


## Overview of Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan Year 2024

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Article Info	ABSTRACT
<p><b>Keywords:</b> Knowledge, awareness action, early detection of breast cancer, female students</p>	<p>Motor function is a function consisting of two components of motor response to stimuli and motor coordination strength. The type of research in this study is descriptive with a quantitative research design, with a population of 34 respondents, the sampling technique in this study was purposive sampling. The instrument used was a motor function observation sheet. It was obtained that the majority of respondents were in the motor function with the TRACE category, namely 17 respondents (50%) motor function with the NORMAL category with a total of 13 respondents (38.2%), motor function with the POOR category, with a total of 3 respondents (8.8%), and the lowest was the respondent with the FAIR motor function category, namely 1 respondent (2.9%). Based on the research and data processing that has been carried out regarding Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, totaling 34 respondents, it was concluded that Based on the research results obtained from 3-4 respondents regarding the Description of Superior and Inferior Dextra Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, the majority of respondents were in the motor function with the TRACE category with no limb movements at all.</p>
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### INTRODUCTION

Motor function is a function that consists of two components, motor response to stimuli and motor coordination strength (Dwi Anto et al., 2022) . Motor function assessment involves evaluating the type of stimulus needed to elicit a motor response. This assessment provides information to the health care team regarding the level of alertness needed to elicit a motor response and the patient's ability to follow commands (Xie et al., 2021) . Evaluation of motor strength and coordination provides an indication of possible problems with the neuronal pathways or cerebellum (Chen et al., 2023) .

Physical assessment of motor function includes symmetrical muscle groups, good gross and fine motor groups, free movement of all extremities according to ROM ( *Range Of Motion* ) , *negative Romberg test* , no *pronator drift* (a test that is useful for detecting mild paralysis), smooth gait that maintains balance when walking on the toes and heels, rapid changing movements ( *point to point maneuvers* ) can be done without difficulty (Xie et al., 2021) .

Global and national data show a significant increase in stroke cases in recent decades. Based on data from the World Health Organization (WHO) in 2020, the number of deaths due to stroke jumped drastically from 2 million to 8.9 million in 2019. A similar situation also occurred in Indonesia, as reflected in the 2019 Basic Health Research (Riskesdas) data. The results of Riskesdas showed that the prevalence of stroke in Indonesia reached 7.0%, with the age group of 75 years and over being the most affected group. Men also tend to be more susceptible to stroke than women. Furthermore, a study at Dr. Pirngadi Hospital Medan revealed that the prevalence of hemorrhagic stroke was higher compared to other types of stroke in the patient population studied.

Motor dysfunction includes hemiparesis and hemiplegia. After a stroke, a person may experience hemiparesis, or weakness, or hemiplegia, or paralysis, in one or more parts of the body. These disabilities are often caused by a stroke in the middle or anterior cerebral artery, which in turn causes an infarction in the motor neurons of the frontal cortex, which controls movement. The arm and leg on the same side of the body, as well as half of the face and tongue, can experience total hemiplegia. Because the nervous system is pyramidally connected to the spinal cord, a stroke on the right side of the brain will cause hemiplegia on the left (left) side of the body, and vice versa (Einstad et al., 2021) .

When a person's motor function is impaired, some common problems that can occur include: the individual has difficulty performing normal body movements, such as walking, running, or even moving from one place to another (Agustin et al., 2022) ; motor disorders often cause coordination problems. This can result in clumsy or uncoordinated movements, as well as difficulty performing tasks that require hand-eye coordination or fine motor skills (Geneva & Usman, 2023) ; there is a possibility of muscle weakness, which can affect strength and ability to perform daily activities. This can cause difficulty lifting objects, standing, or performing other physical activities (Wijaya, 2019) ; muscles may become stiff or tense, resulting in difficulty performing fluid and flexible movements. This stiffness can greatly interfere with mobility and comfort (O'Connor et al., 2020) .

Non-traumatic cerebral circulatory disorders, such as stroke, can cause a variety of neurological symptoms that appear acutely. These symptoms, including hemiparesis which affects about 65% of stroke patients (Xie et al., 2021), are manifestations of rapid brain damage. The pathophysiological mechanism of stroke involves disruption of oxygen and nutrient supply to brain tissue, leading to nerve cell death. People with weak muscles can become immobile, which can cause major problems due to reduced physical activity (Wijaya, 2019) .

