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TELEHEALTH-BASED SELF-MANAGEMENT IN STROKE PATIENTS: A SYSTEMATIC REVIEW

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ABSTRACT

Stroke is a clinical condition in the form of focal and global neurological deficits that develop rapidly and cause death, characterized by blockage and rupture of blood vessels. The 2022 World Stroke Organization annual report states that 12.2 million people worldwide experienced a stroke and 6.6 million of them died, the prevalence of stroke increased by 85%, deaths due to stroke increased by 43% and people with disabilities (DALYs) due to stroke increased by 32%. The problems faced by stroke sufferers are likely to continue to increase and post-stroke complications need to be treated in order to extend life expectancy better. In stroke care, emphasis is placed on intensive medical care and rehabilitation benefits in the acute phase, but care and support in the later stages is just as important as treatment acute phase. People who have long-term health conditions, such as stroke patients, should learning new behaviors or adapting lifestyle to suit their needs. Improving self-management is an important challenge for service systems health worldwide for survival in long-term conditions. Telehealth provides a viable alternative in healthcare, helping clients manage their conditions through improved self-care and access to education and support systems. Additionally, clients and healthcare professionals can exchange important clinical information remotely for the management and support of patients with chronic diseases. This research aims to (1) identify the intervention components of self-management programs for stroke sufferers, (2) identify types of telehealth based self-management programs, and (3) identify the impact of providing telehealth-based self management programs for stroke sufferers. This research uses a systematic review design with the PRISMA flow diagram. Researchers used PICO, articles published from 2014 to May 2024 in English. Searches came from 5 online databases, namely "PubMed", "ProQuest", "Science Direct", "Scopus", and "Embase". Researchers used the Physiotherapy Evidence Database (PEDro) Scale tool to assess the quality of research articles. The initial search yielded 422 articles that were further screened. There are 21 articles for eligibility assessment. After full text review, 8 articles remained that met the inclusion and exclusion criteria and were used for this systematic review. Eight high-quality articles support telehealth-based self-management as an effective method for caring for patients with stroke. Telehealth-based self-management intervention as an alternative method for stroke sufferers.

Keywords: self-management; stroke; telehealth

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INTRODUCTION

Stroke is a clinical condition in the form of focal and global neurological deficits that develop rapidly and cause death, characterized by blockage and rupture of blood vessels (Kuriakose & Xiao, 2020; World Health Organization, 2022). This results in the body's failure to meet the oxygen needs of brain cells in certain areas and causes symptoms (Kariasa, 2022). The World Stroke Organization's 2022 annual report states that 12.2 million people worldwide experienced a stroke and 6.6 million of them died, so that from 1990 to 2019 the number of

stroke incidents increased by 70%, the prevalence of stroke increased by 85%, deaths due to stroke increased by 43% and people with disabilities (DALYs) due to stroke increased by 32% (World Stroke Organization, 2023). Various physical and psychological impacts and complications can arise after a stroke (Dewi et al., 2020). The problems faced by stroke sufferers are likely to continue to increase and post-stroke complications need to be treated in order to prolong better life expectancy (Ikeda et al., 2021). In stroke care, emphasis is placed on intensive medical care and rehabilitation benefits in the acute phase, but care and support in later stages is just as important as acute phase care. People who experience long-term health conditions, such as stroke survivors, must learn new behaviors or adapt their lifestyle to suit their needs (Hwang et al., 2021). Improving self-management (SM) is an important challenge for health care systems worldwide to survive in long-term conditions (World Health Organization, 2015). Self-management is defined as daily actions that can be carried out by individuals and caregivers to minimize the symptoms and development of chronic diseases and minimize various correlations and bad consequences of these diseases (Leviton et al., 2023).

A self-management program is defined as an intervention designed to develop a patient's ability to manage health conditions through education, training, and support to develop the patient's knowledge, skills, or psychological and social resources (Hodkinson et al., 2020). A study conducted by Pearce et al (2016) developed Practical Reviews in Self-management Support (PRISMS) for the implementation of effective self-management, consisting of 14 components for self-management interventions (Pearce et al., 2016). Although many interventions use multiple self-management components, effective configuration and implementation of self-management components is critical (Hwang et al., 2021). Based on the PRISMS taxonomy, Hanlon et al (2017) proposed six components for telehealth self-management support, namely patient education and information, monitoring using feedback and action plans, clinical review, adherence support, psychological support, and lifestyle interventions (Hanlon et al al., 2017). Telehealth provides a viable alternative in healthcare, helping clients manage their conditions through improved self-care and access to education and support systems. Additionally, clients and healthcare professionals can exchange important clinical information remotely for the management and support of patients with chronic diseases.

Telerehabilitation has been carried out using telecommunications devices to provide evaluation and intervention to improve the motor, cognitive and psychosocial functions of stroke sufferers (Hwang et al., 2021). Based on survey results from the Indonesian Internet Service Providers Association (APJII), internet users in Indonesia will reach 215.63 million people in 2022-2023. This number increased by 2.67% compared to the previous period which was 210.03 million users (APJII, 2023). Meanwhile, the use of health applications in Indonesia reached 3rd place globally, namely 57% (Statista Consumer Market Insights, 2022). Based on the background of various telehealth-based self-management program interventions for stroke sufferers, we aim to obtain information on various self-management techniques with the following details: (1) (1) identify the intervention components of self-management programs for stroke sufferers, (2) identify types of telehealth-based self-management programs, and (3) identify the impact of providing telehealth-based self-management programs for stroke sufferers.

