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# Integration of a Train-the-Trainer Model for Improving Stroke Care among Nurses and Caregivers: A Quasi-Experimental Study

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ABSTRACT

***Background:*** Competent nurses and caregivers are essential for preventing stroke complications. In resource-limited settings, staffing and time constraints hinder consistent education. The Train-the-Trainer (TTT) model offers a scalable solution to strengthen nursing capacity and caregiver preparedness. ***Purpose*****:** To evaluate the effectiveness of a TTT program in improving stroke care knowledge and skills among nurses and caregivers. ***Methods*****:** A sequential, multi-phase interventional study using a pre-experimental design for nurses and a quasi-experimental design for caregivers was conducted from July to September 2023 in a tertiary care hospital in India. In Phase 1, 90 nurses from Emergency and Neurology units were enrolled to assess baseline stroke care knowledge and skills. Their assigned patients and caregivers were non-randomly recruited as a historical control group (n = 31) and assessed similarly. In Phase 2, a master trainer delivered TTT structured training to the nurses. These trained nurses educated their newly assigned patients and caregivers, enrolled as the experimental group (n = 31). Outcomes were measured using structured knowledge questionnaires and skill checklists. ***Results*****:** Nurses showed significant improvement in post-training knowledge and skills (mean difference = 5.6; $p < 0.001$). Caregivers in the experimental group demonstrated significantly higher post-test scores in both knowledge and skills compared with historical controls (mean difference = 8.78; $p < 0.001$). ***Conclusion*****:** The TTT model enhanced stroke care competencies among nurses and caregivers, demonstrating its potential as a scalable educational strategy. ***Implications for Nursing*****:** The model strengthens nursing capacity, promotes skill transfer, standardises patient education, and can be integrated into routine and discharge planning

***Keywords:*** Stroke, Caregivers, Nurses, Train-the-trainer model, Patient education, Training of trainers.

**What does this paper add?**

1. This study demonstrates the effectiveness of a Train-the-Trainer (TTT) model in improving stroke care knowledge and skills among both nurses and caregivers of stroke survivors.
2. Nurses trained through the TTT model effectively increased the knowledge and skills of caregivers in various stroke care domains.
3. Implementing the model in stroke care settings has the potential to improve patient outcomes, enhance

healthcare quality, and empower the caregivers, offering a scalable framework for stroke care education.

## Introduction

Stroke remains a major global health concern and is a leading cause of long-term disability worldwide. It occurs when cerebral blood flow is suddenly interrupted due to a thrombus, embolus, or haemorrhage in a specific brain region (Gorthi & Garg, 2022). Effective post-stroke care is essential to reduce complications and optimize patient recovery. Nurses play a pivotal role in implementing evidence-based practices throughout the continuum of stroke care. However, many developing countries face a severe shortage of nursing staff, limiting individualized care delivery (Camicia et al., 2021).

Caregivers also assume a vital role, as most stroke survivors discharged from hospitals continue to experience significant functional deficits. This results in a high caregiver burden and an increased risk of complications (Tziaka et al., 2024). Studies have also highlighted that adequate caregiver support and education significantly influence self-care abilities and recovery outcomes among stroke patients (Setyoadi et al., 2024). In low-resource settings, where regular visits to stroke clinics may not be feasible, caregiver education becomes indispensable. Furthermore, well-organized stroke units are often concentrated in urban or private healthcare settings, underscoring the importance of nurse-led educational interventions to support continuity of care (Bhatt et al., 2024). Nurses, as facilitators of care transitions across settings, are therefore crucial in preventing post-stroke complications.

Despite the recognized importance of education for both nurses and caregivers, delivering standardized and scalable training remains a challenge in resource-constrained settings. Traditional training methods for healthcare professionals, although valuable, can be resource-intensive and time-consuming, particularly when scaling to a large workforce. A potential solution lies in the Train-the-Trainer (TTT) model, which focuses on training selected individuals who, in turn, educate others, creating a cascading effect that broadens knowledge dissemination (Mormina & Pinder, 2018; Nexø et al., 2024). Originally developed by the United States military during World War II, the TTT model, also referred to as triadic, pyramidal, or helper-model training, has been successfully adapted across multiple healthcare domains to strengthen workforce capacity (Nexø et al., 2024; Suhrheinrich, 2011).