Improving motor function in stroke patients requires a multidisciplinary approach involving various therapeutic strategies including physical therapy to strengthen muscles and increase range of motion (Lestari et al., 2019) , occupational therapy helps patients learn or relearn daily skills such as eating, dressing, and bathing in a way that suits their abilities (Mafra et al., 2022) ; motor recovery exercises to target specific motor functions affected by stroke (Taylor et al., 2024) ; functional stimulation and rehabilitation therapy, namely to combine cognition and motor skills, such as games involving thinking and movement skills, can help improve motor function (Xie et al., 2021) ; the use of assistive devices and technology

such as walkers or canes to help patients move more safely (Mandani & Saputra, 2023) ; speech and language therapy (Yuliyanto et al., 2021) , pain and spasticity management, intensive rehabilitation programs (Tohanean et al., 2023) , psychological approaches and emotional support (Al-Yahya et al., 2023) .

Non-pharmacological therapies can be used to treat stroke; the more often and earlier non-pharmacological therapies are given, the greater the chance of restoring function and preventing complications of immobilization and further disability (Agustin et al., 2022). Range of motion exercises are one of these therapies. Early ROM exercises can increase muscle strength and avoid permanent disability. Range of motion (ROM) exercises aim to maintain joint flexibility and increase muscle strength. Regular movements in ROM help joints move more freely and stimulate muscle growth. (O'Connor et al., 2020) .

Warm compresses and active range of motion exercise therapy are solutions to make stroke patients' muscles stronger, according to the findings of the Listiana study (2020). Previous studies have shown that there is an effect in building muscle strength, with range of motion having a greater effect on muscle strength.

Dwi Anto et al. (2022) found that bilateral ROM exercises were more effective in increasing muscle strength compared to unilateral ROM exercises. On the other hand, Lestari et al. (2019) showed that in general, ROM exercise interventions were effective in maintaining or improving joint movement ability and also contributed to increasing muscle mass and tone in stroke patients. The results of this study indicate that both unilateral and bilateral ROM exercises have potential in the rehabilitation of stroke patients, although with different emphases on the aspect of muscle strength.

## METHOD

This study is a quantitative study with Descriptive. The population in this study were non-hemorrhagic stroke patients at Santa Elisabeth Hospital Medan. Sampling using *Purposive Sampling technique* . The sample obtained in this study was 34 respondents. The data collection technique used an observation sheet regarding motor function, namely an observation sheet. Data analysis using univariate analysis with the results of the study obtained that the majority of respondents were in the motor function with the TRACE category, namely 17 respondents (50%) motor function with the NORMAL category with a total of 13 respondents (38.2%), motor function with the POOR category, with a total of 3 respondents (8.8%), and the lowest was the respondent with the FAIR motor function category, namely 1 respondent (2.9%) .

## RESULTS

**Table 5.3** Frequency distribution based on demographic data on the Motor Function Overview of Non-Hemorrhagic Stroke at Santa Elisabeth Hospital Medan in 2024

Characteristics	f	%
Gender		

Characteristics	f	%
Man	20	58,8
Woman	14	41,2
Total	34	100
Age		
> 60 Years	10	29.4
< 60 Years	24	70.6
Total	34	100
Last education		
SD	10	29.4
JUNIOR HIGH SCHOOL	16	47.1
SENIOR HIGH SCHOOL	4	11.8
PT	4	11.8
Total	34	100

Based on table 5.3, it is obtained that from 3-4 respondents, the majority of respondents are male, totaling 20 respondents (58.8 %) and the minority are female, totaling 13 respondents (41.2 %). Based on the age of the respondents, the majority are aged <60 years, totaling 24 (70.6 %) and the minority are aged >60, totaling 10 respondents (29.4 %). Based on the last education, the majority have junior high school education with a total of 16 respondents (47.1 %) and the minority have college education totaling 4 respondents (11.8 %).

**Table 5.4 .** Frequency and Percentage Distribution of Superior Right Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024

Classification	f	%
Zero	0	0
Trace	17	50
Poor	3	8.8
Fair	1	2.9
Good	0	0
Normal	13	38.2
TOTAL	34	100

Based on Table 5.4 shows the frequency distribution and percentage of superior dextra motor function in non-hemorrhagic stroke patients at Santa Elisabeth Hospital Medan in 2024, the highest were respondents with TRACE category motor function with a total of 17 respondents (50%), motor function with NORMAL category with a total of 13 respondents (38.2%), motor function with POOR category with a total of 3 respondents (8.8%), and the lowest were respondents with FAIR motor function category, namely 1 respondent (2.9%).

