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Improving family caregiver understanding of range of motion exercises for community-based stroke care: A pre-experimental study within the clinical pathway

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ABSTRACT

Background: Family caregivers play a crucial role in the recovery of stroke patients, especially in community settings. An adequate understanding of the range of motion (ROM) exercises enables caregivers to actively support rehabilitation and prevent complications. This study aimed to analyze the improvement of family caregivers' understanding of ROM exercises after training.

Methods: This pre-experimental one-group pretest-posttest study involved 25 families with stroke patients for ≥1 month, selected through consecutive sampling in the working area of Puskesmas Tambora, West Jakarta, in July 2025. Interventions included active and passive ROM exercises based on standard operating procedures (SOPs), also it was used to simulate the manual muscle testing (MMT). Measurement instruments used the validity and reliability questionnaires and MMT observation sheets. Data were analyzed by the Wilcoxon test at a significance level of $p<0.05$.

Results: The results showed a significant increase in family caregiver understanding of ROM ($p= 0.000$). Before the training, 88% of respondents (22 people) had sufficient knowledge, and 12% (3 people) had good knowledge. After the training, the proportion of good knowledge increased to 56% (14 people), while moderate knowledge decreased to 44% (11 people).

Conclusion: Structured training effectively enhanced family caregivers' understanding of ROM exercises, supporting their active participation in patient care. These findings suggest that such education can be integrated into community-based non-digital clinical pathways to prevent complications in stroke patients.

Keywords: clinical pathway development, family caregiver education, ROM, stroke.
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INTRODUCTION

Stroke remains a major health issue worldwide and in Indonesia, characterized by high morbidity and mortality rates. Data from the Global Burden of Disease 2019 reveal a 31.97% increase in stroke prevalence compared to 1990, despite a relative decrease in mortality rates.[1] Every minute after a stroke, approximately 1.9 million brain cells can die, leading to severe neurological damage. In Indonesia, stroke is the leading cause of disability, accounting for 11.2%, and contributes to 18.5% of deaths. National data by 2023 recorded a stroke prevalence of 8.3 per 1,000 population, with funding by the National Health Insurance reaching Rp 5.2 trillion.[2,3]

Stroke causes motor function impairment, cognitive disorders, and dependence in daily activities, necessitating consistent long-term rehabilitation.[4] A study at Bekasi General Hospital revealed that most patients experienced muscle weakness, speech disorders, and vision impairments, necessitating assistance with daily activities such as eating and drinking, personal hygiene, elimination, ambulation, mobility, and rest.[5] However, many family caregivers who care for patients lack adequate knowledge about post-stroke care and complication prevention, resulting in suboptimal care quality at home.[6] Other studies have found that many families of stroke patients still lack a clear understanding of the basic principles of post-stroke home care, including movement exercises and joint stiffness prevention.[7]

Various promotional and preventive efforts have been made to raise public awareness, including lifestyle changes and control of stroke risk factors.[8] The theme of World Stroke Day 2024, "Be Greater Than Stroke," emphasizes the need for a proactive approach to stroke prevention through healthy living. However, stroke patient management in the community still faces significant challenges, particularly in preventing long-term complications.[9] The American Heart Association recommends that post-stroke rehabilitation begin as early as possible, with families actively involved as part of the care team to ensure continuity of exercises at home.[10]

One recommended non-pharmacological intervention is range of motion (ROM) exercises, which are beneficial for maintaining joint flexibility, improving muscle strength, and preventing contracture complications.[11] Scientific evidence reveals that ROM, both active and passive, can accelerate motor function recovery when performed regularly and according to procedure.[12] A systematic review highlighted that ROM exercises were among the most effective rehabilitation therapies during the early phase of stroke recovery, as they could enhance neural plasticity and peripheral circulation without causing excessive fatigue for patients.[13] However, limited access to rehabilitation in the community poses a barrier to the sustainability of recovery programs.

