTIVE group represented a remarkable improvement on EQ-5D, VAS with per-protocol analysis
Asano et al, 2021 <sup>14</sup>	After 3 months post-stroke, novel rehabilitation applied to check its impact on functional outcome in comparison with usual care	Total 124 <b>IG:</b> n=61 <b>CG:</b> n=63	Intervention group: Tele-rehab involving physiotherapy and occupational therapy components  Control group received Usual care center based	Not clear	3 months:  1hr center-based rehabilitation session, once or twice a week.	36-item Short- Form Health Survey, (LLFDI), modified Barthel Index (BI), (EQ-5D)	results indicated same number of improvements in both groups. Participants in both groups received same therapy
Wu et al, 2020 <sup>1</sup>	To explore the feasibility and effectiveness of collaborative care model based on	Total 64 <b>IG:</b> n = 32 <b>CG:</b> n = 32	Treatment group experienced home remote rehabilitation based on a collaborative	Internet-based video conferencing and phone calls	Nurse carries out personalized remote rehab instruction two times	Fugl-Meyer Motor Function Assessment (FMA), Berg Balance	Finally, significant difference occurred between two groups with (P < 0.05)

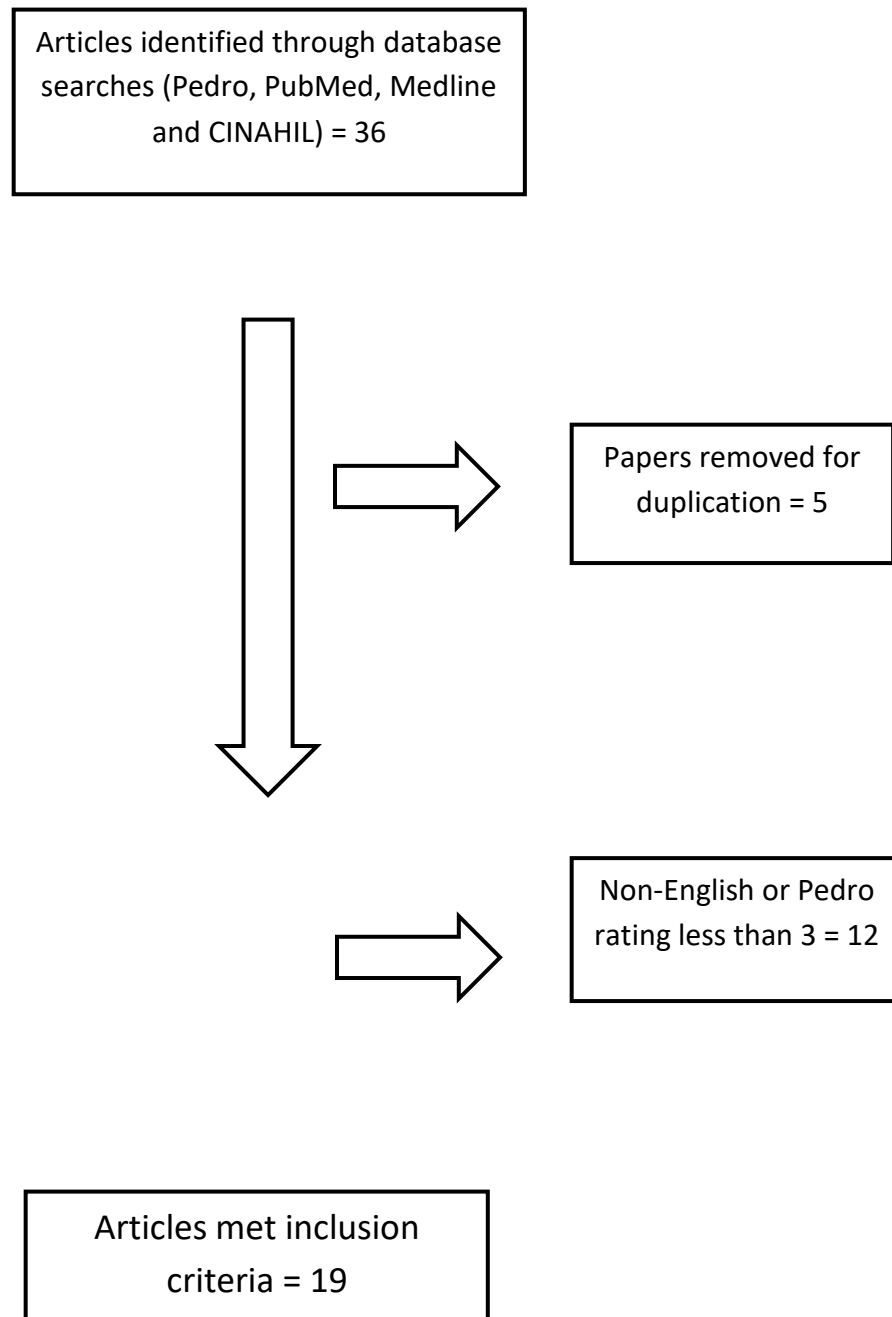
	telerehabilitation exercise training for acute stroke patients		care model.		per week in IG.  Use of telephone once a week for control group for 12 weeks	Scale, Stroke-Specific Quality of Life Scale (SS-QOL)	IG group represented greater improvement in FMA, BBS, SS-QOL.
