



Effect of an Educational Program on Nurses' Performance Regarding Patients with Cerebrovascular Stroke

Hanan Mohamed Mohamed¹, Nadia Mohamed Taha², Naglaa Abd Elkareem Moghazy³

¹ Nursing specialist, Zagazig University Hospitals, Egypt

²Professor, Department of Medical-Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt

³Assistant Professor, Department of Medical-Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt

Corresponding Author: Hanan Mohamed Mohamed E-mail: Hanan_201411@yahoo.com

Article History: Received: 05.05.2023

Revised: 17.06.2023

Accepted: 1.07.2023

ABSTRACT

Background: Stroke is a significant health problem in developing countries including Egypt. Nursing performance during the golden hours of stroke patient care is critical. **Aim of the study:** to evaluate the effect of an educational program on nurses' performance regarding patients with cerebrovascular stroke in intensive care units at Zagazig University Hospitals. **Subjects and methods:** This quasi-experimental study with pre-post assessment was conducted at Zagazig University Hospitals on a sample of 80 nurses. Data were collected using a self-administered questionnaire for knowledge and an observation checklist for practice. The fieldwork was carried out through assessment, planning, implementation, and evaluation phases. **Results:** Nurses' age ranged from 23 to 54 years, with more females (68.8%), carrying a diploma in nursing (77.5%). Only 56.3% had satisfactory pre-intervention knowledge, which increased to 100.0% at post and follow-up phases ($p < 0.001$). Also, and 46.3% adequate pre-intervention practice, which increased to 73.8% and 91.3% at the post and follow-up phases respectively ($p < 0.001$). The study intervention was the main positive predictor of nurses' knowledge and practice scores. **Conclusion and recommendations:** The implementation of a training program based on their identified needs is effective in improving nurses' knowledge and practice. The study recommends implementing the developed program on a wide scale in the study settings and in similar ones. Further research is proposed to assess the impact of the educational training program for staff nurses caring of patients with CVS on quality of life of these patients.

Keywords: Cerebrovascular stroke, Intensive care units, Nurses, Knowledge, Practice

INTRODUCTION

A neurologic symptom caused by cerebral ischemia or hemorrhage is commonly called a *cerebrovascular accident*, or stroke (Patel et al., 2019). Stroke is a leading cause of death and disability. Cerebrovascular stroke (CVS) is a sudden loss of functions resulting from disruption of blood supply to a part of the brain (American Stroke Association, 2017). According to the World Health Organization, it is the world's most deadly category of disease, second only to coronary heart disease (World Health

Organization [WHO], 2016). The majority of these deaths take place in low/middle-income countries (Centers for Disease Control and Prevention [CDC], 2017). The prevalence rate of stroke in Egypt is high (Khedr et al., 2014). However, only a limited number of studies have addressed the epidemiology of stroke in Egypt with no accurate national estimates of prevalence or incidence (Khedr et al., 2013).

The etiology of stroke affects both prognosis and outcomes (Ntaios, 2020). Stroke can be divided into two major

categories: ischemic and hemorrhagic (*Khaku and Tadi, 2020*). The American Stroke Association reports that the majority of strokes is ischemic and account for 88% of all strokes. In ischemic stroke, the blood flow is interrupted by total or partial occlusion of a cerebral artery by a thrombus or an embolus (*American Agency for Health Care Policy and Research, 2016*).

Hemorrhagic stroke results from extravasation of blood in the brain tissues or into the subarachnoid space. Stroke can affect any part of the four parts of the brain: right hemisphere, left hemisphere, cerebellum, or the brain stem. The CVS condition impacts several body functions such as the neuro-sensory, intellectual, communication, and elimination functions. A common deficit caused by stroke is dysphagia (*Grodner et al., 2017*). Other complications include cerebral edema, pneumonia, urinary tract infection and/or loss of bladder control, seizures, depression, pressure ulcers, deep vein thrombosis, ischemic stroke conversion to hemorrhagic stroke, cerebral vasospasm, and hypotension or hypertension (*Shehata et al., 2020*).

Nurses who develop expert skills by working as part of an integrated stroke team play a crucial role in improving patients' outcomes (*Loft et al., 2022*). The nurse has to consider nutritional supplements for patients who are at risk for malnourishment; and implement oral hygiene protocols to reduce the risk of pneumonia. Regular positioning, dermal hygiene, special bed mattresses, cushioned seats must be used until patient is able to move (*Powers et al., 2018*). The nurse has to provide patients with stroke education, information, advice, and the opportunity talk about the impact of illness on their lives (*Kummarg et al., 2018*). Nursing intervention guidelines provide assistance and increase awareness among the nurses who care for these patients (*Sakr et al., 2019*).

