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Design and validation of a comprehensive educational program for stroke nursing care: a mixed methods study

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Abstract

Background Nurse education can assist in developing comprehensive stroke care. This study aimed to design and validate a comprehensive educational program for stroke nursing care.

Methods This study employed a mixed-methods approach, emphasizing four of the six steps in Kern's model of educational program development (needs assessment, initial design, goals and specific objectives, and educational strategy). It was conducted at Shohadaye Tajrish, Loghman-e Hakim, and Imam Hossein Hospitals in Tehran during 2023–2024. The initial phase consisted of a comprehensive needs assessment, a literature review, in-depth interviews with twenty nurses and patients, a careful review of patient documents and medical records, as well as direct observations of patient care. The interviews were analyzed with MAXQDA 20 software using the conventional content analysis method. Validation was conducted through two Delphi rounds, with an agreement level of more than 70% based on the frequency of responses in each round.

Results Through the Delphi method, twenty experts participated in the evaluation and validation process. In the first round of Delphi, 30 learning topics achieved appropriate consensus (mean scores ranging from 2.33 to 3.55), while 2 topics (applying basic nursing concepts in patient care and providing nursing care based on the nursing process) were eliminated due to inappropriate consensus (mean scores ranging from 1 to 2.32). In the second Delphi round, the validation of the remaining 30 items was reexamined, which obtained an appropriate consensus. In the first round of the Delphi study, a significant Kendall's coefficient of concordance was observed (Kendall's $W = 0.735$, $\chi^2 = 30.524$, $p < 0.01$); however, after removing two items in the second round, this coefficient improved, indicating stronger agreement among the participants (Kendall's $W = 0.755$, $\chi^2 = 31.624$, $p < 0.01$).

Conclusion This study developed and validated an educational program focused on professional nursing care for stroke patients, recognizing the critical need for continuous education in the neurology department to update nurses' knowledge and skills with the most current care methods and information.

Clinical trial number Not applicable.

Keywords Short-Term courses, Curriculum, Nursing care, Stroke, Nurses

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Background

According to the World Health Organization (WHO), stroke is defined as "a clinical syndrome characterized by the rapid development of focal or global cerebral function disturbance, with symptoms persisting for at least 24 hours or resulting in death, without any identifiable cause other than of vascular origin" [1].

According to the updated 2025 version of Global Burden of Disease (GBD), stroke continues to be the second leading cause of death among non-communicable disorders (NCDs), resulting in approximately 7 million deaths, and also ranks as the third leading cause of death and disability when considering disability-adjusted life-years lost (DALYs). As reported in this study, which is the most complete GBD stroke epidemiology study to date, 93.8 million (89.0 to 99.3) prevalent strokes occurred in 2021, and 11.9 million (7.7 to 13.2) incident strokes occurred [2, 3]. In Iran, the statistics for stroke during the year 2019 revealed a significant number of prevalent cases, totaling 963,512, encompassing both incident cases and fatalities [4].

Both ischemic and hemorrhagic strokes present significant risks of diverse complications, including brain edema, urinary tract infections, pneumonia, seizures, and blood clots, all of which can substantially affect long-term recovery and overall health outcomes [5]. The timely involvement of medical experts can effectively enhance the chances of recovery, while also minimizing disability, mortality, and recurrence rates [6]. The positive impact of stroke units on the prognosis of stroke patients is widely recognized in the healthcare community [7]. This can be ascribed to the existence of multidisciplinary teams that possess a wealth of expertise, skills, and experience in stroke management. According to Guidelines for Stroke Management, healthcare professionals participating in stroke care are expected to possess a high level of dedication to service, expertise, and adeptness in communication. In addition, staff members who lack the necessary knowledge or competencies should be given the opportunity to receive professional education and training [8].

Nurses have a vital role as stakeholders and team members within the comprehensive stroke care system. They impact all aspects of care, ranging from initial assessments and symptom identification to treatment, rehabilitation exercises, early warning monitoring, psychological assistance, and end-of-life care [9, 10]. As a result, stroke nursing personnel must receive extensive training and education to guarantee their ability to provide optimal care to stroke patients. The insufficient comprehension of present nursing practices for stroke patient care has led to a lack of awareness regarding healthcare advancements, which has had an adverse impact on patient outcomes and the quality of care [11].

The educational approach for stroke nurses is often described as fragmented, meaning it is not consistent or standardized across different institutions or healthcare settings. This lack of uniformity can result in variations in the knowledge and skills of nurses caring for stroke patients [12]. Moreover, it has been reported that numerous hospitals fail to enforce the implementation and adherence to evidence-based protocols for stroke management by nurses [13]. The utilization of continuing education (CE) and professional development programs can contribute to the development of proficient and well-prepared nurses who possess the ability to identify and offer high-quality care to individuals affected by stroke [14].

Several studies, such as that of Santos et al. (2020), which developed and validated a 12-domain educational protocol encompassing 42 items and over 240 care guidelines for nurses working with family caregivers of elderly stroke survivors at home, align with the current research [15]. Also, the study by Abd El-Hady et al. (2022) provided additional evidence by investigating the effectiveness of an ischemic stroke nursing management protocol in enhancing critical care nurses' knowledge and practical application; their results showed a considerable improvement in both aspects after the protocol was implemented [16]. In addition, Mahmood et al. (2022), in their study, used the Delphi method to develop a set of strategies to enhance adherence to home-based exercises after stroke [17].

Nurses are required to possess a valid certificate to provide care to stroke patients in specialized departments. This certification serves as evidence of their competency in delivering care based on the current evidence and advancements in this field [18]. There are specialized stroke courses in other countries. For example, the stroke care course presented by the King's College of London is a short course in which the participants will learn to critically evaluate the evidence for nursing assessments, interventions, and care and to plan the most effective care to meet the individual needs of patients following a stroke [19]. Also, the online stroke management course for nurses is presented by Acute Stroke Nurses Education Network (ASNEN) in Australia, aimed to provide education around all aspects of stroke and stroke care, and to share best practice approaches to help improve patient outcomes across [20].

In Iran, current education and training for nurses who care for stroke patients primarily consist of in-service training and continuing education courses. However, there are notable issues with this approach, including limited educational resources such as inadequate materials, training programs, and support systems. Additionally, there is a need for the integration of existing educational methods to maximize their effectiveness and equip

nurses with the necessary knowledge and skills for effectively managing stroke patients [21, 22]. Research suggests that the effectiveness of education and training for stroke nursing staff can be enhanced through evidence-based guidelines, interactive curricula, and increased opportunities for nurses to practice [23–25]. A comprehensive educational program for stroke nursing care will be developed and validated in this study; this program, offered through university courses or in-service training, will focus on essential aspects of nursing practice to fully equip nurses with the necessary skills and knowledge to improve their professional work environment.

Methods

The study has three main phases: the literature review and qualitative part as the first phase, providing a draft of the program, and the Delphi method as the final phase. The process was developed by adhering to four of Kern's six steps for educational program development (needs assessment, initial design, goals and specific objectives, and educational strategy) [26], and its validity was confirmed through a rigorous two-round Delphi method validation process [27]. We hypothesized that the application of Kern's model by stroke nurses would result in a demonstrable increase in their abilities and self-assurance regarding the production of educational materials intended for patients and their families.