METHOD

This research uses a systematic review conducted based on the systematic literature review reporting guidelines suggested by the Preferred Reporting Items for Systematic Reviews and

Meta-analyses (PRISMA). Researchers used PICO (Problem, Intervention, Comparison Group and Outcomes) to answer the research objectives. Inclusion criteria were outlined by researchers through PICO. Problem (P): stroke patients aged more than 18 years, Intervention (I): telehealth-based self-management, Comparison Group: usual care, Outcomes: components, types and impact of self-management. Inclusion criteria include (1) Randomized controlled research design, (2) Patients with a clinical diagnosis of stroke, (3) Interventions that focus on self-management, (4) Interventions that are telehealth-based, (5) Studies with outcomes that focus on achievement goals, quality of life, lifestyle behavior, daily living activities, self-efficacy, participation, function, and compliance, (6) articles in the year 2014-2024, and in English. The exclusion criteria in this study were (1) Studies that only involved caregiver-related results, (2) Dissertations or theses or study protocols. A systematic literature search was carried out on 5 online databases, namely "PubMed", "ProQuest", "Science Direct", "Scopus", and "Embase", with reporting items using PRISMA and using covidence. The search was carried out with the keywords ((((((stroke) OR (cerebrovascular accident)) OR (CVA)) OR (Cerebrovascular stroke)) OR (cerebrovascular apoplexy) AND ((((((((telehealth) OR (e- mobile)) OR (e-health)) OR (website)) OR (mobile health)) OR (telerehabilitation)) OR (telecare)) OR (telehealthcare) AND ((((((self-care) OR (self-management)) OR (self-help)) OR (self-monitor)) OR (life style)) OR (patient education).

Researchers included RCTs that assessed self-management interventions compared with usual care in adult patients with stroke. (1)Evaluation of Methodological Quality: the quality of RCTs was assessed using the Physiotherapy Evidence Database (PEDro) Scale. Eight research articles showed high quality (Table 1). (2)Search result and relevance: the initial search yielded 422 articles which were further screened and yielded 393 titles and abstracts. Then there were 21 articles for eligibility assessment. After full text review, 8 articles remained that met the inclusion and exclusion criteria and were used for this systematic review. Search results can be found in Figure 1. In this review, the main results of targeted telehealth-based self-management interventions include: (1)Self-management behavior including goal achievement, self-management skills, participation, compliance. satisfaction with the performance of self-management behavior, and community re-integration; (2)Clinical outcomes include depression, health status, physical function, cardiovascular risk, blood pressure control, (3)Self-efficacy, (4) Quality of life (QoL), (5)Knowledge includes stroke risk factors.

RESULTS

8 studies were included in the review of telehealth-based self-management interventions. Researchers independently screened full texts. Data was completed using data extraction tables.

(1) Characteristics of included articles

The eight studies included in the systematic review were experimental studies with a Randomized Control Trial (RCT) design, all of which aimed to test the feasibility of telehealth-based interventions in patients with stroke. The eight studies are from various countries such as Hong Kong, United States, United Kingdom, Canada, New Zealand, Australia, and Taiwan.

(2) Participant Characteristics

The number of participants in each study was 48 - 399 participants, with a total of 1208 participants in the entire study, while those who took part in the research until completion were 967 participants with 241 participants dropping out. All participants suffered from stroke who met the requirements according to the inclusion criteria. Participants' post-stroke

recovery phases were acute phase (N=1), chronic phase (N=3), and acute and chronic survivors (N=4).

(3) Types of Telehealth Delivery

Website-based interventions were the most common in the selected studies, administered via computer, tablet or mobile. Three studies combined website-based interventions with telephone calls (Naqvi et al., 2022; Palmer & Enderby, 2016; Sakakibara et al., 2022a) or with telephone, video, and zoom calls (Lo, Chau, Choi, et al. , 2023b). One study combined a website-based intervention with telephone calls, and emails (Guillaumier et al., 2022a). Then there are studies that combine telephone calls with text messages (Saywell et al., 2021a) or videos (Chumbler et al., 2015a). While others use mobile-based applications (Kang et al., 2019).