Patients with stroke need quality nursing care to improve their prognosis. Nurses' role in providing such care involves caring not only for their physical needs but also for their psychosocial wellbeing (*Wang et al., 2022a*). Thus, in dealing with stroke patients, nurses must apply the main nursing principle of delivery of holistic care (*Saban et al., 2022*). Early detection of any abnormal symptoms/signs and proper management and follow-up is effective in reducing the rate of hospital re-admissions of stroke survivors (*Chauhdry, 2022*).

Significance of the study

Stroke is a significant health problem in developing countries including Egypt. Improvement of stroke care should be achieved through multi and interdisciplinary approaches including public awareness, nursing education, and synergistic approach to stroke care. Hence, this study will shed light on the nursing performance during the golden hours of stroke patient care and factors affecting this performance including educational endeavors.

AIM OF THE STUDY

The aim of this study was to evaluate the effect of an educational program on nurses' performance regarding patients with cerebrovascular stroke in intensive care units at Zagazig University Hospitals. It hypothesized that nurses' post-program knowledge practice will be significantly higher in comparison with their pre-program levels.

SUBJECTS AND METHODS

Research design: A one-group quasi-experimental research design with pre-post-follow-up assessments was used in conducting this study.

Study setting: The study was conducted at Zagazig University Hospitals. It involved all its Intensive Care Units (ICUs): medical, stroke, and Neurological ones.

Subjects: A convenience sample of all the nurses providing care for the patients having cerebrovascular stroke in the previously mentioned units and agreed to participate was recruited in this study. Those available were 80 nurses. This fixed sample size was large enough to demonstrate a pre-post improvement of nurses' knowledge and practice with an Odds Ratio (OR) 2.7 corresponding to small to medium effect size (*Tabachnick and Fidell, 2019*), at 95% level of confidence and 80% power with adjustment for a dropout rate of about 10% using G*Power software for sample size calculation.

Data collection tools: Data collection tools consisted of self-administered questionnaire for knowledge assessment, and an observation for practice. The self-administered questionnaire assessed nurses' level of knowledge regarding the nursing care to be provided for stroke patients in ICUs. It was developed by the researcher based on review of relevant recent literature (*Hickey and Grotto, 1999; Endacott et al., 2009; Morton and Fontaine, 2009*). It consisted of 26 Multiple Choice Questions (MCQs), 30 True/False questions, and one 8-item ranking question. It covered 14 areas of knowledge about CVS disease, namely stroke definition, etiology, types, risk factors, signs and symptoms, ischemic vs hemorrhagic stroke, right vs left sided stroke, diagnosis, treatment, complications, prognosis, prevention, nurse role, and nursing care management. The tool also had a part for nurse's personal characteristics. Each question correctly answered was given a score "1" and a score "0" if incorrectly answered. The scores were summed-up and were converted into percentage scores. The nurse's knowledge was categorized as "satisfactory" if the percent score was 60 or higher, and as "unsatisfactory" if it was less than 60.

The observation checklist was quoted from the researcher's Master's Degree Thesis

(*Mohammed, 2017*) where it was adopted from *Lynn and Lebon (2008)* and *Miller and Mink (2009)*. It was used to assess nurses' practice of the care provided to stroke patients treated in ICUs. It covered three areas of nursing care practice, namely primary assessment, secondary assessment, and nursing care practice. Each item was checked as "done," "not done," or "not applicable." The "done" and "not done" were scored "1" and "0" respectively. The items checked as "not applicable" were left blank and discounted from the total attainable score. The scores of the items of each area and of the whole checklist were summed-up and converted into percentage scores. The nurse's practice was regarded as adequate if the score was 80% or higher, and inadequate if less.

Testing the face and content validity of the tool was done by a jury group of seven experts: 2 professors and 2 assistant professors in medical-surgical nursing, and 3 lecturers in internal medicine from Zagazig University. They reviewed the tool for clarity, comprehensiveness, and applicability. The reliability of the observation checklist was done by assessing its internal consistency using the split-half method. It showed a very good level of reliability with Guttman split-half coefficient = 0.829.

Pilot study: This was carried-out on 10% of the study sample 8 nurse to test the feasibility and applicability of the tools used. The nurses included in the pilot study were not included in the main study sample.

