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Effectiveness of INBELMOTO Print Media in Enhancing Stroke Caregivers' Knowledge and Motor Training Skills: A One-Group Pretest–Posttest Study in a Low-Income Setting

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Abstract

Stroke is a major cause of long-term disability, requiring active caregiver involvement in rehabilitation. In low-income communities, limited access to formal training reduces caregiver competence in performing motor exercises such as Range of Motion (ROM), which are essential for preventing joint stiffness and promoting recovery. This study aimed to develop and evaluate the effectiveness of INBELMOTO, a print-based educational intervention, in improving the knowledge and motor training skills of stroke caregivers. A one-group pretest–posttest design was conducted on 40 caregivers of stroke inpatients at Purwokerto Islamic Hospital, Central Java. The booklet was validated by 12 multidisciplinary experts (I-CVI = 0.958). Caregivers used the material during a three-day inpatient period. Knowledge and motor skills were assessed before and after the intervention. Mean knowledge scores increased from 87.48 to 90.78, and motor skills from 23.75 to 28.78. Knowledge improvement was not statistically significant ($p = 0.070$), but motor skills showed a significant increase ($z = –4.278$; $p < 0.001$; $r = –0.98$). INBELMOTO is a promising low-cost educational tool for enhancing caregiver motor training skills. Future efforts should integrate this approach with audiovisual and hands-on guidance for better outcomes.

Keywords: *Stroke, Caregiver, ROM Exercises, Print Media, Rehabilitation, INBELMOTO, Health Education.*

Introduction

One of the fundamental problems found in stroke caregivers, especially in low-income communities, is the low knowledge of Range of Motion (ROM) exercises as an important part of the rehabilitation process. ROM exercises are carried out with the aim of preventing joint stiffness, maintaining flexibility, and encouraging functional recovery after stroke. Many caregivers do not understand the appropriate type of ROM exercises, the recommended frequency, and how to perform movements safely without causing injury. A study highlighted that informal caregivers in low-income countries often care for patients in situations without adequate medical training or knowledge, this results in low readiness in implementing specific care techniques (I. Evans et al., 2024).

Caregiver readiness is not only determined by knowledge, but also by confidence and practical skills in performing exercises. Many caregivers feel anxious or afraid to perform ROM exercises because they are worried about worsening the patient's condition. This is exacerbated by the lack of written guidance or visual media that can be easily accessed and understood. A study in Brazil showed that passive interventions based on print media alone are not enough if not accompanied by practical instructions and direct communication. Printed materials that are well-designed and adjusted to the user's literacy level still have significant educational value, especially if used in group training or accompanied by stimulation (Pimenta et al., 2008).

Caregiver readiness is also influenced by psychosocial factors including stress, fatigue, feelings of inadequacy, and lack of social support. Another problem is that caregivers from poor groups often face

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a double burden between caring for patients, taking care of the household, and economic pressures, which hinders their ability to learn new skills such as ROM exercises (He et al., 2024). Low levels of self-efficacy are also a barrier. Because without self-confidence, caregivers will be reluctant to try to do the exercises, even if they are given information. Effective interventions need to include psychological empowerment components, not just informative aspects.

In low-income communities, many caregivers do not have access to digital training, the internet, or physical therapy services. Therefore, print media such as INBEMOTO become relevant. Practical, illustrated, and easy-to-understand printed materials allow caregivers to learn independently. A study confirmed that educational materials that are visual and culturally relevant are very effective in reaching low-literacy risk groups (Chaudhary & Kreiger, 2007).

Efforts to improve caregiver readiness can be achieved through education. Self-efficacy-based education using visual media and motor training has been shown to increase the independence of stroke patients in self-care and their motor functions (Wiguna et al., 2021). Studies have shown that self-efficacy moderates the relationship between initial motor skills and post-exercise functional limb use, so training programs that integrate educational elements may improve rehabilitation outcomes. Motor training combined with educational components such as feedback or rewards has been shown to significantly improve upper extremity motor function (Widmer et al., 2022). The motor task-based program approach is highly effective compared to routine therapy (traditional techniques) in improving upper extremity function in stroke patients (Tenberg et al., 2023).

The use of various health education media has been widely carried out with various findings. A study in India stated that a stroke rehabilitation model based on WhatsApp video calls and visual media such as guidebooks and training videos has proven feasible for stroke patients, involving caregivers as active partners in motor training (Gupta et al., 2025). Visual and audio-based educational interventions in populations with limited literacy and resources have been shown to assist caregivers in implementing basic motor training post-stroke at home (Sureshkumar et al., 2015).

