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# Bridging the Knowledge Gap with Multimodal Teaching for Stroke Caregivers

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***Abstract:*** *stroke significantly impacts mortality and morbidity worldwide, especially in low- and middle-income countries like India, imposing considerable challenges on caregivers who often lack adequate education and resources for post-stroke care. This study investigates the effectiveness of a multimodal teaching intervention tailored for caregivers of stroke survivors. Utilizing a quasi-experimental design, 62 caregivers were assigned to experimental and control groups, with pre- and post-test knowledge assessments conducted using structured questionnaires. Results indicate a substantial increase in the experimental group's knowledge scores, rising from a mean of 7.13 to 13.61 ($p < 0.05$), while the control group showed minimal improvement. Remarkably, communication skills and understanding of the concept of stroke yielded the highest gains. These findings affirm that multimodal teaching effectively enhances caregivers' knowledge, suggesting that such innovative educational strategies should be integrated into caregiver education programs to improve outcomes for both caregivers and stroke patients. Limitations include small sample size, regional focus, and potential bias in self-reported assessments.*

**Keywords:** Stroke Rehabilitation; Caregivers; Teaching Methods; Quasi-Experimental Studies; Knowledge.

## Introduction

Stroke is one of the leading causes of long-term disability across the world; it does not only affect the survivor but also his family with enormous emotional, physical, and financial stressors. To help rehabilitate a stroke survivor, caregivers play a necessary role, though many times these caregivers do not really understand post-stroke rehabilitation. This is as a result of inadequate educational resources and training that rely on details regarding recovery after stroke and caregiving roles [1].

Recognizing the need for effective educational interventions, this study aims to evaluate the effectiveness of multimodal teaching as a strategy to enhance caregivers' knowledge regarding

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post-stroke rehabilitation. Multimodal teaching combines various instructional methods, such as visual aids, interactive sessions, and practical demonstrations, to cater to diverse learning preferences and improve knowledge retention [2].

Through this research, aim to provide valuable insights into the impact of educational interventions on caregiver knowledge and, consequently, the quality of care provided to stroke survivors. By fostering a deeper understanding of post-stroke rehabilitation, this study aspires to empower caregivers, ultimately enhancing the recovery journey for stroke survivors and their families [3].

**Aim**

Evaluate the effectiveness of multimodal teaching on the knowledge of caregivers regarding post-stroke rehabilitation in the experimental group. Compare pre-test and post-test knowledge scores to determine significant improvements within the experimental group. Analyse post-test knowledge differences between the experimental and control groups to assess the impact of multimodal teaching.

**Methodology**

This study participated caregivers from stroke survivors and it included both the experimental as well as the control groups. The sample population was taken from female and male medicine wards of R.G. Kar Medical College & Hospital, Kolkata and Sarat Chandra Chattopadhyay Medical College & Hospital, Uluberia, West Bengal. The participants, 62 caregivers, were selected by convenience sampling using a quasi-experimental, non-equivalent pretest and posttest control group design with the selection of two groups, each consisting of 31 caregivers. Ethical approval was given from the institutional committee of RGKMCH, Kolkata, and written informed consent from all participants, strictly following the protocols related to anonymity and confidentiality. Only caregivers who were family members or significant others like spouses and relatives, above 18 years of age, Bengali-speaking, available at the time of data collection, and willing to participate are included in the study. Pretest data regarding demographic characteristics and knowledge levels were obtained on Day 1, and the multimodal teaching intervention was administered to the group in the experimental condition. Data collection was done between 05/12/2023 and 01/01/2024. The post-test knowledge assessment was done on Day 4 using the same structured questionnaire. Descriptive statistical parameters such as frequency, percentage, mean and standard deviation, along with inferential tests such as paired t-test, unpaired t-test, and chi-square test, were applied for the purpose of analyzing the data.

**Hypothesis**

This study hypothesizes that the implementation of multimodal teaching will significantly enhance caregivers' knowledge regarding post-stroke rehabilitation. To evaluate this, the following hypotheses are proposed:

$\mathbf{H_{A1}}$: Mean pre-test and post-test knowledge scores among the caregivers in the experimental group were significantly different after the multimodal teaching intervention at 0.05 level of significance as measured by structured knowledge questionnaire.

