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Telerehabilitation as a physical therapy solution for the post-stroke patient in COVID-19 pandemic situations: A review



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ABSTRACT

Background: Stroke is one of the leading causes of disability among the adult population. One-third of post-stroke patients require ongoing physical rehabilitation to improve their motoric function. But in this COVID-19 pandemic situation, all outpatient visits or non-emergency cases, including in-clinic physical rehabilitation therapy, have been postponed and limited to maintain physical distancing to prevent the spreading of infection. Telerehabilitation can be the answer to overcome this circumstance.

Methods: We conducted a comprehensive search for online literature or studies in 2020. We explored evidence using the following database Cochrane Library, PubMed, and Google Scholar. The keywords used to obtain the relevant research include "telerehabilitation" OR "telemedicine" AND "physical rehabilitation" AND "stroke patient" AND "COVID-19 pandemic". The literature was analyzed based on the

results of previous studies.

Results: Telerehabilitation delivers rehabilitation services via communication technologies involving the patient and the physical therapist communicate using telehealth platform and video-teleconference. Several telerehabilitation techniques can be used for stroke patients' physical exercise, such as portable transcutaneous electrical stimulation (TENS), mirror therapy, home exercise program, and virtual reality exercise. Several studies have shown that telerehabilitation is not inferior than in-clinic physical exercise, and both showed significant improvement in post-stroke patients' motor function.

Conclusions: Telerehabilitation can be the solution for post-stroke patient's physical rehabilitation in the COVID-19 pandemic. This novel health innovation allowed the post-stroke patient to exercise at home and prevent them from the risk of COVID-19 infection.

Keywords: COVID-19 pandemic, telemedicine, telerehabilitation, physical therapy, post-stroke patient

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INTRODUCTION

Stroke is one of the leading causes of disability among the adult population worldwide, with approximately 15 million new cases per year.¹ In Indonesia, stroke is the third mortality caused by non-infectious disease after heart disease and cancer.² One third of the 500,000 post-stroke patients have a severe functional impairment, requiring the sufferer to be continuously in bed and require long rehabilitation.^{1,3} Physical rehabilitation is essential for motor function recovery and to enhance the activity of daily living improvements. Conventional rehabilitative therapy is delivered in a hospital or physical rehabilitation clinic.³ But in this COVID-19 pandemic

situations, most healthcare facilities postponed a lot of outpatient visits and only accepting emergency cases only to maintain physical distancing for COVID-19 infection prevention.⁴

The COVID-19 pandemic started in December 2019 in Wuhan, China still spreading out throughout the world now. As of November 2020, the total COVID-19 infection cases worldwide reached 63.3 million cases, with 1.47 million cases of death. In Indonesia, the entire case reached 544 hundred thousand cases with 17,081 cases of death.⁵ Similar to other countries all over the world, the government of Indonesia has been awaiting the development of effective medicine and vaccines. From the perspective of public

health issues, many issues need to be taken promptly and accurately. This COVID-19 pandemic situation also has many impacts on all health sectors, including physical rehabilitation medicine.⁴ The World Confederation for Physical Therapy has given recommendations to all member organizations to postpone treatments that count as non-emergency cases to ensure safety.⁶ As a consequence, post-stroke patients were the most affected population. Due to postponed treatment and rehabilitation, their motoric function will take a long time to recover.^{6,7}

Rehabilitation is an essential aspect of the healthcare system and very vulnerable during a pandemic response due to the focus of the healthcare system shifts to the acute management of emergency or acutely

ill patients.^{1,8} This poses a challenge for medical rehabilitation providers to adapt their service system during the COVID-19 pandemic.^{1,2} On the other side, technology has played a vital role in society in adapting to this pandemic. Video-conference has become common in our daily lives. Various video and other technologies have allowed long-distance and indirect face-to-face communication between us.^{8,9} One of the technology applications in the health sector is telemedicine. Telemedicine means “healing at a distance,” indicating the use of information and communication technology to improve patient outcomes by increasing access to care and medical

information. There is some kind of telemedicine such as telementoring, telemonitoring, teleconsultation, and telerehabilitation.¹⁰ Telerehabilitation can be the answer for physical rehabilitation circumstances in this COVID-19 pandemic.