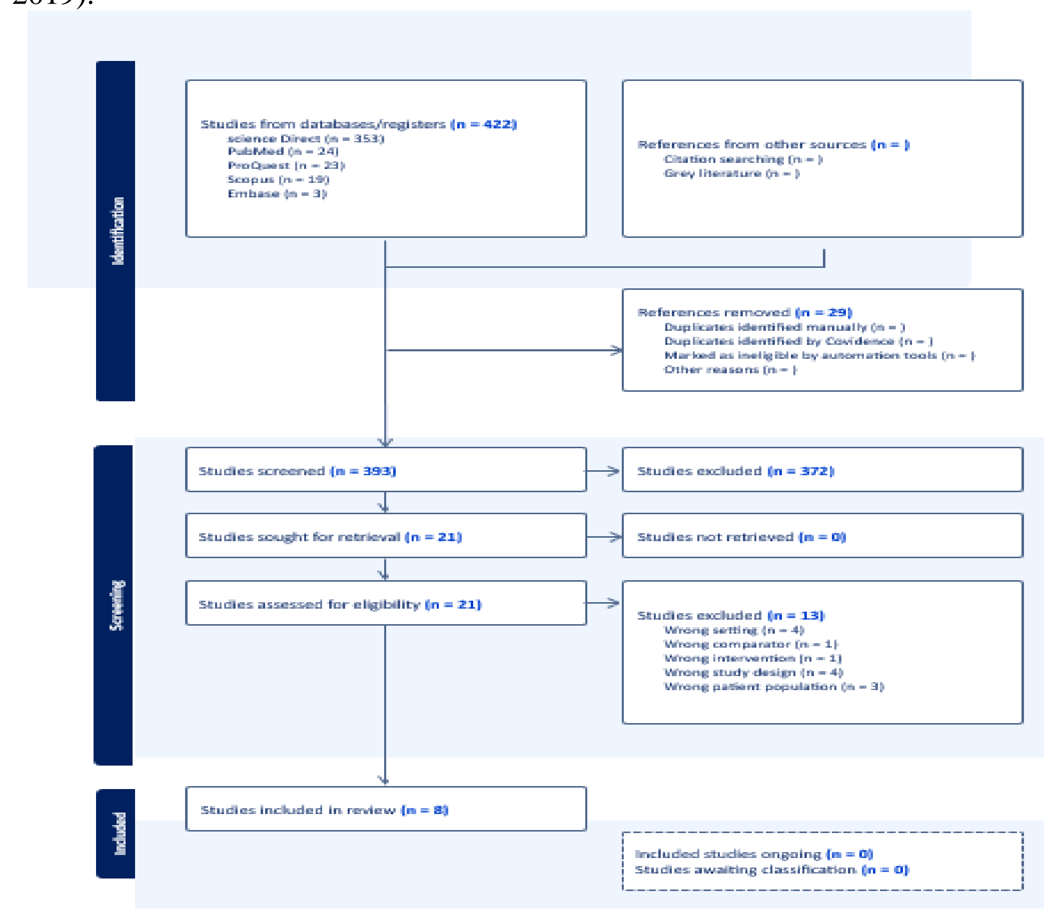

Figure 1. PRISMA diagram of literature search

Table 1.
Results of Quality Assessment of RCT Articles Using the PEDro Scale

Author, Year	(Lo, Chau, Choi, et al., 2023b)	(Naqvi et al., 2023)	(Palmer et al., 2019)	(Sakakibara et al., 2022a)	(Saywell et al., 2021b)	(Guillaumier et al., 2022b)	(Chumbler et al., 2015b)	(Kang et al., 2019)
Eligibility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Random allocation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Concealed allocation	Yes	No	No	Yes	No	No	No	Yes
Baseline comparability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Blind subjects	No	No	Yes	Yes	No	No	No	Yes
Blind therapists	No	No	No	No	No	No	No	No
Blind assessors	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Adequate follow-up	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Intention-to-treat analysis	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Between-group comparisons	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Point estimated variability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Score; Quality	8/10 ; high	6/10 ; high	8/10 ; high	9/10 ; high	7/10 ; high	7/10 ; high	6/10 ; high	8/10; high

(4) Frequency, Duration, and length of Intervention

Intervention frequency varies according to characteristics. Intervention sessions: Telephone sessions 1 time (Palmer et al., 2019), 5 times (Lo, Chau, Choi, et al., 2023b; Saywell et al., 2021a), 7 times (Sakakibara et al., 2022a) . Video conference sessions (Chumbler et al., 2015a; Saywell et al., 2021a). Research conducted monthly home visits (Palmer et al., 2019), 3 visits (Chumbler et al., 2015a), 4 visits (Lo, Chau, Choi, et al., 2023b; Saywell et al., 2021a) , and five follow-up visits (Lo, Chau, Choi, et al., 2023b). The study included a team-based care model with 3-month telehealth visits (Naqvi et al., 2022). The duration of the intervention ranges from 4 weeks to 12 months.

(5) Intervention

The focus of telehealth-based self-management interventions varies. Suzanne et al.'s study focused on interventions that increase self-efficacy and self-management behavior (Lo, Chau, Choi, et al., 2023b). The study by Imamah et al focused on remote blood pressure monitoring of psychological distress and quality of life (Naqvi et al., 2022). The study by Rebecca et al focused on patients with post-stroke aphasia who were able to self-administer and computerized speech and language therapy (Palmer et al., 2019). Other studies focus on self-management for secondary prevention (Sakakibara et al., 2022a), physical function and mobility (Chumbler et al., 2015a; Saywell et al., 2021a), behavior change (Guillaumier et al., 2022b), and knowledge about stroke risk factors (Kang et al., 2019). Various components of self-management support were used in selected studies, and We analyzed regrouped components from the PRIMS taxonomy of self-management support for long-term chronic conditions. Table 2 lists the components of self-management support analyzed in this study. All studies used at least 5 of the 9 components. Meanwhile, the research summary results are in table 3.

Information: Stroke and self-management

Educational components were used in 8 studies. The research discusses recovery of stroke sufferers, blood pressure control, speech and language therapy, secondary prevention of stroke, level of functional ability, lifestyle programs, and stroke risk factors.

Information: Sources of Social Support
One study provided information about community re-integration and patient support groups in the form of the use of videos of experiences of living with stroke, as one component of supporting self-management.

Online Monitoring with Feedback and Action Plans
All studies addressed these components via phone calls, text messages, and online platforms. This includes implementation of the intervention, treatment compliance, health reports, feedback on self-measurement, performance evaluation of targeted behavior, unexpected events resulting from the intervention, changes in conditions, and discussions about the formation of behavior in the future.

Exercises for daily activities
Seven studies consisted of daily activities to improve physical function as one of the intervention sessions included two studies included daily performance of targeted ADL tasks, one addressed exercises to improve abilities in communication with speech and language therapy. One study discussed daily lifestyle exercises applied in everyday life. Three studies discussed physical exercise as telerehabilitation.

Clinical Overview : Routine Follow-up
In six studies, the client's condition and self-management by a health professional were confirmed and reviewed weekly or after the intervention session, or over a period of time during the intervention.

Compliance Support
Six studies included reminder messages about tasks that had to be done, and motivational messages or positive encouragement to increase behavioral compliance.

Psychological Support; Goal Closing, Action Planning and Problem Solving Strategy
A psychological support component was used in all studies

Social Support: with Peers, Peer Mentoring, and Social Groups
One study included peer support among interventions carried out via video conference in the form of experiences of living with stroke.