$\mathbf{H_{A2}}$: There was a huge difference observed between the mean scores of knowledges between the caregivers in the experimental group after administering multimodal teaching and that of the control group as compared by using structured knowledge questionnaire at 0.05 levels of significance.

**Literature review**

The existing literature underscores critical gaps in knowledge and awareness regarding stroke and its management among caregivers, highlighting the urgent need for effective educational interventions to empower caregivers in supporting stroke survivors. Villa-García (2024) examined the significant burden faced by informal caregivers, particularly women, linked to the care recipient's functional dependence. Increased caregiving intensity and emotional strain were associated with diminished caregiver quality of life, emphasizing the necessity for respite care and psychosocial support. Liu et al. (2024) conducted a review of integrated care models for stroke patients, demonstrating significant enhancements in health-related quality of life, daily living activities, and reduced

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depression. The findings indicated that successful models adhered to comprehensive services and patient-centered care, while identifying gaps in geographic coverage and governance, thereby necessitating standardized, interdisciplinary care models to improve patient outcomes and reduce healthcare costs.

MacKenzie et al. (2023) evaluated interprofessional collaboration (IPC) skills in stroke care through simulations with pre-licensure students. Despite variations in delivery methods due to COVID-19, the study found improvements in IPC scores, particularly in roles, responsibilities, and patient-centered collaboration. Participants valued learning about team dynamics, though those engaged solely in virtual experiences preferred in-person simulations. Wang et al. (2024) performed a scoping review to categorize the supportive care needs of stroke patients using the supportive care needs framework (SCNF). The analysis of 34 articles revealed that stroke patients primarily require information, along with psychological, social, rehabilitation, practical, physical, emotional, and spiritual support. This study developed a preliminary SCNF for stroke patients, potentially laying the foundation for future research and clinical implementation of supportive care.

Fors et al. (2024) explored the experiences of stroke survivors discharged to skilled nursing facilities before returning home. Through interviews with 13 participants, the study identified three main categories: Organizational processes, perceived as critical and complex; Rehabilitation, emphasizing the need for timely support; and Adaptation to the changed situation, comprising nine subcategories. Participants expressed low involvement in care planning and goal-setting, alongside limited information about their care, which affected their ability to manage daily life and fostered uncertainty about the future. The findings advocate for tailored care and rehabilitation throughout the care chain, with a focus on goal-setting assistance and coordinated transitions between healthcare organizations. All-purpose, this body of literature highlights the multifaceted needs of stroke survivors and their caregivers, emphasizing the importance of comprehensive support and education in enhancing care outcomes.

**Data analysis and interpretation**

Data presented in the table 1 shows that maximum knowledge gained of participants happened in the area of communication skill as per modified gain (0.62). The 2nd highest knowledge gain was in the area of concept of stroke as per modified gain (0.61). The 3rd highest knowledge gain in the area of Diet therapy as per modified gain 0.52. The knowledge gain was 4th and 5th in the area of Range of motion exercises and Back care and positioning as modified gain 0.45 in both. Post -stroke rehabilitation recorded

**Table 1** Area wise distribution of pre-test and post-test knowledge score of caregivers regarding post-stroke rehabilitation in experimental group.

$n_e$=31

| Area of knowledge | Maximum Score | Mean | | Mean % | | Gain % | | Modified gain | Rank |
|---|---|---|---|---|---|---|---|---|---|
| | | Pre-test | Post-test | Pre-test | Post-test | Actual gain | Possible gain | | |
| Concept of stroke | 5 | 1.77 | 3.74 | 35 | 75 | 40 | 65 | 0.61 | 2nd |
| Post -stroke rehabilitation | 1 | 0.2 | 0.5 | 16 | 52 | 36 | 84 | 0.43 | 6th |
| Range of motion exercises | 4 | 1.45 | 2.58 | 36 | 65 | 29 | 64 | 0.45 | 4th |
| Communication skill | 1 | 0.23 | 0.71 | 23 | 71 | 48 | 77 | 0.62 | 1st |
| Diet therapy | 5 | 2.29 | 3.71 | 46 | 74 | 28 | 54 | 0.52 | 3rd |
| Lifting & transferring from bed to chair | 1 | 0.19 | 0.42 | 19 | 42 | 23 | 81 | 0.28 | 7th |
| Back care & positioning | 3 | 1.03 | 1.93 | 34 | 64 | 30 | 66 | 0.45 | 5th |

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6th highest knowledge gain as per modified gain (0.43). The lowest knowledge gain of care givers obtained in the area of lifting and transferring from bed to chair as per modified gain (0.28).