The TTT model is structured around three essential components: a master trainer, potential trainers, and students, ensuring systematic and sustainable transmission of knowledge and skills (Centers for Disease Control and Prevention, 2020). Although traditional training approaches remain common in healthcare, their scalability is limited.

Recent healthcare studies have demonstrated the effectiveness of the Train-the-Trainer model in diverse settings, including dementia care training for nurse managers and community-based programs for chronic disease management, where it improved knowledge dissemination and feasibility in real-world practice (Hedberg et al., 2024; Sullivan et al., 2024). However, evidence regarding its application in stroke care involving both nurses and caregivers remains limited.

This study, therefore, aimed to evaluate the effectiveness of a Train-the-Trainer-based intervention program in improving stroke-related knowledge and skills among nurses and caregivers of stroke survivors.

## Methods

### Study Design

A quantitative interventional study was conducted using two complementary designs. A quasi-experimental (non-equivalent control group) design was used to assess the effectiveness of the Train-the-Trainer (TTT) intervention on caregivers' knowledge and skills, while a pre-experimental (one-group pre-test post-test) design evaluated the impact of the same intervention on nurses' knowledge and skills. The study is reported in accordance with the TRENDS (Transparent Reporting of Evaluations with Nonrandomized Designs) guidelines.

### Setting

The study was conducted in the Emergency Medicine and Neurology units of a tertiary care referral hospital serving North India. Emergency and neurology units were selected, as they represent the primary points of admission and acute management for stroke patients. Most patients with acute ischemic stroke are admitted through the emergency department and either discharged within 24-48 hours or transferred to neurology units. Therefore, nurses in these units play a critical role in early stroke management and caregiver education.

**Participants**

**Nurses:** All eligible nurses working in Emergency Medicine and Neurology units during the data collection period were included using total enumeration sampling. A total of 90 nurses (50 from Emergency, 40 from Neurology) participated. The inclusion criteria included nurses willing to participate, currently posted in selected units and providing care to stroke patients. The exclusion criteria were nurses on long leave during data collection and those who had previously attended formal structured stroke training within the last six months.

**Caregivers:** Primary caregivers of patients diagnosed with stroke or transient ischemic attack (TIA) admitted to the selected units were recruited using purposive sampling. The inclusion criteria for caregivers were those identified as primary caregivers to patients diagnosed with stroke/TIA, who were able to understand Hindi, Punjabi, or English and who provided written informed consent. The exclusion criteria included formal/professional paid caregivers.

**Sample Size Calculation**

The sample size for caregivers was calculated using OpenEpi, version 3.01 for comparison of two independent means. The calculation was based on mean and standard deviation values derived from a previous interventional study evaluating stroke caregiver education (Gurjar, 2019). The parameters included a two-sided 95% confidence interval, 90% statistical power, and an anticipated effect size of 0.75. The minimum required sample was 56 caregivers (28 per group). After accounting for a 10% attrition rate, the final sample size was increased to 62 (31 per group). The sample size for nurses (n = 90) was determined by total enumeration of eligible nurses in selected units.

**Research Hypotheses**

H1: Nurses will demonstrate significantly improved knowledge and skills following the TTT intervention.

H2: Caregivers trained by TTT-trained nurses will demonstrate significantly higher knowledge and skills compared to historical controls.

**Development of the Training Intervention**

The educational booklet and training materials were developed by the researchers after an extensive review of current international and national stroke management guidelines, including the American Heart Association/American Stroke Association guidelines and the Indian Stroke Association guidelines, along with standard medical-surgical nursing textbooks (Hinkle & Cheever, 2022; Indian Stroke Association, 2024; Powers et al., 2019).

The training was delivered through PowerPoint presentations, demonstrations, interactive discussions, and educational booklets tailored separately for nurses and caregivers. The content included stroke, its types, golden period, risk factors, warning signs, emergency management, pre- and post-thrombolysis care, rehabilitation after stroke, hospital-to-home transition care, positioning, mobility assistance, feeding techniques, medication adherence and prevention of various complications after stroke. The educational booklets were reviewed by a panel of 12 experts in neurology and nursing education to establish content validity. The Content Validity Index (CVI) was calculated, demonstrating excellent agreement among reviewers.

**TTT Model (Training Intervention)**

The Train-the-Trainer model comprises three primary components, as displayed in Figure 1.