Nurses play a crucial role in empowering family caregivers through structured education and supervision in accordance with service standards. A clinical pathway–based approach can provide a structured framework for delivering care and clear, step-by-step guidelines for stroke patient rehabilitation. However, the implementation of family-based clinical pathways in stroke rehabilitation remains under-explored, particularly in the context of limited primary care services in Indonesian communities. Therefore, this study aimed to analyze the increase in family caregivers' understanding of ROM exercises after receiving training. The results of this study were expected to provide preliminary evidence to support the development of non-digital, clinical pathway-based guidelines as a strategy to prevent stroke complications and improve rehabilitation quality in the community.

METHODS

This study used a pre-experimental design with a one-group pretest–posttest approach, conducted in July 2025 in the working area of the Tambora Community Health Center, West Jakarta. The objective of the study was to analyze the improvement in family caregivers' understanding of ROM exercises after receiving training. A total of 25 respondents were chosen utilizing consecutive sampling by families of stroke patients who were in the post-stroke phase of at least one month. Inclusion criteria were willingness to participate, being a family member of a stroke patient, ability to communicate bidirectionally, and absence of cognitive impairment. The exclusion criteria in this study included family caregivers who declined follow-up observations and patients who experienced a decline in clinical condition during the study period. This research received ethical approval from the Research Ethics Committee of Universitas Esa Unggul (number: 0925-06.016/DPKE-KEP/FINAL-EA/UEU/VI/2025). All respondents who agreed to participate were required to sign an informed consent form after receiving a clear explanation of the study's objectives, benefits, and procedures.

The research instruments comprised a structured questionnaire designed to assess caregivers' knowledge of stroke, including its symptoms, prevention, and rehabilitation, as well as a ROM assessment to evaluate their level of understanding. Additionally, muscle strength was evaluated using manual muscle testing (MMT) observation sheets, while the Katz activities of daily living (ADL) Index was utilized to determine the patients' level of functional independence. All instruments were tested for validity and reliability, with a *Cronbach*'s alpha value of 0.70 for the knowledge questionnaire. The item validity test showed *r*-values ranging from 0.53 to 0.89, which were higher than the r-table value of 0.37. These results indicate that the instruments are valid and reliable for use in the study.

The research procedure was conducted in three stages. In the first stage, the researchers conducted a pretest to assess caregivers' knowledge using a questionnaire, patients' muscle strength using MMT, and patients' level of independence using the Katz Index. In the second stage, individual training interventions were carried out with family caregivers at the patients' homes, including explanations about stroke, the benefits of ROM exercises, demonstrations of techniques according to standard operating procedures (SOP), and hands-on ROM practice by the family. Caregivers were instructed to regularly perform ROM exercises with the patients. In the third stage, one week after the training, the researchers conducted follow-up supervision at the patients' homes to perform a posttest with the family caregivers, reassess patients' muscle strength using MMT, and evaluate patients' independence using the Katz Index. In addition, exercise adherence was assessed using a simple observation sheet with three categories: regular, occasional, and non-adherence. The data were analyzed using the Wilcoxon test with a significance level of $p < 0.05$ to determine significant differences between pretest and posttest scores.

RESULTS

This study involved 25 participants who served as caregivers. The characteristics of the respondents, caregivers' knowledge before and after training, muscle strength of stroke patients before and after family training, level of independence of stroke patients before and after family training, and the Wilcoxon analysis of the effect of family training on patient independence and muscle strength are presented in the tables below.

As shown in **Table 1**, the majority of respondents were female (72%), aged ≥ 45 years (64%), had a relationship as the patient's child (64%), and had been caring for the patient for ≥ 6 months (60%). **Table 2** illustrates that before training, most respondents had adequate knowledge (88%), while only 12% demonstrated good knowledge. Following the training, the proportion of respondents with good knowledge increased to 56%, whereas those with adequate knowledge decreased to 44%.