Field work: Data collection lasted from February until August 2021. The fieldwork was carried out through assessment, planning, implementation, and evaluation phases. After securing official permissions, the researcher met with the nursing directors to schedule the fieldwork activities. The researcher explained the aim of the study and its processes to all staff nurses. Eligible ones were recruited after being informed about

their ethical rights and after providing their oral informed consent.

Assessment phase: Nurses' practice was assessed using the observation checklist prior to administration of the knowledge questionnaire to minimize the possibility of bias. The observation was done at morning and afternoon shifts of post patient admission while the nurse was providing care to CVS patients. The researcher then collected baseline pretest data using the self-administered questionnaire. It was completed by nurses in the presence of the researcher to ensure validity of responses.

Planning phase: During this phase, the researcher prepared the educational program and its booklet based on nurses' learning needs identified from the primary assessment data, in addition to related literature. Its main objective was to update staff nurses' knowledge and practice to improve their skills for caring of patients with CVS at ICUS. Its theoretical part covered the anatomy and physiology of the brain, CVS introduction, definition, types, causes, risk factors, signs and symptoms, complications, prognosis, prevention, diagnostic investigations, treatment, and precautions., and nursing assessment and care for patients with CVS at ICUs including primary and secondary assessment. The practical part included nursing primary and secondary assessment, and nursing care including general supportive care, dysphagia assessment and management., care of paralyzed part, care of urinary incontinence, prevention of bed sores, falling, deep venous thrombosis, urinary tract infection.

Implementation phase: The program was implemented for nurses in small group sessions with integration of the theory into practice over 12 sessions (4 theoretical and 8 practical). Each theoretical session lasted for one hour, while each practical session took about 90 minutes. It took one month for each small group. sessions were conducted during

the morning and afternoon shifts. The researcher used simple scientific terms and language to suit the level of the attending nurses, with the use of attractive media and methods. Motivation and reinforcement techniques as praise and recognition during program sessions were used to enhance learning.

Evaluation phase: The effect of the program was evaluated through comparing the change in nurses' knowledge and practice pre-, immediate post-, and 3-month follow-up assessments using the same data collection tools.

Ethical considerations:

The research protocol was approved by the research ethics committee in the Faculty of Nursing at Zagazig University. The researcher clarified the aim of the study and its maneuvers to each nurse, ensuring the rights of refusal or withdrawal at any time. They were also reassured about anonymity and confidentiality of any collected data. They provided an oral informed consent to participate.

Statistical design:

Descriptive statistics were used to present data as frequencies and percentages for qualitative, and means, standard deviations and medians for quantitative variables. Analytic statistics included chi-square for comparing categorical variables. Spearman's rank correlation analyses were used to assess the correlations among quantitative and ranked variables. Multiple regression analysis was applied for identification of the independent predictors of nurses' scores of knowledge and practice. The level of statistical significance was set at p-value <0.05. All analyses were performed on SPSS 20.0 statistical package.

RESULTS

The study sample consisted of 80 nurses 23 to 54 years old, median 28.5 years as presented in Table 1. The highest

percentages were females (68.8%), married (65.0%), and carrying a diploma degree in nursing (77.5%). Their medians of total and current position experience were 11.4 and 5.0 years, respectively. Slightly less than three-fourth of the nurses were residing in rural areas (73.8%). Slightly more than two-thirds of them reported having previously attended training courses.

Table 2 shows that nurses' knowledge of stroke patient care was variable before the intervention. The percentages of nurses having satisfactory knowledge were as low as 27.5% and 37.5% in the areas of nursing management and risk factors, respectively. On the other hand, the majority of the nurses had satisfactory knowledge in the areas of definition (76.3%), complications (72.5%) and prognosis (83.8%). At the post-intervention phase, there were statistically significant improvements in nurses' knowledge with only one exception related to the area of prognosis ($p=0.15$). The improvements continued throughout the follow-up phase in all areas with slight declines in some of them. In total, slightly more than half of the nurses had satisfactory pre-intervention knowledge (56.3%). This increased to 100.0% at post and follow-up phases, and these improvements were statistically significant ($p<0.001$).

In total, as Table 3 displays, nurses' practices related to care of stroke patient were very low before the intervention. This was particularly evident regarding secondary assessment where none of them had total adequate practice. On the other hand, the most adequate practice was related to airway assessment (46.3%). The post-intervention and follow-up phases demonstrated statistically significant improvements in nurses' practices of all areas ($p<0.001$). This reached as high as 90.0% and 91.3% for airway assessment and nursing interventions at the follow-up phase, respectively. Overall, none of the nurses had adequate practice at

the pre-intervention phase. This rose to 73.8% and 91.3% at the post and follow-up phases, respectively. These differences were statistically significant ($p<0.001$).