Phase 1: needs assessment stage

Stage 1: literature review

In this stage, to obtain the knowledge available in the field of related educational programs worldwide, along with the scientific documents required to develop such an educational program, a mixed-methods systematic review was conducted. The initial literature search included both published and unpublished qualitative and quantitative studies made available between January 2000 and May 2024 via the PubMed, Scopus, Web of Science, SID, and MAGIRAN databases. The search strategy was based on keywords and Medical Subject Heading (MeSH) terms, including ((‘Stroke’) OR (‘Cerebrovascular Accident’) OR (‘Brain Vascular Accident’) OR (‘CVA’)) AND ((‘Needs Assessment’) OR (‘Educational Needs Assessment’) OR (‘Determination of Health Care Needs’) OR (‘Assessment of Healthcare Needs’)) AND ((‘Nurses’) OR (‘Nursing Personnel’) OR (‘Registered Nurses’)) AND ((‘Patient’) OR (‘Client’)). The PICO strategy was used to guide for retrieval of relevant articles for this review. PICO represents an acronym for population, intervention, comparison, and outcomes, respectively. To further expand the search, we also utilized electronic searches on Google, manually reviewed the reference lists of published articles, and consulted experts in the field to identify any additional relevant publications. Moreover, to select relevant studies, the four-step Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram: Identification, Screening, Eligibility, and Included was followed. Two researchers reviewed the titles and abstracts of the remaining articles after removing duplicates according to the inclusion criteria (all studies focusing on the educational needs of the stroke nurses written in both Persian and English languages, ab initio until 2024). The third researcher reviewed articles in the case of disagreement between the two assessors. The methodological quality assessment involved using the Mixed Methods Appraisal Tool (MMAT) to evaluate qualitative studies, randomized controlled trials (RCTs), Quasi-experimental controlled trials (QCTs), pre-post one-group studies, and mixed methods studies [28, 29], with the Cochrane risk of bias tool additionally employed to assess the risk of bias present specifically within the RCTs and quasi-experimental study designs [30].

Stage 2: qualitative study (Investigating the needs)

Data collection and participants

This part of the research was carried out within the neurology departments of three principal neurology care centers in Tehran, Iran: Shohadaye Tajrish Hospital, Loghman-e Hakim Hospital, and Imam Hossein Hospital; these hospitals are all associated with Shahid Beheshti University of Medical Sciences, which is located in Tehran, the capital city. For data collection, in-depth and semi-structured individual face-to-face interviews were conducted after obtaining informed consent from the participants. To select the participants, purposeful sampling was performed. The inclusion criteria for nurses were: 1) having at least one year of clinical experience and presently working in a clinical area related to the care of stroke patients; 2) understanding and agreeing with the study's objectives; 3) willing to participate. The inclusion criteria for patients were: 1) being 18 years old and over, 2) having a confirmed diagnosis of stroke by a neurologist, 3) willingness to participate in the study, 4) having the awareness to communicate 5) having the ability to read and write. The place and time of conducting the interview were determined at the participants' convenience. The interviews were conducted without a time limit in a separate room at the health centers or the hospital, where only the interviewer and the participant were present. The interviews continued until all relevant experiences of the participants were fully explained and comprehensive answers were received from the interviewees. To start the interview based on the aim of the study, the following general and open questions were first asked: “What educational needs did you encounter during your treatment process?” (patients) and “What educational needs did you encounter when caring for

stroke patients?" (nurses). During the interview, in-depth and probing questions were asked based on the type of answer to each question in order to explore the depth of the experience: "What do you mean?", "Why?", Please elaborate on that", and "Could you give an example so that I understand what you mean." Each interview lasted 20–45 min. The interviews continued until data saturation. Data saturation was achieved after the 17th interview, but 3 more interviews were conducted to ensure saturation. No participant was excluded/dropped out of the study, nor was any interview repeated.

Data analysis

Conventional content analysis was used for data analysis. The data analysis process was performed according to the steps suggested by Graneheim and Lundman [31]. Immediately after conducting each interview, the recorded interview was transcribed. Then the entire text was read for a general understanding of its content, determining the meaning units and primary codes, and classifying similar primary codes into more comprehensive categories. At the earliest possible time after conducting the interview (generally a few hours after the end of the interview), the lead researcher transcribed the interview verbatim and performed data analysis. Then, the entire text was read several times to get a general understanding of the content of the interview. The entire text was considered as the unit of analysis, and smaller parts, including the words, phrases, sentences, or paragraphs that had a meaning or concept related to the research question, were considered as a meaningful unit. Each meaning unit was first converted into condensed meaning units by keeping the original concept, and then, these units were coded. The coding process was performed by two authors (A.M.N., M.Z.). The codes were classified into subcategories and categories based on their similarities and differences. The data analysis process was performed using MAXQDA software (version 20).

For the present study, the trustworthiness of the data was strengthened by following Lincoln and Guba's four criteria [32], a process complemented by the researcher's sustained involvement with the research subject and a dedicated timeframe for comprehensive data gathering, thus ensuring data credibility. In addition to this, the researchers and two participants reviewed the content of the categories to ensure that the categories accurately reflected the experiences of the participants; a brief report outlining the analyzed data was also given to the participants so that they could verify that the report accurately represented their experiences and attitudes. Dependability was ensured using the opinions of external observers (two nursing specialists in the field of stroke with PhD degrees) as well as the code-recode method during the analysis. Transferability of the findings was obtained through a detailed description of the context, participants, environment, and conditions. In order to ensure conformability, the lead researcher who conducted the analysis excluded her own presuppositions and thoughts and used the opinions of the two specialists to reach a consensus.

Phase 2: providing the draft of the program contents

In this phase, based on qualitative research and a comprehensive review of existing literature, an initial program outline was developed, encompassing the program's mission and vision statements, a detailed list of general and specific learning objectives, and a complete description of teaching methodologies and assessment strategies.

Phase 3: modified Delphi technique

According to the literature, a modified Delphi study should ideally include between seven and fifteen participants; fewer than seven participants may limit the diversity of perspectives, while more than fifteen can hinder effective group discussion and participation during meetings [33]. In this study, initially, 30 selected experts were contacted through email, and 20 people (five neurologists, ten nursing specialists in the field of stroke and program development with PhD degrees, and five neurology nurse educators) agreed to participate in this Delphi. Experts were selected through purposive sampling as representatives of professional groups involved in the care of stroke patients. Inclusion criteria included at least 2 years of clinical or academic experience in treating and caring for stroke patients and willingness to participate. The exclusion criteria were lack of access to the individual during the study and non-completion or incomplete completion of the questionnaires.

Round 1

In the first round of Delphi, the educational topics extracted based on the results obtained from the literature review and qualitative study were designed in the form of a questionnaire. The questionnaire included 32 statements and was emailed to all 20 experts in June 2024. These experts were selected by snowball sampling, i.e., every originally selected expert recruited another expert. When completing the survey, the experts were asked to indicate anonymously how much they agreed with each statement. Agreement was measured on a four-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree. Experts were also given the opportunity to comment and suggest strategies that may not have been included in the questionnaire. Participants were asked to complete and e-mail them within 2 weeks. During this period, a reminder message was sent to the participants to complete and send the questionnaire.