Stroke is one of the diseases that causes long-term disability in the world. Caregivers will be affected when a family member experiences a stroke, especially those from low-income groups. Limited access to formal motor skills training is often an obstacle in the rehabilitation process for post-stroke patients. Therefore, an educational media is needed that is practical, affordable, and easy for caregivers to understand. INBELMOTOS (Instruction on Motor Learning) is an educational print media that is systematically developed to improve caregiver motor skills in caring for stroke patients. Through a Research Development (R&D) approach, this study aims to develop and test the effectiveness of the print media.

Methods

This study is a one-group pretest-posttest design, with the aim of testing the effectiveness of INBELMOTO printed media in improving motor training skills in low-income stroke patient caregivers. INBELMOTO media is a book-shaped media. The book has an ISBN: 978-623-167-646-7 (10). The subjects in this study were 40 caregivers of stroke patients from low-income communities and registered in inpatient services at Purwokerto Islamic Hospital, Central Java, Indonesia. Inclusion criteria consisted of: primary caregivers who were actively involved in patient care during hospitalization, able to read and understand Indonesian language print media, and willing to follow the research procedure by signing an informed consent. Exclusion criteria included caregivers with severe cognitive impairment, significant physical limitations, and not fully present during the intervention. The instruments used were: caregiver motor skills observation sheets (ROM), and media content validation involving 12 experts (nursing, public health, community empowerment, linguists, and physiotherapists).

The research procedure was carried out through pretest, media provision, and posttest stages. Pretest, caregivers were tested first to measure basic knowledge and skills related to motor training of stroke patients. Observation instruments and questionnaires were used in this stage. Media provision, INBELMOTO printed media was given to participants after an explanation of how to use it by the researcher. For 3 consecutive days of hospitalization, caregivers read the media and practiced its contents directly to patients with light supervision. Posttest, evaluation was carried out again using the same instrument to see changes in skills and understanding after the intervention.

Results

Based on the results of the expert review, improvements were then made. After the revised model results had been approved for validity testing, the researcher determined 12 raters with a doctoral degree to conduct the assessment, with areas of expertise in nursing, midwifery, Indonesian language, research practitioners at BRIN, community empowerment, health promotion, epidemiology, and education. Validity test by calculating the CVI value with the Aiken's V approach, so that with 12 raters and a p value <5%, the V value is 0.96. The validity of the content of the INBELMOTO print media was assessed by 12 experts on 36 items, based on the results of the study, the mean I-CVI (Item-level CVI): 0.958, S-CVI/UA (Scale-level CVI, Universal Agreement): 0.67, and mean experts' proportion: 0.97.

The research was conducted for two months from September-October at Purwokerto Islamic Hospital. A limited trial was conducted on stroke caregivers. A limited trial was conducted on 40 stroke caregivers as an intervention group. The average I-CVI of 0.958 indicated that the majority of items were considered relevant by almost all experts, because a value of ≥0.78 was generally considered satisfactory for ≥6 observers (Polit & Beck, 2005). The S-CVI/UA of 0.67 indicates that 67% of items received full agreement from all experts, and although slightly below the ideal value (≥0.80), this is still quite good, especially in the context of new media development. The proportion of experts who rated the items as valid of 0.97 indicates high consistency between items in evaluating the appropriateness of the content of the developed media. This result is in line with the findings of a similar validation study where an average I-CVI above 0.90 was considered to indicate very good content suitability. The use of printed educational guides for stroke caregivers was deemed effective after being validated by a panel of experts with the same procedure, indicating the importance of multidisciplinary involvement in ensuring content relevance (da Costa et al., 2024). Based on the CVI results, INBELMOTO printed media has very good content validation, and is suitable for use as an educational intervention for stroke caregivers. However, some items (with an I-CVI value = 0.916) can be revised or simplified to increase the level of agreement in the next version.

