Nurse Media Journal of Nursing
e-ISSN: 2406-8799, p-ISSN: 2087-7811
https://medianers.undip.ac.id
16(2):316–333, August 2026
https://doi.org/10.14710/nmjn.v16i2.78130

ORIGINAL RESEARCH

A Sequential Explanatory Mixed Methods Evaluation of a Clinical Nursing Practice Guideline for Intracranial Pressure Management

Rungnapha Khiewchaum[1], Pimwalunn Aryuwat[2], Pawena Narasri[3], Mahka Kittitornkul[4], Wanchananan Kuhasak[4]

[1]*Phrapokklao Nursing College, Chanthaburi, Faculty of Nursing, Praboromarajchanok Institute, Chanthaburi, Thailand*
[2]*Boromarajonani College of Nursing Udonthani, Faculty of Nursing, Praboromarajchanok Institute, Udon Thani, Thailand*
[3]*Ramathibodi School of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*
[4]*Phrapokklao Hospital, Chanthaburi, Thailand*

Article Info

Article History:
Received: 28 September 2025
Revised: 15 May 2026
Accepted: 24 June 2026
Online: 31 August 2026

Keywords:
Clinical nursing guideline; intracranial pressure; mixed methods; nurse competence; traumatic brain injury

Corresponding Author:
Pimwalunn Aryuwat
Boromarajonani College of Nursing Udonthani, Faculty of Nursing, Praboromarajchanok Institute, Udon Thani, Thailand
Email:
pimwalunn.aryuwat@bcnu.ac.th

Abstract

Background: Increased intracranial pressure (IICP) is a life-threatening complication of traumatic brain injury (TBI). Previous studies in Thailand have not evaluated the effectiveness of a structured clinical nursing practice guideline (CNPG) in improving nurses' knowledge, skills, and confidence, highlighting the urgent need for a rigorously developed and evaluated CNPG.
Purpose: This study evaluated the effectiveness of a CNPG in improving nurses' knowledge, skills, and confidence in managing IICP among patients with TBI, and explored nurses' perceptions of its feasibility, optimality, and benefits.
Methods: A sequential explanatory mixed methods design was employed. A quantitative pretest–posttest design was conducted from February to September 2024. The intervention involved implementing an IICP CNPG among 45 registered nurses in two neurological wards at a tertiary hospital in eastern Thailand. Data were collected using four validated instruments: the Nurses' Knowledge on IICP Questionnaire, Clinical Skills Observation Checklist, Self-Confidence Scale for IICP Care, and Nurses' Perception of CNPG Questionnaire. In the qualitative phase, 20 nurses participated in two focus group discussions, which were analyzed using conventional content analysis.
Results: Nurses showed statistically significant improvements in knowledge, clinical skills, and self-confidence following CNPG implementation (all $p < .001$). Perceptions of the CNPG in terms of feasibility, optimality, and benefits all significantly exceeded the standard benchmark (all $p < .001$). Eight qualitative themes were identified, highlighting the roles of evidence-based knowledge, repeated training, structured protocols, interprofessional collaboration, and refresher training in improving consistency, confidence, and quality of IICP care.
Conclusion: The CNPG was feasible, effective, and well-accepted among nurses, leading to significant improvements in knowledge, clinical skills, and self-confidence in IICP management. Future research should examine its long-term impact and effectiveness across diverse clinical settings.

How to cite: Khiewchaum, R., Aryuwat, P., Narasri, P., Kittitornkul, M., & Kuhasak, W. (2026). A sequential explanatory mixed methods evaluation of a clinical nursing practice guideline for intracranial pressure management. *Nurse Media Journal of Nursing, 16*(2), 316–333. https://doi.org/10.14710/nmjn.v16i2.78130

Copyright © 2026 by the Authors, Published by Department of Nursing, Faculty of Medicine, Universitas Diponegoro. This is an open-access article under the CC BY-SA License (http://creativecommons.org/licenses/by-sa/4.0/).

1. Introduction

Traumatic brain injury (TBI) remains a critical global health issue, with the rising incidence of traffic-related accidents contributing significantly to mortality and acute disability (Ahmed et al., 2023). Thailand faces a significant TBI burden from traffic accidents, necessitating acute management strategies to prevent secondary brain injury and reduce the high rates of morbidity and mortality (Sirikarn et al., 2024; Suwaryo et al., 2024). While primary injuries occur at the moment of impact, the clinical focus in acute care is on preventing secondary brain injuries (SBIs), such as cerebral edema and herniation (Ganefianty et al., 2021; Rogers et al., 2022). Among these, increased intracranial pressure (IICP) is the most life-threatening complication, often resulting

in poor outcomes if not managed through precise and timely nursing interventions (Eraky et al., 2023; Hickey & Strayer, 2020; Mielcarek et al., 2025). Given that certain routine procedures can inadvertently elevate IICP, adherence to evidence-based clinical practice guidelines is essential for nurses to mitigate complications and reduce TBI-related mortality effectively (Mielcarek et al., 2024; Shim et al., 2023).

TBI can be classified into two categories: primary and secondary injuries. Primary brain injuries occur immediately at the time of trauma and may include skull fractures, contusions, and lacerations (Ganefianty et al., 2021; Rogers et al., 2022). Secondary brain injuries (SBIs), however, develop as a consequence of pathophysiological responses to the initial insult and include complications such as intracranial hematomas, cerebral edema, herniation, and IICP (Eraky et al., 2023). Intracranial pressure (ICP) is the pressure within the craniospinal compartment; an increase in this pressure is a life-threatening complication of SBIs. IICP is a critical and frequently encountered complication, often resulting in poor outcomes if nursing interventions are not precise (Hickey & Strayer, 2020). Notably, certain nursing interventions and medical procedures can inadvertently elevate intracranial pressure, thereby exacerbating the risk of morbidity and mortality (Mielcarek et al., 2024). Evidence demonstrates that adherence to clinical practice guidelines (CPGs) enables nurses to manage TBI and mitigate IICP-related complications more effectively, ultimately lowering disability and mortality rates (Karagianni et al., 2025; Shim et al., 2023). Similar benefits of standardized protocols have also been documented in surgical care, where structured clinical pathways and quality verification processes have been shown to improve patient outcomes, reduce complications, and enhance consistency across providers (Cardell et al., 2024). However, in Thailand, only one CNPG for IICP prevention has been developed specifically for patients with external ventriculostomy. This guideline focuses on patient positioning, care of the cerebrospinal fluid (CSF) drainage catheter, wound care, monitoring for infection at the drainage catheter site and in the CSF collecting bag, monitoring patients' signs and symptoms of CSF infection, and identifying potential risks during patient transfers (Nongyao et al., 2023). Therefore, Thailand lacks a comprehensive CNPG for preventing and managing IICP in patients with TBI.

The foundation of the nursing profession is built on evidence-based practice, which integrates the best available research, clinical expertise, and patient preferences to ensure safe, high-quality care (Naz & Ganaie, 2023). Effectively managing IICP requires nurses to be proficient in neurophysiology, consciousness assessment, and recognizing complex clinical manifestations (Zeeshan et al., 2023). However, international research reveals a consistent gap between required proficiency and actual practice. For instance, novice nurses frequently report low professional confidence and significant difficulty in applying theoretical knowledge to the fast-paced demands of neurological care (Najafi & Nasiri, 2023). While clinical experience naturally may build confidence, research shows that nurses still face substantial perceived barriers when navigating high-pressure scenarios (Haririan et al., 2020).

This study is grounded in evidence-based nursing and the implementation of clinical practice guidelines (CPGs) (Naz & Ganaie, 2023; Pereira et al., 2022). Structured guidelines provide a standardized approach for managing IICP, thereby reducing practice variability and enhancing patient safety (Kitbunyonglers & Petpichetchian, 2018). Within this framework, nurses are viewed as critical agents in applying evidence-informed protocols, integrating their knowledge, technical skills, and clinical judgment to optimize outcomes for TBI patients (Mrayyan et al., 2023). Implementing a CNPG for IICP management is expected to strengthen three core domains of nursing competence: knowledge, skills, and self-confidence (Mielcarek et al., 2024; Najafi & Nasiri, 2023). Enhanced knowledge provides the foundation for recognizing clinical signs of elevated intracranial pressure; improved skills ensure consistent, accurate procedure execution; and increased self-confidence supports nurses' decision-making and adherence to complex care protocols in high-acuity neurological settings (Haririan et al., 2020; Hickey & Strayer, 2020). The conceptual framework guiding this research is presented in Figure 1.