Round 2

In the second round of Delphi, the items with the lower mean report were discussed to revised again, and the necessary corrections to the contents were conducted. The questionnaire was emailed again to previous experts for the second round of Delphi to grade. The second round of Delphi was conducted in July 2024. The experts were asked to repeat the survey within two weeks and either confirm their original score from Round 1 or choose a new score based on a summary of scores acquired from the other experts in the first round. The second Delphi method results were the basis of the final educational program for professional nursing care of stroke patients.

Data analysis

After collecting the questionnaires, they were entered into the SPSS software (Statistical Product and Service Solutions) version 24 (Made by IBM company, New York City, USA) and analyzed. Using descriptive statistics, the mean, standard deviation, and the percentage of response frequency of each statement were calculated. The definition of consensus level in Delphi studies depends on the question and the concepts of research and is also used to determine agreement [34]. In the present study, the agreement level in both rounds was considered to be more than 70% based on the percentage of response frequency. In other words, in cases in which more than 70% of experts agreed and gave homogeneous answers, a consensus was established [33, 35]. Statements with a mean in the upper third of the scores (3.66-5) are appropriate, statements with a mean in the middle third of the scores (2.33–3.65) are indeterminate, and statements with mean in the lower third of the scores (1-2.32) were considered inappropriate [33]. We only accepted statements in the appropriate range as strategies that can meet the educational needs of stroke nurses. Providing statistical feedback on individual responses compared to the responses of other participants helps to modify the results and revise the answers given in the second round [36]. To decide whether to stop or continue Delphi rounds, the Kendall coordination coefficient was calculated. This scale can be used to determine the validity of the opinions of the referees and the degree of consensus among the experts. To examine the consensus of the first and second rounds we calculate Kendall's coefficient, a value between 0 and 1 was used, where a higher value indicates better coordination [37]. The level of significance was set at $p < 0.05$.

Phase 4: content validity assessment

At this stage, the Content validity ratio (CVR) and content validity index (CVI) for each item and scale were calculated to determine the questionnaire's content validity [38]. To determine the necessity and to include the most necessary items, the CVR and to ensure the relevance, the CVI were used [39]. The opinions of twenty experts with research backgrounds in the validation of educational programs were surveyed. The experts were asked to assess the items based on scoring each item from 1 to 3, with a three-degree range of 1 = not necessary, 2 = useful but not essential, and 3 = essential. Then, based on the experts' responses, the CVR was determined using the following equation, and each item was scored and conformed with the Lawshe table for the number of experts involved.

$$CVR = \frac{n_{E-\frac{N}{2}}}{\frac{N}{2}}$$

Where Ne is the number of experts who rated the item as necessary, and N is the total number of experts who rated the item. The acceptable value for the questionnaire's validity is determined according to the Lawshe Table (1975). According to this table, in the case of involving twenty experts, items with a validity score higher than 0.42 were considered acceptable in this study [40]. The experts were asked to score the items based on a 4-point Likert scale (1 = completely irrelevant, 2 = partially relevant, 3 = greatly relevant, 4 = completely relevant) to determine the degree of relevance. The CVI was calculated by dividing the total number of experts who scored 3 or 4 by the total number of experts. The items with a CVI of 0.78 and higher were considered acceptable [41].

Ethical considerations

In alignment with the ethical principles of the Helsinki Declaration and under the approval of the Review Board of Shahid Beheshti University of Medical Sciences (IR.SBMU.PHARMACY.REC.1402.178), the participants at all stages of the study have explained of the purpose of the study, and they were assured of their privacy and confidentiality of their personal information. They were informed regarding the voluntary nature of the study, and they could leave the study at any time. They signed the informed consent form before participating in the study.

Results

According to the steps presented in the methodology, the research findings are as follows:

Phase 1: needs assessment stage

Literature review

This step generally encompasses a comprehensive needs assessment, focusing on the educational needs of stroke patients and the nurses involved in their care. The comprehensive literature search, encompassing both library and electronic databases, initially identified 934 articles; however, after eliminating 158 duplicates, 346 articles

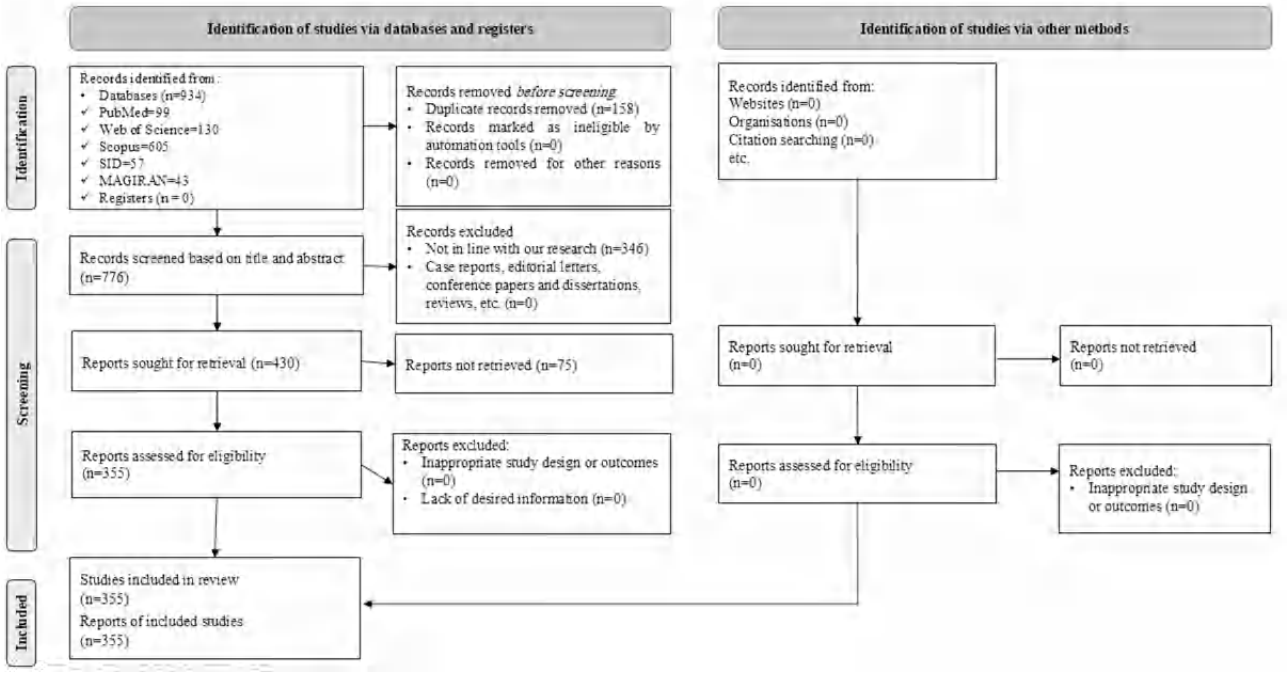

Fig. 1 Flow diagram of the study

Table 1 Sociodemographic characteristics of the nurse who participated in the interviews ($n = 10$)

Nurses	
Variable(s)	***n* (%)**
Gender	
Male	2 (20%)
Female	8 (80%)
Marital status	
Single	3 (30%)
Married	7 (70%)
Educational level	
Bachelor's degree	8 (80%)
Master's degree	2 (20%)
Doctorate	0 (0%)
Type of employment	
Official employment	7 (70%)
Contractual employment	3 (30%)
Ministry of Health Human Resources Plan	0 (0%)
Variable(s)	**Mean (SD)**
Age (year)	35.20 (7.15)
Work experience (year)	13.10 (6.33)

irrelevant to the study's purpose, and 75 articles that were not retrieved, a total of 355 completely pertinent articles were chosen for in-depth analysis. In Fig. 1, we illustrate the flow diagram for identifying and selecting studies.