**Table 5.5 .** Frequency and Percentage Distribution of Left Superior Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024

Classification	f	%
Zero	0	0
Trace	17	50

Classification	f	%
Poor	4	11.8
Fair	4	11.8
Good	3	8.8
Normal	6	17.6
TOTAL	34	100

Based on Table 5.5 shows the frequency distribution and percentage of left superior motor function in non-hemorrhagic stroke patients at Santa Elisabeth Hospital Medan in 2024, the highest were respondents with motor function in the TRACE category with a total of 17 respondents (50%), motor function with the NORMAL category with a total of 6 respondents (17.6%), motor function with the POOR category with a total of 4 respondents (11.8%), motor function with the FAIR category with a total of 4 people (11.8%), and the lowest were respondents with the GOOD motor function category, namely 3 respondents (8.8%).

**Table 5.6 .** Frequency and Percentage Distribution of Inferior Right Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024

Classification	f	%
Zero	0	0
Trace	17	50
Poor	3	8.8
Fair	1	2.9
Good	0	0
Normal	13	38.2
TOTAL	34	100

Based on Table 5.6 shows the frequency distribution and percentage of superior dextra motor function in non-hemorrhagic stroke patients at Santa Elisabeth Hospital Medan in 2024, the highest were respondents with TRACE category motor function with a total of 17 respondents (50%), motor function with NORMAL category with a total of 13 respondents (38.2%), motor function with POOR category with a total of 3 respondents (8.8%), and the lowest were respondents with FAIR motor function category, namely 1 respondent (2.9%).

**Table 5.7 .** Frequency and Percentage Distribution of Inferior Left Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024

Classification	f	%
Zero	0	0
Trace	17	50
Poor	4	11.8
Fair	4	11.8
Good	3	8.8
Normal	6	17.6
TOTAL	34	100

Based on Table 5.7 shows the distribution of frequency and percentage of left superior motor function in non-hemorrhagic stroke patients at Santa Elisabeth Hospital Medan in 2024, the highest were respondents with motor function in the TRACE category with a total of 17 respondents (50%), motor function with the NORMAL category with a total of 6 respondents (17.6%), motor function with the POOR category with a total of 4 respondents (11.8%), motor function with the FAIR category with a total of 4 people (11.8%), and the lowest were respondents with the GOOD motor function category, namely 3 respondents (8.8%).

## Discussion

### Description of Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024

Based on the research results obtained from 3-4 respondents regarding the Description of Superior Dextra Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, that the majority of respondents were in the motor function with the TRACE category, no limb movement at all, visible/palpable muscle contraction vibrations, namely 17 respondents (50%) motor function with the NORMAL category active movement against full resistance without muscle fatigue (normal muscle motor function), with a total of 13 respondents (38.2%), motor function with the POOR category can move extremities, cannot withstand weight, cannot resist examiner pressure, with a total of 3 respondents (8.8%), and the lowest is the respondent with the FAIR motor function category can move extremities, can withstand weight, cannot resist pressure, namely 1 respondent (2.9%).

Based on the research results obtained from 3-4 respondents regarding the Description of Superior Left Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, that the majority of respondents were in the motor function with the TRACE category, no limb movement at all, visible/palpable muscle contraction vibrations, namely 17 respondents (50%), motor function with the NORMAL category, active movement against full pressure without muscle fatigue (normal muscle motor function) with a total of 6 respondents (17.6%), motor function with the POOR category, can move the extremities at all visible/palpable muscle contraction vibrations, with a total of 4 respondents (11.8%), motor function with the FAIR category can move the extremities, can withstand weight, cannot resist pressure with a total of 4 people (11.8%), and the lowest is the respondent with the GOOD motor function category, can move joints to withstand weight, can resist light resistance on the examiner, namely 3 respondents (8.8%).

Based on the research results obtained from 3-4 respondents regarding the Description of Inferior Dextra Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, that the majority of respondents were in the motor function with the TRACE category, no limb movement at all, visible/palpable muscle contraction vibrations, namely 17 respondents (50%) motor function with the NORMAL category active movement against full resistance without muscle fatigue (normal muscle motor function), with a total of 13 respondents (38.2%), motor function with the POOR category can move extremities, cannot withstand weight, cannot resist examiner pressure, with a total of 3 respondents

(8.8%), and the lowest was the respondent with the FAIR motor function category can move extremities, can withstand weight, cannot resist pressure, namely 1 respondent (2.9%).