In the Thai context, the evidence base remains limited. A literature review identified two relevant studies: one establishing evidence-based nursing practices for managing elevated ICP (Figueiredo et al., 2024) and another examining individual and environmental factors influencing nursing practice in neurosurgical units (Inshutiyimana et al., 2025). Both studies emphasized that nursing competence is not static and requires continuously updated guidelines to remain aligned

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

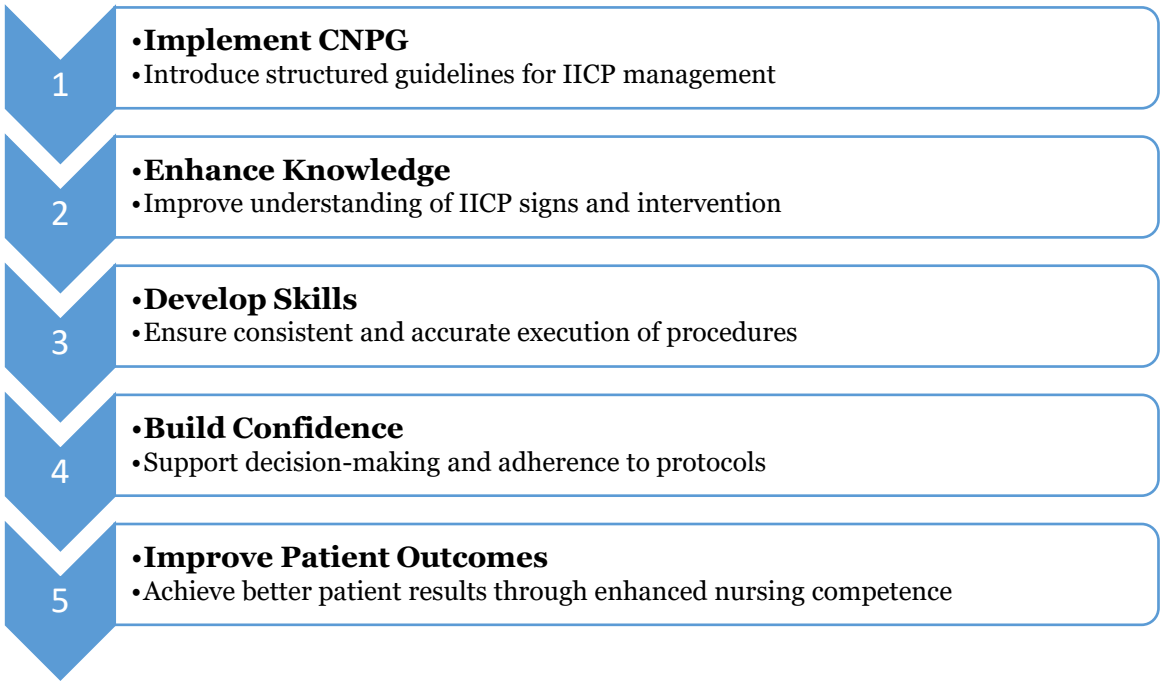


Figure 1. Conceptual framework of enhancing nursing competence in IICP management

with evolving medical standards. Furthermore, the existing Thai CNPG for IICP focuses narrowly on patients with external ventriculostomy (Nongyao et al., 2023) and does not address the broader population of TBI patients requiring comprehensive IICP prevention and management. No study in Thailand has yet evaluated the effectiveness of a structured CNPG on nurses' knowledge, skills, and confidence in IICP management for TBI patients. Structured clinical guidelines have been shown to significantly reduce mortality and improve outcomes for TBI patients by addressing the identified gaps in knowledge and skill application (Kitbunyonglers & Petpichetchian, 2018; Pereira et al., 2022). Therefore, there is an urgent need to develop and evaluate a comprehensive, evidence-based CNPG for IICP management tailored to the Thai clinical context.

To address this gap, this study developed, implemented, and evaluated such a guideline, representing a significant contribution to neurological nursing practice in Thailand. The CNPG for IICP management covers key nursing domains, including neurological status monitoring, intracranial pressure regulation, positioning management, prevention of the Valsalva maneuver, effective ventilation, blood sugar monitoring, timely recognition of complications, and evidence-based nursing interventions to reduce secondary brain injury. This guideline was developed through a systematic review of international literature, evidence grading, and expert review, and was subsequently adapted to align with the local Thai hospital context.

Accordingly, this study aimed to evaluate the effectiveness of a CNPG in improving nurses' knowledge, skills, and confidence in managing IICP among patients with TBI, and to explore nurses' perceptions of the feasibility, optimality, and benefits of the CNPG in practice.

2. Methods

2.1 Research design

This study employed a sequential explanatory mixed methods design (Hwang et al., 2025), combining quantitative and qualitative approaches to evaluate the effectiveness of a CNPG for preventing and managing IICP among patients with TBI. This design was chosen because the quantitative phase provided statistical measures of changes in nursing outcomes, while the subsequent qualitative phase offered an in-depth exploration of nurses' experiences, thereby providing a comprehensive and complementary understanding of the intervention's impacts (Hwang et al., 2025; Hitchcock & Onwuegbuzie, 2022). In the quantitative phase, a single-group pretest–posttest design was used to assess changes in nurses' knowledge, skills, and confidence before and after CNPG implementation. The qualitative phase employed focus group discussions (FGDs) to explore nurses' perceptions of the feasibility, optimality, and benefits of the CNPG in

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

practice. The integration of both strands strengthened the interpretation of findings through triangulation (Hitchcock & Onwuegbuzie, 2022). The study was retrospectively registered with the Thai Clinical Trials Registry (TCTR20250317002) and followed the EQUATOR guidelines, including COREQ and TREND, to ensure methodological rigor and transparency in reporting.

2.2 Setting and participants

The study was conducted in two neurology wards of a tertiary hospital in eastern Thailand. These wards provide specialized care for patients with TBI, including neuromonitoring and management of IICP. This setting was selected because of the high incidence of TBI in the region and the need for consistent, evidence-based nursing practices in critical care environments (Ahmed et al., 2023; Sirikarn et al., 2024).

The sample size was determined using G*Power software, based on an effect size of 0.5 and a statistical power of 0.95, yielding a minimum required sample of 45 participants (Sharma et al., 2020). Purposive sampling was used to recruit registered nurses from the two neurological critical care units. The inclusion criteria were as follows: (1) registered nurses with at least two years of experience caring for patients with TBI and IICP, and (2) nurses currently working in the trauma intensive care unit or neurosurgery unit during the data collection period. The exclusion criteria included nurses who were on educational leave, maternity leave, sick leave, or were otherwise absent from clinical duties during the data collection period. Of the 51 nurses assessed for eligibility, six did not meet the inclusion criteria and were excluded, resulting in a final sample of 45 participants (see Figure 2). The final sample included 24 trauma nurses (53.3%) and 21 neurosurgery nurses (46.7%). Detailed participant characteristics are presented in Table 3.