Figure 1 illustrates statistically significant increases in nurses' standardized scores (max=100.0) of knowledge and practice throughout the intervention phases. The mean knowledge score increased from 63.3 at the pre-intervention phase to 95.3 at the follow-up phase ($p<0.001$). Similarly, the mean practice score increased from 60.2 at the pre-intervention phase to 87.5 at the follow-up phase ($p<0.001$). The lines indicate a rising trend of the scores throughout the intervention phases.

As presented in Table 4, a statistically significant moderate positive correlation was identified between nurses' total scores of knowledge and practice ($r=0.572$). Meanwhile, no statistically significant correlations could be revealed between their total knowledge or practice scores and any of their characteristics.

The multivariate analysis (Table 5) identified the study intervention as the main statistically significant independent positive predictor of nurses' knowledge score, in addition to urban residence and bachelor's degree. The model explains 75% of the variation in their knowledge score. None of the other nurses' characteristics had a significant influence on this score.

As for nurses' practice scores, Table 6 shows that the study intervention was also its main statistically significant independent positive predictor, in addition to nurse's total experience years. The model explains 66% of the variation in the practice score.

DISCUSSION

The aim of this study was to evaluate the effect of an educational program on nurses' performance regarding patients with cerebrovascular stroke in intensive care units at Zagazig University Hospitals. It

hypothesized that nurses' post-program knowledge and practice will be significantly higher in comparison with their pre-program levels. The results demonstrated significantly rising trends of their scores throughout the intervention phases, and the training program was identified as the main independent significant positive predictor of their knowledge and practice scores, thus leading to acceptance of the research hypotheses.

The first research hypothesis set in the current study was related to staff nurses' knowledge. It hypothesized that nurses' knowledge will significantly improve after implementation of the training intervention. To test this, nurses' knowledge was measured at the pre-intervention stage to provide a baseline for comparison. The results demonstrated marked deficiencies in nurses' knowledge related to CVS and related nursing care. The implementation of the study intervention led to significant improvements in nurses' knowledge in almost all tested areas, and this was maintained throughout the 3-month follow-up phase. This could be attributed to the positive impact of the implemented training intervention, which was confirmed by the results of the multivariate analysis, which identified it as the main predictor of the knowledge score. In agreement with this, a randomized clinical trial in Jordan demonstrated significant improvements in health care providers knowledge of stroke care following an educational intervention (*Rababah et al., 2021*).

In addition to the effect of the training intervention, other personal factors have influenced their post-intervention knowledge scores as revealed in the multivariate analysis. Thus, a higher level of nursing qualification and urban residence were identified as significant positive predictors of the knowledge score. This is quite expected given the positive impact of a higher qualification on nurses' knowledge. The effect of urban

residence could be due to more access to training and other sources of information. In congruence with this, a study in Japan showed that the nurses with higher level qualification were more knowledgeable of stroke patients care (*Hisaka et al., 2021*).

The second research hypothesis set in the present study was related to nurses' practice of care for CVS patients. It was hypothesized that nurses' practice will significantly improve after implementation of the training intervention. Their practices demonstrated significant improvements at the post-intervention phase, and this was maintained through the 3-month follow-up phase. This was evident in all areas tested. Overall, none of these nurses had adequate pre-intervention practice. At the post-intervention, significant improvements were revealed in their total practice, and this continued through the follow-up phase, thereby achieving the second set hypothesis. This improvement is undoubtedly attributed to the implementation of the training intervention, which was identified as the main significant positive predictor of the practice score in the multivariate analysis. The success of the training program is due to its content, which was based on staff nurses' identified needs, and its process where adult learning strategies with hand-on training were applied.

The foregoing results are in agreement with previous studies. Thus, a study in China demonstrated significant improvements in nurses' assessment of stroke patients to prevent aspiration due to foreign bodies (*Liu et al., 2022*). Also, a study in Iran demonstrated significant decreases in stroke patients' urinary tract infections rates when a well-trained nurses were appointed for the care of such patients (*Kalani et al., 2022*). Furthermore, a study in China reported significant improvements in nurses' knowledge and practice related to the care for stroke patients with dysphagia following a training intervention (*Zhang et al., 2022*). On

the same line, a study in the United States demonstrated significantly better nurses' practice of care for stroke patients following a triage training intervention (*Kazi et al., 2022*).