Lifestyle Education and Support
Five studies discussed education and support for lifestyle changes such as stroke risk factor management, diet management, physical activity, depression management, healthy lifestyle

Table 2.
Components of self-management interventions

Strategy	(Lo, Chau, Choi, et al., 2023b)	(Naqvi et al., 2022)	(Palmer et al., 2019)	(Sakakibara et al., 2022a)	(Saywell et al., 2021a)	(Guillaumier et al., 2022a)	(Chumbler et al., 2015a)	(Kang et al., 2019)
Information: stroke and self-management	✓	✓	✓	✓	✓	✓	✓	✓
Information: source of social support	✓							
Online monitoring with feedback and action plans	✓	✓	✓	✓	✓	✓	✓	✓
Exercise for daily activities	✓		✓	✓	✓	✓	✓	✓
Clinical review: routine follow-up	✓	✓	✓	✓	✓	✓	✓	
Compliance support	✓	✓	✓	✓	✓	✓	✓	
Psychological support: goal setting, action planning, and problem solving strategies	✓	✓	✓	✓	✓	✓	✓	✓
Social support: peer support, peer mentoring, and social groups	✓							
Education and lifestyle support	✓	✓		✓		✓		✓
Number of components used	9/9	6/9	6/9	7/9	6/9	7/9	6/9	5/9

Table 3.
Research Summary

Author (Year)	Design; Participants	Post-stroke recovery phase	Telehealth Delivery Type	Treatment		Implementation
				Intervention Group	Control Group	
(Lo, Chau, Choi, et al., 2023b)	RCT Intervention Group = 67 Control Group = 67	Acute and chronic survivors	Telephone, video, Zoom, Website	Coaching Ongoing Momentum Building On stroke recovery journey (COMBO-KEY) • At homes, or Zoom or video/phone calls. Accompanied by a Coach Leader and Coach. Coach Leader conducts home visits • Coach makes weekly follow-up phone calls and informs the Coach Leader about the participant's progress • Self-management information, available in print and online, consisting of a workbook, health and life planning tools, access to 15 videos (Duration: 178 minutes) • Telephone hotline	Usual Care Covers stroke or other readily accessible health services such as physical or cognitive training, psychosocial support programs, health consultations, or medical consultations.	• 8 weeks • 4 home visits, • Five follow-up visits • 5 follow-up calls
(Naqvi et al., 2022)	RCT Intervention Group: 25 Control Group: 25	Acute phase stroke	Website-based telehealth, telephone, cloud-based platform integrated with electronic health records	Telehealth After Stroke Care (TASC) • Home wireless Blood Pressure (BP) • In real time delivered to a cloud-based platform • Telehealth videos • Wirelessly transmitted blood pressure readings are recorded • Scheduled interventional telehealth visits • For the 3-month follow-up, a notification appeared on the tablet screen via the app • Participants who did not complete the survey independently were contacted by telephone	Control Group participants will receive blood pressure monitors and tablets at the 3-month follow-up period after the study.	• 3 months
(Palmer et al., 2020)	RCT Group 1: CSLT (97) Group 2:	Acute and chronic survivors	Website, telephone	Computerized speech and language therapy (CSLT) group • To provide increased levels of long-term speech and language therapy (SLT) • Word search exercises are provided on a computer (PC, laptop or tablet) • StepByStep aphasia software	Usual care To improve communication with aphasia sufferers and reduce the impact of aphasia on life	• 6 months • Monthly discussions by telephone and Visits after 6 months, 9 months, and 12 months

Author (Year)	Design; Participants	Post-stroke recovery phase	Telehealth Delivery Type	Treatment		Implementation
				Intervention Group	Control Group	
	Attention Control			• Volunteers or therapy assistants provide encouragement and support to practice computer exercises	Performed by a speech and language therapist or therapy assistant	Primary outcome was assessed after 6 months
	Group (80) Group 3: usual care (101)			• The therapist selects therapy exercises based on the results of a basic language assessment. • The therapist visited at least 1 hour every month Attention Control Group • To differentiate the speech and language therapy (SLT) components of CSLT from the additional activities and attention received. • Puzzle books per day for a 6 month period • The therapist matches the book to the participant's abilities and interests • Compliance is measured using the number of puzzle books sent and the number of telephone contacts made (minimum of four books and four calls expected). • Telephone calls were made every month	Face to face personally or in groups. Intervention in the participant's home, or outpatient facility or community clinic. The therapist assistant is required to visit for at least 1 hour once a month. The usual care group received an average of 5 hours 20 minutes of intervention for 3 months in each session for 1 hour every 2 weeks	• Secondary outcomes were assessed after 6 months, 9 months, and 12 months • Side effects were reported at 3, 6, 9, and 12 months • Quality of life was measured at baseline, 6, 9, and 12 patient completion months 20–30 minutes of exercise daily is recommended over a 6 month period in all groups
(Sakakibara et al., 2022a)	RCT Group Intervention = 64 Control Group = 62	Chronic phase	Website, Telephone	Stroke Coach • Phone sessions with a lifestyle coach • Website-based: self-management guide, self-monitoring tools, and health report cards with grades ranging from A (good control) to F (poor control) on behavioral and cardiometabolic risk factors for stroke	Memory Training Memory training with the same schedule and frequency of phone calls as the stroke coach Manual memory training consisting of seven lesson plans, homework, and cognitive exercises, agenda to schedule appointments and create reminder notes.	• 6 months • 12 months follow-up • 7 telephone sessions of 30-60 minutes • Five 5 – 10 minute “check in” calls
(Saywell et al., 2021a)	RCT Intervention group = 47 Control Group = 48	Acute and chronic survivors	Phone, text message	Augmented Community Telerehabilitation Intervention (ACTIV) ACTIV interventions are carried out in participants' own homes or remotely via telephone contact and text messages ACTIV focuses on 2 functional categories: “staying upright” and “using your arms.” Programs are delivered by physical therapists who have completed ACTIV training, The physical therapist sets patient-centered goals at the first home visit. Select exercises and activities to achieve these goals These calls focus on helping participants formulate strategies to maximize their engagement in the program. Text messages are used to encourage continued practice and acknowledge participant progress.	Standard care After discharge from rehabilitation services in New Zealand there is usually no further formal rehabilitation. To ensure usual care, no effort was made to prevent additional care, and this was not measured	• 6 months • Face-to-face sessions, telephone contacts, and text messages to improve stroke rehabilitation. • Each ACTIV participant receives 4 face-to-face visits, 5 structured phone calls, and personalized text messages.
(Guillaumier et al., 2022a)	RCT Intervention Group = 199 Control Group = 200	Chronic phase	Telephone, Website, email	Prevent 2nd Stroke (P2S) 6 core modules: (1) smoking, (2) alcohol, (3) activity, (4) nutrition, (5) feelings and mood, and (6) blood pressure. Each health risk behavior module begins with 2–3 short questions on a topic of interest Users are asked to set specific goals Progress against goals	Posted and emailed a copy of a letter containing links to internet addresses with publicly available online health programs and guidelines designed for	• 12 week All participants completed a • follow-up survey 6 months