Chen et al, 2017 <sup>8</sup>	To determine relief of caregiver, home based tele-supervising therapy given and checked its effect on bodily function	Total=54 <b>HTR Group:</b> n = 27 <b>COR group:</b> n = 27		video conferencing, high quality video-audio system	Physical exercise: 1 hour, twice in a working day for 12 weeks, with 60 sessions. ETNS Duration: 20 minutes, twice in a working day for 12 weeks, a total of 60 sessions	Modified Barthel Index, Berg Balance Scale, modified Rankin Scale (MRS), Caregiver Strain Index, root mean square of muscles	HTR group individuals presented similar and improved results as conventional physiotherapy
Linder et al, 2015 <sup>16</sup>	assess the effectiveness of home-based robot assisted rehabilitation with home exercise program compared with home exercise program alone on QOL and depression in stroke survivors.	Total=99 <b>Robot + HEP Group:</b> n =51 <b>HEP Group:</b> n=48	Home-based robot-assisted rehabilitation and home exercise program versus home exercise program (HEP)	Weekly phone calls, internet	IG: Hand Mentor Pro for 2 hrs. and HEP for 1 hr.-5 days/wk. for 8wk  CG: HEP for 3 hrs., 5 days/week for 8 wk.	Stroke Impact Scale (SIS) Center for Epidemiologic Studies Depression Scale (CES-D), FMA	Robot-assisted therapy with HEP and HEP alone using a telerehabilitation may be a valuable approach to improve QOL and depression in stroke patients, especially in an underserved population.