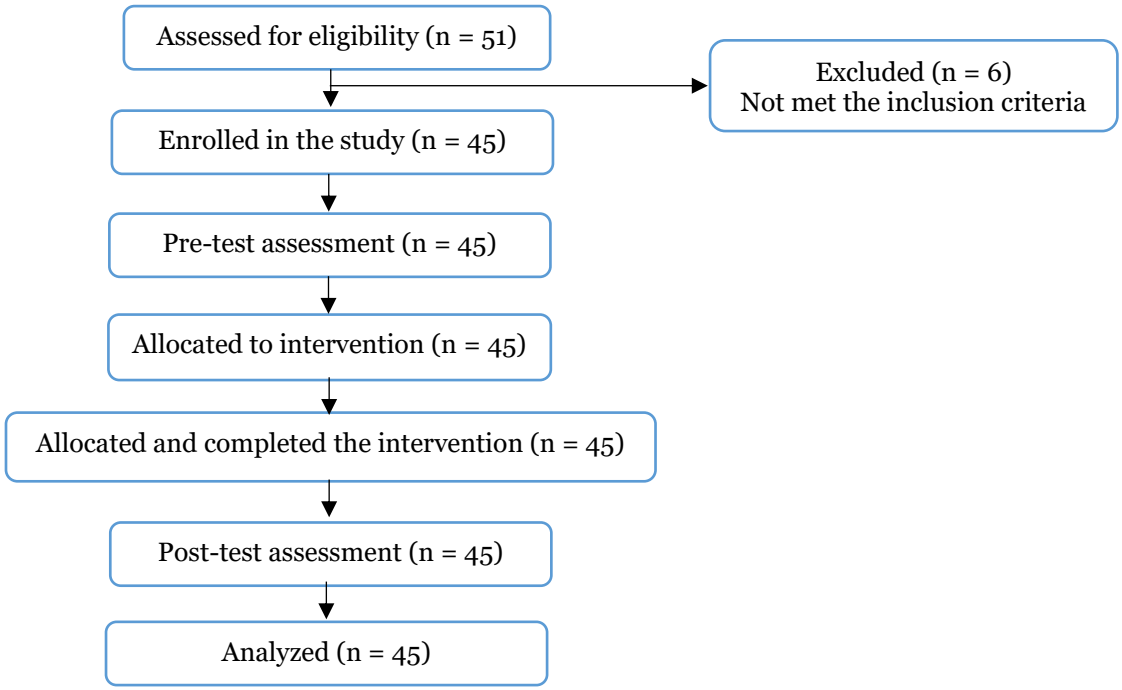


Figure 2. CONSORT flow diagram depicting the single-group pretest-posttest design

The purposive sampling approach ensured that nurses with relevant clinical experience were included, thereby supporting the evaluation of the CNPG in real-world practice (Tajari et al., 2024). For the qualitative phase, a purposive subsample of 20 nurses was selected from the 45 quantitative participants. Selection was guided by maximum variation sampling to ensure diversity in terms of ward type (trauma and neurosurgery), years of clinical experience (less than 10 years and more than 10 years), and specialty certification status. This subsample size was determined based on data saturation, as no new categories or insights emerged during the second focus group session (Pope & Mays, 2020). Ethical approval and informed consent were obtained before participation, in accordance with research standards for human subjects (Resnik, 2025).

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

2.3 Intervention

The intervention in this study was the development and implementation of a CNPG for the prevention and management of IICP in patients with TBI. The CNPG was developed following a rigorous scientific process. First, a systematic review of the international literature on IICP management was conducted, and evidence was graded according to the levels of evidence framework (Kitbunyonglers & Petpichetchian, 2018; Pereira et al., 2022). The drafted guideline was then reviewed by a panel of five clinical experts, comprising two neurological intensive care nursing specialists, one neurosurgeon, one advanced practice nurse in critical care, and one nursing education specialist. Each expert evaluated the guideline content for accuracy, clinical relevance, completeness, and applicability to the Thai hospital context. The content validity of the guideline was confirmed through expert consensus, with a content validity index (CVI) of 0.85 or above required for each item to be retained. Revisions were made based on expert feedback before the guideline was piloted in the two neurological units. The content was adapted from current research, international standards, and national practices, with revisions made to align with the local Thai hospital context.

The intervention was delivered by the principal investigator, who was an advanced practice nurse with expertise in neurological critical care, with support from two trained research assistants who assisted with pretest and posttest data collection and the supervision of guideline implementation. The education and training phase comprised four weekly sessions of 45–60 minutes each, covering the pathophysiology of TBI and IICP, evidence-based nursing interventions, practical demonstrations of CNPG procedures, and case-based discussions with return demonstrations. The intervention was conducted over 32 weeks (February–September 2024) and comprised five structured phases: baseline assessment, CNPG development and piloting, education and training, CNPG implementation, and perception evaluation. Table 1 summarizes the timing, duration, and activities of researchers and participants for each phase.

The CNPG emphasized key areas of nursing care, including monitoring of neurological status, regulation of intracranial pressure, timely recognition of complications, and evidence-based nursing interventions to reduce secondary brain injury. By providing a step-by-step approach, the guideline was designed to enhance consistency in nursing practices, promote patient safety, and improve the overall quality of care (Mielcarek et al., 2024; Zeeshan et al., 2023).

2.4 Measurement and data collection

Data were collected using a set of structured instruments that were developed by the research team to capture demographic information, nursing outcomes, and nurses' perceptions of the Clinical Nursing Practice Guideline (CNPG) for preventing and reducing increased intracranial pressure (IICP). All instruments were reviewed by experts in critical care nursing to establish content validity and tested for reliability before use (Tajari et al., 2024).

Demographic Data Form. This form was designed to record participants' demographic information, including age, gender, educational background, length of clinical experience, prior training in brain injury care, and experience in caring for patients with TBI.

Nurses' Knowledge on IICP Questionnaire. This 19-item questionnaire was developed by the research team to assess nurses' knowledge of IICP prevention and management. Item development was guided by a review of relevant literature and expert input on IICP nursing care. Items covered neurological assessment, monitoring, detection of complications, and evidence-based nursing interventions. The instrument was reviewed by three critical care nursing experts, yielding a CVI of 0.83. Reliability testing was conducted among 20 nurses with characteristics similar to the study sample, yielding a Cronbach's alpha of 0.70, indicating acceptable internal consistency.

Clinical Skills Observation Checklist. This checklist was developed by the principal investigator to evaluate technical skills in implementing the CNPG. Items reflected the key nursing actions required in the guideline and were completed through direct observation of participants' practices. Expert review by three critical care nursing specialists confirmed content validity with a CVI of 0.84. Intra-observer reliability testing among 20 similar nurses yielded a reliability coefficient of 0.75, indicating satisfactory consistency in observation.

Self-Confidence Scale for IICP Care. This 10-item self-report scale was developed by the research team to measure nurses' confidence in caring for patients with IICP. Item development was guided by a review of the relevant literature on nursing confidence in critical care. Items

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

included both positive and negative statements, rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Total scores ranged from 10 to 50, with higher scores indicating greater professional confidence; a mean score above 3.5 was interpreted as a high level of confidence. Expert review confirmed strong content validity with a CVI of 1.0. Reliability testing among 20 similar nurses demonstrated a Cronbach's alpha of 0.80, indicating good internal consistency.

Table 1. Clinical Nursing Practice Guideline (CNPG) implementation phases

Phase	Time & Duration	Researcher Activities	Nurse Participant Activities
Phase 1: Baseline Assessment	Feb 2024 (4 weeks); 60–90 mins/session	Reviewing patient records to identify existing practices; administering pretests.	Providing demographic data; completing pre-tests for knowledge, skills, and self-confidence.
Phase 2: Development & Piloting	May 2024 (12 weeks); 90–120 mins/session	Developing and updating the CNPG based on evidence; facilitating a pilot in two units.	Engaging in the pilot study of the IICP CNPG.
Phase 3: Education & Training	June 2024 (4 weeks); 45–60 mins/session	Providing structured training including lectures, case discussions, and demonstrations.	Attending education sessions (e.g., pathophysiology of TBI with IICP and nursing roles to prevent IICP effects among TBI patients); participating in practical demonstrations and discussions. Session topics were as follows: - Session 1: Pathophysiology of TBI and IICP; signs and symptoms of IICP; neurological assessment including Glasgow Coma Scale (GCS) and vital sign monitoring. - Session 2: Evidence-based nursing interventions for IICP prevention, including positioning management (head elevation 30–45 degrees), prevention of the Valsalva maneuver, and provision of effective ventilation. - Session 3: Practical demonstration of CNPG procedures, including effective suctioning technique (suction pressure ≤ 120 mmHg), blood sugar monitoring, and timely recognition of IICP complications. - Session 4: Case-based discussions and return demonstration; nurses applied the CNPG to simulated clinical scenarios and received feedback from the principal investigator.
Phase 4: Implementation	June–Aug 2024 (12 weeks); 60–90 mins/ session	Supervising the application of the CNPG; evaluating post-test outcomes.	- Applying the CNPG to routine care of TBI patients, including: (1) neurological status monitoring using GCS and vital sign recording; (2) positioning management with head elevation 30–45 degrees; (3) provision of effective ventilation; (4) prevention of Valsalva maneuver; (5) effective suctioning with suction pressure ≤120 mmHg; (6) blood sugar monitoring; and (7) timely recognition of IICP complications. - Post-test assessments of knowledge, skills, and self-confidence were completed at the end of this phase.
Phase 5: Perception Evaluation	Sept 2024 (4 weeks); 45–60 mins/session	Conducting semi-structured interviews and focus group discussions.	Sharing perceptions and clinical experiences after using the IICP CNPG.