Interviews

Twenty qualitative interviews were conducted, with participants including ten neurology nurses (two head nurses, six staff nurses, and two nursing instructors) and ten patients who had experienced a stroke. The results revealed that the average age of the nurses interviewed was 35.20 ± 7.15 years, their average work experience was 13.10 ± 6.33 years, and the majority of participants were female (80%), married (70%), and held bachelor's degrees (80%). The sociodemographic characteristics of the nurse are presented in Table 1.

The interviews' findings indicated a mean patient age of 61.30 ± 11.96 years and an average illness history of 4.20 ± 2.57 years, and the majority of participants were male (60%), married (80%), self-employed (30%), with primary education (40%). The sociodemographic characteristics of the patients are presented in Table 2.

Four themes emerged from the analysis of the participant's qualitative interviews, including: 1) "Stroke-Related Deficits," which included three subthemes: "Physical Functions," "Cognitive Functions," and "Emotion Functions"; 2) "Information," which included three subthemes: "Stroke-Related Information," "Information on Post-Stroke Care," and "Information on Being Productive and Continuing Living After Stroke"; 3) "Rehabilitation and Care," which included two subthemes: "Rehabilitation" and "Health-Related Care"; and 4) "Social Participation," which included three subthemes: "Support in Living," "Community Re-Integration," and "Relationship." Table 3 displays the theme along with its subthemes. A significant degree of overlap was observed between patients and nurses regarding information and rehabilitation and care; however, the remaining two themes exhibited less convergence across participant

Table 2 Sociodemographic characteristics of the patients who participated in the interviews ($n = 10$)

Patients	
Variable(s)	***n* (%)**
Gender	
Male	6 (60%)
Female	4 (40%)
Marital status	
Single	2 (20%)
Married	8 (80%)
Educational level	
Primary school	4 (40%)
Secondary school	2 (20%)
High school	2 (20%)
Academic education	2 (20%)
Occupation	
Employee	2 (20%)
Unemployed	2 (20%)
Self-employed	3 (30%)
Housewife	2 (20%)
Retired	1 (10%)
Having an underlying disease	
NO	2 (20%)
Yes	8 (80%)
Variable(s)	**Mean (SD)**
Age (year)	61.30 (11.96)
History of illness (year)	4.20 (2.57)

perspectives, with patients more frequently reporting on social participation, while nurses more often highlighted stroke-related deficits.

Stroke-related deficits

The first extracted theme was stroke-related deficits. In explaining their educational needs, participants in the study detailed a variety of physical (impaired mobility, pain, falls, fatigue, incontinence, and swallowing difficulties), cognitive (impaired memory, cognition, and attention), and emotional (low mood) deficits directly resulting from their strokes. As quoted by one participant:

> *"Six months ago, I experienced symptoms such as numbness and paralysis on one side of my body. When I was in the hospital, the doctors and nurses gave me some general explanations about this disorder, which I thought were not enough. At that time, my doctor told me that you have had a transient ischaemic attack. For a long time, I didn't really know what my disorder was and how it was treated" (Patient 4).*

Information

Another theme that was extracted was information. In this study, survivors reported that they had received insufficient stroke-related information in terms of stroke prevention, stroke risk, stroke causes, recovery, and secondary prevention. The nurses also expressed inadequate information in terms of stroke care, treatment, and managing long-term complications. One of the participants stated that:

> *"Some aspects of stroke, such as assessment and management of depression, rehabilitation and prevention of disability, preparation for training patients and their caregivers for home management, and how to communicate with dysphagic patients, require specialized knowledge and skills that some nurses providing patient care do not possess" (Nurse 5).*

Rehabilitation and care

The third theme covered the educational needs of the participants in terms of rehabilitation and care. Survivors reported educational needs related to rehabilitation, including physical and occupational therapy, as well as post-stroke care, including medical care (including home care and secondary prevention) and managing habit changes that affected their health and overall well-being. As stated by one of the patients:

Table 3 The main theme extracted from the participants' interviews

Core concept	**Thems**	**Subthemes**
Educational Needs	Stroke-Related Deficits	Physical Functions
		Cognitive Functions
		Emotion Functions
	Information	Stroke Related Information
		Information on Post-Stroke Care and Rehabilitation
		Information on Being Productive and Continuing to Live After Stroke
	Rehabilitation and Care	Rehabilitation
		Health-Related Care
	Social Participation	Support in Living
		Community Re-Integration
		Relationship

"A few months ago, I had a stroke and spent several weeks in the hospital, then I was discharged home with numerous residual disorders. At home, my caregivers felt unprepared to care for me; they were worried about my condition and constantly seeking medical consultations to find out when my disorders would be relieved. How can the next attack be avoided? And when is the patient's next visit? Although they found the received responses to be vague and difficult to interpret" (Patient 7).

Social participation

The fourth theme of this study was social participation. Participants in this study expressed educational needs related to performing activities of daily living, returning to work, reintegrating into society, and maintaining relationships. One of the participants said:

"The long-term disabilities following a stroke often affect social participation so that necessitating support for patients to return to work, access social benefits, manage daily activities, stay connected with family and friends, and organize finances" (Nurse 10).

Patient's medical records

To gather the necessary information at this point, 25 medical records were reviewed, revealing a range of frequently occurring patient problems such as physical deficits, cognitive and memory deficits, impaired consciousness, hemodynamic disorders, swallowing problems, visual and speech impairments, and the experience of pain, incontinence, and emotional distress manifested as anxiety and depression. For example:

"The patient's level of consciousness should be monitored, and if the level of consciousness decreases or new neurological disorders occur, the treating physician should be informed" (impaired consciousness).
"The patient's heart rate and rhythm should be monitored, and in case of arrhythmia and hemodynamic disturbances, the treating physician should be informed" (hemodynamic disorders).
"The patient should receive daily respiratory and four-limb physiotherapy" (physical deficits).
"The patient should be consulted and visited by a gastroenterologist regarding the placement of a percutaneous endoscopic gastrostomy (PEG) tube" (swallowing problems).