Based on the research results obtained from 3-4 respondents regarding the Description of Inferior Sinistra Motor Function in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, that the majority of respondents were in the motor function with the TRACE category, no limb movement at all, visible/palpable muscle contraction vibrations, namely 17 respondents (50%), motor function with the NORMAL category, active movement against full pressure without muscle fatigue (normal muscle motor function) with a total of 6 respondents (17.6%), motor function with the POOR category, can move the extremities at all visible/palpable muscle contraction vibrations, with a total of 4 respondents (11.8%), motor function with the FAIR category can move the extremities, can withstand weight, cannot resist pressure with a total of 4 people (11.8%), and the lowest is the respondent with the GOOD motor function category, can move joints to withstand weight, can resist light resistance on the examiner, namely 3 respondents (8.8%).

The majority of patients had junior high school education, namely 16 respondents (47.1%). Researchers assume that education can affect the motor function of non-hemorrhagic patients because with broad knowledge and insight, someone can find ways to improve their own motor function. This is in line with Nurjaman's research (2023), education can increase a person's insight or knowledge in general, someone with a higher education will have broader knowledge and a positive attitude compared to someone with a lower level of education.

Based on the classification of the age range of non-hemorrhagic patients, the majority are in the age range <60 years as many as 24 respondents (70.4%). Researchers assume that the older the age, the greater the risk of stroke. People with age >50 years tend to experience stroke twice, because the older, the blood vessels become thinner and more fragile. The age range reaches 50 years, humans will experience a loss of 10-20% of the strength and muscle mass as they had at the age of 30 years. Increasing age makes muscles weaker and muscle mass smaller so that the power and force produced are weaker. Reaching the age of 50 years can cause a decrease in the function of the human musculoskeletal system. Reduced muscle mass is the cause of decreased muscle endurance which occurs more in the lower extremity organs

This is in line with research by Sesep et al. (2024), non-hemorrhagic stroke sufferers are more likely to be over 45 years of age because at that age there is weakness in muscle strength in both the upper and lower extremities, all parts of the body's extremities experience functional decline, especially in motor function.

Based on gender, the majority of patients were male, as many as 20 respondents (58.8%). Researchers assume that male gender influences the incidence of non-hemorrhagic stroke. This can be seen from the lifestyle of men who smoke a lot, drink alcohol, so that it can interfere with motor function in patients with non-hemorrhagic stroke. This is in line with research by Ilham Darmawan, Indhit Tri Utami (2024), stating that stroke is known to be more common in men than women. This may be more related to other triggering factors that are more common in men than women, such as smoking, drinking alcohol, and so on.

Based on the results of Harsono's 2009 research (in Setiawan's 2020 research), it was stated that patients who experience non-hemorrhagic strokes are caused by a disruption in the blood supply to the brain which causes disruption of neuron function, so that the resulting impact will cause disruption of impulse transmission which then affects the strength of the hand muscles or impaired motor function in non-hemorrhagic stroke patients.

Researchers assume that poor motor function in patients with non-hemorrhagic stroke is further exacerbated by the lack of activity or activities carried out by the patient after being diagnosed with Non-Hemorrhagic Stroke, because the ability and range of motion are already impaired and do not function properly/not normally, so this will affect their motor function.

Based on the results of the study, all respondents involved in this study showed symptoms of hemiparesis or hemiplegia, which indicate a disorder in the central nervous system, especially on one side of the body. Hemiparesis and hemiplegia are conditions that describe weakness (hemiparesis) or paralysis (hemiplegia) on one side of the body, which is generally caused by damage to the brain.

Based on these results, it can be concluded that damage to a particular brain hemisphere is most likely to occur in the brain hemisphere opposite the affected side of the body. Respondents experienced Hemiparesis/Paralysis on the right side of the body occurs because damage occurs in the left hemisphere of the brain, respondents who experience Hemiparesis/Paralysis on the left side of the body occurs due to damage to the right hemisphere of the brain, which also controls the opposite side of the body. The results showed that all respondents experienced hemiparesis or hemiplegia, which means there is an indication of damage to the hemisphere of the brain that controls the affected side of the body. This can be caused by various factors, such as stroke, traumatic brain injury, or other vascular disorders.