Author (Year)	Design; Participants	Post-stroke recovery phase	Telehealth Delivery Type	Treatment		Implementation
				Intervention Group	Control Group	
					the general public	
(Chumbler et al., 2015a)	RCT Intervention Group = 23 Control Group = 25	ronic phase	Telephone, video teleconferencing	Stroke telerehabilitation (STeleR) Home visits, five telephone calls, and a home messaging device Outcome measurements included the Falls Efficacy Scale and the Stroke Specific Patient Satisfaction scale (SSPSC) Research assistants conducted telephone interviews to collect participant surveys and open-ended comments.	Usual care UC participants can receive any services provided as part of their usual VA or non-VA care, such as home health care.	• 3 months, 6 months follow-up • Three home visits, Five phone calls • Book for 3 months,
(Kang et al., 2019)	RCT Intervention Group = 38 Control Group = 38	Acute and chronic phases	Mobile based application	Stroke health education mobile app (SHEMA): The SHEMA app is free to download The content covers the same 12 health education topics as the booklet in the Control Group. The role of the research assistant is as follows: . Help patients install the SHEMA application on their personal smartphone. . Explain the contents of SHEMA and the operation method to the patient for 45 minutes.	• Stroke health education content covers 12 topics on risk factors in stroke patients such as: history of stroke, heart disease, age, irregular work and sleep patterns, obesity, family history and genetic factors, hyperlipidemia, hypertension, unbalanced diet, diabetes mellitus, changes in environmental temperature, and gender. • A trained research assistant provides standard post-stroke health education as follows: 1. Provide health education booklets related to stroke to patients. 2. Approximately 45 minutes to explain the contents of the booklet to the patient.	• 30 days • Read SHEMA booklets or content at home for 7-14 days, and five minutes per day is the minimum requirement • Approximately 45 minutes to explain the contents of the booklet and SHEMA to the patient

Outcome Measures

Table 4 and 5 shows the results of the telehealth-based self-management intervention.

(1) Self-management Behavior

In our review, goal achievement (N=2), self-management skills (N=2), participation (N=2), compliance (N=5), satisfaction with self-management behavior performance (N=2), and Community re-integration (N=1) was found to be a result of self-management behavior. In studies that used goal attainment as the outcome (Palmer et al., 2019; Sakakibara et al., 2022a) only one showed statistically significant improvement in a group comparison study (Palmer et al., 2019), and one study reported no there were reported changes within groups or between groups (Sakakibara et al., 2022b). The results of achieving goals such as increased function, and improved lifestyle behavior (Palmer et al., 2019; Sakakibara et al., 2022b). Self-management skills in the form of the patient's ability to make changes in physical function abilities that are self-managed and computerized produce clinically significant improvements (Palmer et al., 2019). Two studies measured participation outcomes, and one study reported a statistically significant effect (Palmer et al., 2019). Five studies measured adherence and two studies reported significant results (Lo, Chau, Choi, et al., 2023b; Palmer et al., 2019). Satisfaction with the performance of self-management behavior was reported by two studies and produced a significant effect (Chumbler et al., 2015a; Lo, Chau, Choi, et al., 2023b).

Community re-integration was found in only one study and had a positive impact (Lo, Chau, Choi, et al., 2023b).

(2) Clinical Results
Neuro-QoL depression (N=1), health status (N=4), physical function (N=2), cardiovascular risk (N=1), and blood pressure (N=1) were measured as clinical outcomes. Regarding depression neuro-QoL, the study by Naqvi et al (Naqvi et al., 2023) showed significant improvement in both groups but the differences between groups were not significant. Four studies reported health status as a clinical outcome, namely cognitive function, depression, communication skills, blood sugar control, and balance. Only one study reported clinically significant improvement (Palmer et al., 2019). Regarding physical abilities associated with safe interventions increasing post-stroke physical activity and speech and language therapy were reported by two studies (Palmer et al., 2020; Saywell et al., 2021a). Regarding cardiovascular risk, it showed a statistically significant effect in reducing HbA1c in the intervention group compared to the control group, where a 1 percent reduction in HbA1c was associated with a 17% reduction in stroke risk (Sakakibara et al., 2022b). Additionally, regarding blood pressure control, a study reported that team-based remote blood pressure monitoring showed a positive impact on patient well-being (Naqvi et al., 2023).

(3) Self-Efficacy
Self-management support with virtual and hybrid versions of the protocol, medication adherence, ability to perform daily tasks, and ability to manage falls were measured as self-efficacy outcomes, but only one study reported significantly greater improvements in self-efficacy (Lo, Chau , Choi, et al., 2023b).

(4) Quality of Life
Quality of life was measured in five studies (Guillaumier et al., 2022a; Kang et al., 2019; Lo, Chau, Choi, et al., 2023b; Naqvi et al., 2023; Sakakibara et al., 2022b), and only one study reported a nonsignificant improvement difference (Lo, Chau, Choi, et al., 2023b).