The data shown in table 2 indicates that in the experimental group, the majority had average knowledge 58.06%, 12.90% had good knowledge, whereas only 29.03% of the caregivers had a poor knowledge level. By contrast, in the control group, most the caregivers had average knowledge, to wit 67.74%, 9.68% had good knowledge, and only 22.58% of the caregivers had poor knowledge.

The data presented in table 3 shows that in the experimental group, 90.32% of caregivers had good knowledge level and 9.68% of caregivers had average knowledge level but no one had poor knowledge. Whereas, in the control group, 64.52% of caregivers had average knowledge level, 16.13% had good knowledge and only 19.35% of caregivers had poor knowledge level.

The data presented in the table 4 shows that the mean post-test knowledge score of caregivers (13.61) is significantly higher after the administration of multimodal teaching than the mean pretest knowledge score of caregivers (7.13) with mean difference of 6.48 which is statistically significant as evident from the 't' value of 17.23 with df (30) at 0.05 level of significance as calculated by paired 't' test. Hence, the null hypothesis ($H_{01}$) was rejected and the research hypothesis ($H_1$) was accepted. So, it indicated that the increased knowledge of caregivers was not by chance.

Therefore, it may be inferred that the multimodal teaching is effective in increasing knowledge of caregivers.

**Table 2** Frequency and percentage distribution of pretest knowledge level of caregivers in both experimental group and control group.

| | $n_e$=31, $n_c$=31 | | | |
|---|---|---|---|---|
| **Knowledge level** | **Experimental group** | | **Control group** | |
| | **Frequency** | **Percentage (%)** | **Frequency** | **Percentage (%)** |
| Good (>10), (Mean + 1SD) | 4 | 12.9 | 3 | 9.68 |
| Average (6-10), (Mean ± 1SD) | 18 | 58.06 | 21 | 67.74 |
| Poor (<6), (Mean - 1SD) | 9 | 29.03 | 7 | 22.58 |

**Table 3** Frequency and percentage distribution of post-test knowledge level of caregivers in both experimental group and control group

| | $n_e$=31, $n_c$=31 | | | |
|---|---|---|---|---|
| **Knowledge score** | **Experimental group** | | **Control group** | |
| | **Frequency** | **Percentage (%)** | **Frequency** | **Percentage (%)** |
| Good (>10), (Mean + 1SD) | 28 | 90.32 | 5 | 16.13 |
| Average (6-10), (Mean ± 1SD) | 3 | 9.68 | 20 | 64.52 |
| Poor (<6), (Mean -1SD) | Nil | Nil | 6 | 19.35 |

**Table 4** Mean, median, mean differences, SD and 't' value of pretest and post-test knowledge score of caregivers in experimental group.

| | | | | | $n_e$ =31 |
|---|---|---|---|---|---|
| **Knowledge score** | **Mean** | **Median** | **SD** | **Mean Difference** | **t' value** |
| Pretest | 7.13 | 07 | 2.62 | 6.48 | 17.23* |
| Post test | 13.61 | 14 | 2.29 | | |

't' df (30) = 2.042, p <0.05, *Significant

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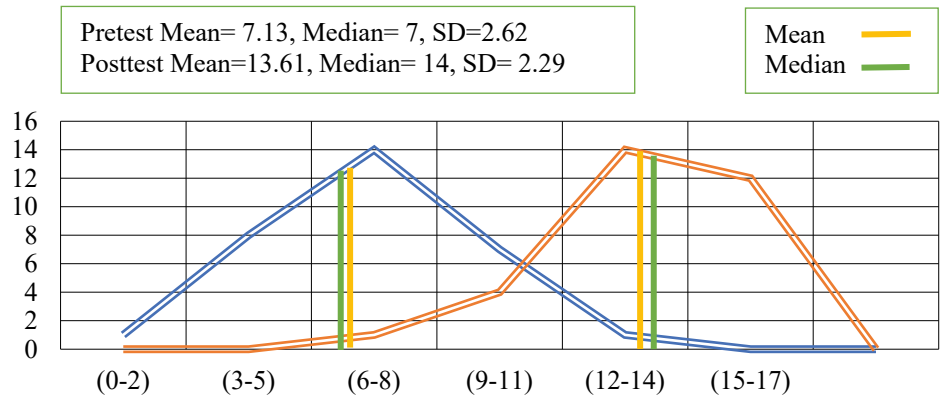