Telerehabilitation is defined as delivering rehabilitation services via communication technologies.^{1,2} In a previous study with intervention used home-based daily telerehabilitation to improve arm motor function after chronic stroke, four weeks of daily therapy was significantly associated with remarkable (97.9%) adherence and significant

improvement in patient’s clinical condition and was not dependent on their skill level in using a computer.⁸ The other clinical trial shows that home telerehabilitation is not inferior in that in-clinic physical therapy improves post-stroke patients’ motoric function.¹¹ This review will explain the use of telerehabilitation and its evidence-based medicine as a physical therapy solution at home for stroke patients in this COVID-19 pandemic situation.

METHODS

We conducted a comprehensive search for online literature or studies in 2019-2020. We explored evidence using the following

Table 1. Summary of the studies included in this literature review

Author	Country	Type of study	Objective	Key findings
Wang et al., 2010	Taiwan	Literature review	Review and give some suggestions about the potential for current neurorehabilitation therapy that can be practiced at home.	A transcutaneous electrical stimulation device helps to maintain muscle strength and reduce spasticity at home. A combination of primary home exercises with virtual reality technology such as video games helps maintain physical balance and protect against functional deterioration. ³
Middleton et al., 2020	USA	Descriptive study	To describe the process and cost of telerehabilitation for rehabilitative patients.	Telerehabilitation is useful in this pandemic situation, and the cost is an important consideration when developing this new program. ⁸
Nugraha et al., 2020	Indonesia	Literature review and expert recommendations	Providing some recommendations regarding rehabilitation medicine based on practical and opinion of authors at different levels of health systems.	Some recommendations were provided for each health system, including the government level, hospital level, and health professional level. ²
Cramer et al., 2019	USA	Randomized controlled trial	Compare the efficacy of home-based telerehabilitation and traditional in-clinic physical therapy.	Both home-based telerehabilitation or traditional in-clinic rehabilitation produced quite the same improvement in arm motor function. ¹¹
Stein et al., 2020	USA	Literature review and expert recommendations	To describe plans for adjustment of physical rehabilitation in COVID-19 pandemic situation.	The essential adjustment to the pandemic situation is protecting the health care workers, and the usage of technology is beneficial to establish outpatient service while keeping physical distance. ⁴
Quigley et al., 2020	Australia	Literature review	To provide the evidence-based of telerehabilitation, the usage considerations, and its challenge.	Telerehabilitation is a potential and feasible solution for physical rehabilitation service during the COVID-19 pandemic, but some modifications should be considered in its standard practices. ¹²
Chang and Reveret, 2020	Korea	Point of view	To study the advantage of telerehabilitation for stroke patients during the COVID-19 pandemic.	Telerehabilitation is a useful approach for physical rehabilitation and consultation for stroke and post-stroke patients during the COVID-19 pandemic. ¹³
Mantovani et al., 2020	Italy	Literature review	To review the current evidence-based medicine of cognitive rehabilitation for telerehabilitation.	Telemedicine and virtual reality technology beneficial both for the patients and families to fulfill their cognitive and psychosocial needs. ⁹
Turolla et al., 2020	USA	Literature review	To review the benefits of musculoskeletal physical therapy through telerehabilitation during the COVID-19 pandemic.	Telerehabilitation is a promising alternative model as a solution for physical rehabilitation for musculoskeletal dysfunction in this COVID-19 pandemic. ⁶

database Cochrane Library, PubMed, and Google Scholar. The keywords used to obtain the relevant study include “telerehabilitation” OR “telemedicine” AND “physical rehabilitation” AND “stroke patient” AND “COVID-19 pandemic”. We used a Boolean operator to specify the finding result further. We also search for evidence listed in article references and choose a study relevant to our topic. We only included full-text studies published in English in this review. A total of 9 papers were found related to our topic. A summary of the studies can be seen in [Table 1](#).

DISCUSSION

The situation of Physical Rehabilitation Medicine in COVID-19 Pandemic

The COVID-19 pandemic affects all sectors, including physical rehabilitation medicine. Rehabilitation practices have reduced the capacity during the COVID-19 pandemic. This capacity reduction is not only because of the prevention of the spreading of the COVID-19 infection, but also the need for hygiene and special personal protective equipment.⁸ The World Confederation for Physical Therapy suggests their organization's members postpone treatments that are not considered emergency cases. Because of these issues, many non-COVID-19 patients who require rehabilitation have delayed treatment.⁶ This condition also affects all rehabilitative patients, including

the post-stroke patients who occupied most rehabilitative populations. The other reason is COVID-19 is an infection that is transmitted through direct contact, and stroke patient in their in-clinic rehabilitation visit can increase the risk of COVID-19 infection. The probability of COVID-19 infection rises because of the increasing number of contact transmission.¹⁴ The other important point is stroke patients have a crucial period to recover in their first six months after stroke; they will undergo rehabilitation therapy regularly and more often, which resulted in a higher risk of COVID-19 infection.^{1,3}

The COVID-19 pandemic expected will be a long-term pandemic¹⁴; a solution for this condition is needed to prevent the disability, improve the motoric function of post-stroke patients, and reduce the risk of COVID-19 infection. The utilization of telerehabilitation for stroke patients can be the answer to reduce the probability of COVID-19 infection while they can continue their physical rehabilitation.

