Competence Assessment Instruments in Perianesthesia Nursing Care: A Scoping Review of the Literature

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Purpose: *To identify competence assessment instruments in perianesthesia nursing care and to describe the validity and reliability of the instruments.*
Design: *A scoping review in a systematic manner.*
Methods: *A search in CINAHL, MEDLINE, and ERIC was carried out to identify empirical studies from 1994 to 2015. A narrative synthesis approach was undertaken to analyze the data.*
Findings: *Nine competence assessment instruments in perianesthesia nursing care were identified. The instruments used three types of data collection methods: Self-report, observation, and written examinations. The most commonly reported validity method was content validity involving expert panels and reliability tests for internal consistency and inter-rater's consistency.*
Conclusions: *Integrating more than one data collection method may give support to overcoming some of the limitations, such as lack of objectivity and misinterpretation of the assessment results. In an ever-changing environment, perianesthesia nursing competence requires constant reassessment from the perspective of content validity, scoring methods, and reliability.*

Keywords: *competence assessment instrument, perianesthesia nursing care, literature review.*
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PERIANESTHESIA NURSING CARE is commonly regarded as a nursing specialty concerned with providing nursing care to patients undergoing or recovering from anesthesia. Internationally, in a large umbrella of the perianesthesia specialty, perianesthesia nursing includes planning and caring for preanesthesia, intra-anesthesia, and postanesthesia patients until the patient is discharged into a ward setting or home.[1,2] Furthermore, perianesthesia nursing care can be expanded from the operating theater environment to various clinical settings such as diagnostic, therapeutic, obstetrical procedures, and pain management.[1,2] In various environments, perianesthesia nurses are expected to be experts, to be able to make flawless and rapid judgments, and to deal professionally with the ethical issues.[2-4] Therefore, they require a set of

specialized knowledge and skills to satisfy the complicated needs of a patient in perianesthesia care.[1,5]

International council of nurses defined competence as *the effective application of a combination of knowledge, skill and judgment demonstrated by an individual in daily practice or job performance.[6]* In the case of the United States of America, nurses in perianesthesia care periodically take a certain number of supplementary courses, continuing education credits, or web-based learning to maintain their certification.[3,7,8] In Europe, there is no specific regulation for recertification of nurses in perianesthesia care and nursing training varies a great deal both nationally and internationally.[9] Therefore, it is essential to provide a more accurate assurance when evaluating whether a professional has achieved an acceptable level of knowledge and skills.[10]

To provide safe care for patients and maintain the credibility of nurses by providing the capabilities to correspond to dynamic circumstances, a system of competence assessment in perianesthesia care is demanded. However, the competence assessment instruments currently used in perianesthesia nursing education and practice may lack validity or reliability, or both. A competence assessment instrument developed by a valid and reliable process would be beneficial for a more rigorous evaluation of the competence of nurses and enable the identification of deficiencies in professional development and educational needs.[11-14]

To date, little information is available regarding what competence assessment instruments exist in perianesthesia nursing care, and how valid and reliable they are. Thus, comprehensive research focusing on competence assessment in perianesthesia nursing care as well as the validity and reliability of the assessment instruments is necessary. For this purpose, a scoping review methodology has been conducted to provide an overview of the current literature related to competence assessment in perianesthesia nursing care.

Purpose

The purpose of this review was to describe how competence in perianesthesia nursing care has been assessed. The review aimed to identify competence assessment instruments in perianesthesia nursing care and to describe the validity and reliability of the instruments.

Methods

A scoping review refers to a process of mapping or summarizing the existing literature to understand the range of the field.[15-19] In this study, a scoping literature review methodology based on the framework (five stages) outlined by Arksey and O'Malley[20] was undertaken to identify the literature available in the field of perianesthesia nursing care.

Stage 1. Identifying the Research Questions

A scoping review was carried out to answer following questions:

1. What instruments were used to assess competence in perianesthesia nursing care?
2. How were the validity and reliability of the assessment instruments reported in the literature?