One of the causes of brain damage is non-hemorrhagic stroke. Non-Hemorrhagic Stroke occurs due to thrombus due to atherosclerotic plaque that provides vascularization to the brain or by emboli from blood vessels outside the brain that are stuck in the cerebral arteries. Thrombus and emboli in the blood vessels will be released and lowered until trapped in the distal blood vessels, then causing reduced blood flow to the brain so that brain cells will experience a lack of nutrition and oxygen which causes brain infarction. Infarction in the hemispheres of both brains can cause paralysis with weakness on the opposite side of the body. While bilateral infarction can cause damage to the hemisphere side area or paralysis/parase of both extremities and decreased muscle strength and passive range of motion on both sides or opposite (Lestari et al., 2019)

## CONCLUSION

Based on the results of the Motor Function Description in Non-Hemorrhagic Stroke Patients at Santa Elisabeth Hospital Medan in 2024, a study with 34 respondents found that the majority of respondents were in the TRACE category motor function, namely 17 respondents (50%), NORMAL category motor function with 13 respondents (38.2%), POOR category motor function, with 3 respondents (8.8%), and the lowest was the respondent with the FAIR motor function category, namely 1 respondent (2.9%).

## REFERENCES

- Agustin, T., Susanti, I. H., & Sumarni, T. (2022). Implementasi Penggunaan Range Of Motion (ROM) Terhadap Kekuatan Otot Klien Stroke Non Hemoragik. *Journal of Management Nursing, 1*(4), 140–146. <https://doi.org/10.53801/jmn.v1i4.70>
- Al-Yahya, E., Esser, P., Weedon, B. D., Joshi, S., Liu, Y. C., Springett, D. N., Salvan, P., Meaney, A., Collett, J., Inacio, M., Delextrat, A., Kemp, S., Ward, T., Izadi, H., Johansen-Berg, H., Ayaz, H., & Dawes, H. (2023). Motor learning in developmental coordination disorder: behavioral and neuroimaging study. *Frontiers in Neuroscience, 17*(June), 1–14. <https://doi.org/10.3389/fnins.2023.1187790>
- Chen, Y. W., Li, K. Y., Lin, C. H., Hung, P. H., Lai, H. T., & Wu, C. Y. (2023). The effect of sequential combination of mirror therapy and robot-assisted therapy on motor function, daily function, and self-efficacy after stroke. *Scientific Reports, 13*(1), 1–10. <https://doi.org/10.1038/s41598-023-43981-3>
- Dwi Anto, C., Adriani, P., Yusmiranti, & Novitasari, D. (2022). Implementasi Range of Motion untuk Meningkatkan Kekuatan Otot Ekstremitas Pasien Stroke dengan Hambatan Mobilitas Fisik. *Kolaborasi Jurnal Pengabdian Masyarakat, 2*(4), 327–335. <https://doi.org/10.56359/kolaborasi.v2i4.128>
- Einstad, M. S., Saltvedt, I., Lydersen, S., Ursin, M. H., Munthe-Kaas, R., Ihle-Hansen, H., Knapskog, A. B., Askim, T., Beyer, M. K., Næss, H., Seljeseth, Y. M., Ellekjær, H., & Thingstad, P. (2021). Associations between post-stroke motor and cognitive function: a cross-sectional study. *BMC Geriatrics, 21*(1), 1–10. <https://doi.org/10.1186/s12877-021-02055-7>
- Gainau, M. B. (2021). *Pengantar Metode Penelitian* (C. Subgya (ed.); Edisi elek). Penerbit PT KANISIUS.
- Geneva, R., & Usman, S. (2023). Gambaran Karakteristik Individu Dengan Kejadian Stroke Pada Pasien Poliklinik Penyakit Saraf. *Jurnal Kedokteran STM (Sains Dan Teknologi Medik), 6*(2), 159–167. <https://doi.org/10.30743/stm.v6i2.466>
- Ilham Darmawan, Indhit Tri Utami, A. T. P. (2024). Penerapan Range Of Motion (ROM) Exercise Bola Karet Terhadap Kekuatan Otot Pasien Stroke Non Hemoragik. *Jurnal Cendikia Muda, 4*, 246–254.
- Lestari, M., Pujiastuti, S. E., Santjaka, A., Student, N., Program, P., Kesehatan, P., & Semarang, K. (2019). *Intervention range of motion ( ROM ) and foot massage towards motor function in non hemorrhagic patient.* 82–88.
- Mafra, M., Lenzi, O. M. W., Silveira, F. S., Schmitt, M. V., de Oliveira, J. F., & de Sousa, C. A. (2022). Multimodal exercise program contributes to balance and motor functions in men and women with Parkinson’s disease differently: an intervention study. *Motriz. Revista de Educacao Fisica, 28*. <https://doi.org/10.1590/s1980-657420220015221>
- Mandani, Y. R., & Saputra, G. N. (2023). Gangguan Gerak Pada Stroke. *Cermin Dunia Kedokteran, 50*(7), 360–364. <https://doi.org/10.55175/cdk.v50i7.642>
- Nurjaman, M. S. (2023). *Gambaran Kekuatan Otot Stroke Hemoragik Sekolah Tinggi Ilmu Kesehatan Karsa Husada Program Studi S1 Keperawatan Garut.* 47.
- Nursalam. (2013). *Metodologi Penelitian Ilmu Keperawatan Pendekatan Praktis Edisi 3* (Edisi