***a. Master Trainer***

The master trainer is the trainer who runs the course, often an expert with extensive knowledge and experience in the subject matter. He/she aims to develop and deliver the training curriculum, ensuring that it effectively transmits the knowledge and skills (Al-Abedi & Mansour, 2022).

In the current study, the Principal Investigator (PI)/ first author was the master trainer, utilizing clinical expertise and input from subject matter experts to design and deliver the training program. The Principal Investigator holds a Master's degree in Neuroscience Nursing and has over two years of clinical experience in neurosurgical nursing, along with two years of academic experience in undergraduate nursing education. The trainer had prior experience in stroke care, patient education, and skill-based training. The master trainer developed a Train-the-Trainer conceptualized intervention program and then trained the nurses (potential trainers).

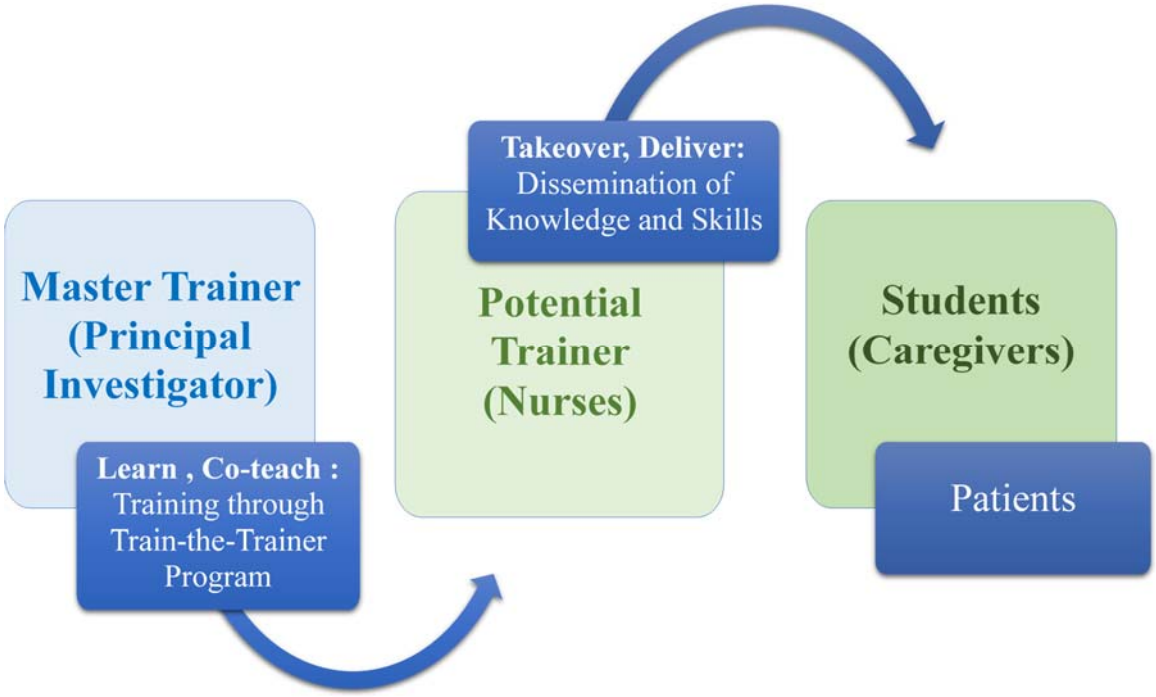


**Figure 1. Components of the Train-the-Trainer model used in the study**

***b. Potential Trainers***

The potential trainers are the trainees who attend the course and who will become internal trainers within the organization. The potential trainer aims to participate in the initial training program led by the Master Trainer; practice delivering training modules, and receive feedback on their performance. Once deemed competent, they take the responsibility of delivering the training program to other employees within the organization (Al-Abedi & Mansour, 2022).

In the current study, staff nurses were the potential trainers. They were part of the training program where their knowledge and skills regarding patient care for stroke survivors were refreshed.

***c. Students***

The students are taught by the potential trainers once they have completed the course. These are the employees within the organization who will be receiving the training delivered by the newly trained internal trainers. They aim to participate and engage in the training program and apply the learned knowledge and skills to their work activities (Al-Abedi & Mansour, 2022).