Stage 2. Identifying Relevant Studies

A literature search was carried out using the electronic databases, CINAHL, MEDLINE (Ovid), and ERIC in September, 2015. Single and combined search terms included: **competen*, assess*, scale*, tool*, evaluat*, measure*, nurs*, perian(a)esth*, prean(a)esth*, intraan(a)esth*, postan(a)esth*, an(a)esthe*, PACU, perioperati*, preoperati*, intraoperati*, postoperati*, recovery, valid*, and reliab***. To uncover any additional publications or gray areas in the literature, hand searching of reference lists for key articles and a search using a general internet browser (Google Scholar) was undertaken. The search covered all countries, but only the English language from the last two decades (1994 to 2015) were included. During this period, nursing education has been under reform in Europe and research concerning competence in nursing has increased.[21]

Stage 3. Study Selection

For the study selection, the scoping review adopted similar methods to a systematic review. References were included if they measured **any**

aspect of the scoping in relation to nurses' competence in perianesthesia care on the basis of the inclusion criteria (Table 1). In the search, perianesthesia nursing care was operationally defined as nursing care related to patients undergoing procedures requiring sedation, analgesia, and anesthesia in the operating unit, anesthesia procedural areas, or postanesthesia care units (PACUs).

The initial search generated 232 research articles. Two researchers (Y.J. and R.L.) independently reviewed and applied the selection criteria to all titles and abstracts. During the title and abstract screening process, references were marked as either "include," "unclear," or "excluded," and the former two categories marked on the abstract screening were included for the full-text review. After the titles (deletion of 132 references, which did not meet the inclusion criteria based on the title) and abstracts (deletion of 71 references, which did not meet the inclusion criteria based on the abstracts) of the articles were scrutinized, 19 articles remained for the full-text review. In addition, 18 references identified by manual searches were included for full-text review to determine their study eligibility. In all, 37 articles were assessed as relevant based on the inclusion criteria. After reviewing the full text, 24 references were excluded because their participants did not comprise perianesthesia nurses (n = 4), they were evaluations of teaching methods or orientation programs (n = 9), they were not empirical studies but guidelines or standards (n = 5), and they did not evaluate competence in perianesthesia nursing (n = 6). Finally, 13 articles met the selection criteria and were included in the analysis (Figure 1).

Stage 4. Charting the Data

The charting of the studies provided an overview of the existing literature. A spreadsheet was created to chart relevant data based on the focus of the scoping question (Y.J.). To identify the range of the study, 13 articles were summarized by the author with regards to year of publication, country, purpose of study, design/sample/participant/ ethics, instrument, and key findings. On the basis of the summary of the data, competence assessment instruments were identified and charted specifically by a data collection method, the domain/ category (item), a scale/scoring, and the validity and reliability of the instruments.

A scoping study tends to present broader themes for which the various types of study might be applicable and is less likely to seek to assess the quality of the studies included.[20] As a scoping study, this review did not conduct a quality appraisal process. Instead of a quality appraisal of the studies included, this review focused on describing the quality of the instruments identified to find the answers to the research questions.

Stage 5. Collating, Summarizing, and Reporting of the Results

On the basis of the charting, commonalities, themes, and gaps in the literature were identified. A narrative synthesis approach was undertaken to analyze the data. To summarize the validities and reliabilities of the instruments, the "Guidelines reporting the psychometric soundness of instruments" were used.[22] One (Y.J.) of the researchers