Observations

The researcher observed that acceptance of their health problem (stroke) and accessibility to physiotherapy and occupational therapy services on an outpatient basis were the most important expressed needs of the patients and their caregivers. They were also looking for information about the disease and its treatment process, returning to work, home care, and follow-up the treatment process which the nurses often lacked sufficient knowledge in these areas and were told to ask their doctors any questions they had, and doctors did not have enough time to explain all of the patient's questions.

Phase 2: providing the draft of the program contents

The results obtained from the above four methods were then integrated into categories and sub-categories to form the basis for the draft preparation of the program thematic headings. In the second phase (program development), the goals and learning objectives (cognitive, emotional, and behavioral) of the program to familiarize nurses with professional nursing care measures of stroke patients were developed in the form of a questionnaire for the nurses involved in the care and treatment of stroke patients after preparing the list of topics in the previous step. A total of thirty-two general learning topics were identified to address the educational needs of stroke nurses, which were organized into four main fields: overview of stroke, stroke-related deficits, hospital-specialized stroke nursing care, and post-discharge stroke nursing care (see Table 4 for details).

Phase 3: modified Delphi technique

The mean age of the Delphi panels' participants was 44.15 ± 11.20. Most of the participants were female (65%), married (75%), with a doctorate degree (75%), and full-time employment status (90%). The demographic characteristics of the participants are presented in Table 5.

In the first round of the Delphi, a questionnaire consisting of 32 educational topics was sent to 20 experts, 30 of the topics achieved appropriate consensus (mean scores ranging from 2.33 to 3.55), while 2 topics (applying basic nursing concepts in patient care and providing nursing care based on the nursing process) acquired inappropriate consensus (mean scores ranging from 1 to 2.32) mainly due to their overlap with other proposed educational topics and were eliminated. In the second round of the Delphi, 3 topics (etiology of ischemic and hemorrhagic stroke, risk factors and prevention of stroke, and specialized care in the field of patient monitoring (level of consciousness, blood pressure, blood sugar, temperature, etc.) following stroke) were edited based on the views of the panels' participants in the first round and the validation of the remaining 30 items was reexamined, which obtained an appropriate consensus. The results of the second Delphi round indicated that, on average, the agreed-upon scores assigned to educational topics did

Table 4 Needs identified in the first step

Category	Sub-category
Overview of stroke	• Anatomy and physiology of the nervous system • Stroke definition and its epidemiology • Etiology of ischemic and hemorrhagic stroke • Risk factors and prevention of stroke
Stroke-related deficits	• Physical Deficits • Cognitive Deficits • Emotional Deficits
Hospital-specialized stroke nursing care	• Diagnosis and treatments during different phases of stroke recovery (acute, subacute, and chronic phases). • Common and ongoing medications for stroke prevention and treatment • Specialized care in the field of patient monitoring (level of consciousness, blood pressure, blood sugar, temperature, etc.) following stroke • Specialized care in the field of visual, language, and swallowing disorders following stroke • Specialized care in the field of movement disorders following stroke • Specialized care in the field of cognitive disorders following stroke • Specialized care in the field of VTE (venous thromboembolism) and infection prevention following stroke • Specialized care in the field of bowel and bladder management following stroke • Principles of stroke rehabilitation • Principles of effective interdisciplinary teamwork in stroke care • Principles of transitional care in stroke patients • Principles of palliative and end-of-life care in stroke patients • The professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans). • Ethical issues in the care of stroke patients • Telenursing and virtual care in stroke
Post-discharge stroke nursing care	• Secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions). • Nutrition and physical activity for stroke patients • Principles of home care for stroke patients and their caregivers • Principles of family-centered care for stroke patients • Counseling and emotional support for stroke patients and their caregivers • Effective stroke education and follow-up for post-stroke patients • Effective social participation of stroke patients (support in living, community re-integration, and relationships). • Social and family effects of stroke • Applying basic nursing concepts in patient care • Providing nursing care based on the nursing process

Table 5 Sociodemographic characteristics of the participants in the Delphi panels ($n=20$)

Variable(s)	*n* (%)
Gender	
Male	7 (35%)
Female	13 (65%)
Marital status	
Single	5 (25%)
Married	15 (75%)
Educational level	
Bachelor's degree	3 (15%)
Master's degree	2 (10%)
Doctorate	15 (75%)
Type of employment	
Part-time	2 (10%)
Full time	18 (90%)
Variable(s)	**Mean (SD)**
Age (year)	44.15 (11.20)
Clinical work experience (year)	10.38 (4.13)
Academic experience (year)	10.25 (3.99)

not increase and in some cases actually decreased when compared to the scores from the first round (Table 6).

Kendall's coefficient of concordance was used to examine the consensus of the first and second rounds. The findings showed that in both Delphi rounds, Kendall's coefficient values were above 0.7, indicating acceptable consensus. In addition, the results showed that after removing items 31 and 32, the value of Kendall's coefficient improved (Table 7).

Phase 4: content validity assessment

The results from the initial round enabled the computation of a CVR value for every one of the 32 research questions, which subsequently demonstrated that 30 questions successfully met or exceeded the minimum acceptable CVR of 0.42, a standard established for research panels with 20 participants. Furthermore, the first round of the Delphi process yielded a Content Validity Index (CVI) of 0.803 for the questionnaire, a result considered acceptable based on the established CVI threshold (Table 8).

Table 6 Delphi questionnaire analysis

NO	Item(s)	Round 1	Round 2
		Mean ± SD	Mean ± SD
1	Anatomy and physiology of the nervous system	3.75 ± 0.44	3.75 ± 0.44
2	Stroke definition and its epidemiology	3.85 ± 0.37	3.80 ± 0.67
3	Etiology of ischemic and hemorrhagic stroke	3.85 ± 0.37	3.85 ± 0.37
4	Risk factors and prevention of stroke	3.90 ± 0.31	3.90 ± 0.31
5	Physical deficits	3.95 ± 0.22	3.85 ± 0.37
6	Cognitive deficits	3.95 ± 0.22	3.95 ± 0.22
7	Emotional deficits	3.90 ± 0.31	3.80 ± 0.52
8	Diagnosis and treatments during different phases of stroke recovery (acute, subacute, and chronic phases).	3.95 ± 0.22	3.85 ± 0.49
9	Common and ongoing medications for stroke prevention and treatment	3.85 ± 0.37	3.85 ± 0.37
10	Specialized care in the field of patient monitoring (level of consciousness, blood pressure, blood sugar, temperature, etc.) following stroke.	3.90 ± 0.31	3.80 ± 0.52
11	Specialized care in the field of visual, language, and swallowing disorders following stroke	3.90 ± 0.31	3.90 ± 0.31
12	Specialized care in the field of movement disorders following stroke	3.85 ± 0.49	3.85 ± 0.49
13	Specialized care in the field of cognitive disorders following stroke	3.90 ± 0.31	3.90 ± 0.31
14	Specialized care in the field of VTE (venous thromboembolism) and infection prevention following stroke	3.95 ± 0.22	3.95 ± 0.22
15	Specialized care in the field of bowel and bladder management following stroke	3.95 ± 0.22	3.95 ± 0.22
16	Principles of stroke rehabilitation	3.85 ± 0.49	3.85 ± 0.49
17	Principles of effective interdisciplinary teamwork in stroke care	3.95 ± 0.22	3.95 ± 0.22
18	Principles of transitional care in stroke patients	3.90 ± 0.31	3.70 ± 0.73
19	Principles of palliative and end-of-life care in stroke patients	3.95 ± 0.22	3.90 ± 0.31
20	The professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans).	3.95 ± 0.22	3.85 ± 0.49
21	Ethical issues in the care of stroke patients	3.85 ± 0.49	3.85 ± 0.49
22	Telenursing and virtual care in stroke	3.95 ± 0.22	3.95 ± 0.22
23	Secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions).	3.95 ± 0.22	3.95 ± 0.22
24	Nutrition and physical activity for stroke patients	3.80 ± 0.41	3.70 ± 0.57
25	Principles of home care for stroke patients and their caregivers	3.80 ± 0.41	3.75 ± 0.44
26	Principles of family-centered care for stroke patients	3.80 ± 0.52	3.80 ± 0.52
27	Counseling and emotional support for stroke patients and their caregivers	3.85 ± 0.49	3.75 ± 0.64
28	Effective stroke education and follow-up for post-stroke patients	3.85 ± 0.37	3.75 ± 0.55
29	Effective social participation of stroke patients (support in living, community re-integration, and relationships).	3.90 ± 0.31	3.90 ± 0.31
30	Social and family effects of stroke	3.85 ± 0.37	3.80 ± 0.41
31	Applying basic nursing concepts in patient care	1.95 ± 0.89	---
32	Providing nursing care based on the nursing process	1.90 ± 0.83	---

