

**Original Research****Assessment of Stroke Patients' Muscle Strength Following a Combination of Mirror Therapy and ROM (Range of Motion) Exercises Based on Self-Care Theory****Ima Nadatien<sup>1\*</sup>, Umi Salamah<sup>2</sup> Nur Hidaayah<sup>3</sup>**<sup>2</sup> Department of Nursing Masters, Faculty of Nursing and Midwifery, Nahdlatul Ulama University, Surabaya, Indonesia<sup>1,3</sup> Universitas Nahdlatul Ulama Surabaya, East Java, Indonesia**ABSTRACT**

**Background:** When blood flow problems kill off some brain cells, the result is a neurological deficiency known as a stroke. There have been 507 reported cases of stroke in East Java, while the overall stroke prevalence in Indonesia has jumped from 7% to 10.9% (Riskesdas, 2020). The researchers at RSI Darus Syifa's Surabaya set out to determine how much of an impact self-care theory-based mirror therapy and range-of-motion exercises had on the muscular strength of stroke patients admitted to the inpatient unit.

**Methods:** A true experimental with a pretest-posttest control group design was utilised in this type of research. One hundred and ten stroke patients made up the study's population. There were a total of 34 participants in this study, with 17 serving as control subjects and 17 as interventionists. Sampling was based on probability sampling using simple random sampling. The Medical Research Council (MRC) scale was utilised by the device to measure muscular strength. Mann-Whitney and the Wilcoxon Signet Rank Test were used to examine the collected data.

**Results:** In the inpatient ward of the Darus Syifa Surabaya Hospital, stroke patients who undergo a combination of mirror therapy and range of motion exercises based on self-care theory show a significant improvement in muscle strength, according to the Mann-Whitney test ( $p < 0.05$ ).

**Conclusion:** The study found that stroke patients' muscle strength improved with a combination of mirror therapy and range of motion exercises grounded in self-care theory.

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**INTRODUCTION**

When blood arteries in the brain get clogged or burst, it can lead to a condition known as a stroke, which is characterised by a loss of neurological function. As a result of motor control disorders, which can lead to a lack of coordination, body balance, and

the ability to maintain certain positions, paresis of the upper limbs is a common complication for stroke patients who endure ongoing neurological deficits that impact their day-to-day functioning. Stroke survivors also commonly have reduced motor function in both their upper and lower limbs, which limits their functional movement, and hemiparesis affects 55% to 75% of them.

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The prevalence of stroke in Indonesia based on diagnosis by health workers is 7 per mile, and those diagnosed by health workers or symptoms are 12.1 per mile. The prevalence of stroke based on diagnosis by health workers and symptoms is highest in South Sulawesi (17.9%), DI Yogyakarta (16.9%), Central Sulawesi (16.6%), followed by East Java at 16 per mile (Riskesdas, 2018). The prevalence of stroke in the city of Surabaya also increased in 2007–2013. In 2007, the prevalence of stroke in Surabaya was 0.7%, then in 2013, it increased by 16.2% (Depkes RI, 2013).

According to the results of the 2013 Riskesdas survey, the number of stroke sufferers was 507 patients in the province of East Java, and the highest percentage of stroke sufferers was in the city of Surabaya, and data on the dependency level of the elderly due to stroke was 39.53% depending on the total and 7.63% depending on moderate in meeting daily needs. The prevalence of stroke in Indonesia based on diagnosis by health workers is 7 per mile, and those diagnosed by health workers or symptoms are 12.1 per mile. The prevalence of stroke based on diagnosis by health workers and symptoms is highest in South Sulawesi (17.9%), DI Yogyakarta (16.9%), Central Sulawesi (16.6%), followed by East Java at 16 per mile (Riskesdas, 2018).

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According to the theory of care, adults should constantly work to improve their own lives, health, and quality of life. According to Orem, self-care is an individual's responsibility in order to keep themselves well and to lessen the impact of whatever illness they may be afflicted with. Stroke is defined by the appearance of symptoms that

damage a person's health and have a lasting effect on their life. An integral part of managing a stroke is practicing self-care.

From January to March 2022, 103 stroke patients were treated in the inpatient rooms at the Islamic Hospital Darus Syifa's Surabaya. Of those, 84 patients, or 82%, developed hemiparesis, according to a preliminary study. In order to help stroke patients with hemiparesis, physiotherapists will have them do passive range-of-motion exercises for about 10 minutes once while they're in the hospital. The goal is to get the family involved so they can be there for the client emotionally and psychologically, which the patient can undergo once they leave the hospital.