A total of 40 caregivers of inpatient stroke patients participated in this study. All respondents came from Purwokerto Islamic Hospital, which is a health service institution with neurological rehabilitation services in the Banyumas area, Central Java. Based on age, the majority of caregivers were in the age range of 19–40 years (56.4%), followed by the age group of 41–60 years (33.7%), age <18 years (7.6%), and 61–80 years (2.3%). Respondents were dominated by women (65.1%), while men numbered 34.9%. In terms of education, the majority were high school graduates (45.3%), followed by junior high school (27.9%), elementary school (19.2%), and college (7.6%). Based on occupation, the most respondents were housewives (40.1%), self-employed (28.2%), and private (17.4%), with the rest working as farmers, civil servants, or not/not yet working. Most of the patients who were assisted had ischemic stroke (87.8%), and only a small number had hemorrhagic stroke (12.2%). The majority of caregivers had incomes below the minimum wage (82%), and only 18% had incomes above the minimum wage. The duration of stroke experienced by patients was mostly <6 months (86%), and most patients had only experienced one stroke (81.4%). As many as 80.8% of caregivers had no previous experience in caring for stroke patients, and most of them lived within 6–10 km (38.4%) of the hospital. The most common source of information was obtained from health workers (65.7%), followed by electronic media and social media. The average score of caregiver knowledge about rehabilitation was 91.02 (SD = 13.54), while the motor training score was 25.99 (SD = 7.74). Analysis of knowledge measurement results. The test results before and after intervention on the knowledge variable are as follows:

Knowledge variables	Mean	SD
Before	87,48	11,87
After	90,78	9,11

The results of the descriptive analysis showed an increase in the average knowledge score of stroke caregivers after being given the INBELMOTO print media intervention. Before the intervention, the average knowledge of caregivers was 87.48 (SD = 11.87), and increased to 90.78 (SD = 9.11) after the intervention. Although the increase was seen descriptively, inferential statistical tests (paired t-test and Wilcoxon) showed that the difference was not statistically significant (p = 0.156 for t-test; p = 0.070 for Wilcoxon). This indicates that the intervention provided a trend of increasing knowledge, but was not strong enough to be concluded as a statistically significant increase. The test for differences in

average knowledge between before and after being given stroke motor learning information (INBELMOTO's) used the Wilcoxon sign-rank test (n = 40).

Knowledge variables	W	z	p	Rank-Biserial Correlation
Before & after	50,00	-1,811	0,07	-0.47

Based on the Wilcoxon signed-rank test, there was an increase in caregiver knowledge scores after the provision of INBELMOTO printed media, but the increase was not statistically significant. The test results showed a z value = -1.811 and p = 0.070 (p > 0.05), with a rank biserial correlation value of -0.47, indicating a moderate effect. Although not statistically significant, the p value approaching 0.05 and the fairly large effect correlation indicate that printed media has moderate educational potential, especially when combined with other approaches.

The results of the pretest intervention and posttest variables of motor training ability, with an average of motor training before and after the provision of stroke motor learning information (INBELMOTO's) (n = 40).

Motor training variables	Mean	SD
Before	23,75	7,77
After	28,78	8,52

Although there was an increase in the average motor training score from 23.75 to 28.78, this result was not statistically significant at the 95% confidence level (p > 0.05), but was close to the significance limit. The results of the paired t-test showed an increase in the caregiver's motor training score after being given INBELMOTO printed media, from an average of 23.75 (SD = 7.77) to 28.78 (SD = 8.52). However, this increase was not statistically significant, with a t value (39) = 1.92 and p = 0.062. This shows that the intervention provides a positive trend, but is not statistically strong enough to conclude its effectiveness with confidence. The test for differences in the average motor training between before and after INBELMOTO was given using the Wilcoxon sign-rank test (n = 40).

Variabel	W	z	p	Rank-Biserial Correlation
Motor training before & after	3,50	-4,278	<0,001	-0.98

The results of the Wilcoxon signed-rank test showed that there was a statistically significant difference between the motor training scores before and after the provision of INBELMOTO printed media. The z value = -4.278 and p < 0.001, with a rank biserial correlation of -0.98, indicating a very strong effect of the intervention on improving caregiver motor skills. Thus, although the previous paired t-test showed results that were close to significant, the Wilcoxon non-parametric test provides strong evidence that print-based interventions significantly improve caregivers' ability to train stroke patients' motor skills.

Discussion

A total of 40 caregivers of inpatient stroke patients at Purwokerto Islamic Hospital participated in this study. The majority of respondents were female, aged 19–40 years, and had a secondary education (SMA). Most worked as housewives and had incomes below the minimum wage. The majority had no previous experience in caring for stroke patients, and most lived within a 6–10 km radius of the hospital. These demographic characteristics have important implications in the context of the effectiveness of educational interventions such as INBELMOTO print media. Caregivers with low education levels and low incomes tend to experience higher stress and difficulty in understanding rehabilitation materials, especially without intensive assistance (Sohkhlet et al., 2023). In this study, caregivers with low economic conditions require additional support both educationally and psychosocially during the rehabilitation process. In addition, the identity and availability of caregivers greatly affect the