Regarding the staff nurses' factors influencing their post-intervention practices, the current study multivariate analysis identified their experience years as significant positive predictors of the practice score. This indicates the importance of actual practice in improving their clinical skills. The finding is in congruence with a study in Japan where the practice of the nurses having long experience years was significantly better in the care of stroke patients (*Hisaka et al., 2021*).

Limitations of the study: The researcher was faced with many obstacles during the study. Firstly, patients' turnover was high so that the nurses had not enough time to answer the questionnaire sheet in due time. Secondly, due to the shortage in staff nurses' numbers, the hospital did not allow to free them completely to engage in program full attendance. This problem was overcome by implementing the program twice per shift to two small groups. Thirdly, due to short-term leaves, as day-off, casual leaves, and short sick-leaves, the researcher had to repeat the missed sessions for these nurses separately.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the nurses providing care to patients with CVS in the ICUs in the study settings have deficient related knowledge and practice. The implementation of a training program based on their identified needs is effective in improving their of knowledge and practice, with rising trends of their scores throughout the intervention phases.

The study recommends implementing the developed program on a wide scale in study settings and in similar ones. The nurses providing care for CVS patients in ICUs need continuing on-job training. Further research is

proposed to assess the impact of the educational training program for staff nurses caring for patients with CVS on quality of life of these patients.

REFERENCES

- American Agency for Health Care Policy and Research (2016)*: Diagnosis and treatment of swallowing disorders: dysphagia in acute care stroke patients. Available at: <http://www.ncbi.gov/>. [Accessed date 2018 Jan 15].
- American Stroke Association (2017)*: Assessment of swallowing: a useful screening tool for dysphagia after acute attack of cerebro-vascular stroke. Available at: stroke.ahajournals.org/content/30/2/28. [Accessed date 2017 Nov].
- Centers for Disease Control and Prevention [CDC], (2017)*: Stroke Fact Sheet. 2016. [Last cited on 2017 Jun 01]. Available from: https://www.cdc.gov/dhdspl/data_statistics/fact_sheets/fs_stroke.htm.
- Chauhdry H. (2022)*: Understanding the importance of recognising, treating and preventing stroke. *Nurs Stand.*; 37(1):77-82. doi: 10.7748/ns.2021.e11596. Epub 2021 Oct 11. PMID: 34632749.
- Endacott R., Jevon P., and Cooper S. (2009)*: Clinical nursing skills core and advanced. New York: Oxford press Co, pp. 410-37.
- Grodner M., Long S., and Deyoung S. (2017)*: Foundation and clinical applications of nutrition: a nursing approach. 3rd ed. London: Mosby Co, pp. 501-504.
- Hickey J.V., and Grotto J.C. (1999)*: What is the role of stroke in overall care?, *Journal of- Disease Management and Health Outcome*; 6(6):193-202.
- Hisaka Y., Ito H., Yasuhara Y., Takase K., Tanioka T., and Locsin R. (2021)*: Nurses' Awareness and Actual Nursing