In the current study, caregivers of stroke survivors functioned as dedicated participants or students in the learning process. Caregivers of stroke survivors were trained by the nurses in practical aspects of stroke care, prevention of complications, and caregiving techniques.

**Instruments**

Data was collected using structured and validated instruments developed by the researchers based on current stroke management guidelines.

***Part A: Socio-demographic Profile***

A structured proforma was used to collect the socio-demographic profile of nurses and caregivers. Socio-demographic variables for nurses included age, gender, designation, professional status and work experience. Sociodemographic variables for caregivers included age, gender, marital status, educational status, occupation, income, and relationship with the patient.

***Part B: Questionnaire to Assess the Stroke Knowledge:*** Stroke care knowledge was assessed using self-developed multiple-choice questionnaires for nurses (30 items; score range 0-30) and caregivers (20 items; score range 0-20), covering domains, such as stroke overview, risk factors, warning signs, acute management, complication prevention, and rehabilitation. The internal consistency of the knowledge questionnaire was tested using Cronbach's α and found to be 0.72.

***Part C: Checklist to Assess the Skills:*** The skills of caregivers regarding stroke were assessed by a self-developed checklist with skill domains, like nasogastric tube feeding, endotracheal/ tracheostomy tube suctioning, back care, oral care, and range of motion exercises. Score one was given to each correct step performed, and zero to each incorrect or not performed step. The inter-rater reliability of the skill checklist was assessed using Cohen's κ, which was 0.77.

**Data Collection Procedure**

The study was conducted in two phases, aligned with the sequential steps of the Train-the-Trainer (TTT) model: Learn, Co-teach, Takeover, and Deliver.

***Phase 1***

Baseline knowledge and skills of 90 nurses were assessed using a self-developed questionnaire and checklist. Additionally, a control group of 31 caregivers was enrolled to evaluate their baseline knowledge and skills before the intervention. The TTT model was applied, and stroke care training was delivered to nurses through structured teaching sessions using PowerPoint presentations, group discussions, and booklets. The initial training workshop conducted by the Master Trainer for nurses was delivered over two consecutive days, with a total duration of 10 hours (5 hours per day), including theoretical sessions, demonstrations, interactive discussions, and supervised return demonstrations. This corresponded to the *Learn* phase, where nurses acquired foundational knowledge and skills. Subsequently, during the *Co-teach* phase, nurses practised delivering selected modules under the guidance of the Master Trainer and received feedback to enhance their teaching competency.

***Phase 2***

Trained nurses progressed to the *Takeover* and *Deliver* phases. They conducted knowledge and skills training sessions for an experimental group of 31 caregivers. Seven days post-training, the caregivers' knowledge and skills were reassessed. All pre-test and post-test assessments were conducted by the Principal Investigator to ensure consistency in data collection. Skills were evaluated through direct observation using standardized checklists.

**Ethical Considerations**

Ethical approval was obtained from the Institutional Ethics Committee on 03/04/2023. The study was conducted between July and September 2023. Written informed consent was obtained from all participants (nurses and caregivers) before inclusion. Participants were provided with a participant information sheet explaining the study objectives and procedures. Participation was voluntary, and participants were informed of their right to withdraw at any time without any consequences.

Confidentiality was maintained by coding all data and storing it in password-protected electronic files accessible only to the Principal Investigator. No personal identifiers were included in the final analysis or publication, and participants did not receive any financial compensation.

**Data Analysis**

Data was analyzed using SPSS, version 20.0. Descriptive statistics (percentage, mean, standard deviation) were used for data summarization, while inferential statistics (Chi-square, McNemar test, Mann-Whitney test, and Wilcoxon signed-rank test) were used for hypothesis testing. A p-value $< 0.05$ was considered statistically significant.

**Results**

A total of 90 nurses (50 from Emergency and 40 from Neurology units) and 62 caregivers (31 control and 31 experimental) participated in the study.

***Demographic Characteristics***

The mean age of nurses was 35.2 ± 7.1 years (range: 23-54 years). The majority were female (68.8%) and nursing officers (91.2%). Most participants held a graduate degree in nursing (78.9%) and had a mean work experience of 10.2 ± 5.9 years. Table 1 reports that nurses from Emergency and Neurology units were comparable in demographic and professional characteristics ($p > 0.05$). The mean age of caregivers was 37.35 ± 10.94 years in the control group and 38.58 ± 11.00 years in the experimental group. Most caregivers in both groups were male and married. The groups were comparable in most demographic variables except socioeconomic status ($p < 0.05$).