Telerehabilitation for Stroke Patients in COVID-19 Pandemic

Telerehabilitation is a branch of telemedicine. Telerehabilitation is defined as a versatile, interdisciplinary service in facilitating physical rehabilitation care at home with various rehabilitative services for patients with disabilities through telecommunication technology.^{1,2} Telerehabilitation is the application

of telecommunication technology for supporting rehabilitation services, defined by the delivery of rehabilitation services via information and communication technologies. In the clinical term, telerehabilitation comprises a range of rehabilitation services that include assessment, monitoring, prevention, intervention, supervision, education, consultation, and counseling.⁸⁻¹⁰ The rehabilitation process is a continuous interactive process that requires frequent monitoring of the patient's functional ability, which is used to guide and adjust therapy delivery based on the patient's progress.^{1,8}

Practically, telerehabilitation has been applied before the COVID-19 pandemic happened. Telerehabilitation consisted of three elements that support each other: the home platform (patient's home), the health provider or health platform, and the health operator.² Telerehabilitation used a video-conference as a communication medium between the health care workers, i.e., a physical therapist with the patients. All exercise sessions were delivered via a telehealth provider on a tablet computer or by mobile phone. The exercises performed in each session are individually following the patient's impairments and progressed with each patient's goal.^{3,8} The physical training for post-stroke patients consisting of each motoric function strengthening goal can be seen in [Table 2](#).

Several potential telerehabilitation techniques can be used to stimulate physical exercise for post-stroke patients. These techniques help to maintain muscle strength with minimal assistance. Therefore, patients and their families can apply at home with assistance from the physical therapist through monitoring via video-conference. The techniques are as follows:

1. Portable Transcutaneous Electrical Stimulation Device

Transcutaneous electrical stimulation (TENS) devices use different current and frequency parameters to stimulate sensory and peripheral nerves. Electrical sensory input can contribute to routine rehabilitation and improve early poststroke lower-extremity impairment. This device is safe and easy to use. In

Table 2. Kind of physical exercise for improving post-stroke patient's motoric function⁶

Motor-strengthening category	Physical exercise
Upper extremity strengthening	<ul style="list-style-type: none"> ● Shoulder flexion ● Shoulder abduction ● Elbow flexion
Trunk strengthening	<ul style="list-style-type: none"> ● Row ● Modified seated abdominal crunches
Lower extremity strengthening	<ul style="list-style-type: none"> ● Hip flexion and extension ● Hip abduction ● Knee flexion and extension ● Ankle plantarflexion and dorsiflexion
Balance and functional mobility	<ul style="list-style-type: none"> ● Weight shifting ● Reaching ● Turning ● Marching ● Sit to stand from a chair.

hemiplegic and flaccid extremities, an appropriate stimulation site significantly improves the flaccid muscle of the limb. The application of TENS for more than 30 minutes on the flaccid muscle effectively reduced the chronic stroke patient's spasticity. Therefore, TENS can be an easy and simple tool for muscle exercise and maintain therapeutic effects in stroke patients. Continuous sensory stimulation periods, such as TENS with basic exercise, significantly impact patient improvement motor function after stroke.³

2. Mirror Therapy

Mirror therapy has been proven as a practical rehabilitation exercise for post-stroke patients. This therapy uses a mirror reflecting the movement of a normal limb and gives the illusion of the affected limb's movement. That visual stimulus will facilitate the neurons involved in imitative learning through interaction in the neural motor area. 15 to 60 minutes of therapy per session for 2 to 8 weeks significantly improves motor function. Practically, the mirror is usually positioned between the normal and hemiplegic limb so that the movement of the normal limb is perceived as the movement of the hemiplegic limb. This therapy is done by the physical therapist's simple instruction during a video-teleconference and can be performed under minimal assistance.³

3. Home Exercise Programs

The home exercise programs were shown to have no inferiority compared with the outpatient visit. The exercises that can be done during telerehabilitation are cycle and walking training under supervision. This exercise significantly improved the patients walking ability in the long term. Due to the simple and basic instructions, the exercise can be done smoothly at home, assisted by the patient's family member.^{3,6}