Table 1. Inclusion and Exclusion Criteria

| Review question	Inclusion Criteria	Exclusion Criteria
Participants	Perianesthesia nurse, anesthesia nurse/nurse anesthetist, anesthesiology nurse, anesthesia care team, OR nurse, student nurse anesthetist, recovery room nurse, postanesthesia care unit nurse, perioperative nurse	Operating room nurses without anesthesia nurses (eg, focus only on scrub nurses and/or circulation nurses) Anesthesia care team without anesthesia nurses (eg, focus only on physicians), air force nurse anesthetists
Interest	Perianesthesia nurse's competence assessment instrument	Assessment instrument for other purposes (eg, competence of preceptors or competence-based education)
Study design	Original empirical studies and mixed method, instrument validation studies	Literature reviews, editorial, discussion articles, guideline, standards, qualitative study
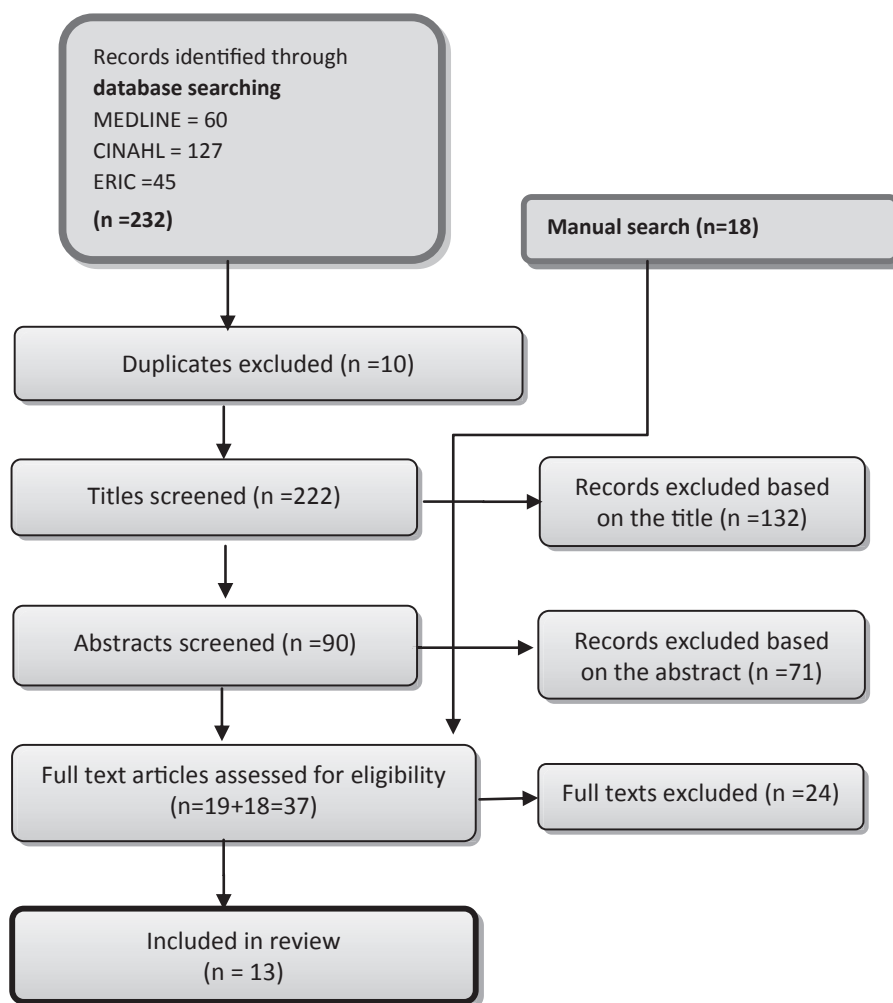
Figure 1. Flowchart of the search and selection process.

charted the data, collated, and summarized the commonalities, themes, and gaps. The consistency and accuracy of the summary were checked by other researchers (R.L., R.M., and H.L.). Any changes were discussed by all the researchers, and a final decision arrived at through consensus.

Results

Thirteen relevant articles were reviewed (Table 2). Among the reviewed articles, seven articles were from the United States, two from Australia, two from Finland, and two from the UK. Ten of the total 13 articles reported were within the last 5 years. This indicates that the concern for competence assessment in perianesthesia care has increased since 2010. One article measured the competence of PACU nurses. Six articles measured the competence of nurse anesthetists or nurse anesthetist students. Six articles focused on perioperative nurses' competence. Eleven articles reported the ethical aspects such as voluntary nature, informed consent, confidentiality, anonymity, and ethics committee's approval, whereas two did not clarify the ethical issues.

As a result of the analysis of these 13 articles, nine competence assessment instruments were finally identified.

To examine the nature and methodological features of the instruments, nine instruments were described by types of data collection methods, the domain/category, number of items,