**Table 1. Socio-demographic and professional profile of nurses working in emergency and neurology units**

| Characteristics | Nurses N=90 | Emergency nurses n=50 | Neurology nurses n=40 | $\chi^2$/ Fisher's exact (df) *p-value* |
|---|---|---|---|---|
| | n (%) | n (%) | n (%) | |
| **Age(years)*** | | | | |
| 18-30 | 26(28.9) | 19(38.0) | 7(17.5) | 5.28(2).07[f] |
| 31-43 | 53(58.9) | 27(54.0) | 26(65) | |
| ≥44 | 11(12.2) | 4(8.0) | 7(17.5) | |
| **Gender** | | | | |
| Male | 28(31.2) | 15(30.0) | 13(32.5) | .06(1).79 |
| Female | 62(68.8) | 35(70.0) | 27(67.5) | |
| **Designation** | | | | |
| Nursing Officer | 82(91.2) | 46(92.0) | 36(90.0) | |
| Senior Nursing Officer | 6(6.6) | 4(8.0) | 2(5.0) | 2.41(2).30[f] |
| Nursing Assistant | 2(2.2) | - | 2(5.0) | |
| Superintendent | | | | |
| **Professional status** | | | | |
| Diploma in nursing | 16(17.8) | 7(14.0) | 9(22.5) | |
| Graduate in nursing | 71(78.9) | 41(82.0) | 30(75.0) | 1.21(2).55[f] |
| Postgraduate in nursing | 3(3.3) | 2(4.0) | 1(2.5) | |
| **Work experience **** | | | | |
| ≤2 years | 7(7.7) | 5(10.0) | 2(5.0) | |
| 3-7 years | 27(30.0) | 17(34.0) | 10(25.0) | 5.38(3).14[f] |
| 8-12 years | 29(32.3) | 18(36.0) | 11(27.5) | |
| ≥13 years | 27(30.0) | 10(20.0) | 17(42.5) | |

**Mean age(yrs)±SD:35.2±7.1, Range 23-54.*
*N= total sample; n=frequency; %= percentage;* $\chi^2$= Chi-square test; *f=fisher exact.*
*** Work experience(yrs)±SD:10.2± 5.9.*
*N= total sample; n=frequency; %= percentage;* $\chi^2$= Chi-square test; *f=fisher exact.*

***Nurses' Knowledge and Skills***

Nurses demonstrated a statistically significant improvement in stroke care knowledge following the intervention (mean difference = 5.6; $p < 0.001$), as shown in Table 2. The mean knowledge score increased from 18.3 ± 4.7 in the pre-test to 23.9 ± 6.0 in the post-test. When analyzed by unit, neurology nurses showed greater improvement (mean difference = 6.9) compared to emergency nurses (mean difference=4.5). Knowledge levels were categorized as poor (≤10), good (11-20), and very good (≥21), with a notable increase in the proportion of nurses in the "very good" category from 24.4% to 71.1% following the intervention.

Table 3 reports that nurses demonstrated improvement in key skill domains, like suctioning and feeding practices following the intervention. In feeding practices, statistically significant improvement was observed in specific steps, such as patient positioning during feeding and measurement of gastric residual volume among both neurology and emergency nurses ($p<0.05$). Further domain-wise analysis revealed significant improvement in selected back care and oral care practices, including petrissage ($p = 0.01$), percussion techniques ($p = 0.03$), and use of emollient after oral care ($p = 0.05$). No significant differences were observed in other skill components, such as overall back care, oral care, and range of motion techniques, and suctioning practices among these nurses, suggesting generally good pre-existing proficiency.