4. Virtual Reality Exercise

The utilization of virtual reality in stroke rehabilitation is increasing nowadays, concomitant with technology development. A previous study showed that virtual reality technology improved the motor function of the post-stroke patient. Virtual reality can also improve upper

limb function, gait and balance, global motor function, and cognitive function in post-stroke patients. Nevertheless, virtual reality equipment is usually expensive and complicated and may only be available in advanced specialist hospitals.¹¹ In recent years, researchers and clinicians have been studied virtual reality technology as an innovative therapy for a variety of diseases, including neurological disorders. Virtual reality allows interaction between patients and the virtual environment on the computer naturally. Virtual reality has several advantages compared to conventional rehabilitation therapy, such as sensorimotor interactions between patients and the virtual environment that allows the transfer of skills from the virtual world to the real world. Also, patient compliance and satisfaction when interacting with the virtual environment during therapy are better than conventional rehabilitation.^{11,15}

One application of virtual reality technology is the Nintendo Wii system, which is equipped with a balance board and bars that allow body movement in a virtual reality gaming environment. This advantage has proven to be useful as an adjunct therapy to improve dynamic balance in post-stroke patients.¹⁵ Some examples of video game that used virtual reality that can be applied in telerehabilitation for post-stroke patients can be seen in Figure 1.¹¹

Evidence-Based Practice of Telerehabilitation for Post-Stroke Patients

Several studies have been done regarding the efficacy of telerehabilitation. One of them is a study by Cramer et al., who did a randomized controlled trial to compare the effectiveness of home-based telerehabilitation vs. in-clinic physical therapy in 124 stroke patients with arm motor deficits. They found that both home-based telerehabilitation and in-clinic rehabilitation produced substantial gains in arm motor function.¹¹ Their study concomitant with the study hypothesis that telerehabilitation is not inferior to in-clinic therapy for improving arm motor function and stroke knowledge.^{8,11} Telerehabilitation has several advantages both for the patients and also the health workers.^{2,12} The patients' benefits include decreasing hospitalization number and the prevention of rehospitalization, an early discharge from rehabilitation units, reducing costs and saving time, and improvements in health outcomes and quality of life, and an early return to normal activity.^{6,12} The benefits for physiotherapists are that they can maintain continuous physical rehabilitation exercises, they can also provide education to patients through remote and direct consultation in the home environment, carry out physical assessments and plan a targeted physical rehabilitation exercise program, can monitor the physical development of patients, provide them with continuous feedback and supervision.^{2,6}

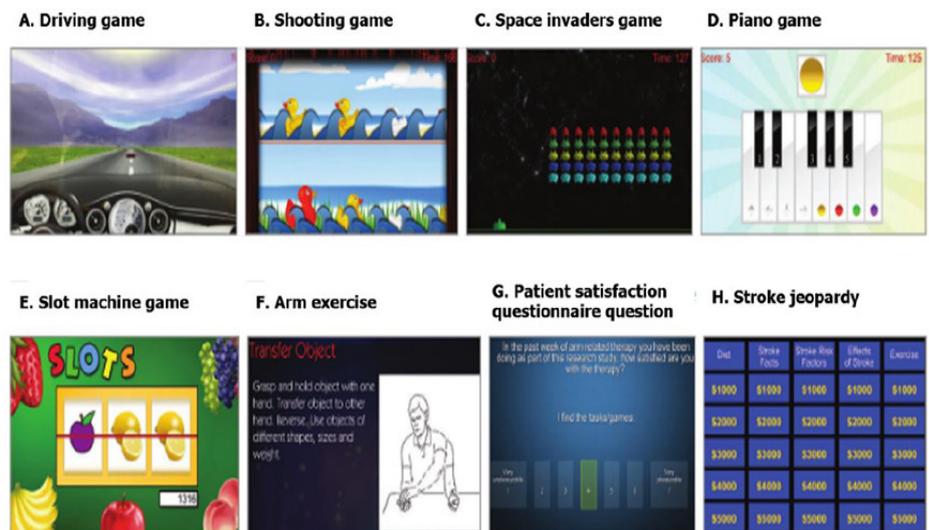


Figure 1. Examples of video game for post-stroke patients¹¹

Aside from the benefits mentioned above, the critical consideration while implementing telerehabilitation is cost.^{1,7} Cost is an essential factor because telerehabilitation is a novel program. The transition from a conventional program to innovation needs many adaptations, and the cost is the crucial part.^{7,8} Middleton et al. observed that the most considerable expense they found in the development phase of telerehabilitation was the telehealth platform's license.⁸ The telehealth platform's selection may be a proper target in cost efficiency when designing a new program. Although there are more affordable options; however, it is important to consider other features such as ease of use, compatibility with other devices, ease of testing, and transmission security.^{8,10} The limitation of this review is the small number of clinical studies included in this review. Most of the studies included in this review were literature review, editorial, and point of view articles. This is because COVID-19 is a new pandemic; therefore, clinical trial study is challenging to perform.