Table 2. Summary of the 13 Included Studies

Authors/Year/Country	Purpose	Design/Sample (Participant) Ethics	Instrument	Key Findings
Collins and Callahan/2014/ United States[30]	To test a clinical evaluation tool in terms of validity and to identify the relationship between the clinical evaluation score and NCE (National Certification Examination) score	Ex post facto cross-sectional study design/N = 137 (certified registered nurse anesthetist (CRNA) students) and evaluators (N = not mentioned)/*ethical issues: Not mentioned*	Clinical evaluation Instrument	17-Item clinical evaluation tool measured only three underlying constructs, technical skill, patient focus concept, and manage resource. No correlation between clinical evaluation score and NCE
Cook et al/2013/United States[29]	To assess recent CRNA graduate's preparation and performance for entry into practice	Cross-sectional survey design/N = 560 (CRNAs) and N = 696 (employers)/*ethical issues: Not mentioned*	Professional competence	Most of new graduates enter into nurse anesthesia practice prepared with the required knowledge and skills to practice as safe, competent providers
Gaba et al/1998/United States[31]	To assess anesthesia care provider's performance on technical skills and behavior when responding to critical events	Quasi experimental study/N = 72 (residents, faculties, and CRNAs) and N = 5 (evaluators)/*ethical issues: Anonymity and informed consent*	• Crisis management behaviors tool • Technical action check-list	Successful at implementing appropriate technical action in general performing (>80% of checklist). Crisis management behavior varied with some teams rated as minimally acceptable or poor
Gabriel/2013/United States[7]	To determine relationships between written examination scores, self-assessment score, and performance scores in a simulated environment	Validation studies of three measurements/N = 18 (CRNAs) and N = 2 (evaluators)/*ethical issues: Voluntary participation and informed consent*	• Knowledge examination • Mini-CEX (clinical exercise) • Technical action checklist	Written examination 67% correct. Simulation performance 77.28%. Negative correlation between written examination and performance scores in simulation
Gillespie et al/2011/Australia[23]	To describe the influence of years of operating room (OR) experience and specialty education on nurses' perioperative competence	Cross sectional survey/N = 345 (perioperative nurses) *ethical issues: Voluntary participation, anonymity, informed consent, and ethics committee*	PCS-R (Perceived Competence Scale-Revised)	More experienced nurses and those with specialty education reported higher competence scores

(Continued)

Table 2. Continued

Authors/Year/Country	Purpose	Design/Sample (Participant) Ethics	Instrument	Key Findings
Gillespie et al/2012/Australia[24]	To describe the development and validation of the revised perioperative competence scale	Cross sectional survey design/N = 1,138 (perioperative nurses)/ *ethical issues: Ethics committee's approval, anonymity, voluntary nature, and informed consent*	PPCS-R (perceived perioperative competence scale-revised)	40 Items were grouping six dimensions. OR nurses were more likely to perceive high level perioperative competence (total score 174.7(min 0-max 200)
Gillespie and Pearson/2013/ UK[25]	To compare operating department practitioner (ODP) and operating theater (OT) nurses' perception of their perioperative competence	Cross-sectional survey/N = 214 (perioperative nurses)/ *ethical issues: Informed consent and ethics committee's approval*	PPCS-R	Both groups reported their competence high across all subscales. There were significant differences in dimension, foundational knowledge and skill, and empathy between two groups
Greenfield et al/2014/United States[28]	To identify encounters with 14 topics (eg, basic life support and advanced cardiac life support) related to postanesthesia and assess perianesthesia nurses' competence	Cross-sectional survey design/N = 54 (obstetric postanesthesia care unit (PACU) nurses) and N = 68 (surgical PACU nurses)/ *ethical issues: Voluntary nature, confidential, and anonymity*	NCS (nurse competence scale)	Surgical PACU nurses showed high encounters each topic in their practice and indicated high competency
Henrichs et al/2009/United States[33]	To determine whether experienced anesthesia teams have comparable skill levels in managing acute conditions	Prospective, randomized, single-blinded study/N = 61 (anesthesiologists and CRNAs) and N = 2 (evaluators)/*ethical issues: Ethics committee's approval and informed consent*	Technical action checklist	CRNA group achieved maximum scores on bronchospasm and loss of pipeline oxygen, whereas they had difficulty in MH (malignant hyperthermia) and hyperkalemia
Meretoja et al/2004/Finland[26]	To examine nurses' perception of competence in different university hospital work environments	Cross-sectional survey/N = 498 (perioperative nurses) *ethical issues: Informed consent, voluntary nature, anonymity, confidentiality, and ethics committee's approval*	NCS	Operation room unit nurses showed high competence level in managing situations, whereas diagnostic and teaching-coaching was lower than the ward nurses

(Continued)