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

Nurses' Perception of CNPG Questionnaire. This 30-item scale was developed by the research team to assess perceptions of the CNPG in terms of feasibility, optimality, and perceived benefits. Item development was guided by the literature on clinical guideline evaluation and expert input. The scale included both positively and negatively phrased items, rated on a five-point Likert scale. Expert review by three critical care nursing specialists confirmed content validity across three domains: feasibility (CVI = 0.81), optimality (CVI = 0.88), and perceived benefits (CVI = 0.93). Reliability testing among 20 similar nurses demonstrated Cronbach's alpha values of 0.70 for feasibility, 0.75 for optimality, and 0.90 for perceived benefits, indicating acceptable to excellent internal consistency (Williams et al., 2022).

Semi-Structured Interview Guide. For the qualitative phase, a six-question semi-structured interview guide was developed by the principal investigator to explore nurses' perceptions and experiences with CNPG. The guide focused on practicality, effectiveness, barriers, and perceived value of the guideline in daily practice. The guide was reviewed by three experts, yielding a CVI of 0.83, and was pilot-tested with a small group of nurses to refine clarity and appropriateness before use. The six main questions and their associated probes are presented in Table 2.

Table 2. Semi-structured interview questions and probes

Interview Questions	Probes
- Can you describe your experiences in caring for patients with IICP in critical care settings?	- What specific procedures did you perform? What was most challenging for you?)
- What challenges do nurses commonly encounter when managing patients with ICP monitoring or cerebrospinal fluid drainage?	- How did these challenges affect the quality of care you provided? What kind of support would have been helpful?)
- How do current nursing practices in your unit support the standard of care for IICP management?	- Are there any gaps between current practice and the standard of care? Can you give an example?)
- What are your perceptions regarding the usefulness and applicability of the IICP CNPG?	- Was the guideline easy to understand and follow? Did it help improve your clinical practice? In what way?)
- What challenges or barriers did you encounter while implementing the CNPG in your unit?	- Were there any conflicts with existing hospital protocols? How did you handle them? What would help overcome these barriers?)
- What factors facilitated the successful implementation of the IICP CNPG in your clinical setting?	- What institutional or team support was most helpful? What would you recommend to other units implementing this guideline?)

Data collection took place between February and September 2024, covering both the quantitative and qualitative phases of the study. A structured process was followed to ensure the accuracy, consistency, and completeness of the data (Tajari et al., 2024). In the pretest phase (February–March 2024), demographic information was collected from participants using the Demographic Data Form. Patient records were also reviewed using the Nursing Documentation System (NDS), focusing on clinical variables such as diagnosis, severity of head injury, Glasgow Coma Scale (GCS) scores, treatment interventions, and length of hospital stay (Eraky et al., 2023; Ganefianty et al., 2021; Rogers et al., 2022). During this period, the nurses completed baseline assessments using the Nurses' Knowledge on IICP Questionnaire, Clinical Skills Observation Checklist, and Self-Confidence Scale for IICP Care.

In the implementation phase (February–June 2024), the Clinical Nursing Practice Guideline (CNPG) was introduced to participating nurses in two neurological units. Structured training sessions, including lectures, demonstrations, and case-based discussions, were conducted to strengthen knowledge and skills in IICP management (Karagianni et al., 2025; Shim et al., 2023). Nurses were encouraged to apply the guideline under supervision in their daily care activities.

In the posttest phase (August–September 2024), nurses were reassessed using the same set of instruments: the Knowledge Questionnaire, Skills Checklist, and Self-Confidence Scale. This allowed for a comparison of pre- and post-intervention outcomes. At the same time, the Nurses' Perception of CNPG Questionnaire was administered to evaluate the feasibility, optimality, and perceived benefits of the guideline.

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

For the qualitative phase, two focus group interviews were conducted in September 2024 with a purposive subsample of 20 nurses. Each group included trauma and neurosurgery nurses with varying years of experience. Data collection and analysis were conducted concurrently to monitor data saturation; the 20-participant sample was considered sufficient, as no new categories or insights emerged during the second focus group session. The discussions were guided by the Semi-Structured Interview Guide and facilitated by an advanced practice nurse (APN) not involved in the intervention. Two research assistants observed, took field notes, and monitored group dynamics. Interviews were audio-recorded, transcribed verbatim, and checked for accuracy before analysis. The stepwise approach to data collection ensured that both quantitative and qualitative data were systematically obtained, providing a comprehensive dataset for subsequent analysis and integration (Mielcarek et al., 2024; Zeeshan et al., 2023).

2.5 Data analysis

Quantitative data were analyzed using SPSS version 29. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize participant characteristics. Normality tests were conducted to determine the appropriate statistical methods. The Wilcoxon signed-rank test was used to compare pretest and posttest scores for knowledge, clinical skills, and self-confidence. Nurses' perceptions of the CNPG were analyzed using the one-sample Wilcoxon signed-rank test, comparing scores against a criterion value of 3.50. Statistical significance was set at $p < .05$. Qualitative data were analyzed using conventional content analysis. The integration of quantitative and qualitative findings was performed in line with the sequential explanatory mixed methods design (Hwang et al., 2025).

2.6 Trustworthiness

The trustworthiness of the qualitative data was ensured through four criteria (Pope & Mays, 2020). Credibility was established through prolonged engagement with participants and member checking, whereby participants confirmed that the generated themes accurately reflected their clinical experiences. Dependability and confirmability were supported by maintaining a detailed audit trail of all analytical decisions; two research assistants independently coded the transcripts, and any discrepancies were resolved through consensus with an advanced practice nurse to minimize researcher bias. Transferability was enhanced by providing a thick description of the hospital setting and participant backgrounds, allowing readers to assess the applicability of the findings to other neurological care contexts (Pope & Mays, 2020).

2.7 Ethical consideration

This study was reviewed and approved by the Institutional Review Board (IRB) of the participating tertiary hospital before data collection began (COA No. 014/67). The study was also retrospectively registered with the Thai Clinical Trials Registry (TCTR20250317002). Written informed consent was obtained from all participants prior to participation. Anonymity was maintained by assigning codes instead of using personal identifiers. All data were stored securely and were accessible only to the research team. The study was conducted in accordance with the principles of the Declaration of Helsinki (World Medical Association, 2013).

3. Results

3.1. Participant characteristics

A total of 45 nurses participated in the study, including 24 trauma nurses (53.3%) and 21 neurosurgery nurses (46.7%). Participants' ages ranged from 21 to 52 years, with a mean age of 33.96 years (SD = 9.90). All held a bachelor's degree in nursing, and seven nurses (15.6%) reported additional specialty certifications. The average length of clinical experience was 12.27 years (SD = 10.03). Of these, 64.4% had fewer than 10 years of practice experience, while 35.6% had more than 10 years. The mean duration of experience in caring for patients with brain injury was 11.38 years (SD = 9.41). Table 3 presents detailed demographic characteristics.

3.2. Quantitative results

3.2.1 Nursing outcomes after CNPG implementation

Post-intervention assessments showed improvements in all nursing outcomes. Knowledge scores increased to a mean of 17.89 (SD = 1.11), clinical skills improved to a mean of 9.02 (SD =

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

0.89), and self-confidence increased to a mean of 44.49 (SD = 2.61). The detailed results are presented in Table 4.

Table 3. Characteristics of nurses in the trauma and neurosurgery units (n = 45)

Characteristics	n (%)	Mean (SD)
Ward		
Trauma intensive care unit	24 (53.33)	
Neurosurgery unit	21 (46.67)	
Age (years)		33.96 (9.90)
Years of clinical experience		12.27 (10.03)
< 10 years	29 (64.44)	
≥ 10 years	16 (35.56)	
Experience in caring for patients with TBI		11.38 (9.41)
Educational qualification		
Bachelor's degree only	38 (84.4)	
Bachelor's degree with additional specialty certifications	7 (15.6)	

Note. SD = standard deviation; TBI = traumatic brain injury.

3.2.2 Pre–post comparison

The Wilcoxon signed-rank test indicated significant improvements after the implementation of CNPG. Knowledge (pre-test M = 12.16, SD = 1.26; post-test M = 17.89, SD = 1.11; Z = 5.87, p < .001), skills (pre-test M = 5.00, SD = 0.90; post-test M = 9.02, SD = 0.89; Z = 5.89, p < .001), and self-confidence (pre-test M = 25.87, SD = 2.98; post-test M = 44.49, SD = 2.61; Z = 5.85, p < .001) all showed statistically significant gains (Table 4).