The findings presented in **Table 3** indicate that muscle strength improved among stroke patients after training. The percentage of patients with normal muscle strength increased by 4% to 20%, while those capable of performing movements without resisting gravity decreased from 32% to 12%. Similarly, **Table 4** demonstrates an improvement in patient independence following family training, with the proportion of totally independent patients increasing by 20% to 32%, and the proportion of highly dependent patients decreasing from 20% to 4%. **Table 5** further shows that the Wilcoxon Signed Rank Test revealed significant differences between

Table 1. Characteristics of 25 respondents

Variable	n (%)
Gender	
Male	7 (28.0)
Female	18 (72.0)
Age	
< 45	9 (36.0)
≥ 45	16 (64.0)
Relationship by Patient	
Spouse	7 (28.0)
Children	16 (64.0)
Other	2 (8.0)
Length of treatment	
< 6 months	10 (40.0)
≥ 6 months	15 (60.0)

n, frequency of participants; %, percentage of participants

Table 2. Data on 25 caregivers' knowledge before and after training

Variable	Pre-test n (%)	Post-test n (%)
Adequate	22 (88.0)	11 (44.0)
Good	3 (12.0)	14 (56.0)

n, frequency of participants; %, percentage of participants

pre-test and post-test results across all variables, indicating that family training effectively increased caregiver knowledge ($Z = -4.435$; $p < 0.001$), improved patient muscle strength ($Z = -2.782$; $p < 0.001$), and enhanced patient independence as measured by the Katz Index ($Z = -2.570$; $p < 0.001$).

DISCUSSION

The results of this study reveal that providing knowledge to family caregivers facilitated by nurses is effective in improving family understanding, patient muscle strength, and patient independence in performing daily activities. These findings align with the studies that emphasize that family involvement in stroke rehabilitation plays a crucial role in accelerating motor function recovery and preventing post-stroke complications. Active family involvement also strengthens the patient's emotional support system, improves adherence to exercise, and helps reduce the risk of post-stroke depression.[14]

Table 3. Muscle strength of 25 stroke patients before and after family training

Muscle Strength	Pre-test n (%)	Post-test n (%)
No contraction	3 (12.0)	0 (0.0)
Muscle twitching	4 (16.0)	1 (4.0)
Movement devoid of resisting gravity	8 (32.0)	3 (12.0)
Movement against gravity	6 (24.0)	7 (28.0)
Movement against light resistance	3 (12.0)	9 (36.0)
Normal strength	1 (4.0)	5 (20.0)

n, frequency of participants; %, percentage of participants

Table 4. Level of independence of 25 stroke patients before and after family training

Level of Independence	Pre-test n (%)	Post-test n (%)
Most dependent	5 (20.0)	1 (4.0)
Moderately dependent	2 (8.0)	3 (12.0)
Moderate	4 (16.0)	2 (8.0)
Mildly dependent	6 (24.0)	3 (12.0)
Minimal dependence	3 (12.0)	8 (32.0)
Total independent	5 (20.0)	8 (32.0)

n, frequency of participants; %, percentage of participants

Table 5. Wilcoxon analysis of the effect of family training on patient independence and muscle strength (n=25)

Variable	Z	P-value
Family knowledge (pre-post)	-4.435b	0.001
Muscle strength (pre-post)	-3.782b	0.001
Katz Index (pre-post)	-3.570b	0.001

The study also found that many respondents previously lacked understanding of stroke and its symptoms. This is important because ischemic stroke is caused by a disruption in blood supply to the brain, while hemorrhagic stroke occurs due to the rupture of brain blood vessels.[15] Both conditions result in brain cells being deprived of oxygen and nutrients, leading to damage that can cause paralysis, speech disorders, and other bodily function impairments.[16] This lack of understanding prevents families from recognizing the importance of early detection and ongoing rehabilitation.