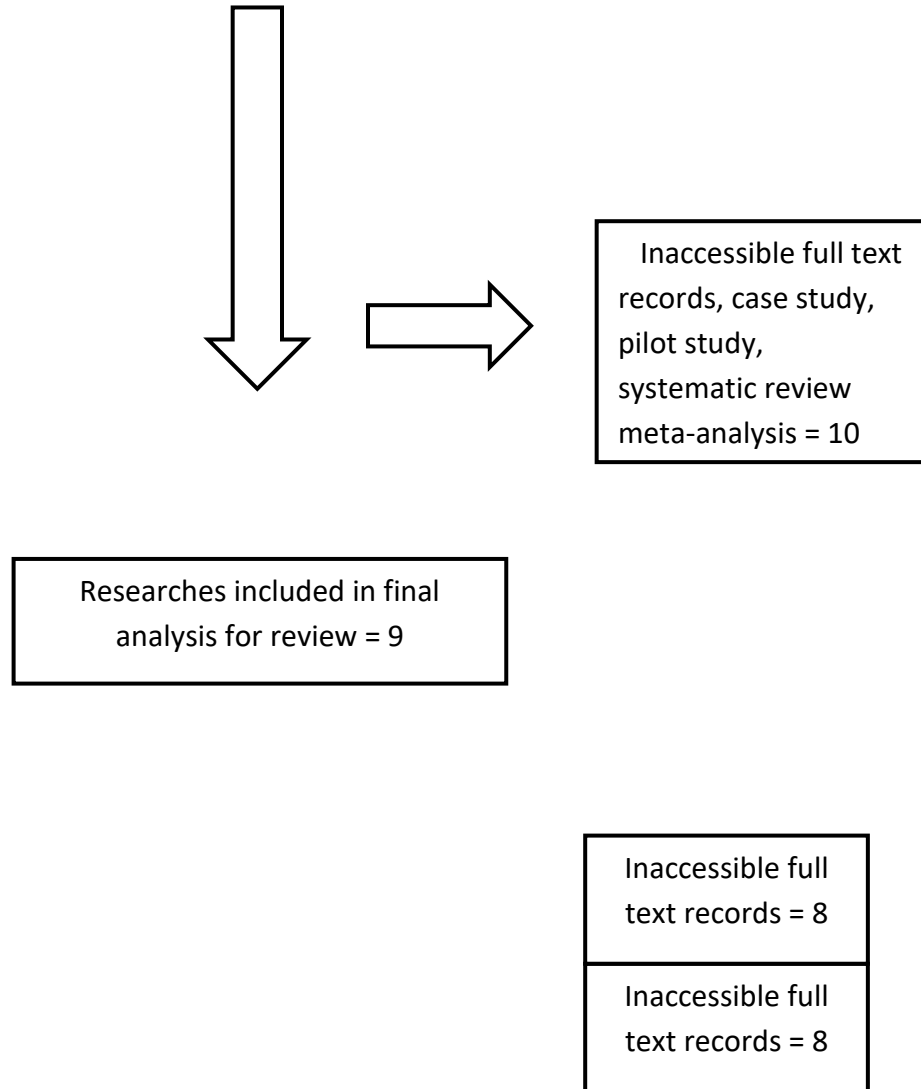


Da Silva et al, 2015 <sup>17</sup>	To compare the effect of a rehabilitation treatment using the Nintendo Wii (NW) with (CPT) to improve sensory-motor function and QOL for post-stroke patients.	Total 30 <b>NW group:</b> n=15 <b>CPT group:</b> n=15	virtual (NW) intervention group: UL, LL, and trunk muscles stretched for 10 minutes. NW games for 50 mins. CPT group: bilaterally sustained stretching of the UL, LL, trunk musculature	multimedia projector  not clear	60-minute treatment sessions twice a week for two months	FM and SF-36	PROM with pain scores, motor function of UE, balance, QOL improved by using VR Nintendo Wii. VR provides similar improvement as CPT
Kizony et al, 2013 <sup>13</sup>	to evaluate the clinical effectiveness of a quasi-home-based Tele-motion rehabilitation (TMR) program, using the Gartner System, in improving functional ability of the weak upper extremity post-stroke.	Total 18 <b>Tele-rehab intervention group:</b> n=9 <b>conventional group:</b> n=9	TMR group: customized video games are used for (UE) control group: self-training UE exercises by principles of motor control.	internet  remote online monitoring	twelve 45 min sessions over 4 weeks	Fugl-Meyer Motor Assessment (FMA) upper extremity sub-test, (CAHAI-7), Motor Activity Log (MAL)	TMR therapy increases UE functions in post stroke survivors. No significant differences occurred between two groups.
Singh et al, 2013 <sup>15</sup>	To evaluate the effectiveness of virtual reality games while substituting the standard physiotherapy time	Total 50 <b>IG:</b> 27 <b>CG:</b> 23	IG: 90 minutes standard physiotherapy while in addition to the virtual reality balance games for 30 minutes  CG: 2 hours of routine physiotherapy treatment	Not clear	12 treatment sessions For 6 consecutive weeks, 2 hours session/twice weekly	Timed Up and Go test (TUG), Barthel Index (BI), Six-Minute Walk test, 30-second Sit to Stand test	Between group difference was not significant with ( $p > 0.05$ ), So substituting a portion of PT treatment with VR games was as effective as standard physiotherapy