(5) Knowledge
Knowledge related to stroke risk factors was reported by two studies, where one study reported that a telehealth-based intervention could increase knowledge but was not superior to the control group. Other studies show that promoting healthy lifestyle behaviors improves health outcomes (Kang et al., 2019; Sakakibara et al., 2022a).

Table 4.
Summary of Article Study Results

Author (Year)	Outcome Measures			Goals and Results
	Pre	Post	Evaluation	
(Lo, Chau, Choi, et al., 2023b)	*Baseline*	8 weeks	• Self-efficacy • Satisfaction with the performance of self-management behavior • Quality of life • Community re-integration	To examine the effect of the COMBO-KEY program • There is no significant difference at baseline • Participants in the intervention group experienced a significantly greater improvement in total SSEQ scores at week 8 • Participants in the intervention group improved significantly in SSBPS, SSQOL, and RNLI total scores at 8-week follow-up • Intervention group participants demonstrated significantly greater improvements in self-efficacy, satisfaction with performance, HRQoL, and community reintegration at 8-week follow-up. • Stroke survivors who participate in community-based self-management programs have higher self-efficacy in self-management and quality of life, increasing their reintegration into the community and satisfaction with the performance of self-management behavior.

Author (Year)	Outcome Measures			Goals and Results
	Pre	Post	Evaluation	
(Naqvi et al., 2022)	*Baseline*	3 months	• Control blood pressure and medication compliance • Patient-Reported Outcomes Measurement Information System Managing Medications and Treatment (PROMIS-MMT): self-efficacy • Patient Activation Measure (PAM): patient involvement in health services • Neuro-QOL cognitive function: Neuro-QOL (Quality of Life in Neurological Disorders) • Neuro-QOL depression • PHQ-9 (Patient Health Questionnaire-9)	To determine the feasibility of Patient-reported outcomes (PROs) into Telehealth After Stroke Care (TASC) and explore the impact of a remote blood pressure monitoring program • PHQ-9 depression scores were lower in TASC at 3 months compared with usual care • No significant differences were observed in PROMIS-MMT, PAM, or Neuro-QoL, depression neuro-QoL measurements • There was no significant difference between the intervention group and the Control Group regarding BP medication adherenc
(Palmer et al., 2019)	*Baseline*	3 months 6 months 9 months 12 months	• Therapy Outcome Measures (TOMs), between baseline and 6 months after randomization. • Communication Outcomes After Stroke (COAST). • Maintenance of treatment effect • Changes in the number of treated words, generalization to untreated words as measured by the CAT test, changes in caregivers' perceptions of patient communication and social participation (assessed using CarerCOAST), and changes in caregivers' quality of life (CarerCOAST). • Safety outcomes included negative effects of CSLT • Health-related quality of life (HRQoL)	An effective, low-cost approach to providing speech and language therapy is needed. • The CSLT group experienced an increase in finding words by 16.2% • Mean changes in functional communication in conversation based on TOM were very similar across interventions • The CSLT approach does not improve functional communication in conversation • CSLT plus usual care produced clinically significant improvements in personally relevant word discovery but did not result in improvements in conversation. • Big CACTUS demonstrated that CSLT along with usual care enabled an increased amount of therapy practice and significantly improved the ability to retrieve personally relevant words selected for practice. • There was no effect of time after stroke on the ability to improve word discovery • CSLT may be considered a safe intervention and low-cost option to provide additional word search therapy for patients with chronic post-stroke aphasia.
(Sakakibara et al., 2022a)	*Baseline*	6 months 12 months	• Lifestyle behavior: Health Promoting Lifestyle Profile II • Specific behavioral and cardiometabolic risk factors, health-related quality of life (HRQoL), cognitive status, and depressive symptoms.	To test the efficacy of stroke coaches on lifestyle behavior and risk factor control • Differences between groups on HPLPII were not significant. The relationship between lifestyle and groups did not change over time. • HRQoL (physical component) and blood sugar control (HbA1c) have significant differences between Stroke Coach and memory training • Stroke Coach experienced a statistically significant increase in HRQoL (mental component). • Fat consumption was reduced by 4 g per day in Stroke Coach and increased by approximately 3 g per day in memory training in T3
(Saywell et al., 2021a)	*Baseline*	6 months 12 months follow-up	• Physical subcomponent: Stroke Impact Scale • Hand grip strength and balance: A JAMAR hand-held dynamometer • Balance was assessed using the Step Test • Self-Efficacy: Stroke Self-Efficacy Questionnaire (SSEQ) • Health outcomes and impact of stroke: Visual Analogue Scale (VAS) from EuroQol 5D (EQ-5D)	To investigate whether ACTIV improves physical function compared with usual care. • There were significant differences in physical function between groups. Improvements in physical function were not maintained at 12 months of follow-up. • ACTIV showed no significant effect on grip strength, balance, or self-efficacy (SSEQ). • The ACTIV group showed significant improvement on the EQ-5D VAS at 6 months • The effect of ACTIV on the EQ-5D VAS at 12 months was also significant, but participants in the intervention group had significantly lower EQ-5D VAS scores than the control group. • There were no significant differences between groups in the incidence of adverse events of any severity