Table 2. Continued

Authors/Year/Country	Purpose	Design/Sample (Participant) Ethics	Instrument	Key Findings
Meretoja and Koponen/2012/Finland[27]	To develop a model to compare nurses' optimal and actual competencies in the clinical setting	Qualitative and quantitative/N = 24 (experts), N = 87 (perioperative nurses), and N = 88 (nurse managers)/*ethical issues: Informed consent, voluntary nature, and hospital approval*	NCS	Optimal competence was higher than the nurses' self-reported actual competence and nurse manager's assessed level of actual competence
Murray et al/2005/United States[32]	To evaluate scenario content, to provide further validation of a simulation based acute care assessment, and to compare the acute care skills of anesthesia trainees	Validation test of a simulation based acute care assessment/N = 58 (nurse anesthetist students and residents) and N = 6 (evaluators)/*ethical issues: Ethics approval for the protocol*	Technical action checklist	Most educated and experienced received high scores, providing to support the validity of simulation
Robertson et al/2014/UK[34]	To describes and evaluate the new scale of nontechnical skill (NOTECHS II) of an entire operating theater team	Observation study in real setting/N = 297 (OR cases) and N = 2 (evaluators)/*ethical issues: Ethics committee's approval and informed consent*	Oxford NOTECHS II	Most operations were performed by well-coordinated and functioning teams

the scale/scoring system, validity (content, criterion, and construct), and reliability (internal consistency, inter-rater, and intra-rater/test-retest) (Table 3).

Three types of data collection methods were identified: Self-reporting, observation (direct or reflect), and written examinations. Four assessment instruments used a self-report method, which was the most frequently conducted data collection method in this review.[7,23-29] In addition to self-reporting, two of the four instruments used preceptors or managers' assessment by reflective observation.[27,29] One instrument used a reflective observation method alone assessed by faculty members.[30] Two assessment instruments used a direct observation method in simulated situations,[7,31-33] and one instrument in a real clinical setting.[34] One instrument was designed as a written examination to test the knowledge of nurse anesthetists[7] (Table 3).

Most of the instruments were composed of several competence areas called domains, categories, dimensions, or competencies. As the result of charting the domains of competence from nine instruments, frequently measured domains were "managing situation," "collaboration/team work," "knowledge," "practice skills," and "assessing/judgment." The range of the number of items was between 3 and 73. The types of scales used were the Likert scale and ordinary scale (n = 6), visual analog scale (n = 1), a binary scale (n = 1), and multiple choice (n = 1).

In the process of using competence assessment instruments, many studies took into account issues related to validity and reliability (Table 3). In this review, validity was described from the perspective of content, criterion, and construct validity. The most frequently reported *content validity* method was the Delphi technique (n = 4).[7,23-28,34] Two types of *criterion validity* were predictive validity (n = 1)[30] and concurrent validity (n = 1).[34] *Construct validity* was tested by several techniques such as exploratory factor analysis (n = 1),[23-25] confirmatory factor analysis (n = 2),[23-25,30] and principal component analysis (n = 1).[23-25]

For the reliability test, this review focused on internal consistency, inter-rater, and intrarater/test-retest technique. *Internal consistency* and *inter-rater consistency* were commonly reported for reliability tests. Four instruments reported Cronbach's coefficient as the internal consistency[7,23-27] and the direct observation instrument stressed inter-rater reliability among evaluators.[7,31-34] Not all instruments documented validity and reliability. Two instruments used in simulated settings paid attention to reliability rather than validity. One instrument reported neither validity nor reliability tests.[29]

Discussion

A scoping review was undertaken to describe what competence assessment instruments exist in perianesthesia nursing care, and how valid and reliable they are. In the review, three assessment instruments, nurse competence scale (NCS) and perceived perioperative competence scale - Revised (PPCS-R), and nontechnical skills (NOTECHS II) were considered as psychometrically sound as they clarified the issues of validity and reliability sufficiently (Table 3). Because these assessment instruments vary in content, purpose, and data measurement method, the results of the narrative synthesis showed that perianesthesia nursing care still requires sound competence assessment instruments from the perspective of validity and reliability.