Chumbler et al, 2012 <sup>9</sup>	To determine the effect of a multifaceted stroke telerehabilitation (STeleR) intervention on physical function, and secondarily on disability, in veterans poststroke	Total 48 <b>STeleR group:</b> n=25 <b>Usual care group:</b> n=23	IG: received tele-visits for exercise guidance with use of assistive technology, Calls occurred approximately every 14 days CG: UC participants get routine care usual service	Telephone, Tele visits, in-home messaging device (IHMD)	6 months STeleR intervention : 1-hour tele visits, 5 telephone intervention	motor subscale of the Telephone Version of the Functional Independence Measure (FONEFIM), overall Function Component of the Late-Life Function and Disability Instrument (LLFDI),	At 6 months, compared with the usual care group, the STeleR group showed significant improvement s in 4 of the 5 (LLFDI) with (P<0.05), and approached significance in 1 of 3 Function component subscales (P=0.06).
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**PRISMA FLOW DIAGRAM**





## DISCUSSION

In this systematic review of literature, we show that telehealth for physical function as well as for quality of life in poststroke patients appear to be as effective as in-person therapies, if not better. The duration of treatment for various studies added in this review ranges from 2 months to 12 months which contributes a good factor for stroke recovery. Linder at al., used Hand Mentor Pro, it was a robot-assisted instrument which allowed active-assisted mobility of

fingers and wrist by using a pneumatic pump. There were 3 major components which were used in this device like arm unit, a computer control box and a data collection device with communication module for proper communication. Reduction of spasticity, motor control improvement by various means were the result of involving modules.<sup>16</sup>

In another study conducted by Chen et al, network data system, therapist end and patient end were 3 basic components of TR system. This is important to note that underlying purpose of rehabilitation is to increase the mobility, ADL's, functional outcomes in stroke survivors, so that they could actively participate in social and at workplace environment..<sup>8</sup>

An exercise book containing different types of diagrams, sketches, written instructions about performing different types of activities and dosage of each exercise was provided to participants for doing proper activities. Patients were encouraged to actively participate in their home based activities for improving affected UE function like turning light switches on and off, opening and closing of refrigerator door and self-grooming and bathing activities for themselves.<sup>16</sup>

Overall, all the included studies in this review were randomized controlled trials, no any other study was added in this review. Outcomes measures were improved while following in included studies.

Therapist could have a copy of exercise chart so that if patient felt any uncomfortable condition while doing exercise than therapist could change according to requirement.<sup>10</sup>

In this review, effect of TH studied with its impact on QOL and physical function in stroke patients. Based on conclusion of these studies, TH is an alternative way of care delivery to the patients as it increases the engagement of patients in exercise program while staying at home. So, at the end the use of TH provides positive results in stroke survivors.<sup>6</sup>

Based on evidence collected from our data suggested that the results of the included studies are optimistic. Although the conclusions drawn from exploration of 9 researches are insufficient, analysis of the results is instructive for medical exercise and guidance of researches in the future.

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## **Conclusion**

For patients with stroke, tele-health has shown positive impact on physical function and quality of life and TH may also improve depression while relieving caregiver burden. Regarding the effectiveness of tele-health in stroke survivors' evidence has been evaluated. After participation in tele-health or tele-rehabilitation programs, stroke survivors can improve their physical function, QOL with various functional outcomes. Although, burden on caregiver with cost effectiveness contribute a major barrier in the treatment of these patients, so this review was able to identify interventions of TH or TR which directly address QOL and physical function but separately indicating a major research gap.

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