Table 4. Nursing outcomes before and after CNPG implementation and nurses' perceptions of the CNPG (n = 45)

Variables	Pretest	Posttest	Z	*p*-value
	M(SD)	M(SD)		
Nursing Outcomes				
Nurses' knowledge	12.16 (1.26)	17.89 (1.11)	5.87	<.001
Nurses' skills	5.00 (0.90)	9.02 (0.89)	5.89	<.001
Nurses' self-confidence	25.87 (2.98)	44.49 (2.61)	5.85	<.001
Nurses' Perceptions	Mean	SD		
Feasibility	4.72	0.31	5.86	<.001
Optimality	4.65	0.29	5.86	<.001
Benefits	4.67	0.30	5.85	<.001

Note: Pretest and posttest nursing outcomes were compared using the Wilcoxon signed-rank test. Nurses' perceptions were compared against a criterion value of 3.50 using the one-sample Wilcoxon signed-rank test. Z = standardized test statistic

3.2.3 Nurses' quantitative perceptions of CNPG

Nurses' perceptions of the CNPG were measured quantitatively using the 30-item Nurses' Perception of CNPG Questionnaire and analyzed using the one-sample Wilcoxon signed-rank test. Nurses reported positive perceptions of the CNPG in terms of feasibility, optimality, and benefits. The overall mean scores across the three domains were compared against a criterion mean of 3.50, which represents a value above the midpoint of a five-point Likert scale and is widely used as the threshold for indicating a favorable or acceptable level of agreement in nursing and educational research (Adams & McGuire, 2022; Aldosari, 2026; Kincaid, 2024). Scores exceeding this threshold were interpreted as indicating positive perceptions toward the guideline. For feasibility, the mean score was 4.72 (SD = 0.31), suggesting that nurses found the CNPG practical and applicable in routine care. For optimality, the mean was 4.65 (SD = 0.29), reflecting agreement that the guideline was appropriate, effective, and aligned with evidence-based practice. For benefits, the mean score was 4.67 (SD = 0.30), indicating that nurses perceived the CNPG as valuable in improving patient safety, care quality, and professional confidence. These results are presented in Table 4.

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

3.3. Qualitative finding

Analysis of the FGDs produced eight themes that reflected nurses' experiences with the CNPG for the prevention and management of IICP. The themes were derived inductively from two FGDs involving 20 nurses from the trauma and neurosurgery units. An overview of the themes and representative subthemes is presented in Table 5.

Table 5. Themes and subthemes from focus group interviews (n=20)

Themes	Sub-themes
Strengthening Knowledge and Skills through Evidence-Based Practice	Knowledge gaps clarified; structured reasoning provided; repeated training reinforced learning
Enhancing Confidence in Clinical Practice	Progressive confidence building; repeated training reduced uncertainty
Practicality and Ease of Use	Step-by-step structure; accessible for novice nurses and students
Consistency in Nursing Practice	Standardization of procedures; reduction in practice variation
Challenges in Implementation	Protocol discrepancies; resource and workload constraints
Professional Growth and Quality of Care	Ongoing professional development; improved patient safety
Interprofessional Collaboration and Communication	Need for physician consultation; teamwork in guideline application
Sustainability and Need for Refresher Training	Risk of knowledge fade over time; need for periodic retraining

3.3.1 Theme 1: Strengthening knowledge and skills through evidence-based practice

The CNPG was perceived to enhance nurses' knowledge and clinical skills by grounding care in evidence-based principles. While some content was already familiar to participants, the guideline provided clearer clinical reasoning and a more structured approach to IICP management. Nurses noted that they had previously performed procedures without fully understanding the underlying rationale. As one participant explained, *"We knew the content of IICP knowledge, but we did not know what accurate reasons are in caring for patients with IICP"* (FG1-P1). Repeated exposure to the guideline was identified as a key factor in consolidating learning. A nurse added, "*Repeated training on IICP knowledge with reliable documents promoted our knowledge"* (FG1-P2). Nurses further reflected that applying refreshed knowledge in clinical practice had a meaningful impact on patient outcomes and their visibility within the multidisciplinary team, as stated by P3: "*Our role in critical care, applying knowledge to practice, is very important, particularly in efforts to preserve life and prevent limb loss, is now much more evident to the broader medical team"* (FG1-P3). Together, these accounts suggest that the CNPG not only helped address knowledge gaps but also strengthened the clinical reasoning that underpins safe IICP care.

3.3.2 Theme 2: Enhancing confidence in clinical practice

Participants consistently described how their confidence in IICP care grew progressively with repeated engagement with the guideline. Initial exposure was perceived as challenging, with nurses reporting difficulty understanding and applying certain items. However, participants reported greater confidence following subsequent training. One nurse noted:

> *The second time of training use of the IICP guideline is better than the first time because we feel that the first time of training use of the IICP was hard because we did not understand and could not follow some items of this IICP guideline.* (FG2-P1)

Another participant reinforced this progression, stating: "*The second time of examining knowledge and training use of the IICP guideline are more confident to assess and manage patients with IICP"* (FG2-P2). These accounts suggest that a single training session may be

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

insufficient and that repeated training may be important for building and maintaining clinical confidence in IICP management.

3.3.3 Theme 3: Practicality and ease of use

The CNPG was widely described as practical, well-structured, and easy to follow in daily clinical practice. Its step-by-step format was particularly valued by nurses with less experience, as well as those supervising nursing students. One participant explained, "*It increased my understanding of caring for patients with brain injury, and I think we could easily follow this structure, especially our novice nurses and nursing students"* (FG2-P1). Another nurse affirmed the guideline's usability at the point of care: "*It worked because when I cared for patients with brain injuries, I could read and follow it"* (FG2-P3). These findings indicate that the CNPG's design successfully balanced clinical comprehensiveness with practical usability, making it an accessible reference tool across different experience levels.

3.3.4 Theme 4: Consistency in nursing practice

A prominent benefit identified by participants was the CNPG's role in promoting consistency across nursing practice. Prior to guideline implementation, participants reported variations in clinical procedures among nursing staff. Following structured demonstrations and training, nurses reported greater alignment in their approach to IICP care. One nurse stated, "*After demonstrating how to use the IICP guideline, we could follow and work in the same way in caring for patients with brain injury"* (FG2-P2). The guideline's evidence base was cited as the foundation for this standardization. A concrete example of practice change was highlighted by one participant:

> *We should work in the same way because this guideline is based on evidence. For example, effective suctioning for patients with brain injuries requires controlling the suction device pressure to no more than 120 mmHg. Previously, when we performed suctioning, we adjusted the suction device pressure to about 200 mmHg*. (FG1-P6)

This example illustrates how the CNPG was perceived as helping address potentially harmful practices and promoting greater procedural consistency.

3.3.5 Theme 5: Challenges in implementation

Despite the overall positive reception, participants identified implementation challenges, particularly discrepancies between the CNPG and existing hospital-specific protocols. These inconsistencies created uncertainty and required nurses to exercise additional clinical judgment before applying certain guideline recommendations. One nurse shared: "*The blood sugar level of this guideline is not the same protocol we use, and I think we need to consult physicians before following this aspect of the guideline"* (FG2-P4). Resource constraints and high patient workloads were also reported as barriers to consistent guideline adherence. These findings underscore that successful guideline implementation requires not only staff training but also institutional alignment and adequate resources.

3.3.6 Theme 6: Professional growth and quality of care

Nurses reported that engaging with the CNPG contributed positively to their professional identity and ongoing development. The guideline was perceived as a valuable educational resource that extended beyond immediate clinical application to support long-term professional growth. One participant observed, "*This guideline is more useful because it could achieve our IICP knowledge"* (FG1-P7). Nurses also described how the guideline helped them understand the rationale behind long-standing routines, which they felt improved the quality of their care: *"Nurses had been following practices passed down from senior nurses without knowing the reasons behind them, for example, why the head must be elevated 30 degrees. After using this guideline, we understood the reasons, and this has improved the quality of patient care"* (FG2-P5). Another participant highlighted the guideline's broader educational value for both staff and students: "*When nurse staff and nursing students use this protocol, it helps them to care for patients safely"* (FG2-P6). All these accounts reflect the CNPG's dual role as both a clinical protocol and a professional development tool that supports safe, high-quality care delivery.