- Practice Situation of Stroke Care in Acute Stroke Units: A Japanese Cross-Sectional Web-Based Questionnaire Survey. *Int J Environ Res Public Health*.;18(23):12800. doi: 10.3390/ijerph182312800. PMID: 34886526; PMCID: PMC8657563.
- Kalani Z., Ebrahimi S., and Fallahzadeh H. (2022):** Effects of the liaison nurse management on the infectious stroke complications: a randomized controlled trial. *BMC Nurs.*;21(1):29. doi: 10.1186/s12912-021-00802-0. PMID: 35057795; PMCID: PMC8772205.
- Kazi S., Fanta J., Mehta T., DeHaan K., Wolf J., and Sandhu D. (2022):** Stroke Nurse Triage: Effects on Time Metrics at a Regional Stroke Center. *S D Med.*;75(2):72-75. PMID: 35704868.
- Khaku A.S., and Tadi P. (2020):** Cerebrovascular Disease (Stroke) [Updated 2019 Nov 19]. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; Available from: <https://www.ncbi.nlm.nih.gov/books/NBK430927/>
- Khedr E.M., Elfetoh N.A., Al Attar G., Ahmed M.A., Ali A.M., and Hamdy A. (2013):** Epidemiological study and risk factors of stroke in Assiut Governorate, Egypt: community-based study. *Neuroepidemiology*; 40:288-294.
- Khedr E.M., Fawi G., Abdela M., Mohammed T.A., Ahmed M.A., El-Fetoh N.A., and Zaki and A.F. (2014):** Prevalence of ischemic and hemorrhagic strokes in Qena Governorate, Egypt: a community based study. *Journal of Stroke and Cerebrovascular Diseases*; 23(7): 1843-1848.
- Kummarg U., Sindhu S., and Muengtawepongsa S. (2018):** The Early Outcomes of Nurse Case Management in Patients with Acute Ischemic Stroke Treated with Intravenous Recombinant Tissue Plasminogen Activator: A Prospective Randomized Controlled Trial. *Neurol Res Int.*;2018:1717843. Published 2018 Jun 7. doi:10.1155/2018/1717843
- Liu Z.Y., Wei L., Ye R.C., Chen J., Nie D., Zhang G., and Zhang X.P. (2022):** Reducing the incidence of stroke-associated pneumonia: an evidence-based practice. *BMC Neurol.*;22(1):297. doi: 10.1186/s12883-022-02826-8. PMID: 35953801; PMCID: PMC9367053.
- Loft M.I., Volck C., and Jensen L.R. (2022):** Communicative and Supportive Strategies: A Qualitative Study Investigating Nursing Staff's Communicative Practice With Patients With Aphasia in Stroke Care. *Glob Qual Nurs Res.* ;9:23333936221110805. doi: 10.1177/2333 3936221110805. PMID: 35912132; PMCID: PMC9335487.
- Lynn P., and Lebon M. (2008):** *Taylor's Clinical Nursing Skills: a nursing process approach*, 2nd ed, New York, Lippincott Williams & Wilkins Co., pp. 19-21,167-8,185-6,268-9.
- Miller J., and Mink J. (2009):** *Acute Ischemic Stroke: Not a moment to lose*, Nursing, Lippincott Williams & Wilkins Co., 39(issue 5):36-42.
- Mohammed H.M. (2017):** *Nurses' Role Regarding Caring for Patient with Cerebral Vascular stroke in Intensive Care Unit*. Master thesis of Faculty of Nursing Zagazig University, Egypt.
- Morton P.G., and Fontaine D.K. (2009):** *Critical care Nursing A Holistic Approach*, 9th ed., New York: Lippincott & Williams Co, pp. 829-99.
- Ntaios G. (2020):** Embolic Stroke of Undetermined Source: JACC Review Topic of the Week. *J. Am. Coll. Cardiol.*; 75(3):333-340.
- Patel A.R., Patel A.R., and Desai S. (2019):** The Underlying Stroke Etiology: A Comparison of Two Classifications in a Rural Setup. *Cureus.*;11(7):e5157.

Published 2019 Jul 17. doi:10.7759/cureus.5157

Powers W.J., Rabinstein A.A., Ackerson T., Adeoye O.M., Bambakidis N.C., and Becker K. (2018): Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*; 49(2). doi:10.1161/STR.000000000000158

Rababah J.A., Al-Hammouri M.M., and AlNsour E. (2021): Effectiveness of an educational program on improving healthcare providers' knowledge of acute stroke: A randomized block design study. *World J Emerg Med.* ;12(2):93-98. doi: 10.5847/wjem.j.1920-8642.2021.02.002. PMID: 33728000; PMCID: PMC7947558.

Saban K.L., Tell D., De and La Pena P. (2022): Nursing Implications of Mindfulness-Informed Interventions for Stroke Survivors and Their Families. *Stroke*. 2022 Jul 29:101161STROKEAHA122038457. doi: 10.1161/STROKEAHA.122.038457. Epub ahead of print. PMID: 35904017.

Sakr M.D., Metwaly E.A., and Taha N.M. (2019): Effect of intervention guidelines on nursing performance regarding patients with angina. *Egypt Nurs J*;16:70-9.

Shehata H.S., Ahmed S.M., Abdelalim A.M., and El Sherbiny N. (2020): Knowledge and attitude towards stroke among

workers in Cairo University Hospitals. *Egypt J Neurol Psychiatry Neurosurg* [serial online] 2016 [cited 2020 Mar 3];53:54-9. Available from: <http://www.ejnpn.eg.net/text.asp?2016/53/1/54/176374>

Tabachnick B.G., and Fidell L.S. (2019): Using Multivariate Statistics (7th ed.). Pearson.