**Fig.1 Frequency** polygon showing pretest and post-test knowledge score of caregivers in experimental group

In Figure 1 Frequency polygon shows that the pretest knowledge score mean was 7.13 and median 7. The maximum frequency lies in the class interval 6-8 in pretest. The skewness coefficient calculated for pretest curve was 0.14 that means it is positively skewed. A distribution is skewed if one of its tails is longer than other. The distribution of pretest score shown as a positive skew. This means that it has a long tail in the positive direction [4]. In the post-test, knowledge score mean was 13.61 and median 14. The maximum frequency lies in the class interval of 12-14. The skewness calculated for post-test curve was – 0.51 that means it was negatively skewed. The distribution of post-test score has a negative skew since it has a long tail in negative direction [5].

This figure also shows that the post-test knowledge score lies in the right side of the pretest knowledge score, indicating the post-test knowledge score of caregivers had enhanced after administration of multimodal teaching regarding post-stroke rehabilitation [6].

The data presented in table 5 indicates that the mean post-test knowledge score of caregivers (13.61) in experimental group was significantly higher after administration of multimodal teaching than mean post-test knowledge score (7.84) in control group with a mean difference of 5.77 which was statistically significant as evident from the 't' value of 9.67 with df (60) at 0.05 level of significance as calculated by unpaired 't' test [7].

Hence, the null hypothesis ($H_{02}$) was rejected and the research hypothesis ($H_2$) was accepted which indicated that the increase in knowledge level was not by chance.

Therefore, it may be inferred that the multimodal teaching was effective in increasing knowledge level of caregivers.

**Result**

The purpose of this study is to assess the effectiveness of multimodal teaching on the knowledge of caregivers concerning post-stroke rehabilitation. Most caregivers in both the groups, experimental and control, had average knowledge; however, some caregivers had shown poor understanding and, thus, needed improvement in terms of education. Following the intervention, there was a significant knowledge increase seen in the experimental group with a post-test score at a mean of 13.61 as opposed to

**Table 5** Mean, median, SD, mean difference and 't' value of post-test knowledge score among caregivers in experimental group and control group.

| | | | | $n_e$=31, $n_c$=31 | |
|---|---|---|---|---|---|
| **Knowledge score** | **Mean** | **Median** | **SD** | **Mean Difference** | **'t' value** |
| Experimental group | 13.61 | 14 | 2.29 | 5.77 | 9.67* |
| Control group | 7.84 | 08 | 2.41 | | |

't' df (60) = 2.000, p <0.05, * Significant

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the pre-test mean score of 7.13 ($p < 0.05$), while the control group showed slight improvement; therefore, proving the success of the intervention. The maximum knowledge improvements were observed in communication skills with a value of 0.62 and in the topic of stroke with a value of 0.61 while minimum improvements were found in the practical skills like lifting and transfer that only had 0.28 improvement. Conclusion: Multimodal teaching proved to be a good strategy for showing significant improvement in the knowledge base of caregivers so that they become better equipped for post-stroke care [8].

**Discussion**

The findings of this study indicate that multimodal teaching is an effective approach for enhancing caregivers' knowledge of post-stroke rehabilitation, particularly in theoretical domains such as communication and stroke awareness. Nonetheless, the limited improvement in practical skills underscores the need for incorporating hands-on training components into caregiver education programs. Future interventions should integrate practical demonstrations and skill-based training to facilitate comprehensive learning and skill retention.

A key limitation of this study is the relatively small sample size (n=31 per group), which may restrict the generalizability of the findings. While the results provide valuable insights into the effectiveness of multimodal teaching, additional research with larger and more diverse samples is necessary to validate these findings and assess their broader applicability.