Table 7 Kendall coordination coefficient values of two Delphi rounds (W)

Round	Kendall's W	χ^2	df	*P*
First	0.735	30.524	29	0.000
Second	0.755	31.624	29	0.001

Following the first round, the remaining 30 items proceeded to the second round of the Delphi process, where they were assessed by the expert group, with 30 questions ultimately achieving a CVR exceeding the predetermined threshold of 0.42, which was a necessary benchmark given the 20-member panel. Also, in the second round of the Delphi, the CVI for the questionnaire was calculated to be 0.839, a value deemed acceptable according to the recommended threshold value of CVI (Table 9). Following these steps, the educational program was developed in three main parts [Table 10], including the program's mission and vision, general learning topics, general goals, special goals, and teaching and evaluation methods.

Discussion

This study aimed to design and validate a comprehensive educational program for stroke nursing care. According to the results, twenty experts participated in the initial Delphi round to validate thirty-two proposed educational topics, leading to a consensus on thirty of the proposed headings and the elimination of two items that failed

Table 8 Proposed questionnaire items and their respective content validity ratios (round 1 Delphi)

NO	Item(s)	CVR				CVR (> 0.42)
		Completely relevant	Greatly relevant	Partially relevant	Completely irrelevant	
1	Anatomy and physiology of the nervous system	15	5	0	0	0.50
2	Stroke definition and its epidemiology	17	3	0	0	0.70
3	Etiology of ischemic and hemorrhagic stroke	20	0	0	0	1.00
4	Risk factors and prevention of stroke	15	5	0	0	0.50
5	Physical deficits	15	3	2	0	0.50
6	Cognitive deficits	16	2	2	0	0.60
7	Emotional deficits	17	3	0	0	0.70
8	Diagnosis and treatments during different phases of stroke recovery (acute, subacute, and chronic phases).	17	2	1	0	0.70
9	Common and ongoing medications for stroke prevention and treatment	20	0	0	0	1.00
10	Specialized care in the field of patient monitoring (level of consciousness, blood pressure, blood sugar, temperature, etc.) following stroke.	17	3	0	0	0.70
11	Specialized care in the field of visual, language, and swallowing disorders following stroke	18	2	0	0	0.80
12	Specialized care in the field of movement disorders following stroke	18	2	0	0	0.80
13	Specialized care in the field of cognitive disorders following stroke	16	4	0	0	0.60
14	Specialized care in the field of VTE (venous thromboembolism) and infection prevention following stroke	16	3	1	0	0.60
15	Specialized care in the field of bowel and bladder management following stroke	17	2	1	0	0.70
16	Principles of stroke rehabilitation	16	3	1	0	0.60
17	Principles of effective interdisciplinary teamwork in stroke care	19	1	0	0	0.90
18	Principles of transitional care in stroke patients	18	2	0	0	0.80
19	Principles of palliative and end-of-life care in stroke patients	16	4	0	0	0.60
20	The professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans).	15	2	3	0	0.50
21	Ethical issues in the care of stroke patients	15	3	2	0	0.50
22	Telenursing and virtual care in stroke	17	3	0	0	0.70
23	Secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions).	16	2	2	0	0.60
24	Nutrition and physical activity for stroke patients	15	3	2	0	0.50
25	Principles of home care for stroke patients and their caregivers	16	3	1	0	0.60
26	Principles of family-centered care for stroke patients	15	3	2	0	0.50
27	Counseling and emotional support for stroke patients and their caregivers	16	4	0	0	0.60
28	Effective stroke education and follow-up for post-stroke patients	17	3	0	0	0.70
29	Effective social participation of stroke patients (support in living, community reintegration, and relationships).	16	1	3	0	0.60
30	Social and family effects of stroke	15	3	2	0	0.50
31	Applying basic nursing concepts in patient care	12	5	3	0	0.20
32	Providing nursing care based on the nursing process	11	6	3	0	0.10

to achieve the necessary level of agreement among the experts. During the second Delphi round, the expert members reevaluated and subsequently approved the 30 remaining educational topics that were under consideration for validation. Further supporting previous research, this study demonstrated that the proposed educational topics achieved satisfactory levels of consensus and content validity following a rigorous two-round Delphi process, thereby confirming their appropriateness for the intended educational purpose. The results of this study were in line with the previous studies. For example, Santos et al. (2020), in their study, developed a nursing care protocol for family caregivers of elderly people after stroke. In this study, the developed protocol, whose validity was assessed through the two rounds of the Delphi technique, consisted of 12 domains, containing 42 items and 240 care guidelines, and qualifies for the transition of care after hospital discharge, assisting nurses in home care practice [15]. The results of this study were in agreement with the results of the current study. In addition,

Table 9 Proposed questionnaire items and their respective content validity ratios (round 2 Delphi)