**Table 2. Comparison of knowledge scores regarding stroke among nurses**

| Nurses | Pre-test Mean±S.D. (Range) | Post- test Mean±S.D. (Range) | Mean difference | p value* |
|---|---|---|---|---|
| Total nurses N=90 | 18.3±4.7 (5-27) | 23.9±6.0 (8-30) | 5.6 | *<0.001* |
| Neurology nurses n=40 | 17.5±5.4 (5-26) | 24.4±6.4 (8-29) | 6.9 | *<0.001* |
| Emergency nurses n=50 | 19.0±3.9 (10-27) | 23.5±5.8 (11-30) | 4.5 | *<0.001* |

***** *Wilcoxon signed rank test;* Max attainable score: 30.

**Table 3. Comparison of key skill domains of nurses regarding care of patients with stroke**

| | Frequency of correct steps | | P value* | Frequency of correct steps | | p value* |
|---|---|---|---|---|---|---|
| | Neurology nurses n=40 | | | Emergency nurses n=50 | | |
| | Pre-test n(%) | Post-test n(%) | | Pre-test n(%) | Post-test n(%) | |
| **Feeding** | | | | | | |
| Patient propped up/Fowler's during feed | 35(87.5) | 39(97.5) | 0.001 | 31(62.0) | 42(84.0) | 0.05 |
| NG secured adequately with tape | 38(95.0) | 40(100.0) | 0.50 | 47(94.0) | 49(98.0) | 0.62 |
| NG placement assessment by aspirating gastric content or stethoscope | 40(100.0) | 40(100.0) | - | 50(100.0) | 50(100.0) | - |
| Measure gastric contents aspirated before feed | 22(70.0) | 34(85.0) | 0.23 | 20(40.0) | 36(72.0) | 0.001 |
| No air entry during feed | 40(100.0) | 40(100.0) | - | 50(100.0) | 50(100.0) | - |
| Height of holding the syringe is appropriate | 35(87.5) | 37(92.5) | 0.50 | 50(100.0) | 50(100.0) | - |
| No air entry after feed | 37(92.5) | 40(100.0) | - | 48(96.0) | 50(100.0) | 0.15 |
| Water instillation after feed | 40(100.0) | 40(100.0) | - | 50(100.0) | 50(100.0) | - |
| Propped up/fowler till minimum 30 minutes after feed | 34(85.0) | 37(92.5) | 0.75 | 30(60.0) | 37(74.0) | 0.39 |
| **Suctioning** | | | | | | |
| Ensure ET/TT tube is intact/ no dislodgement | 40(100.0) | 40(100.0) | - | 43(86.0) | 50(100.0) | 0.50 |
| Check for blockage of the tube | 40(100.0) | 40(100.0) | - | 48(96.0) | 50(100.0) | 0.50 |
| Appropriate position given for suctioning | 40(100.0) | 40(100.0) | - | 48(96.0) | 49(98.0) | 0.50 |
| Aseptic technique while gloving and handling suction tube | 33(82.5) | 38(95.0) | 0.18 | 35(70.0) | 40(80.0) | 0.33 |
| Hyper oxygenate before suctioning | 36(90.0) | 39(97.5) | 0.37 | 38(76.0) | 45(90.0) | 0.14 |
| Adequate size of suction catheter used | 29(72.5) | 33(82.5) | 0.75 | 35(70.0) | 39(78.0) | 0.62 |
| No suction pressure applied while inserting | 40(100.0) | 40(100.0) | - | 50(100.0) | 50(100.0) | - |
| At one time suction no longer than 15 seconds | 40(100.0) | 40(100.0) | - | 46(92.0) | 47(94.0) | 0.50 |
| Clean suction catheter by normal saline | 37(92.5) | 38(95.0) | 1.0 | 50(100.0) | 50(100.0) | - |
| Suction out in rotatory motion | 33(82.5) | 36(90.0) | 0.06 | 47(94.0) | 48(96.0) | 1.00 |
| ET/TT tube suction followed by oral suction | 40(100.0) | 40(100.0) | - | 50(100.0) | 50(100.0) | - |
| Maintain record of sputum colour, content and odour | 33(82.5) | 37(92.5) | 0.34 | 30(60.0) | 38(76.0) | 0.11 |

***** *Calculated by the McNemar test.*

***Caregivers' Knowledge and Skills***

Caregivers in the experimental group demonstrated significantly higher knowledge scores compared to the control group following the intervention (mean difference = 8.78; $p < 0.001$), as displayed in Table 4. Knowledge levels were categorized as poor (≤10), good (11-15), and very good (≥16). In the control group, the majority of caregivers (87.1%) had poor knowledge scores, whereas in the experimental group, 80.6% achieved very good knowledge levels, as demonstrated in Figure 2.