Author (Year)	Outcome Measures			Goals and Results
	Pre	Post	Evaluation	
			Physical activity outside the study (PAOS)	• ACTIV is not effective in improving physical function ACTIV may be effective in preventing deterioration or even improving physical function in stroke survivors, immediately after discharge from the hospital
(Guillaumier et al., 2022a)	*Baseline*	12 weeks 6 month	• HRQoL at 6-month follow-up: EuroQol Visual Analogue Scale (EQ-VAS) • Additional HRQoL measurements used the EQ-5D-5L descriptive system (EQ-5D), which consists of 5 dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression).	• To evaluate the effectiveness of the Prevent 2nd Stroke (P2S) intervention (P2S) • There were no significant differences between groups for other secondary outcomes at follow-up. • An online program that delivers health behavior change information improves self-assessed HRQoL of stroke survivors at 6-month follow-up.
(Chumbler et al., 2015a)	*Baseline*	3 months 6 month follow-up	• Self-efficacy related to falls: Falls Efficacy Scale (FES) • Stroke-Specific Patient Satisfaction with Care participants: (SSPSC)	To determine the effect of intervention at home stroke telerehabilitation (STeleR) • the STeleR group showed statistically significant improvement on one of the two SSPSC scales (satisfaction with hospital care, p = 0.029) and approached significance on the second SSPSC scale (satisfaction with home care, p = 0.077). • There was no improvement in falls-related self-efficacy • There were significant group differences in the two satisfaction with care scores. • The total home care score increased from 9.3 to 11.0 in the STeleR group, and decreased from 10.6 to 10.2 in the UC group, a difference that approached statistical significance (p = 0.077)
(Saywell et al., 2021a)	*Baseline*	6 months 12 months follow-up	• Physical subcomponent: Stroke Impact Scale • Hand grip strength and balance: A JAMAR hand-held dynamometer • Balance was assessed using the Step Test • Self-Efficacy: Stroke Self-Efficacy Questionnaire (SSEQ) • Health outcomes and impact of stroke: Visual Analogue Scale (VAS) from EuroQol 5D (EQ-5D) • Physical activity outside the study (PAOS)	To investigate whether ACTIV improves physical function compared with usual care. • There were significant differences in physical function between groups. Improvements in physical function were not maintained at 12 months of follow-up. • ACTIV showed no significant effect on grip strength, balance, or self-efficacy (SSEQ). • The ACTIV group showed significant improvement on the EQ-5D VAS at 6 months • The effect of ACTIV on the EQ-5D VAS at 12 months was also significant, but participants in the intervention group had significantly lower EQ-5D VAS scores than the control group. • There were no significant differences between groups in the incidence of adverse events of any severity • ACTIV is not effective in improving physical function • ACTIV may be effective in preventing deterioration or even improving physical function in stroke survivors, immediately after discharge from the hospital

Table 5.
Effects of Self-Management Interventions

	Results	Number of Studies	RCT	
			Article	Influence
Self-management behavior	Achievement of objectives	2	(Palmer et al., 2019; Sakakibara et al., 2022a)	+++, -
	Self-management skills	2	(Palmer et al., 2019; Sakakibara et al., 2022a)	+++, -
	Participation	2	(Naqvi et al., 2022; Palmer et al., 2019)	+, +++
	Obedience	5	(Kang et al., 2019; Lo, Chau, Choi, et al., 2023a; Naqvi et al., 2022; Palmer et al., 2019; Sakakibara et al., 2022a)	+++, + +++, - -
	Satisfaction with the Performance of self-management behavior	2	(Chumbler et al., 2015a; Lo, Chau, Choi, et al., 2023a)	+++, +++
	Community reintegration	1	(Lo, Chau, Choi, et al., 2023a)	+++
Clinical Results	Depression	1	(Naqvi et al., 2022)	+
	Health status	4	(Naqvi et al., 2022; Palmer et al., 2019; Sakakibara et al., 2022a; Saywell et al.,	+, +++ ^

	Results	Number of Studies	RCT	
			Article	Influence
			2021a)	+
	Physical function	2	(Palmer et al., 2019; Saywell et al., 2021a)	+++ ^
	Cardiovascular risk	1	(Sakakibara et al., 2022a)	+++
	Control blood pressure	1	(Naqvi et al., 2022)	+++
Self-Efficacy		4	(Chumbler et al., 2015a; Lo, Chau, Choi, et al., 2023b; Naqvi et al., 2022; Saywell et al., 2021a)	+++ + ^ ++
Quality of life		5	(Guillaumier et al., 2022b; Kang et al., 2019; Lo, Chau, Choi, et al., 2023a; Naqvi et al., 2022; Sakakibara et al., 2022a)	+++, + +++, +++ -, +++
Knowledge	Stroke risk factors	2	(Kang et al., 2019; Sakakibara et al., 2022a)	+ +++

DISCUSSION

(1) Intervention

Various impacts, both physical and psychological, can arise after a stroke. The physical impacts often experienced by stroke sufferers include hemiparesis, hemiplegia, fatigue, aphasia, dyspagia, muscle stiffness, while the psychological impacts of stroke sufferers can experience stress, panic and even depression which contribute to a decrease in quality of life and disruption of fulfilling activity needs independently (Dewi et al. al., 2020). In addition, stroke sufferers after an attack can also experience complications including brain edema, pneumonia, urinary tract infections/incontinence/urinary retention, seizures, decubitus, joint stiffness and muscle atrophy, deep vein thrombosis (DVT), depression and anxiety (Kariasa , 2022). The problems faced by stroke sufferers are likely to continue to increase and post-stroke complications need to be treated in order to prolong better life expectancy (Ikeda et al., 2021). Studies show that a person's life priorities, after the first year of stroke, include optimizing physical functioning, emotional well-being, and more importantly, maintaining self-identity, resuming life roles, and reintegrating into society (Lo, Chau, Lam, et al., 2023; Lo et al., 2021). Research on the life experiences of stroke survivors consistently shows the importance of inviting stroke survivors to play an active role in managing their daily lives amidst post-stroke challenges (Chau et al., 2021; Lo, Chau, Lam, et al., 2023; Lo et al., 2021).