NO	Item(s)	CVR				CVR (> 0.42)
		Completely relevant	Greatly relevant	Partially relevant	Completely irrelevant	
1	Anatomy and physiology of the nervous system	18	2	0	0	0.80
2	Stroke definition and its epidemiology	17	3	0	0	0.70
3	Types and causes of stroke	18	2	0	0	0.80
4	Symptoms, risk factors, and prevention of stroke	15	5	0	0	0.50
5	Physical deficits	18	2	0	0	0.80
6	Cognitive deficits	16	2	2	0	0.60
7	Emotional deficits	17	3	0	0	0.70
8	Diagnosis and treatments during different phases of stroke recovery (acute, subacute, and chronic phases).	17	2	1	0	0.70
9	Common and ongoing medications for stroke prevention and treatment	20	0	0	0	1.00
10	Hemodynamic and respiratory monitoring of stroke patients	17	3	0	0	0.70
11	Specialized care in the field of visual, language, and swallowing disorders following stroke	18	2	0	0	0.80
12	Specialized care in the field of movement disorders following stroke	18	2	0	0	0.80
13	Specialized care in the field of cognitive disorders following stroke	16	4	0	0	0.60
14	Specialized care in the field of VTE (venous thromboembolism) and infection prevention following stroke	16	3	1	0	0.60
15	Specialized care in the field of bowel and bladder management following stroke	17	2	1	0	0.70
16	Principles of stroke rehabilitation	16	3	1	0	0.60
17	Principles of effective interdisciplinary teamwork in stroke care	16	4	0	0	0.60
18	Principles of transitional care in stroke patients	18	2	0	0	0.80
19	Principles of palliative and end-of-life care in stroke patients	16	4	0	0	0.60
20	The professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans).	15	2	3	0	0.50
21	Ethical issues in the care of stroke patients	15	3	2	0	0.50
22	Telenursing and virtual care in stroke	17	3	0	0	0.70
23	Secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions).	16	2	2	0	0.60
24	Nutrition and physical activity for stroke patients	15	3	2	0	0.50
25	Principles of home care for stroke patients and their caregivers	16	3	1	0	0.60
26	Principles of family-centered care for stroke patients	15	3	2	0	0.50
27	Counseling and emotional support for stroke patients and their caregivers	16	4	0	0	0.60
28	Effective stroke education and follow-up for post-stroke patients	17	3	0	0	0.70
29	Effective social participation of stroke patients (support in living, community reintegration, and relationships).	16	1	3	0	0.60
30	Social and family effects of stroke	15	3	2	0	0.50

in the study by Putra et al. (2024), a three-round Delphi method consisting of a panel of 24 experts was applied and resulted in the production of a self-care guideline to prevent rehospitalization in stroke patients containing seven themes around self-care activities, including drug therapy, physical exercise, diet and nutrition, stress management, self-motivation, functional status screening, and control for risk factors [42]. The results of this study were also consistent with the present study's results. Furthermore, Fuhrmann et al. (2021) conducted a methodological study to construct and validate an educational manual for family caregivers of older adults after a stroke. In their study, in the second stage aimed to assess the expert consensus, a global CVI of 0.97 was obtained and in the face validation, a consensus of 95.51% by the target population which ultimately led to the development of an educational manual for family caregivers of older adults after a stroke, which was validated in terms of content and appearance [43]. The findings of this study were in line with the current study's results. Moreover, in the study conducted by Olaoye et al. (2020), experts in the field of neurorehabilitation and vocational rehabilitation (VR) from 6 countries participated in this 3-round Delphi survey via e-mail, and a return-to-work intervention program was developed for stroke survivors [44]. The results of this study were similar to our study's findings.

Table 10 The educational program for professional nursing care of stroke patients

The program's mission and vision: **This program aims to familiarize nurses with professional care measures for stroke patients.**					
Field category	**General learning topics (sub-category)**	**Goals**	**Learning objectives**	**Teaching Strategies**	**Evaluation strategies**
Overview of stroke	• Anatomy and physiology of the nervous system • Stroke definition and its epidemiology • Types and causes of stroke • Symptoms, risk factors, and prevention of stroke	• Familiarity with the anatomy and physiology of the central and peripheral nervous systems • Familiarity with the definition of stroke and its epidemiology • Familiarity with different types and causes of stroke • Familiarity with symptoms, risk factors, and general principles of stroke prevention	• Explaining the anatomy and physiology of the nervous system (central and peripheral nervous systems) (cognitive) • Defining stroke and its epidemiology (cognitive) • Explaining symptoms, risk factors, and general principles of stroke prevention (cognitive)	• Interactive lecture • group discussion • question and answer • scenario presentation • e-learning	• Short-answer, open-ended written tests
Stroke-related deficits	• Physical deficits • Cognitive deficits • Emotional deficits	• Familiarity with the physical deficits of stroke • Familiarity with the cognitive deficits of stroke • Familiarity with the emotional deficits of stroke	• Examining and managing physical deficits of stroke and its different types (psychomotor/cognitive) • Examining and managing cognitive deficits of stroke and its different types (psychomotor/cognitive) • Examining and managing emotional deficits of stroke and its different types (psychomotor/cognitive)	• Interactive lecture • group discussion • question and answer • scenario presentation • e-learning	• Short-answer, open-ended written tests

Table 10 (continued)

The program's mission and vision: **This program aims to familiarize nurses with professional care measures for stroke patients.**					
Field category	**General learning topics (sub-category)**	**Goals**	**Learning objectives**	**Teaching Strategies**	**Evaluation strategies**
Hospital-specialized stroke nursing care	• Diagnosis and treatments during different phases of stroke recovery (acute, subacute, and chronic phases). • Common and ongoing medications for stroke prevention and treatment • Hemodynamic and respiratory monitoring of stroke patients • Specialized care in the field of visual, language, and swallowing disorders following stroke • Specialized care in the field of movement disorders following stroke • Specialized care in the field of cognitive disorders following stroke • Specialized care in the field of VTE (venous thromboembolism) and infection prevention following stroke • Specialized care in the field of bowel and bladder management following stroke • Principles of stroke rehabilitation • Principles of effective interdisciplinary teamwork in stroke care • Principles of transitional care in stroke patients • Principles of palliative and end-of-life care in stroke patients • The professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans). • Ethical issues in the care of stroke patients • Telenursing and virtual care in stroke	• Familiarity with diagnosis and treatments during different phases of stroke recovery (acute, subacute, and chronic phases). • Familiarity with common and ongoing medications for stroke prevention and treatment • Familiarity with hemodynamic and respiratory monitoring of stroke patients • Familiarity with specialized care in the field of visual, language, and swallowing disorders following stroke • Familiarity with specialized care in the field of movement disorders following stroke • Familiarity with specialized care in the field of cognitive disorders following stroke • Familiarity with specialized care in the field of VTE (venous thromboembolism) and infection prevention following stroke • Familiarity with specialized care in the field of bowel and bladder management following stroke • Familiarity with principles of stroke rehabilitation • Familiarity with principles of effective interdisciplinary teamwork in stroke care • Familiarity with principles of transitional care in stroke patients • Familiarity with principles of palliative and end-of-life care in stroke patients • Familiarity with the professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans). • Familiarity with ethical issues in the care of stroke patients • Familiarity with telenursing and virtual care in stroke	• Examining physical examinations of stroke patients and interpreting their blood tests and imaging scans (psychomotor/cognitive) • Knowledge of Common and ongoing medications for stroke prevention and treatment (cognitive) • Examining and managing the hemodynamic and respiratory status of stroke patients (psychomotor/cognitive) • Performing specialized care in the field of visual, language, and swallowing disorders of stroke patients (psychomotor/cognitive) • Performing specialized care in the field of movement disorders of stroke patients (psychomotor/cognitive) • Performing specialized care in the field of cognitive disorders of stroke patients (psychomotor/cognitive) • Performing specialized care in the field of VTE (venous thromboembolism) and infection prevention in stroke patients (psychomotor/cognitive) • Performing specialized care in the field of bowel and bladder management of stroke patients (psychomotor/cognitive) • Knowledge of principles of stroke rehabilitation (cognitive) • Performing effective interdisciplinary teamwork in the care process of stroke patients (psychomotor/cognitive) • Providing transitional care for stroke patients (psychomotor/cognitive) • Providing palliative and end-of-life care for stroke patients (psychomotor/cognitive) • Performing the professional role of stroke nurses (monitoring patients' condition, assisting with treatment, facilitating rehabilitation, educating patients and families, and designing individualized nursing care plans). (psychomotor/cognitive) • Knowledge of ethical issues in the care of stroke patients (cognitive) • Knowledge of telenursing and virtual care in stroke (cognitive)	• Interactive lecture • group discussion • question and answer • scenario presentation • e-learning	• Short-answer, open-ended written tests • Practical exams