**Table 4. Comparison of knowledge scores regarding stroke among caregivers**

| Caregivers | Mean±S.D | Range | Mean difference | p value* |
|---|---|---|---|---|
| **Control group** n=31 | 9.58±2.50 | 5-16 | | |
| **Experimental group** n=31 | 17.96±2.28 | 10-20 | 8.38 | <0.001 |

** Calculated by the Mann-Whitney U test; Maximum score -20.*

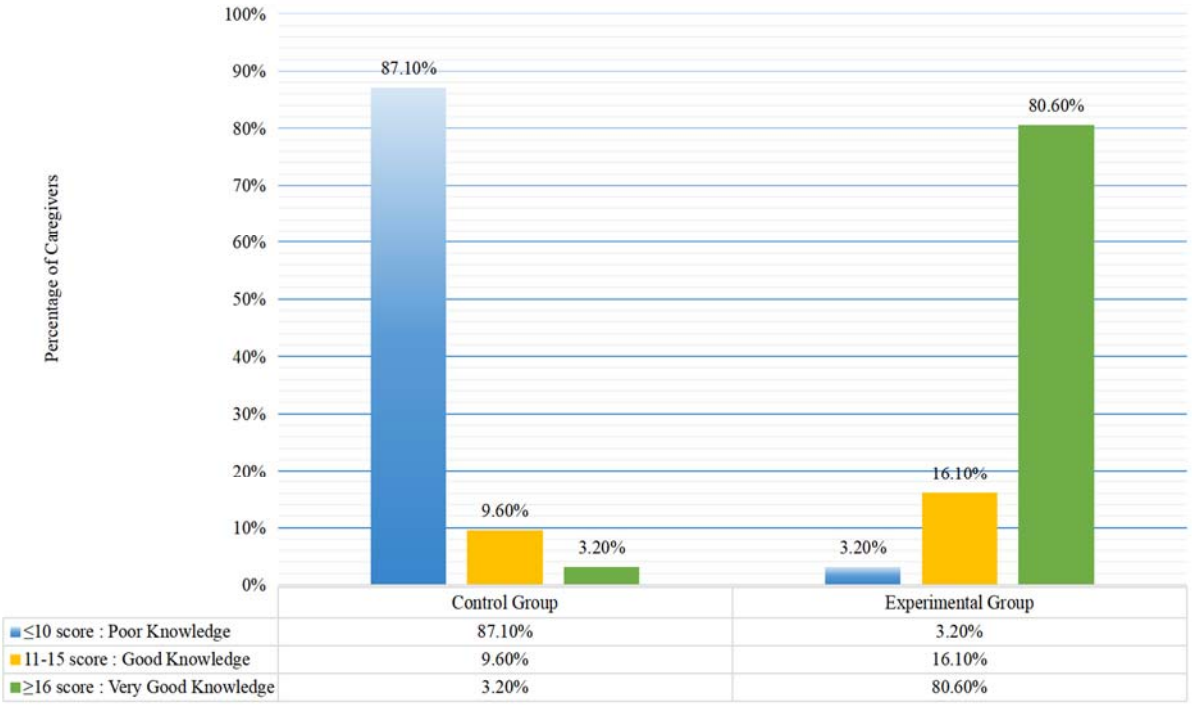


**Figure 2. Comparison of knowledge level between the control and experimental groups of caregivers**

Caregivers in the experimental group demonstrated significantly higher skill performance compared to the control group across multiple domains of stroke care. In feeding practices, significant improvements were observed in patient positioning, gastric residual volume assessment, prevention of air entry, and post-feeding positioning ($p < 0.05$). Similarly, selected suctioning practices showed improvement, particularly in maintaining aseptic technique, appropriate suction duration, and correct procedural methods ($p < 0.05$). A comprehensive improvement was noted in back care, oral care, and range of motion exercises, where caregivers in the experimental group performed significantly better across all components compared to the control group ($p < .05$). These findings indicate that the intervention was effective in enhancing caregivers' practical skills required for post-stroke care.

**Discussion**

This study integrated the Train-the-Trainer (TTT) model to enhance stroke care knowledge and skills among nurses working in acute care settings and

caregivers of patients with ischemic stroke. In this study, the first author trained a selected group of nurses, who then effectively transferred their acquired knowledge and skills to a larger group of caregivers. This approach is particularly beneficial in resource-constrained settings, such as developing countries, where limitations in time and staffing are prevalent (Abrudan et al., 2021).