- 3). Penerbit Salemba Medika.
- O'Connor, K. P., Lavoie, M. E., Stip, E., Borgeat, F., & Laverdure, A. (2008). Cognitive-behaviour therapy and skilled motor performance in adults with chronic tic disorder. *Neuropsychological Rehabilitation*, 18(1), 45–64. <https://doi.org/10.1080/09602010701390835>
- Puspitasari, P. N. (2020). Hubungan Hipertensi Terhadap Kejadian Stroke. *Jurnal Ilmiah Kesehatan Sandi Husada*, 12(2), 922–926. <https://doi.org/10.35816/jiskh.v12i2.435>
- Ramadhayanti, A. (2019). *Aplikasi SPSS untuk Penelitian dan Riset Pasar*. Penerbit PT Elex Media Komputindo.
- Sekaran, U., & Bougie Roger. (2006). Research methods for business. A skill building approach ( 5th ed.). *New York: John Wiley and Sons*, 1–447.
- Sesep, F., Marbun, M., Murni, L., & Sagala, B. (2024). *Indonesian Trust Nursing Journal (ITNJ) PENGARUH LATIHAN RANGE OF MOTION PASIF TERHADAP KEKUATAN OTOT PADA PASIEN STROKE NON HEMORAGIK DI MURNI TEGUH MEMORIAL HOSPITAL*. 2(2), 14–20.
- Syapitri, H., Amila, & Aritonang, J. (2021). Metodologi Penelitian Kesehatan. In *Ahlimedia Press*.
- Taylor, E. M., Cadwallader, C. J., Curtin, D., Chong, T. T. J., Hendrikse, J. J., & Coxon, J. P. (2024). High-intensity acute exercise impacts motor learning in healthy older adults. *Npj Science of Learning*, 9(1). <https://doi.org/10.1038/s41539-024-00220-2>
- Tohanean, N., Tucan, P., Vanta, O. M., Abrudan, C., Pintea, S., Gherman, B., Burz, A., Banica, A., Vaida, C., Neguran, D. A., Ordog, A., Tarnita, D., & Pisla, D. (2023). The Efficacy of the NeuroAssist Robotic System for Motor Rehabilitation of the Upper Limb—Promising Results from a Pilot Study. *Journal of Clinical Medicine*, 12(2), 1–17. <https://doi.org/10.3390/jcm12020425>
- Wijaya, B. J. (2019). Fungsi Motorik Ekstremitas Penderita Stroke Iskemik Pasca Rehabilitasi. *Syifa' MEDIKA: Jurnal Kedokteran Dan Kesehatan*, 8(1), 26. <https://doi.org/10.32502/sm.v8i1.1356>
- Xie, R., Chen, Y., Chen, K., & Chen, Z. (2021). Intervention Effect of Rapid Rehabilitation Nursing Combined with Continuous Nursing after Discharge on Patients with Cerebral Infarction in Recovery Period and the Changes in Motor Function, Mental State, and Quality of Life. *Evidence-Based Complementary and Alternative Medicine*, 2021. <https://doi.org/10.1155/2021/8065868>
- Yuliyanto, G., Utami, I. T., & Inayati, A. (2021). The Effect Of AIUEO Therapy To The Communication Patient Of Post Stroke Motoric Aphasia In Pontianak City. *Cendikia Muda*, 1(3), 339–343.