effectiveness of stroke patient rehabilitation (Hoon Ong et al., 2016). Caregivers who are immediate family members, such as spouses or children, provide better rehabilitation outcomes than non-family caregivers or aid workers. In this study, the characteristics of caregivers who are mostly women from households reinforce the importance of a simple, applicable, and household-based educational approach such as the INBELMOTO print media. Structured caregiver education programs can increase caregiver satisfaction and accelerate patient functional recovery, especially when combined with conventional physical therapy (Hong et al., 2017). This supports the selection of print media as an initial intervention that can be used flexibly by caregivers with diverse educational backgrounds and experiences. The characteristics of respondents in this study reflect the population of stroke caregivers in low-income communities with secondary education levels. These characteristics support the urgency of using educational media that is easily accessible and understandable, and show that the success of the intervention is highly dependent on the preparation of materials that are responsive to the social and demographic conditions of caregivers.

This study showed an increase in the average knowledge score of stroke caregivers after being given an intervention in the form of INBELMOTO printed media. The average knowledge score increased from 87.48 (SD = 11.87) before the intervention to 90.78 (SD = 9.11) after the intervention. Although descriptively there was an increase, the results of the paired t-test showed that the increase was not statistically significant ($p = 0.156$), and the results of the Wilcoxon signed-rank test showed a p value = 0.070. Thus, the intervention showed an increasing trend, but was not statistically strong enough to be concluded as a significant increase. This insignificant increase could be caused by several factors: The short duration of the intervention (only during hospitalization), may not be enough to form a deep conceptual understanding. The passive delivery method through printed media without direct assistance or discussion can limit the absorption of information, especially for caregivers with elementary to secondary education levels. The characteristics of the respondents, most of whom had never cared for stroke patients before and had high physical and emotional burdens, so that the focus on understanding the educational material may be disturbed.

Wilcoxon Signed-Rank Difference Test for Knowledge. Based on the Wilcoxon signed-rank test, there was an increase in caregiver knowledge scores after being given INBELMOTO printed media. The average knowledge score increased from 87.48 (SD = 11.87) to 90.78 (SD = 9.11). However, this increase was not statistically significant, with a value of $W = 50.00$, $z = -1.811$, and $p = 0.070$ ($p > 0.05$). The rank biserial correlation of -0.47 indicated a moderate effect on increasing knowledge. The correlation value of -0.47 is in the moderate effect category. This indicates that the intervention has a positive direction of influence, but the magnitude is not enough to produce a statistically significant difference. Possible causes include: short duration of intervention (during hospitalization); Low intensity of interaction between participants and media; and Limited reading ability or caregiver understanding due to educational background. Although not statistically significant, the p-value approaching the 0.05 limit and the medium effect size indicate that print media has educational potential, especially when combined with other, more interactive strategies.

Previous research has shown that face-to-face caregiver education programs combined with physical rehabilitation result in significant increases in caregiver satisfaction and understanding, compared to just providing written materials (Hong et al., 2017). Likewise, another study explained that the most effective educational interventions were those that combined print, audiovisual, and direct training sessions, as they strengthened information retention and active caregiver involvement (da Costa et al., 2024). In the context of a population with a lower secondary education background and low income, as in this study, the use of a single medium is likely to have limited effectiveness unless followed by an interactive approach or direct training. The INBELMOTO print media showed potential in improving stroke caregiver knowledge, but in a single format and limited time, the increase was not statistically significant. This study strengthens the recommendation to use multimodal interventions (a combination of print, verbal, audiovisual) and participatory approaches to make information more easily absorbed and applied in daily care practices.

These findings support previous studies that print-based educational interventions do improve caregiver knowledge, but significant gains are more likely to be achieved when combined with direct training (R. L. Evans et al., 1988). A scoping review found that the most effective caregiver education interventions typically included print media accompanied by practical training or regular mentoring, particularly in low-risk socioeconomic groups (da Costa et al., 2024). It was further explained that educational interventions based on printed manuals and simple training were effective in improving the daily care skills of stroke caregivers, including physical exercise and rehabilitation. A meta-analytic

study concluded that caregiver education programs, especially those that included practical exercises, contributed positively to the competence and functional outcomes of stroke patients (Lee et al., 2007).

INBELMOTO print media shows potential in improving stroke caregivers' knowledge, but in a single format and limited time, the increase is not statistically significant. This study strengthens the recommendation to use multimodal interventions (a combination of print, verbal, audiovisual) and participatory approaches so that information is more easily absorbed and applied in daily care practices. The study shows that education-based interventions can improve stroke caregivers' knowledge, but the impact is greater when combined with counseling or practical training (Visser-Meily et al., 2005). Likewise, the results of other studies emphasize that caregiver education is effective when accompanied by mentoring sessions or emotional reinforcement, not just passive media such as print (da Costa et al., 2024).