Researchers also obtained data that the success rate of ROM (*Range of Motion*) therapy to increase the degree of muscle strength was still not optimal, namely 87% (73 patients) with a muscle strength scale of 1-2 when discharged from the hospital. Stroke patients can benefit from a mix of mirror therapy and range of motion exercises to increase their muscle strength. A novel approach to rehabilitation, mirror therapy encourages the patient to move their healthy limbs in a controlled environment. Reducing pain and improving motor function of the upper extremities in stroke patients, mirror therapy involves viewing and moving healthy limbs in front of a mirror while sick ones are behind it (bilateral training) (Weber, Nilsen, Gillen, Yoon, & Stein, 2019; R.-Z. Yuan et al., 2021).

The use of mirror therapy can help stroke survivors regain some of their lost strength and mobility. Early ROM exercises can boost strength by stimulating the motor units involved, which is why they are so effective in maintaining or improving the level of perfection in the ability to move joints normally and completely, which in turn increases muscle mass and tone. the muscles (Birinci, Kaya Mutlu, & Altun, 2022; Hekim, Çolak, & Bonab, 2023; Louw et al., 2017; Tekeoglu Tosun, Ipek, Razak Ozdincler, & Saip, 2021). The respondent's hand and foot strength can be enhanced with a range of motion exercises, and delayed stroke treatment can lead to long-term handicaps (Potter & Perry, 2017).

## **MATERIALS AND METHOD**

This study employed a pre-and post-test control group design to conduct its experiments. One hundred and ten stroke patients made up the study's population. There were a total of 34 participants in this study, with 17 serving as control subjects and 17 as interventionists. Sampling was based on probability sampling using simple random sampling. The Medical Research Council (MRC) scale is utilised by the device that measures muscular strength. We used the Mann-Whitney U-test and the Wilcoxon Sign Rank test to examine the collected data.

Participants underwent a structured intervention programme that included both the control and intervention groups. The intervention group received a specific dose of physiotherapy exercises tailored to improve muscular strength. The exercises were administered at a frequency of three sessions per week, each session lasting for 60 minutes, over a total duration of 12 weeks. The control group received standard care without the additional physiotherapy exercises. The effectiveness of the intervention was evaluated by comparing pre-and post-test results of both groups, using the MRC scale to measure changes in muscular strength.

## **RESULTS**

The majority of respondents who experienced a stroke were male (62%). Table 1 shows that there was no gender difference between the control and intervention groups (14 in the former and 7 in the latter), with a p-value of 0.123. The majority of stroke survivors (56%) were in their 46-55 year old (early elderly) years.

Of the total sample size of 19, 10 were in the intervention group and 9 were in the control group; a p-value of 0.268 indicates that there was no significant difference in age between the two. With a value of 0.549, there was no difference in the level of education between the intervention group and the control group. The majority of stroke survivors (53%) had basic education.

There were 10 individuals in the intervention group and 8 people in the control group. There was no difference in the degree of work between the intervention group and the control group ( $p = 0.205$ ), and nearly half of the respondents who had a stroke (41%), based on occupation, did not work. Nearly three-quarters of stroke survivors reported their symptoms for less than a year. The p-value for the difference in suffering duration between the control and intervention groups was 0.144, indicating no significant difference.

**Table 1.** Distribution of the frequency characteristics of respondents who had a stroke at Darus Syifa' Hospital Surabaya in 2022

Characteristics	Group				Total		of Equity Value
	Intervention		Control		F	%	
	F	%	F	%			
<b>Age</b>							
46 - 55 <sup>years</sup>	10	57	9	54	19	56	0.368
56 – 50 <sup>years</sup>	6	40	7	43	13	38	
> 65 <sup>years</sup>	1	3	1	3	2	6	
<b>Total</b>	17	100	17	100	34	100	
<b>Gender</b>							
Male	14	83	7	24	21	62	0.123
Female	3	17	10	76	13	38	
<b>Total</b>	17	100	17	100	34	100	
<b>Education Level</b>							
(SD, SMP)	10	74	8	68	18	53	0.549
Secondary (SMA)	15	22	6	19	11	32	
High(D3,S1,S2)	2	4	3	13	5	15	
<b>Total</b>	17	100	17	100	34	100	
<b>Employment</b>							
Not Working	8	49	6	31	14	41	0.205
PNS/TNI/Polri	2	14	2	15	4	12	
Farmers/traders/laborers	5	32	6	31	11	32	
Private/ Entrepreneurs	2	5	3	23	5	15	
<b>Total</b>	17	100	17	100	34	100	
<b>Length of Suffering</b>							
< 1 <sup>year</sup>	14	89	12	79	26	77	0.144
> 1 <sup>year</sup>	3	11	5	21	8	23	
<b>Total</b>	17	100	17	100	34	100	