Wang Z., Zhao H., Zhu Y., Zhang S., Xiao L., Bao H., Wang Z., Wang Y., Li X., Zhang Y., and Pang X. (2022a): Needs for nurses to provide spiritual care and their associated influencing factors among elderly inpatients with stroke in China: A cross-sectional quantitative study. *Palliat Support Care.*;20(3):407-416. doi: 10.1017/S1478951522000426. PMID: 35469586.

World Health Organization [WHO], (2016): Cardiovascular Diseases (CVDs), Fact Sheet. 2016. [Last cited on 2017 May 24]. Available from: http://www.who.int/media_centre/factsheets/fs317/en/

Zhang X., Zhao J., Zheng L., Li X., and Hao Y. (2022): Implementation strategies to improve evidence-based practice for post-stroke dysphagia identification and management: A before-and-after study. *Int J Nurs Sci.*;9(3):295-302. doi: 10.1016/j.ijnss.2022.06.010. PMID: 35891917; PMCID: PMC9305012.

Table 1: Demographic characteristics of nurses in the study sample (n=80)

	Frequency	Percent
Age:		
<30	41	51.3
30+	39	48.8
Range	23-54	
Mean±SD	31.8±9.0	
Median	28.5	
Gender:		
Male	25	31.3
Female	55	68.8
Marital status:		
Married	52	65.0
Unmarried	28	35.0
Nursing qualification:		
Diploma	62	77.5
Bachelor	18	22.5
Experience years (total):		
<10	42	52.5
10+	38	47.5
Range	1-34	
Mean±SD	11.4±9.5	
Median	11.4	
Experience years (current):		
<5	36	45.0
5+	44	55.0
Range	<1-34	
Mean±SD	8.9±8.6	
Median	5.0	
Residence:		
Rural	59	73.8
Urban	21	26.3

Table 2: Nurses' knowledge about stroke patient care throughout intervention phases

Satisfactory (60%+) knowledge of stroke:	Time						X ² (p-value) Pre-post	X ² (p-value) Pre-FU
	Pre (n=80)		Post (n=80)		FU (n=80)			
	No.	%	No.	%	No.	%		
Definition	61	76.3	73	91.3	79	98.8	6.61 (0.01*)	18.51 (<0.001*)
Etiology	46	57.5	78	97.5	76	95.0	36.70 (<0.001*)	31.06 (<0.001*)
Types	36	45.0	73	91.3	70	87.5	39.40 (<0.001*)	32.31 (<0.001*)
Risk factors	30	37.5	75	93.8	78	97.5	56.10 (<0.001*)	65.64 (<0.001*)
Symptoms/signs	53	66.3	79	98.8	80	100.0	29.26 (<0.001*)	32.48 (<0.001*)

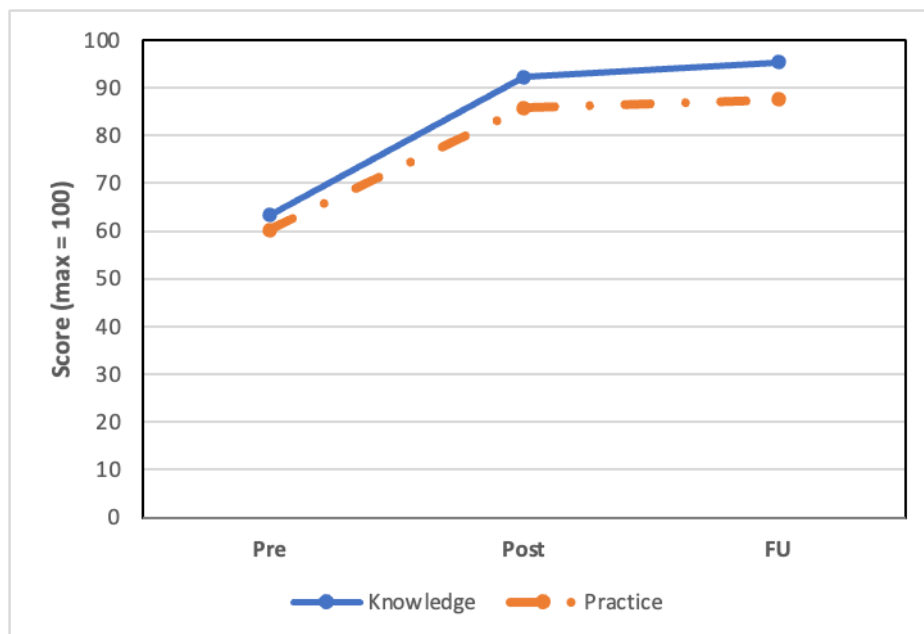
Ischemic vs hemorrhagic	36	45.0	71	88.8	72	90.0	34.56 (<0.001*)	36.92 (<0.001*)
Right vs left	33	41.3	67	83.8	71	88.8	30.83 (<0.001*)	39.67 (<0.001*)
Diagnosis	44	55.0	77	96.3	77	96.3	36.92 (<0.001*)	36.92 (<0.001*)
Treatment	51	63.8	78	97.5	78	97.5	29.17 (<0.001*)	29.17 (<0.001*)
Complications	58	72.5	78	97.5	80	100.0	19.61 (<0.001*)	25.51 (<0.001*)
Prognosis	67	83.8	73	91.3	76	95.0	2.06 (0.15)	5.33 (0.02*)
Prevention	34	42.5	67	83.8	68	85.0	29.24 (<0.001*)	31.26 (<0.001*)
Nurse role	49	61.3	80	100.0	79	98.8	38.45 (<0.001*)	35.16 (<0.001*)
Nursing management	22	27.5	74	92.5	75	93.8	70.42 (<0.001*)	73.55 (<0.001*)
Total:								
Satisfactory	45	56.3	80	100.0	80	100.0	44.80	44.80
Unsatisfactory:	35	43.8	0	0.0	0	0.0	(<0.001*)	(<0.001*)