Motor Training Ability (Pretest–Posttest). The results of the measurement of caregivers' ability to train stroke patients' motor skills showed a descriptively significant increase. The average score increased from 23.75 (SD = 7.77) before the intervention to 28.78 (SD = 8.52) after being given INBELMOTO printed media. However, the results of the paired t-test showed that this increase was not statistically significant at the 95% confidence level, with $t(39) = 1.92$ and $p = 0.062$ ($p > 0.05$). However, the p-value approaching 0.05 indicates a positive trend, where printed media has the potential to increase caregivers' ability to perform motor training independently. This increase in ability may be hampered by several factors, including: short intervention duration (limited during hospitalization); characteristics of caregivers who do not have previous experience; and the format of printed media which, although practical, may not sufficiently explain the visual or kinesthetic aspects of movement. However, this positive trend remains important as an early indication that simple educational media such as INBELMOTO can motivate caregivers to be actively involved in the rehabilitation process of stroke patients.

This study strengthens previous findings that caregiver training involving step-by-step instructions in physical exercises can improve basic care skills competency (da Costa et al., 2024). It is further explained that interventions that rely on written and pictorial guidance have been shown to be effective, especially when delivered in a home context with minimal supervision. Likewise, this study also underlines the importance of caregiver involvement in stroke patient motor training (Visser-Meily et al., 2005). They stated that caregivers empowered through practical education can accelerate patients' functional recovery if accompanied by structured training.

Conclusion

This study shows that the provision of INBELMOTO printed media to caregivers of inpatient stroke patients at Purwokerto Islamic Hospital provides an increasing trend in two main aspects: knowledge and motor training skills. Descriptively, there was an increase in the average knowledge score from 87.48 to 90.78 and an increase in the motor training skills score from 23.75 to 28.78. However, the inferential statistical test showed that the increase in knowledge was not statistically significant ($p = 0.070$, Wilcoxon test) with a moderate effect ($r = -0.47$), and the increase in motor training skills was close to significant ($p = 0.062$, paired t-test). These findings indicate that educational printed media has moderate to strong educational potential, especially in increasing caregiver involvement in the rehabilitation process of stroke patients. However, its effectiveness is still limited if used alone and for a short time, without direct training or other interactive reinforcement. These results support previous studies that concluded that the most effective caregiver educational interventions are multimodal, namely combining printed media with direct training sessions, audiovisual media, or regular professional assistance. Print media such as INBELMOTO are effective as a starting point for cheap, flexible, and accessible education for caregivers with lower-middle educational and economic backgrounds. Based on the research results, important things are suggested. First, the development of Multimodal Interventions Print media such as INBELMOTO should be equipped with exercise demonstration videos, face-to-face sessions, or virtual assistance, so that caregivers' understanding of rehabilitation techniques is more comprehensive. Second, longer duration and intensity of intervention, because longer-term interventions, including post-hospitalization follow-up sessions, so that their effects on caregiver knowledge and skills can reach statistical significance and sustainability of practice. Third, structured involvement of health workers. Educational interventions should involve physiotherapists or rehabilitation nurses to provide periodic supervision or feedback, in accordance with findings from caregiver-mediated interventions studies. Fourth, adjustment of content to socio-economic characteristics. Educational materials must be designed with language and illustrations that are appropriate to the caregiver's educational background, using a contextual approach that is

applicable in everyday life. Five, larger scale follow-up research is needed, with more robust experimental designs (e.g., RCTs), involving more respondents and comparing different types of interventions (print vs audiovisual vs combination) to determine long-term effectiveness.

Abbreviations

INBELMOTO: informasi, belajar, motorik

ROM: range, of, motion

Ethics Approval and Consent to Participate

This study has received a recommendation from the health research ethics committee of the Muhammadiyah University of Purwokerto, declared to have passed and has received the research ethics number KEPK/UMP/24/XI/2023.

Competing Interest

The authors declare that they have no competing interests.

Availability of Data and Materials

The datasets generated and analyzed in this study are not publicly available because ethical guidelines prohibit researchers from providing research data to third-party individuals.

Authors' Contribution

Study concept and design: SDKN, HRTN, SMNH, SRMLN; Acquisition of data: SDKN, HRTN, SMNH; Analysis and interpretation of data: SDKN, SNH, SRMLN; Drafting of the manuscript: SDKN, HRTN; Critical revision of the manuscript for important intellectual content: SDKN, HRTN, SMNH. All authors have read and approved this final manuscript.

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