Most respondents in this study also demonstrated limitations in performing ADL, such as eating, personal hygiene, elimination, and mobility. This is consistent with the findings that explained that ADL impairments are a consequence of brain damage caused by stroke, with variations depending on the location and severity of the lesion.[17] In addition to physical barriers, stroke patients often experience emotional issues, sleep disorders, and a decline in quality of life.[18] Therefore, comprehensive rehabilitation and family support are essential to ensure optimal recovery.

Unfortunately, research findings also reveal that most patients only undergo routine treatment and follow-up but do not participate in rehabilitation programs or regular exercise. However, post-stroke rehabilitation is very important to improve quality of life.[19] Physical therapy, occupational therapy, speech therapy, and structured exercise have benefits for improving motor function and accelerating recovery.[20] Additionally, managing risk factors through medication, a healthy diet, and lifestyle modifications remains an integral part of preventing recurrence.[21]

Families caring for stroke patients face significant challenges in adapting to the patient's condition. Higher levels of disability have been shown to increase the family's burden, both physically and psychologically.[22] Therefore, interventions such as skill-building, psychoeducation, and emotional support are essential.[23] In this context, nurses play a crucial role as educators and facilitators to enable families to support patients' recovery optimally at home.

This study shows that training caregivers can help motivate patients to perform ROM exercises, leading to improved muscle strength and greater independence in ADL.[24] Family involvement also improves patient compliance, making rehabilitation more effective.[25] In addition to supporting physical rehabilitation, family education also plays a crucial role in preventing stroke complications. Families can help patients maintain a healthy diet, such as increasing consumption of vegetables, fruits, lean proteins, and fiberAs a result, caregivers become the first line of defense in ensuring the continuity of care and preventing stroke recurrence.[26] Mechanistically, increased muscle strength through ROM exercises occurs due to the activation of motor units caused by repetitive movements. ROM is effective in improving muscle strength and motor function. Regular monitoring remains crucial for assessing the effectiveness of rehabilitation programs and adapting them to individual conditions.[27]

As a practical implication, a structured clinical pathway model can be proposed as a guide for patients and their families. This model includes understanding stroke conditions, appropriate management, and the importance of rehabilitation and exercise, as well as strategies for preventing recurrent attacks. With this guidance, patients and families will be better able to make informed decisions, adopt a healthy lifestyle, and access healthcare facilities as needed. Thus, this intervention not only improves patients' quality of life but also strengthens families' capacity as an integral part of the rehabilitation team.

Although this study provided encouraging findings, several limitations should be acknowledged. The one-group pretest–posttest design without a control group limits the ability to establish a causal relationship between the intervention and outcomes. The relatively small sample size also restricts the generalizability of the results to a broader population. Therefore, further research using an experimental design with a larger sample size and a longer observation period is strongly recommended. In addition, the development of non-digital educational media, such as guidebooks, leaflets, and posters, should be integrated into community nursing programs. These efforts would help strengthen community-based rehabilitation services and support the achievement of a healthier Indonesia.[28]

CONCLUSION

Providing education on ROM exercises to family caregivers, facilitated by nurses, has proven effective in improving muscle strength among stroke patients while also supporting their independence in daily activities. This intervention highlights the crucial role of family empowerment in the success of home-based rehabilitation. The findings of this study offer preliminary evidence that caregiver training can serve as a fundamental component in developing community-based clinical pathway guidelines for stroke rehabilitation. This aligns with efforts to strengthen primary nursing care services and prevent stroke-related complications.

ETHICAL CLEARANCE

This study has obtained ethical approval by number: 0925-06.016/DPKE-KEP/FINAL-EA/UEU/VI/2025.

CONFLICT OF INTEREST

The researcher declares that there are no conflicts of interest associated with the conduct, analysis, or reporting of this study.

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AUTHOR CONTRIBUTIONS

MA designed the study, collected and processed the data, and drafted the initial manuscript. RH, DN, and Y contributed to study design and manuscript revision.

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