**Table 2.** An examination of the pre- and post-treatment muscle strength of stroke patients in the inpatient room of Darus Syifa's Surabaya Hospital in 2022 using data derived from the Self Care Theory

Variables	Group	N	Mean Rank	Sum of Rank (Positive)	Min Max
Muscle Strength	Interventional	17	9.00	153.00	3 – 5
	Control	15	8.00	120.00	2 – 4
Statistical Analysis		<i>Wilcoxon</i> = 0.000 < (0.05)			

Table 2 shows that no respondent in Negative Ranks had a lower posttest score than their pretest score; 17 intervention group and 15 control group respondents had higher posttest scores than their pretest scores; and 2 control group respondents had identical posttest and pretest values in ties. A significant difference was found between the pre-and post-test results of muscle strength in the intervention group and the control group when the Wilcoxon Sign Rank Test was used to compare the two groups. The significance level was sig (2-tailed) = 0.000 < = 0.05.

**Table 3.** Research conducted in 2022 at the Inpatient Room of RSI Darus Syifa' Surabaya on the effects of a self-care theory-based intervention involving mirror therapy and range of motion (ROM) on the muscle strength of stroke patients

Variables	Group	N	Mean Rank	Sum of Rank	Mann-Whitey U
Muscle Strength	Interventional	17	25.06	426.00	16.000
	Control	17	9.94	169.00	
Statistical Analysis		<i>Mann - Whitney</i> = 0.000 < (0.05)			

The intervention group has the higher average value of the two groups, as seen in Table 5.5 above. Final Product The strength of the muscles in both the intervention and control groups was compared using the Mann-Whitney test. The results showed a significant difference between the two groups, indicating that the intervention group's use of mirror therapy in conjunction with ROM (Range of Motion) exercises based on self-care theory had an impact on the muscle strength of stroke patients in the inpatient room of RSI Darus Syifa's Surabaya.

## DISCUSSION

According to the study's findings in Table 1, which compares the intervention and control groups using the Mann-Whitney test, the post-test data for the control group is significantly different from the post-test data for the intervention group in terms of muscle strength. This suggests that the combination of mirror therapy and range of motion exercises based on self-care theory has an effect on the muscle strength of stroke patients in the inpatient room of RSI Darus Syifa's Surabaya.

As a kind of motor imagery-based rehabilitation, mirror therapy involves the use of a mirror to deliver visual stimulation, which the afflicted body part then attempts to mimic. Roger-Ramachandran was the first to propose this treatment to alleviate post-amputation pain. Innovative and cutting-edge, mirror therapy creates the optical illusion of motor recovery by having patients perceive and move healthy limbs in front of a mirror while their paresis limbs are behind it. (Kim, Song, Park, & Lee, 2023; Seyyah & Topuz, 2023; R. Yuan et al., 2023).

It takes time for stroke victims to recover and achieve their full adjustment function following a first or subsequent attack. Joint mobilisation with range of motion is one rehabilitation programme that can be given to stroke patients; however, recovery is faster for patients who experience a first-attack stroke compared to those who experience a second or advanced stroke. Therefore, therapy is urgently needed to reduce advanced cerebral injury. Stroke survivors may find relief through medical rehabilitation, which may include physiotherapy.

Patients can improve their mobility, stability, and overall health with the help of physiotherapy. Stroke sufferers must take their physiotherapy programmes seriously. If the goal of physiotherapy is to increase mobility and function as quickly as possible, then everyone participating in the programme must take it seriously. How well this programme works depends on how well patients follow their physiotherapy regimen.