The findings of the present study demonstrated a statistically significant improvement in both knowledge and skills among nurses and caregivers following the intervention. Nurses showed a marked increase in knowledge scores, with a shift from predominantly "good" to "very good" knowledge levels. Similarly, caregivers in the experimental group demonstrated significantly higher knowledge scores compared to the control group. In terms of skills, both nurses and caregivers exhibited improvements across key domains of stroke care, particularly in feeding practices, back care, and oral care, indicating the effectiveness of the intervention in enhancing practical competencies.

Educating caregivers is essential for successful stroke rehabilitation. The caregivers should be well educated regarding the proper care techniques, so that they can prevent long-term complications and aid in the recovery of their patients (Kumar et al., 2015). The burden of the understaffed nursing team is reduced as we empower and support the caregivers to achieve a successful recovery for their patients (Kumar, 2016).

The findings of the present study are consistent with existing literature supporting the effectiveness of the TTT model in healthcare settings. A study by Shen et al. (2018) investigated the effectiveness and feasibility of conducting a Train-the-Trainer (TTT) program in community settings for managing stable coronary artery disease (SCAD). Their findings demonstrated that the TTT program for SCAD management in community settings was generally feasible and effective, but obstacles remain, including patients' noncompliance, nurses' busy work schedules, and a lack of policy support.

Similarly, Mellinger et al. (2022) explored the use of a TTT model for dementia care training for nurse managers and their interactions with family caregivers in nursing homes. The training helped the nurse managers provide a more comprehensive assessment and management of important dementia care problems in the patients. The results concluded that the TTT model was associated with positive outcomes, as nurse managers demonstrated increased knowledge and self-efficacy in providing dementia care to the patients.

### *Strengths and Limitations*

This study provides empirical evidence supporting the effectiveness of the TTT model in stroke care education for both nurses and caregivers. However, the study was conducted in a single tertiary care institution, which may limit generalizability. Additionally, randomization was not feasible in the caregivers' group due to logistical constraints and ethical considerations. Future research should consider multi-centre trials with larger sample sizes and long-term follow-up to assess the retention of knowledge and skills.

The Train-the-Trainer (TTT) model demonstrates its value as a robust framework for improving healthcare outcomes, particularly in resource-limited settings. By leveraging the cascading flow of knowledge inherent in the TTT model, healthcare systems can achieve sustainable improvements in patient and caregiver well-being (Zhao et al., 2024).

## Conclusion

The findings of this study suggest that the Train-the-Trainer model is a promising strategy for enhancing stroke care knowledge and skills among nurses and caregivers. This approach offers an efficient method for disseminating evidence-based knowledge to a large workforce and empowering caregivers to provide optimal support for stroke survivors. Implementing the TTT model in stroke care settings has the potential to improve patient care practices, enhance healthcare quality, and promote caregivers as active partners in the recovery process. Future research with longer follow-up is required to evaluate the sustainability of knowledge and skill retention over time.

## Implications for Nursing

The findings highlight the Train-the-Trainer (TTT) model as a feasible and scalable strategy for strengthening nursing capacity in stroke care. By enhancing nurses' knowledge and practical skills, the model supports consistent, evidence-based practice across clinical settings. Its cascading approach enables efficient transfer of essential caregiving skills to family caregivers, improving preparedness and continuity of care after discharge. Integration of TTT-based programs into routine in-service training and discharge planning can standardize patient education and reduce caregiver

burden. This model is particularly valuable in resource-constrained settings, offering a scalable approach to expanding the reach of nursing education and improving the quality of stroke care.

**Ethical Approval**

This study was approved by the Institutional Ethics Committee of Post Graduate Institute of Medical Education and Research, Chandigarh, India (INT/IEC/2023000328) on 03/04/2023. The study was carried out in PGIMER, Chandigarh, India.

**Trial/Protocol Registration**

Clinical Trials Registry India (CTRI) CTRI/2023/07/055602
Link: https://ctri.nic.in/Clinicaltrials/rmaindet.php?trialid=89913&EncHid=35558.64662&modid=1&compid=19

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**Conflict of Interests**

The authors declare no conflict of interests**.**

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**Author Contributions**

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