CONCLUSION

Telerehabilitation delivers rehabilitation services via communication technologies involving the patient and the physical therapist communicate using telehealth platform and video-teleconference. Telerehabilitation can be the solution for post-stroke patient's physical rehabilitation in the COVID-19 pandemic. This novel health innovation allowed the post-stroke patient to exercise at home and prevent them from the risk of COVID-19 infection.

CONFLICT OF INTEREST

There is no competing interest regarding the manuscript.

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AUTHOR CONTRIBUTION

I Made Yoga Prabawa, Dedi Silakarma, and M. Widnyana are responsible for the study from the conceptual framework.

REFERENCES

1. Chen J et al. Telerehabilitation approaches for stroke patients: systematic review and meta-analysis of randomized controlled trials. *Journal of Stroke and Cerebrovascular Diseases*. 2015;24(12);2660-2668.
2. Nugraha B, Wahyuni LK, Laswati H, Kusumastuti P, Tulaar AB, Gutenbrunner C. COVID-19 pandemic in Indonesia: Situation and challenges of rehabilitation medicine in Indonesia. *Acta Medica Indonesiana*. 2020; 52(3); 299.
3. Wang CC et al. Care for Patients with Stroke During the COVID-19 Pandemic: Physical Therapy and Rehabilitation Suggestions for Preventing Secondary Stroke. *Journal of Stroke and Cerebrovascular Diseases*. 2020; 105182.
4. Stein J, Visco CJ, Barbuto S. Rehabilitation Medicine Response to the COVID-19 Pandemic. *American Journal of Physical Medicine & Rehabilitation*. 2020.
5. Sylaja PN et al. The SARS-CoV-2/COVID-19 pandemic and challenges in stroke care in India. *Annals of the New York Academy of Sciences*. 2020.
6. Turolla A, Rossetini G, Viceconti A, Palese A, Geri T. Musculoskeletal physical therapy during the COVID-19 pandemic: is telerehabilitation the answer?. *Physical therapy*. 2020; 100(8); 1260-1264.
7. Falvey JR, Krafft C, Kornetti D. The essential role of home-and community-based

physical therapists during the COVID-19 pandemic. *Physical therapy*. 2020; 100(7), 1058-1061.

8. Middleton A, Simpson KN, Bettger JB, Bowden MG. COVID-19 Pandemic and Beyond: Considerations and Costs of Telehealth Exercise Programs for Older Adults With Functional Impairments Living at Home—Lessons Learned from a Pilot Case Study. *Physical Therapy*: 2020.
9. Mantovani E et al. Telemedicine and virtual reality for cognitive rehabilitation: a roadmap for the COVID-19 pandemic. *Frontiers in neurology*. 2020; 11.
10. World Health Organization. Telemedicine: Opportunities and Development in Member States. 2010. WHO: Geneva.
11. Cramer SC, Dodakian L, Le V, See J, Augsburg R, McKenzie A, Scacchi W. Efficacy of home-based telerehabilitation vs. in-clinic therapy for adults after stroke: a randomized clinical trial. *JAMA neurology*. 2019; 76(9); 1079-1087.
12. Quigley A, Johnson H, McArthur C. Transforming the Provision of Physiotherapy in the Time of COVID-19: A Call to Action for Telerehabilitation. 2020
13. Chang MC & Revéret BM. Usefulness of telerehabilitation for stroke patients during the COVID-19 pandemic. *American Journal of Physical Medicine & Rehabilitation*. 2020.
14. Hu Y, Sun J, Dai Z, Deng H, Li X, Huang Q, Xu Y. Prevalence and severity of coronavirus disease 2019 (COVID-19): A systematic review and meta-analysis. *Journal of Clinical Virology*. 2020; 104371.
15. Dos Santos et al. The use of Nintendo Wii in the rehabilitation of poststroke patients: a systematic review. *Journal of Stroke and Cerebrovascular Diseases*. 2015; 24(10); 2298-2305.



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