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

3.3.7 Theme 7: Interprofessional collaboration and communication

Nurses recognized that effective IICP management extended beyond individual nursing practice and required close collaboration with physicians and other members of healthcare team. The CNPG was perceived to function as a shared reference point that facilitated communication across professional boundaries. When the guidelines conflicted with existing medical orders or institutional protocols, nurses reported seeking physician guidance before proceeding, reflecting the importance of interprofessional consultation. One nurse explained, "*I need to discuss with the doctor first before applying some parts of this guideline because the protocol in our ward is a little different*" (FG1-P8). This theme highlights the importance of embedding guideline implementation within a collaborative, team-based approach to patient care.

3.3.8 Theme 8: Sustainability and need for refresher training

A recurring concern among participants was the sustainability of knowledge and skills gained through initial CNPG training. Nurses acknowledged that without ongoing reinforcement, clinical knowledge could fade over time, particularly in settings with high workloads. The need for scheduled refresher training was therefore widely endorsed. As one nurse stated: "*We need to reboot the IICP protocol training to refresh things because it's easy to forget over time*" (FG2-P7). Another participant suggested embedding the CNPG into regular orientation and continuing education programs, stating, "*If new nurses and nursing students use this protocol from the beginning, they will be better at caring for patients with brain injury*" (FG2-P8). These findings suggest that the long-term sustainability of the CNPG depends on integrating guideline-related training into routine staff development rather than relying on one-time implementation efforts.

Overall, the eight themes suggest that the CNPG was perceived to provide meaningful benefits across multiple dimensions of nursing practice, including knowledge, confidence, consistency, professional growth, and interprofessional collaboration. At the same time, the findings highlight that sustainable implementation requires addressing protocol discrepancies, resource constraints, and the need for structured, ongoing refresher training. These qualitative insights complement and enrich the quantitative findings, providing a more comprehensive understanding of nurses' experiences with the CNPG in IICP management.

4. Discussion

This study examined the effectiveness of a CNPG for the prevention and management of IICP among patients with TBI. The findings demonstrated statistically significant improvements across all three nursing outcome domains following CNPG implementation, suggesting that the structured guideline effectively addressed existing gaps in IICP-related knowledge, skills, and self-confidence. Nurses' perceptions of the CNPG were highly favorable, with mean scores for feasibility, optimality, and benefits all significantly exceeding the predetermined criterion, indicating that the guideline was regarded as both practically applicable and clinically valuable in real-world settings.

Qualitative analysis further enriched these findings, revealing eight themes that reflect the CNPG's multidimensional impact on nursing practice, including strengthened knowledge and skills, enhanced confidence, improved consistency, professional growth, and interprofessional collaboration. Implementation challenges such as protocol discrepancies, resource constraints, and the risk of knowledge fading over time were also identified, underscoring the need for sustained institutional support and periodic refresher training.

The findings of this study suggest that the CNPG provided a structured, evidence-based framework that empowered nurses to deliver more consistent and confident care for patients with TBIs. Significant gains in knowledge, skills, and self-confidence indicate that structured education, combined with practical guidelines, can effectively bridge common gaps in nursing competence (Ahmed et al., 2023; Bernard et al., 2022; Sirikarn et al., 2024). This is vital in IICP management, where timely interventions are critical to preventing secondary brain injury and reducing mortality (Butterfield et al., 2023). The positive perceptions of feasibility, optimality, and benefits further suggest that the CNPG was not only theoretically sound but also highly applicable in real-world settings. Nurses specifically valued the clarity and simplicity of the protocol, which enhanced their willingness to apply it consistently. This highlights the necessity of designing guidelines that balance evidence-based rigor with ease of use, especially in high-

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

acuity environments where workload and stress levels are substantial (Kitbunyonglers & Petpichetchian, 2018; Pereira et al., 2022).

The findings are also consistent with previous studies that emphasize the role of structured clinical guidelines in enhancing nursing competence (Eraky et al., 2023; Ganefianty et al., 2021; Rogers et al., 2022). Comparable outcomes have been observed in other critical care contexts; for instance, nurses caring for patients with digital chest drainage systems demonstrated significantly enhanced knowledge and practical performance after receiving educational guidelines (Mahmoud et al., 2023). Similar findings have been observed in emergency care, where greater work experience was associated with stronger self-confidence during high-pressure resuscitation events, even when family members were present (Haririan et al., 2020). These findings are particularly important given that novice nurses frequently experience low professional confidence and uncertainty in practice (Najafi & Nasiri, 2023). In addition, similar outcomes have been observed in surgical care, where standardized pathways and quality verification protocols improved consistency, reduced complications, and enhanced patient outcomes (Cardell et al., 2024). This is further supported by broader educational evidence: globally, simulation-based learning has been widely adopted in nursing education and clinical practice to build competence effectively and safely (Miller, 2023). These results align with current conceptualizations of nursing competency, which recognize it as a dynamic interplay of knowledge, self-assessment, and adaptability, supported by structured guideline implementation such as the CNPG (Mrayyan et al., 2023).

Moreover, the structured rollout of the CNPG mirrors the disciplined strategies used in ICU settings, where implementation frameworks have helped achieve measurable outcomes such as reduced workload and maintained accuracy (Faulds et al., 2023). In other nursing domains, structured training has significantly influenced confidence. For example, in palliative care for non-cancer patients, nurses with prior training in hospice and end-of-life care demonstrated higher confidence in delivering complex care (Kim et al., 2020). This suggests that the effectiveness of the CNPG may stem not just from its content, but from its implementation design. Nurses' positive perceptions of the CNPG in terms of feasibility, optimality, and benefits also align with earlier research, which demonstrates that when guidelines are practical and evidence-based, nurses are more likely to integrate them into routine care (Kitbunyonglers & Petpichetchian, 2018; Pereira et al., 2022). However, sustaining such integration requires organizational and cultural support.

Evidence from acute care nursing highlights that while nurses can drive evidence-based improvements, barriers such as hierarchy and siloed decision-making may hinder long-term adoption, underscoring the importance of systemic support (Ominyi & Beryl, 2024). In addition, the high levels of perceived benefits are consistent with evidence that structured protocols not only improve patient safety but also reinforce professional confidence (Miranda et al., 2023). The qualitative findings in this study further support prior work, which shows that clinical guidelines reduce variability in practice and promote greater consistency among nurses (Mielcarek et al., 2024; Zeeshan et al., 2023). Themes such as strengthened knowledge, improved skills, and enhanced teamwork align with studies that emphasize the educational value of guideline-based training in fostering professional growth (Kiegaldie et al., 2023). Furthermore, the challenges identified in this study, including discrepancies between guidelines and institutional protocols, align with prior research showing the importance of aligning evidence-based recommendations with local policies and resources to ensure sustainability (Ogunbiyi et al., 2023).

The qualitative results add depth by showing how the CNPG influenced professional identity and growth. Themes of strengthened knowledge and enhanced teamwork align with evidence that reflective practice enables nurses to translate their clinical experiences into improved patient care (Lucas, 2023). However, the identified challenges, such as discrepancies with hospital protocols and limited resources, reveal an urgent need for institutional alignment to ensure sustainability (Ganefianty et al., 2021; Zeeshan et al., 2023). Ultimately, these guidelines are most effective when supported by continuous training and organizational commitment.

A major strength of this study is the use of a sequential explanatory mixed-methods design, which enabled a comprehensive evaluation of the CNPG by combining measurable outcomes with a contextual understanding of nurses' experiences (Bhatarasakoon & Chiaranai, 2024). The development and validation of study-specific instruments, using expert review, content validity indices, and reliability testing, further enhanced the rigor of the study (Inshutiyimana et al., 2025;

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

Figueiredo et al., 2024). Conducting the study in specialized neurological wards added clinical relevance, as the findings reflect real-world challenges and practices in high-acuity care environments (Querzola et al., 2023).

5. Implications and limitations

This study's findings carry several important implications for nursing practice, education, and policy. In terms of clinical practice, the significant improvements observed in knowledge, skills, and self-confidence suggest that hospitals should adopt structured, evidence-based nursing guidelines as a core component of their critical care protocols. The systematic use of such guidelines may contribute directly to safer patient care and reduced rates of secondary brain injury in TBI patients. Regarding nursing education, the results suggest that a single training session is insufficient for building sustained competence. Repeated, structured exposure to the guidelines is important, and nurse managers and educators should incorporate the CNPG into regular staff orientation programs, annual competency reviews, and ongoing professional development activities. The guideline's step-by-step format also makes it a valuable teaching resource for novice nurses and nursing students, helping to bridge the gap between theoretical knowledge and practical application in high-acuity settings.