There may be adverse effects on patients if they do not adhere to their physiotherapy regimen (Rahayu, 2020). According to Table 5.1, 26 individuals were surveyed after a stroke occurred at RSI Darus Syifa's Surabaya over the last year. Of these, 14 were assigned to the intervention group and 12 were placed in the control group.

There are other alternatives that can be applied to stroke patients to improve sensory-motor functional status and are non-invasive, economical interventions that are directly related to the contralateral motor system that has lesions, namely range of motion exercise therapy using mirror *therapy*) (Phansopkar & Qureshi, 2022; Salhab, Sarraj, & Saleh, 2016; Yalçın, Mülkoğlu, Gülmez, & Genç, 2024). This procedure is performed by placing a mirror in the patient's midsagittal plane so that the patient can see the image of the healthy limb, and provide visual feedback that can correct the paresis of the limb.

The purpose of range of motion (ROM) exercises is to build muscle and improve flexibility by preserving and expanding the range of motion in the joints. Early range-of-motion (ROM) exercises can boost muscular strength by stimulating more motor units to work together; this, in turn, leads to an increase in muscle strength; and, if left untreated, hemiparesis patients risk irreversible disability (Li, Wei, Gou, & He, 2018; Rispati, Ernawati, Supriyadi, Riskawaty, & Halid, 2023; Suwardianto, 2013).

Together, mirror therapy and range-of-motion exercises (ROM) stimulate motor functions in a way that neither alone nor in conjunction with ROM exercises can: visual stimulation activates the sensory-motor cortex, which in turn activates the parietal cortex and cerebellum, causing muscles to contract. Furthermore, mirror therapy's visual cues excite neurone cells in the brain's visual cortex, which in turn promotes motor activation and coordination of movement in the limbs. Patients with this ailment who receive a mix of mirror therapy and ROM (range of motion) treatments tend to heal more quickly (Alitonang, 2020; Amasyali & Yaliman, 2016; Ribeiro & Silva, 2019; Suryani, 2019; Wilastri M. Alitonang, 2020).

Indrawati (2018) reported on another study that used 30 participants to examine the effects of mirror therapy and range-of-motion exercise treatment on cortisol levels and upper-extremity motor strength in stroke survivors at Dr. Wahidin Sudiro Husodo Mojokerto Hospital. According to Rofina's (2019) research, which included ten participants in the internal treatment room of RSUD dr. TCHillers Maumere, patients with decreased physical mobility as a result of a stroke showed an effect of mirror therapy on muscle strength.

The explanation above shows empirical evidence that the combination exercise technique of mirror therapy and ROM is able to increase muscle strength and physical mobility in stroke patients. Where *mirror therapy* can help increase muscle strength and joint stiffness so that patients can see the image of a healthy hand and provide visual feedback that can improve hands. Therapy performed on stroke patients is aimed at developing, maintaining, and restoring motion by means of motor exercise therapy, stimulating the hands to perform a movement or muscle contraction, thus helping to restore limb function lost due to stroke.

## CONCLUSION

Research conducted at the Inpatient Room of Darus Syifa's Surabaya Hospital on stroke patients found that a combination of mirror therapy and ROM (range of motion) based on self-care theory significantly improved muscle strength compared to pre- and post-treatment measures. In the inpatient room of Darus Syifa's Surabaya Hospital, patients who have suffered a stroke can improve their muscle strength through a programme that combines mirror therapy with ROM (Range of Motion), which is based on self-care theory. Integrating mirror therapy and ROM exercises into the rehabilitation protocols for stroke patients can significantly enhance muscle strength and recovery.

Healthcare professionals should be trained to deliver these therapies effectively, ensuring they are incorporated into routine patient care. Educating patients and their families on the benefits and techniques of these therapies is crucial, allowing them to continue exercises at home. Regular monitoring of patient progress is essential to adjust therapy plans as needed, ensuring optimal outcomes.

A multidisciplinary approach involving physiotherapists, occupational therapists, and nurses will provide comprehensive care, while customised therapy plans tailored to individual patient needs will maximise rehabilitation benefits. Future research should focus on the long-term effects of combining mirror therapy and ROM exercises on stroke patients, considering different stages of recovery. Expanding studies to include larger and more diverse patient populations will provide more generalizable results.

Developing digital tools or mobile applications to guide patients through these exercises at home could enhance adherence and track progress. Additionally, incorporating patient feedback into therapy protocols can help refine and improve interventions, making them more patient-centred and effective.

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