Competence Assessment Instruments in Perianesthesia Nursing

The NCS measured the competence of operating room nurses.[26] Because NCS was originally developed to measure the generic competence of practicing nurses in different phases of their career and in a variety of clinical settings, it might be an appropriate instrument to compare competence of perianesthesia nursing with those of other fields of nursing. Gillespie et al[23-25] benchmarked the minimum standards of clinical performance from generic competence assessments and developed a self-assessment tool, the PPCS-R, which enables the special contexts of perioperative care to be depicted. Perioperative nursing is a complex field where perianesthesia nurses strive to cover surgical intervention, anesthesiology, and post anesthetic care. In addition, perianesthesia nurses practice in collaboration with other health professionals such as other operating room nurses, surgeons, and anesthesiologists. Therefore, the PPCS-R is a likely instrument to assess competence

Table 3. Psychometric Properties of the Competence Assessment Instruments

| Instrument (Data Collection Method) | Domain/ Category (Item) | Scale/Scoring | Validity | | | Reliability | | | Articles |
			Content	Criterion	Construct	Internal Consistency	Inter-rater	Intrarater Test-retest	
Mini-clinical exercise (S)	Seven domains (7): Medical interviewing skills, physical examination skills, humanistic qualities/ professionalism, clinical judgment, counseling skills, organization/ efficiency, overall clinical competences	9-Point scale: 1-3 Unsatisfactory, 4-5 satisfactory, 7-9 superior	—	—	—	0.95	—	—	Gabriel 2013[7]
PPCS-R (perceived perioperative competence scale-revised) (S)	Six domains (40): Foundational skills and knowledge (9), leadership (8), collaboration (6), empathy (5), proficiency (6), professional development (6)	5 Likert: 1 = Never, to 5 = always	Delphi, CVI 0.97	—	PCA, EFA, CFA	0.95-0.98	—	—	Gillespie et al 2011[23], Gillespie et al 2012[24], Gillespie and Pearson 2013[25]
NCS (nurse competence scale) (S + RO by managers)	Seven competence categories (73): Helping role (7), teaching-coaching (16), diagnostic function (7), managing situations (8), therapeutic interventions (10), ensuring quality (6), and work role (19)	Visual Analog Scale (0-100): 0 = A very low level, 100 = very high level. Frequency of use 0 = not applicable. 1 = very seldom to 3 = very often in my work	Content analysis, Delphi	Refer to previous studies	Refer to previous studies	Good	—	—	Meretoja et al 2004[26], Meretoja and Koponen 2012[27], Greenfield et al 2014[28]

(Continued)

Table 3. Continued

Instrument (Data Collection Method)	Domain/ Category (Item)	Scale/Scoring	Validity			Reliability			Articles
			Content	Criterion	Construct	Internal Consistency	Inter-rater	Intrarater Test-retest	
Professional competence (S + RO by employers)	Clinical practice, independence, knowledge, teamwork, judgment/critical thinking (17)	Five Likert scale	—	—	—	—	—	—	Cook et al 2013[29]
Clinical Evaluation Instrument (RO by faculty members)	Not clearly explained. Patient assessment and anesthetic plan, didactic transfer of knowledge, perianesthetic management, communication skills/professional role, and care and equipment (17)	Four Likert scale: 1 = Failure, 2 = below expectations, 3 = meets expectations 4 = above expectations	—	PRE, with National Certification Examination	CFA	—	—	—	Collins and Callahan 2014[30]
Crisis management behaviors tool (DO in simulation)	10 Domains (12): Orientation to case, inquiry/ assertion, communication, feedback, leadership, group climate, anticipation/ planning, work load distribution, vigilance, and re-evaluation	Five-point ordinary scale: 1 = Poor, 2 = minimally acceptable, 3 = standard, 4 = good, and 5 = outstanding	—	—	—	—	Satisfactory	—	Gaba et al 1998[31]

(Continued)

Table 3. Continued

Instrument (Data Collection Method)	Domain/ Category (Item)	Scale/Scoring	Validity			Reliability			Articles
			Content	Criterion	Construct	Internal Consistency	Inter-rater	Intrarater Test-retest	
NOTECHS II (Nontechnical Skills) (DO)	Four domains (16): Leadership and management, teamwork and cooperation, problem solving and decision-making, situation awareness	Eight-point scale	Delphi	CON	Tested	—	Good	—	Robertson et al 2014[33]
Technical action checklist (DO in simulation)	Items depend on the scenarios (3-7): eg, bronchospasm (5)	Binary scale: 0 = Absence, 1 = present	—	—	—	—	Good, 0.80	—	Gaba et al 1998[31], Henrichs et al 2009[33]
	Acute Hemorrhage (6)						0.85		Gabriel 2013[7]
	Hyperkalemia (6)						—	Moderately reliable	Murray et al 2005[32]
Knowledge examination (W)	Airway management, clinical pharmacology, physiology, and anesthesia technology (30)	Multiple choice	Delphi	—	—	0.60	—	Tested	Gabriel 2013[7]

CFA, confirmatory factor analysis; CON, concurrent validity; CVI, content validity index; EFA, exploratory factor analysis; PCA, principal component analysis; PRE, predictive validity.