Self-management refers to a person's active involvement in managing their physical, emotional, and role needs for living healthily with a chronic condition. It highlights the learning and use of core self-management skills, namely goal setting, action planning, problem solving, decision making, communication, and resource utilization so that the person can manage his or her health condition effectively (Lo, Chau, Choi, et al., 2023a).The main focus of telehealth-based self-management support in selected studies is lifestyle behavior change, practicing speech and language skills, physical activity and participation, functional mobility, ADL, knowledge of stroke risk factors and blood pressure monitoring with outcomes measuring quality of life, self- secondary prevention management, self-efficacy, self-management behavior and care satisfaction in stroke patients. Participation restrictions are difficulties encountered during the integration of stroke survivors into premorbid life roles (Hwang et al., 2021). Factors that determine the participation of stroke sufferers are not only age and gender but also the sufferer's functional/physical abilities, independence in ADLs, severity of stroke, and the onset of depression (Ru et al., 2017).

Most self-management interventions primarily evaluate clinical outcomes, and self-management supports focus on medication and emotional management skills, such as appropriate medication adherence and stress management in chronic conditions. However,

outcomes related to functioning or participation are also important indicators and goals of self-management support that help improve clients' role management abilities (Warner et al., 2015). One study in this review addressed self-monitoring for blood pressure monitoring (Naqvi et al., 2022). The studies included in this review provided telehealth-based self-management support, which focused on improving role management abilities and medication and emotional management skills of stroke survivors. This can be considered an important aspect for building self-management support interventions for stroke sufferers.

(2) Types of Telehealth Delivery

Nine components of self-management support for stroke survivors regrouped based on the PRISMS taxonomy for long-term conditions are provided via telehealth. Methods include messaging, telephone, video conferencing, and online platforms. Additionally, telehealth interventions are delivered alone or in combination of two types of interventions. All studies use messaging as a tool to support, monitor, and provide information tailored to target behavior. Hwang et al (2021) reported that information about issues related to health behavior motivation and potential risks provided through message interventions can increase clients' knowledge and thereby reduce health threats (Hwang et al., 2021). This is consistent with self-management support interventions that could be included in the types of messaging identified in this review. Telecommunication can be adopted to improve management of long-term conditions (Kassavou & Sutton, 2018; Posadzki et al., 2016), and direct interactions, such as voice calls, between clients and health professionals can contribute to building confidence by providing information and receiving feedback. back immediately (Tighe et al., 2020). The studies selected in this review used two-way telecommunications with telephone calls or videoconferencing, delivered with the aim of monitoring psychological symptoms, medication adherence, and educational self-management support. Five studies provided information on stroke, monitoring cardiovascular risk management and blood pressure, daily assessment of client performance, and communication with health professionals using digital platforms (Guillaumier et al., 2022a; Kang et al., 2019; Lo, Chau, Choi , et al., 2023a; Naqvi et al., 2023; Evidence-based interventions, along with an appropriate level of guidance through digital platforms, can drive disease-specific health behavior changes and help manage a variety of users and conditions effectively (Son et al., 2020). The various types of self-management provision identified in this review are effective ways to support telehealth-based self-management interventions in stroke survivors. This can assist in selecting the appropriate type of telehealth delivery and can be supplemented with self-management support strategies.

(3) Results and Effects of a Telehealth-Based Self-management Support Intervention

Outcomes included in this review were self-management behaviors, clinical outcomes, self-efficacy, quality of life, and knowledge. We could not find consistent improvements in detailed results. However, the measurement results that show positive effects are achievement of self-management behavior goals, self-management skills, satisfaction with the performance of self-management behavior, community re-integration, participation, compliance, cardiovascular risk and physical function as clinical outcome measures. self-efficacy and quality of life, as well as knowledge. Evaluation of goal achievement is used to facilitate goal setting and as a tool for evaluating program results. Goal setting is one of the core elements of self-management support especially in the rehabilitation setting, which is an important step in helping to encourage community transition among stroke survivors (Parke et al., 2015). Mood disorders are also a symptom that often occurs in stroke sufferers (Singer et al., 2021). After a stroke, many patients not only experience some physical disability including difficulty in moving, speaking, and seeing, but patients generally also show changes in mood or emotions even after rehabilitation therapy (Schöttke & Giabbiconi, 2015). Anger, frustration, lack of

motivation, and crying or laughing for the wrong reasons are also common in stroke patients. Post-stroke depression (Robinson & Jorge, 2016), post-stroke anxiety (Maaijwee et al., 2016), and pseudobulbar affect (Gillespie et al., 2016) are common post-stroke mood disorders (Singer et al., 2021).

The interventions provided are tailored suggestions for lifestyle behavior change, medication adherence, and blood pressure monitoring, physical exercise education and activities, and client-centered daily ADL tasks. Studies measuring mobility outcomes have provided physical exercise via video conferencing, and the results have also shown positive effects on balance and fall prevention. For stroke sufferers who experience limited mobility after the attack, appropriate physical activity is necessary for lifestyle changes and adaptation after acute treatment. Home telehealth can be effective for assessing the healthcare needs of stroke survivors and their caregivers, as well as providing them with information and emotional support (Hwang et al., 2021). Previous studies have reported excellent acceptability and positive attitudes towards mobile-based interventions for stroke management (Mahmood et al., 2019). However, the development and implementation of techniques that take into account the familiarity and comfort of stroke survivors and their caregivers may be considered in the future.

Limitations

The limited number of studies included in this review is because there are not many studies that support telehealth-based self-management in stroke patients. The wide variety of available intervention focuses places limitations on improving significant outcomes. In addition, varying sample sizes provide differences in measurement results and intervention effects. Stroke is a chronic disease that requires changes in healthy lifestyle behavior and adaptation processes, so it is necessary to prove that self-management interventions have long-term effects.

CONCLUSION

Telehealth-based self-management interventions were not found to be consistent across all outcomes, but this review found a positive impact on a variety of self-management program-related outcomes. Therefore, we suggest a telehealth-based self-management intervention as an intervention for stroke patients. Various types of telehealth-based self-management interventions and the components used provide a variety of options that can be implemented in stroke patients. Based on these findings, trials are needed to establish a consistent basis regarding the effectiveness of telehealth-based self-management interventions in stroke patients in the future.

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