From a policy perspective, hospital administrators and nurse leaders should conduct systematic protocol reviews to identify and resolve conflicts between evidence-based guidelines and existing institutional protocols prior to guideline implementation. Adequate staffing levels and workload management are equally critical to supporting consistent guideline use. At a broader level, the findings support the integration of clinical nursing practice guidelines into national nursing standards to promote consistency and quality of care across healthcare settings in Thailand and beyond.

Despite these positive findings, several implementation challenges were identified. Some nurses noted discrepancies between the CNPG and existing hospital protocols, such as differences in blood sugar monitoring standards, which created uncertainty about adherence in practice. Furthermore, resource limitations and high patient workloads occasionally hindered strict compliance with the guideline, reflecting systemic barriers that extend beyond individual nursing competence. These findings echo previous studies that emphasize the importance of aligning guidelines with institutional policies and ensuring adequate staffing and resources to support their use.

This study has several limitations that necessitate cautious interpretation of the findings. First, the single-group pretest-posttest design without a control group prevents definitive causal attribution of improvements to the CNPG. A randomized controlled trial would provide stronger causal evidence in future research. Second, the outcome instruments were locally developed and, while demonstrating strong content validity and reliability, lack established construct validity; future psychometric validation studies are recommended. Third, the sample was drawn from two wards in a single tertiary hospital in eastern Thailand, which may limit generalizability to facilities with different resources, staffing models, or cultural contexts. Fourth, reliance on self-reported measures of confidence and perceptions introduces potential response bias, and the study did not directly measure clinical patient outcomes. Finally, the lack of long-term follow-up means that the sustainability of these improvements has not yet been confirmed; longitudinal research is essential to determine whether behavioral changes persist over time.

6. Conclusion

This study evaluated the effectiveness of a CNPG for preventing and managing IICP among patients with TBI and explored nurses' perceptions of its feasibility, optimality, and benefits. The findings showed statistically significant improvements in nurses' knowledge, clinical skills, and self-confidence after CNPG implementation, suggesting the structured guideline effectively addressed gaps in nursing competence related to IICP management. Nurses' perceptions of the CNPG were highly positive, with feasibility, optimality, and benefits scores all significantly exceeding the predetermined criterion, indicating that the guideline was regarded as practical, appropriate, and valuable in real-world clinical settings. Qualitative findings further supported these results, showing that CNPG strengthened evidence-based practice, improved consistency in care delivery, promoted professional growth, and facilitated interprofessional collaboration. Implementation challenges, including protocol discrepancies and resource constraints, highlight

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

the importance of institutional alignment and sustained administrative support for successful guideline adoption. Future research should examine the long-term impact of CNPG implementation, assess its effectiveness across diverse clinical settings, and explore strategies to sustain guideline adherence through ongoing institutional support and refresher training.

Acknowledgments

The authors express their deepest gratitude to all participants and individuals involved in the research.

Author contribution

RK: conceptualization, data acquisition, analysis, writing the original draft, and manuscript review. PA: conceptualization, analysis, writing the original draft, and manuscript review. PN: conceptualization, data acquisition, analysis, and writing the original draft. MK: conceptualization and data acquisition. WK: conceptualization, data acquisition, analysis, and writing the original draft. All authors have read and agreed to the published version of the manuscript and are accountable for all aspects of the work to ensure that questions regarding the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest

The authors declare that they have no competing interests.

Funding

This research was supported by Phrapokklao Nursing College, Chanthaburi, under Grant No. PNC-Res-S09-1-7_PUR.

Declaration of Generative Artificial Intelligence (AI)

The authors used AI-assisted writing technology (Claude, Anthropic) to improve the manuscript's readability and language. All AI-generated suggestions were carefully reviewed, edited, and verified by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the content. AI was not used for data analysis, interpretation of results, or any part of the research process.

References

Adams, K. A., & McGuire, E. K. (2022). *Research methods, statistics, and applications*. SAGE Publications.

Ahmed, S. K., Mohammed, M. G., Abdulqadir, S. O., Abd El-Kader, R. G., El-Shall, N. A., Chandran, D., Misbah-ur Rehman, M., & Dhama, K. (2023). Road traffic accidental injuries and deaths: A neglected global health issue. *Health Science Reports, 6,* e1240n. https://doi.org/10.1002/hsr2.1240

Aldosari M. S. (2026). Perceptions, challenges, and innovations in educational rehabilitation for students with intellectual disabilities in Saudi Arabia. *BMC Medical Education*, *26*(1), 1109. https://doi.org/10.1186/s12909-026-09590-0

Bernard, F., Barsan, W., Diaz-Arrastia, R., Merck, L. H., Yeatts, S., & Shutter, L. A. (2022). Brain oxygen optimization in severe traumatic brain injury (BOOST-3): A multicenter, randomized, blinded-endpoint, comparative effectiveness study of brain tissue oxygen and intracranial pressure monitoring versus intracranial pressure alone. *BMJ Open, 12*(3), e060188. https://doi.org/10.1136/bmjopen-2021-060188

Bhatarasakoon, P., & Chiaranai, C. (2024). Bridging the gap from theory to practice: Teaching evidence-based nursing strategies for developing critical thinkers and lifelong learners. *Pacific Rim International Journal of Nursing Research*, 28(3), 469–478. https://doi.org/10.60099/prijnr.2024.268645

Butterfield, M., Bodnar, D., Williamson, F., Parker, L., & Ryan, G. (2023). Prevalence of secondary insults and outcomes of patients with traumatic brain injury intubated in the prehospital setting: A retrospective cohort study. *Emergency Medicine Journal, 40*(3), 167–174. https://doi.org/10.1136/emermed-2022-212513

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

Cardell, C. F., Peters, X., Hu, Q. L., Robinson-Gerace, A., Mistretta, S., Wescott, A., Maggard-Gibbons, M., Hoyt, D. B., & Ko, C. Y. (2024). Evidence review for the American College of Surgeons quality verification part III: Standardization, protocols, and achieving better outcomes for patient care. *Journal of the American College of Surgeons. 239(5), 494–510,* https://doi.org/10.1097/xcs.0000000000001126

Nongyao, D., Lablai, P., & Pinsuwan, M. (2023). Development of nursing practice guidelines for the prevention of increased intracranial pressure in patients with cerebrospinal fluid drainage from the cerebral ventricles at Pranakhon Si Ayutthaya Hospital. *Vajira Nursing Journal, 25*(2), 27–39. https://he02.tci-thaijo.org/index.php/vnj/article/view/265234

Eraky, A. M., Treffy, R. W., & Hedayat, H. (2023). Cisternostomy as a surgical treatment for traumatic brain injury-related prolonged and delayed intracranial pressure elevation: A case report. *Cureus, 15*(4), e37508. https://doi.org/10.7759/cureus.37508

Faulds, E. R., Dungan, K., & McNett, M. (2023). Implementation of continuous glucose monitoring in critical care: A scoping review. *Current Diabetes Reports, 23*, 69–87. https://doi.org/10.1007/s11892-023-01503-5

Figueiredo, R., Castro, C., & Fernandes, J. B. (2024). Nursing interventions to prevent secondary injury in critically ill patients with traumatic brain injury: A scoping review. *Journal of Clinical Medicine*, *13*(8), 2396. https://doi.org/10.3390/jcm13082396

Kincaid, H. (2024). Statistical variable selection and causality in the social and behavioral sciences. *Quality &* Quantity, *59*(2), 1383–1404. https://doi.org/10.1007/s11135-024-02013-6

Ganefianty, A., Songwathana, P., & Nilmanat, K. (2021). Transitional care programs to improve outcomes in patients with traumatic brain injury and their caregivers: A systematic review and meta-analysis, *Belitung Nursing Journal, 7*(6), 445–456. https://doi.org/10.33546/BNJ.1592

Haririan, H., Soleimani, A., & Hassankhani, H. (2020). The relationship between work experience and self-confidence of emergency nurses with family presence during resuscitation. *Journal of Critical Care Nursing, 12*(4), 46–53. http://jccnursing.com/article-1-474-en.html

Hickey, J. V., & Strayer, A. L. (2020). *The clinical practice of neurological and neurosurgical nursing implementation of clinical practice guidelines in public health: An overview of systematic (8th ed.)*. Lippincott Williams & Wilkins.