Data collection method: (S) = self-report, (RO) = reflective observation, (DO) = direct observation, (W) = written examination.

in the nature of perioperative care consisting of not only foundational knowledge and skills but also collaboration, empathy, and leadership. However, further validation tests are needed to increase the accuracy of the instruments to measure core competence in perianesthesia nursing.

Self-directed assessment has a weakness because of the fact that there is little public accountability.[35] In response to this weakness, and as an alternative to self-reporting, NOTECHS II used direct observation to evaluate nontechnical skills such as teamwork and cooperation, leadership and management, problem solving, decision-making, and situation awareness in the real clinical setting.[34] Critical incidents caused by insufficient competence in nontechnical skills have been paid increasing attention. NOTECHS II reported validity and reliability appropriately, and it can be used as an important instrument to measure nontechnical skills in perianesthesia nursing.

In addition to the real clinical setting, there are two instruments (crisis management behaviors tool and technical action checklist) used for direct observation to assess nurses' performance with regard to their technical skills and behavior in a simulated environment.[7,31-33] In a simulated setting, observers or examiners evaluate nurse's performance as an outcome of nurse's competence in simulated conditions.[36] One of the advantages of a simulated environment is that it enables assessment of a nurse's skills and behavior in recognizing and responding to crucial changes such as patients in critical conditions, problem solving, and communication management.[7] However, the simulated setting is not natural and a nurse may not perform in the same way as they would in real situation.[37] Furthermore, perianesthesia professionals have an integrated ability as regards knowledge, skills, and roles that encompasses the preoperative phases to the postoperative phases, where they work together as a team with other health professionals. When considering competence assessment in a simulated environment, examiners need to plan carefully how well the use of simulation can be controlled and how well the assessment outcome matches real perianesthesia nursing practice. Because the subject of a competence assessment study using a direct observation method is human, it is important to conduct studies with ethically accepted methods

and to clarify the ethical issues such as recruiting participants, consent, approval process, recoding, and storing data. All the studies considered that used the direct observation method did take into account such ethical issues and described them in detail.[7,31-34]

In the nursing context, there is a tendency to consider that knowledge is equal to competence; nurses who have a high score in written tests were treated as being competent and having met the approved standards despite no measurement being made of their actual performance. Researches pointed out that the correlation between written examinations and performance scores is low.[38,39] Gabriel[7] supported this finding by showing a low to moderate correlation between written examination scores and performance scores in competence measurement. This is evidence that competence assessment requires multiple assessment methods to reduce the possibility of misinterpreting the result and to increase the validity of the measurement tool. However, combined approaches need more time and resources, and compound-errors might occur when analyzing the results.[36]

Validity and Reliability of Competence Assessment Instruments

One of the essential issues in evaluating the quality of an assessment instrument is validity; the ability to which an instrument measures what it is intended to measure.[22] In this review, content, criterion, and construct-related validity were considered to describe the validity of the instruments. Content validity involves the processes of pooling instrument items through searching the literature, seeking expert opinions (Delphi method), pilot testing, or qualitative research.[22] The most commonly reported content validity was seeking expert opinion (Delphi method). However, it was noted that the Delphi method used in this study was not explained clearly in terms of the process of reduction of items and the agreement among expert panel's opinion. Clarifying the Delphi method with objective measures such as content validity ratio or content validity index is recommended in reporting content validity (eg, content validity index = 0.97).[24]

The criterion validity is divided into two types of validity: Concurrent validity and predictive

validity. Concurrent validity indicates a measure of how one test correlates with another test that measures the same variable.[40] Predictive validity indicates a measure of how one test predicts an outcome based on information from other test.[40] For instance, Collins and Callahan[30] tested whether student nurse anesthetist's clinical scores measured by the "clinical evaluation instrument" were predictive of National Certification Examination. It found that the instrument did not significantly correlate with the National Certification Examination scores, and a further test may be needed.