Table 10 (continued)

The program's mission and vision: **This program aims to familiarize nurses with professional care measures for stroke patients.**					
Field category	**General learning topics (sub-category)**	**Goals**	**Learning objectives**	**Teaching Strategies**	**Evaluation strategies**
Post-discharge stroke nursing care	• Secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions). • Nutrition and physical activity for stroke patients • Principles of home care for stroke patients and their caregivers • Principles of family-centered care for stroke patients • Counseling and emotional support for stroke patients and their caregivers • Effective stroke education and follow-up for post-stroke patients • Effective social participation of stroke patients (support in living, community re-integration, and relationships). • Social and family effects of stroke	• Familiarity with secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions). • Familiarity with the nutrition and physical activity of stroke patients • Familiarity with principles of home care for stroke patients and their caregivers • Familiarity with principles of Family-centered care for stroke patients • Familiarity with counseling and emotional support for stroke patients and their caregivers • Familiarity with effective stroke education and follow-up of post-stroke patients • Familiarity with effective social participation of stroke patients (support in living, community re-integration, and relationships). • Familiarity with the social and family effects of stroke	• Knowledge of secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions). (cognitive) • Providing education in the field of secondary prevention of stroke (lifestyle modifications, managing risk factors, and appropriate pharmacological interventions) for stroke patients and their caregivers (psychomotor/cognitive) • Providing education in the field of nutrition and physical activity for stroke patients and their caregivers (psychomotor/cognitive) • Providing education in the field of home care for stroke patients and their caregivers (psychomotor/cognitive) • Providing education in the field of family-centered care for stroke patients and their caregivers (psychomotor/cognitive) • Performing counseling and emotional support for stroke patients and their caregivers (psychomotor/cognitive) • Performing effective stroke education and follow-up for post-stroke patients (psychomotor/cognitive) • Providing education for stroke patients and their caregivers to follow up on the patient's status effectively (psychomotor/cognitive) • Knowledge of effective social participation of stroke patients (support in living, community re-integration, and relationship) (cognitive) • Knowledge of social and family effects of stroke (cognitive)	• Interactive lecture • group discussion • question and answer • scenario presentation • e-learning	• Short-answer, open-ended written tests • Practical exams

Also, Xu et al. (2016), in their study used a two-round online Delphi survey method to determine the key elements of stepping on after stroke fall prevention program and Kendall's coefficient of concordance indicated good agreement within round 2 rankings (W = 0.30, Chi squared = 333.356, df = 53, $p < 0.001$) [45]. The results of this study were consistent with the present study's results. Furthermore, in the study conducted by Tu et al. (2023), a modified Delphi process with an expert panel of multidomain experts was used to evaluate a self-help cognitive behavioral therapy (CBT) program for reducing the stigma of stroke survivors. Seventeen experts accepted the invitation to participate, and all completed two rounds of the Delphi survey. Six sections and 26 items were identified. Consensus was reached among experts that the self-help CBT program included the following six sections: health education, understanding stigma, cognition change, skills training and self-care, self-acceptance, and relapse prevention [45]. The results of this study were in agreement with the current study's results. Additionally, in a study conducted by Chen et al. (2020), through two-round Delphi study and by adopting the Kendall coefficient W test, the care bundle for stroke survivors with psychological symptoms consisted were developed [46]. The results of this study were in line with the current study's results.

In general, the results of the present study were consistent with the previous research. The evidence has shown that healthcare professionals need to update their skills regularly, and continuing education or continued professional development (CPD) enables the renewal and updating of skills in healthcare settings [47, 48]. In the current study, through a mixed methods approach, emphasizing four of the six steps in Kern's model of educational program development and the Delphi method, a comprehensive educational program aimed to address the educational needs of stroke nurses and familiarize

them with the most updated knowledge and skills regarding care measures of these patients was developed.

Study limitations

This study had several limitations, including the short interview times necessitated by the healthcare personnel's heavy workload, the participants' limited knowledge base, and the relatively low rate of nurses and patients' participation. Also, the needs assessment stage of the study was limited to interviews with only nurses and patients, so a more inclusive approach is recommended for future research; this limitation should be addressed by including interviews with a wider range of healthcare professionals, including physicians and the patient's family caregivers, to ensure a more complete and accurate assessment. Given the qualitative nature of this study's approach and the context-dependent nature of the results obtained, consistent with other qualitative investigations, the applicability of these findings to other communities and cultural contexts is restricted. In addition, the present study was limited by its need for elite participation in the Delphi process; the inherent difficulty in securing the participation of elites and in obtaining their feedback on the results contributed to a longer than anticipated study duration.

Conclusion

Through a mixed methods approach and the Delphi method, this study successfully developed and rigorously validated the innovative "comprehensive educational program for stroke nursing care," a program designed to enhance the skills and knowledge of nurses in providing optimal care for stroke patients. The expert panel's high response rates and positive feedback are strong evidence supporting the program's high relevance and demonstrable effectiveness. This program's comprehensive approach, focusing on core aspects of nursing practice, ensures that nurses are equipped with the essential skills and knowledge to foster a more positive and efficient work environment, ultimately leading to improved patient outcomes.

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Author contributions

Design of the study: AM.N., M.Z., A.A., R.K.; data collection: AM.N.; analysis and interpretation of data: M.N.; manuscript preparation: AM.N., M.Z., A.A., R.K.; manuscript revision: AM.N., M.Z., A.A., R.K.; All authors checked and confirmed the final manuscript before submission. The author(s) read and approved the final manuscript.

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Data availability

This current study's datasets will be made available upon request from the corresponding authors.

Declarations

Ethics approval and consent to participate

In alignment with the ethical principles of the Helsinki Declaration and under the approval of the Review Board of Shahid Beheshti University of Medical Sciences (IR.SBMU.PHARMACY.REC.1402.178), the participants at all stages of the study have explained of the purpose of the study, and they were assured of their privacy and confidentiality of their personal information. They were informed regarding the voluntary nature of the study, and they could leave the study at any time. They signed the informed consent form before participating in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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