Hitchcock, J. H., & Onwuegbuzie, A. J. (2022). *The Routledge handbook for advancing integration in mixed methods research*. Taylor & Francis.

Hwang, Y., Knobf, M. T., & Sadler, L. S. (2025). Integration in Mixed-Methods Research With an Exemplar Explanatory Sequential Study. *Nursing Research*, *74*(2), 144–149. https://doi.org/10.1097/NNR.0000000000000796

Inshutiyimana, S., Uwishema, O., Ramadan, N., Ghanem, L., Al Maaz, Z., Mukamitari, V., Wojtara, M., & Mshaymesh, S. (2025). The importance of neurosurgical nursing in low- and middle-income countries - A critical review. *Annals of Medicine and Surgery*, *87*(2), 720–724. https://doi.org/10.1097/MS9.0000000000002910

Karagianni, M., Brotis, A. G., Vrettou, C. S., Goupou, K., Stranjalis, G., & Fountas, K. N. (2025). Cerebral perfusion pressure in severe traumatic brain injury survivors and non-survivors: A aeta-analysis. *Brain Sciences, 15*(11), 1161. https://doi.org/10.3390/brainsci15111161

Kiegaldie, D., Weerasekara, I., & Shaw, L. (2023). Investigating the effects of intraprofessional learning in nursing education: Protocol for a longitudinal study. *Nursing Reports, 13*(2), 740–750. https://doi.org/10.3390/nursrep13020065

Kim, S., Lee, K., & Kim, S. (2020). Knowledge, attitude, confidence, and educational needs of palliative care in nurses caring for non-cancer patients: A cross-sectional, descriptive study. *BMC Palliative Care, 19*(1), 105. https://doi.org/10.1186/s12904-020-00615-y

Kitbunyonglers, S., & Petpichetchian, W. (2018). Evidence-based fast track nursing management in care of patients with traumatic brain injury having increased intracranial pressure: A case study. *Thai Journal of Nursing and Midwifery Practice, 5*(1), 5–18. https://he02.tci-thaijo.org/index.php/apnj/article/view/130995

Lucas, B. (2023). Using reflection in nursing practice to enhance patient care. *RCN Nursing Standard, 38*(6), 44–49. https://doi.org/10.7748/ns.2023.e11598

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

Mahmoud, S. F., Mourad, A. H., & Senosy, A. M. K. (2023). Effect of educational guidelines on nurses' performance for caring of critically ill patients with digital chest drainage system. *Egyptian Journal of Health Care*, *14*(4), 864–873. https://doi.org/10.21608/ejhc.2023.334880

Mielcarek, J., Thompson, J. A., Appavu, B., Adelson, P. D., & Reuter-Rice, K. (2024). Nursing interventions and intracranial pressure change in pediatric patients with severe traumatic brain injury. *Dimensions of Critical Care Nursing, 43*(5), 231–238. https://doi.org/10.1097/dcc.0000000000000656

Miller, A. N. (2023). The use of simulation-based learning as an educational tool in nursing. *Nursing in Critical Care, 28*(3), 338–340. https://doi.org/10.1111/nicc.12904

Miranda, M., Silva, A. K. L. da, Sales, A. de A., & Barbosa, N. S. (2023). Communication and safe and effective nursing care in surgical center and intensive care: Integrative review. *Revista Ciências Em Saúde, 13*(2), 42–51. https://doi.org/10.21876/rcshci.v13i2.1393

Mrayyan, M. T., Abunab, H. Y., Abu Khait, A., Rababa, M., Al-Rawashdeh, S., & Algunmeeyn, A. (2023). Competency in nursing practice: a concept analysis. *BMJ Open, 13*(6), e067352. https://doi.org/10.1136/bmjopen-2022-067352

Najafi, B., & Nasiri, A. (2023). Explaining novice nurses' experience of weak professional confidence: A qualitative study. *SAGE Open Nursing, 9*, 237796082311534. https://doi.org/10.1177/23779608231153457

Naz, H., & Ganaie, N. A. (2023). Evidence-based practice in nursing: A comprehensive review. *Clinical Medicine And Health Research Journal*, *6*(3), 713–715. https://doi.org/10.18535/cmhrj.v3i6.254

Ogunbiyi, O., Akhideno, I., & Fagbohun, O. A. (2023). The post coronavirus disease-19 pandora-box: Future directions for critical care in low and medium-income countries. *Medical Research Archives, 11*(5). https://doi.org/10.18103/mra.v11i5.3775

Ominyi, J., & Beryl, N. A. (2024). Bridging knowledge and practice: Exploring evidence-based practice implementation in acute care nursing. [Preprint]. Research Square. https://doi.org/10.21203/rs.3.rs-5334518/v1

Pereira, V. C., Silva, S. N., Carvalho, V. K. S., Zanghelini, F., & Barreto, J. O. M. (2022). Strategies for the implementation of clinical practice guidelines in public health: An overview of systematic reviews. *Health Research Policy and Systems, 20*(1), 13. https://doi.org/10.1186/s12961-022-00815-4

Pope, C., & Mays, N. (2020). *Qualitative research in health care*. John Wiley & Sons.

Querzola, G., Bellomo, A., Salvadori, E., & Pantoni, L. (2023). Outcome of patients older than 85 years hospitalized in a neurology unit. *Aging Clinical and Experimental Research, 35*, 1753–1761. https://doi.org/10.1007/s40520-023-02468-x

Rapp, A., Kobeissi, H., & Fahim, D. K. (2025). Updated review of the management of and guidelines for traumatic brain injury. *Journal of Clinical Medicine, 14*(19), 6796. https://doi.org/10.3390/jcm14196796

Resnik, D. B. (2025). *The ethics of research with human subjects: Protecting people, advancing science, promoting trust*. Springer Nature.

Rogers, E., Beauclair, T., Thyen, A. B., & Shi, R. (2022). Utilizing novel TBI-on-a-chip device to link physical impacts to neurodegeneration and decipher primary and secondary injury mechanisms. *Dental Science Reports, 12,* 11838. https://doi.org/10.1038/s41598-022-14937-w

Sharma, S. K., Mudgal, S. K., Thakur, K., & Gaur, R. (2020). How to calculate sample size for observational and experimental nursing research studies. *National Journal of Physiology, Pharmacy and Pharmacology, 10*(1), 1–8. https://doi.org/10.5455/njppp.2020.10.0930717102019

Shim, Y. J., Kim, J., Kim, H., Oh, J., & Ha, E. J. (2023). Intracranial pressure monitoring for acute brain-injured patients: When, how, what should we monitor? *Korean Journal of Neurotrauma, 19*(2), 149–161. https://doi.org/10.13004/kjnt.2023.19.e32

Sirikarn, P., Chaisirin, W., & Ruangsomboon, O. (2024). Neuromonitoring for traumatic brain injury in Thailand. *Chulalongkorn Clinical Chronicle, 32*(1), e240007. https://he02.tci-thaijo.org/index.php/ccc/article/view/267083

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811

Suwaryo, P.W., Kadir, F., Omar, A., & Singh, S. K. D. (2024). Prevalence of persistent post-concussion syndrome in adults after mild traumatic brain injury. *Nurse Media Journal of Nursing, 14*(2), 199–*209*. https://doi.org/10.14710/nmjn.v14i2.56529

Tajari, M., Ashktorab, T., Ebadi, A., & Zayeri, F. (2024). Designing and psychometric evaluation of safe *nursing* care instrument in intensive care units. *BMC Nursing*, *23*(1), 629. https://doi.org/10.1186/s12912-024-02322-z

Williams, M., Wiggins, R., & Vogt, P. R. (2022). *Beginning quantitative research*. Sage.

World Medical Association. (2013). WMA - the World Medical Association-Declaration of Helsinki. https://www.wma.net/what-we-do/medical

Zeeshan, M. S., Abbas, A. D., Mahmood, S., Shaikh, M. H., Ali, R., & Khan, N. (2023). Nurses' knowledge regarding Glasgow Coma Scale at tertiary care Hospital Karachi, Pakistan. *Pakistan Journal of* Health *Sciences*, *4*(5), 100–104. https://doi.org/10.54393/pjhs.v4i05.711

Copyright © 2026, e-ISSN 2406-8799, p-ISSN 2087-7811