**Conclusion**

The findings indicated that post-stroke rehabilitation knowledge among caregivers increased strongly after participation in multimodal teaching sessions. Initially, a multidimensional approach was not used; thus, their knowledge scores about the key constructs were only average to poor before the intervention, suggesting a strong gap in effective educational approaches in this area. Following the intervention during which the multimodal teaching approach was implemented with the experimental group of caregivers, their knowledge scores increased significantly from 7.13 to 13.61 ($p < 0.05$).

Studies indicated that the treatment did indeed fill the gaps pertaining to education in a proper way. There is noticeable improvement in terms of communication skills and understanding the concept of strokes. A few of the aspects, like the application of practical skills in lifting and transferring the patient, were witnessed to be less improved; however, the results overall establish the fact that the multimodal approach does help in preparing caregivers for all the complexities arising out of post-stroke care [9].

This research emphasizes the importance of innovative educational strategies tailored to caregivers' unique needs, ultimately contributing to better care for stroke survivors [10]. In light of these results, it is recommended that similar multimodal teaching interventions be integrated into caregiver education programs to enhance their knowledge and skills further, thereby improving outcomes for both caregivers and stroke patients.

**Limitation**

1. The small sample size (n=31 for both groups) limits the generalizability of findings to a broader caregiver population.
2. Conducted at two medical colleges in West Bengal, the study may not reflect the experiences of caregivers in other regions.
3. A short follow-up period restricts the assessment of long-term knowledge retention and effectiveness of the intervention.
4. Self-reported knowledge assessments may introduce bias, as participants could overestimate their understanding.
5. The lack of practical assessments limits evaluation of how well caregivers apply their knowledge in real-life scenarios.

**Practical Implications**

The study highlights the effectiveness of multimodal teaching, but its real-world implementation is crucial for maximizing its benefits. Hospitals and community health centers can incorporate multimodal teaching strategies into routine caregiver training programs. Healthcare professionals should receive training on delivering multimodal education effectively, ensuring caregivers can comprehend and apply the information. Mobile applications and online resources can further enhance accessibility and reinforce learning. By institutionalizing

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multimodal teaching in caregiver education, healthcare systems can improve post-stroke recovery outcomes and reduce the burden on families and medical institutions.

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**Authors Contribution**

Jharna Mondal led the conceptualization, data analysis, and drafted the manuscript. Prof. Debarchana Mandal supervised the study design, methodology, and provided critical revisions. Saraswati Bera contributed to data collection, curation, and preliminary analysis. Bidhan Dolai assisted with literature review, data interpretation, and manuscript editing. All authors reviewed and approved the final manuscript.

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**Conflict of Interests**

The authors declare no conflicts of interest.

**Consent to Publication**

All authors consent to the publication of this manuscript.

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of article.

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# Подолання прогалини в знаннях за допомогою мультимодального навчання для осіб, які здійснюють догляд за пацієнтами після інсульту

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***Анотація:*** *інсульт суттєво впливає на рівень смертності й інвалідності у світі, особливо в країнах із низьким та середнім рівнем доходу, таких як Індія, створюючи серйозні труднощі для доглядальників, які часто не мають належної освіти й ресурсів для післяінсультного догляду. Це дослідження вивчає ефективність мультимодального навчального втручання, адаптованого для доглядальників осіб, які перенесли інсульт. Використовуючи квазіекспериментальний дизайн, 62 доглядальники були розподілені на експериментальну та контрольну групи, а оцінка знань проводилася до й після втручання за допомогою структурованих анкет. Результати показали суттєве зростання рівня знань в експериментальній групі: з середнього значення 7,13 до 13,61 ($p < 0,05$), тоді як у контрольній групі покращення були незначними. Найбільший приріст знань спостерігався у сфері комунікативних навичок та розуміння поняття інсульту. Отримані результати підтверджують, що мультимодальне навчання ефективно підвищує обізнаність доглядальників, що свідчить про необхідність інтеграції подібних освітніх стратегій у програми навчання доглядальників для покращення результатів як для них, так і для пацієнтів. Обмеженням дослідження є невеликий розмір вибірки, регіональна специфіка та потенційна упередженість самооцінок.*

**Ключові слова:** реабілітація після інсульту, доглядальники, методи навчання, квазіекспериментальні дослідження, знання