Construct validity is known as one of most difficult processes because it focuses on the theoretical meanings of measurements, the logical relationship between one concept and other concepts, and the link of theory with the empirical world.[41] Collin and Callahan[30] showed the importance of construct validity tests. They conducted factor analysis for a clinical evaluation instrument used to measure clinical performance of student nurse anesthetists in six competence areas and revealed that it actually measured only three competence areas. They suggested not only a redefinition of key concepts, but also a revision of the instrument through further validation tests. If a certain clinical evaluation tool is used as evidence to decide a student's success or failure, ensuring the instrument's validity is critical. The gap between scores obtained from an evaluation tool and the true values should be minimal.[30]

The second issue was reliability. Cronbach's alpha coefficient was the most frequently used reliability test in this review. A coefficient alpha of 0.70 is regarded as an acceptable level for new scales, and the number of items is recommended to be shortened if the alpha coefficient value is greater than 0.90.[42] For example, the PPCS-R Cronbach's alpha coefficient was 0.95 to 98. It seems that some redundancy remains and the reliability might be optimized (between 0.70 and 0.90), and the feasibility might be increased by reducing the quantity of items.

One important issue in the direct observation method is the reliability of evaluators. All observation studies having multievaluator demonstrated inter-rater reliability. Most researchers were well aware of the reliability of inter-raters (satisfactory to good).[7,31,33,34] However, the assessment results might fluctuate by the consistency within an evaluator (intra-raters' reliability). The consistencies of the intrarater reliability were tested by one study.[32]

It was noted that four instruments (four of nine) did not address either the validity or reliability or both. Other literature review studies concerning assessment had the same difficulty of a lack of information on validity and reliability.[40,42] The clarification as how to develop and test the instruments in terms of validity and reliability is essential information to determine the quality of the instruments. To minimize the probability of missing information and to clarify the instrument's validity and reliability systematically, the use of structured reporting framework such as Guidelines Reporting the Psychometric Soundness[22] or consensus-based standards for the selection of health measurement instruments (COSMIN)[43] is recommended.

In the review, some researchers treated an instrument as a valid and reliable tool when it had been tested in other studies, and used it without further psychometric tests. Because it is not possible to use the instrument in exactly the same setting as those for which it was developed, psychometric properties such as validity, reliability, cultural difference, language translation, and feasibility for the participants should be tested again.

Limitations

Regarding the selection process, the inclusion and exclusion criteria may have influenced the outcomes of this research. This is especially because of the fact that the search was limited to the English language. In perianesthesia nursing practice, most countries tend to develop instruments in their own languages. This can be one explanation why the quantity of studies conducted in the United States is high.

Nursing practices in perianesthesia care vary among countries. To increase the possibility of capturing perianesthesia nursing competence instruments, nurses caring patients undergoing or recovering from anesthesia such as perianesthesia nurses, PACU nurses, nurse anesthetist, anesthesia

nurses, and perioperative nurses were included as inclusion criteria. These various professional groups might cause issues with the validity in this search result.

This scoping review did not conduct a quality appraisal process of the studies included. This might cause a bias in the interpretation of the research results. However, the psychometric properties of instruments discussed by the recommendations of DeVon et al[22] can be partial evidence of a quality appraisal of this review. Some instrument psychometrics have been reported in previous studies but they have not been included in this review process.

Conclusions

This scoping review found that at least nine assessment instruments have been used to assess perianesthesia nurses' competence by means of self-report, observation, and written examination methods. This review concluded that perianesthesia nursing care is still lacking in sound assessment instruments. Integrating more than one data collection method is recommended to overcome the limitations such as the lack of objectivity and to provide a more comprehensive view of competence measurement.

This review provides valuable information for nurse educators who are developing evaluation methods for student nurses, nurse managers who are helping nurses to identify professional development and educational needs, and perianesthesia nursing organizations who are planning continuing education programs to improve nursing competence. In particular, nurses in perianesthesia care have a primary responsibility for providing safe care through continuous professional development. This review may be used to support nurses when reflecting on their practices to identify areas of strength and weakness.

Future research should focus on the development of more valid assessment instruments for perianesthesia nursing care. For perianesthesia nursing care, competence assessment studies need to be replicated to improve psychometric properties of the assessment tool; this can be done through re-exploring content validity, scoring methods, and reliability. Because perianesthesia nursing care is always evolving, there is a need for a study of future competence covering health information competence, ethical competence, and cultural competence in perianesthesia nursing.

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