(*) Statistically significant at $p < 0.05$

Table 3: Nurses' total practice related to stroke patient care throughout intervention phases

Adequate (80%+) practice	Time						X ² (p-value) Pre-post	X ² (p-value) Pre-FU
	Pre (n=80)		Post (n=80)		FU (n=80)			
	No.	%	No.	%	No.	%		
Airway assessment	37	46.3	64	80.0	72	90.0	19.57 (<0.001*)	35.26 (<0.001*)
Breathing assessment	24	30.0	53	66.3	63	78.8	21.05 (<0.001*)	38.32 (<0.001*)
Circulation assessment	36	45.0	59	73.8	60	75.0	13.71 (<0.001*)	15.00 (<0.001*)
Total primary assessment	28	35.0	57	71.3	64	80.0	21.11 (<0.001*)	33.15 (<0.001*)
Secondary assessment	0	0.0	46	57.5	63	78.8	64.56 (<0.001*)	103.92 (<0.001*)
Nursing interventions	7	8.8	60	75.0	73	91.3	72.13 (<0.001*)	108.90 (<0.001*)
Total:								
Adequate	0	0.0	59	73.8	73	91.3	93.47	134.25
Inadequate	80	100.0	21	26.3	7	8.8	<0.001*	<0.001*

(*) Statistically significant at $p < 0.05$



Statistically significant at $p < 0.001$

Figure 1: Nurses' total scores of knowledge and practice related to stroke patient care throughout intervention phases

Table 4: Correlation between nurses' scores overall knowledge and practice and their characteristics

	Spearman's rank correlation coefficient	
	Knowledge	Practice
Practice	.572**	
Characteristics:		
Age	-.031	-.074
Qualification	.087	.033
Experience (total)	-.043	-.087
Experience (current)	-.060	-.059
No. of courses	.011	-.023

(**) Statistically significant at $p < 0.01$

Table 5: Best fitting multiple linear regression model for the knowledge score

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	54.15	2.53		21.422	0.000	49.17	59.13
Intervention	28.91	1.12	0.85	25.766	0.000	26.70	31.12
Urban residence	3.67	1.25	0.10	2.938	0.004	1.21	6.13
Bachelor's degree	2.46	1.27	0.06	1.936	0.054	-0.04	4.97

r-square=0.75

Model ANOVA: $F=137.12$, $p < 0.001$

Variables entered and excluded: age, gender, experience, marital status, training courses

Table 6: Best fitting multiple linear regression model for the practice score

	Unstandardized Coefficients		Standardized Coefficients	t-test	P-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	61.41	1.20		51.148	0.000	59.05	63.78
Intervention	25.33	1.20	0.80	21.025	0.000	22.96	27.70
Total experience	-0.16	0.06	-0.10	-2.636	0.009	-0.28	-0.04

r-square=0.66

Model ANOVA: F=224.50, p<0.001

Variables entered and excluded: age, gender, qualification, current experience, marital status, residence, unit has instructions, instructions followed, supplies, training courses, knowledge score