

A systematic review of healthcare professionals' core competency instruments

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Abstract

While technical and profession-specific competencies are paramount in the delivery of healthcare services, the cross-cutting core competencies of healthcare professionals play an important role in healthcare transformation, innovation, and the integration of roles. This systematic review describes the characteristics and psychometric properties of existing instruments for assessing healthcare professionals' core competencies in clinical settings. It was guided by the JBI methodology and used the COSMIN checklist (Mokkink et al., User manual, 2018, 78, 1) to evaluate the methodological quality of the included studies. A database search (CINAHL, Scopus, and PubMed) and additional manual search were undertaken for peer-reviewed papers with abstracts, published in English between 2008 and 2019. The search identified nine studies that were included in the synthesis demonstrating core competencies in professionalism, ethical and legal issues, research and evidence-based practice, personal and professional development, teamwork and collaboration, leadership and management, and patient-centered care. Few instruments addressed competencies in quality improvement, safety, communication, or health information technology. The findings demonstrate the reviewed tools' validity and reliability and pave the way for a comprehensive evaluation and assessment of core competencies into clinical practice.

KEYWORDS

competence assessment, core competency, healthcare professionals, nurses and physicians, psychometrics testing, validity and reliability, systematic review

1 | INTRODUCTION

Quality of care and patient safety are arguably the dominant themes of the modern healthcare agenda and are increasingly important for defining the “true north” as the healthcare industry continues its transformation to offer greater added value to patients and stakeholders (Sfantou et al., 2017). Today's healthcare delivery system aims to provide patient-centered, efficient, effective, safe, timely, and easily

accessible care (Karami, Farokhzadian, & Foroughameri, 2017). This is due to a combination of increasing technological advancements, rising expectations and demand for sustainability, magnified by staff shortages, turnover, migration, and possible geopolitical instabilities (Muller, 2012; World Health Organization [WHO], 2013). This in turn has intensified international professional regulations. Many countries have initiated improved competency requirements with minimum standards of knowledge, skills, and attitudes for healthcare practice

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(Muller, 2012; Nursing Council of Hong Kong, 2012; Singapore Nursing Board, 2018; The European Parliament and Council of the European Union, 2005; WHO, 2015).

For example, the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) has begun implementing stringent accreditation policies requiring hospitals to implement processes to evaluate the standards of healthcare system, continuously assure quality of services, improve patient safety, and upgrade the competency level of healthcare workers (James, 2013). These policies and processes focus predominantly on the integration of competence standards of healthcare professionals.

The continuous evaluation of these competence standards has therefore risen to the top of the agenda for strategic healthcare planners (Wilkinson, 2013). This has created a set of nexus questions including (i) what instruments exist for measuring these competence standards, (ii) do these instruments measure all core competence themes to the required depth and width, and (iii) is there a single tool that comprehensively measures the core competence of healthcare professionals as they work toward shared visions and delivery expectations?

This paper addresses these questions with a focus on core competencies of healthcare professionals (nurses and physicians), as they collectively constitute over 85% of the total healthcare system workforce (American Association of College of Nursing [AACN], 2008; WHO, 2015). Moreover, the interplay of nurses and physicians in particular plays a pivotal role in the integrated healthcare mission (Lombarts, Plochg, Thompson, & Arah, 2014).

1.1 | Background

Modern healthcare delivery systems accentuate patient-centered care, safe practice, and improved delivery efficiency and effectiveness (Karami et al., 2017). This requires healthcare leadership to explore ways to mutually improve core and other competences at the same time (Institute of Medicine [IOM], 2011). To achieve these aspirations, healthcare leaders should recognize the need for competency assessment frameworks, understand their capabilities and limitations, and apply them appropriately to ensure that healthcare professionals are suitably prepared and qualified (Muller, 2012; WHO, 2013).

The WHO (2013) defines competence as a vital characteristic of quality service delivery and safe clinical practice. Professional competence is the ability of healthcare professional to serve effectively both the individual and the wider community according to the rules of clinical performance (Mulder, 2014). Competence frameworks usually specify a set of (i) core competencies, (ii) technical/functional competencies, (iii) behavioral competencies, and (iv) leadership competencies. Core competencies are defined as the values, attitudes, and beliefs that the organization stands for and that all healthcare providers must uphold and demonstrate every day (Albarqouni et al., 2018). These core competencies define a cluster of attributes of knowledge, skills, and attitudes that allow the healthcare professional to perform tasks following acceptable delivery standards (Albarqouni

et al., 2018). The concept of core competence was first developed by enterprizes during the late 1970s to safeguard and sustain their businesses and to increase competitiveness (Sisman, Gemlik, & Yozgat, 2012).

Technical competencies are the skills and capabilities of healthcare workers to practice and perform effectively and safely without leader supervision while applying appropriate knowledge, skill, and judgment (International Council of Nurses [ICN], 2009). That is to say, they include the specific knowledge and skills required for successful job performance in specialty field such as intensive care unit. Behavioral competencies are the capacity to interact and integrate with other people in specific contextual situations of practice (Bahreini, Shahamat, Hayatdavoudi, & Mirzaei, 2011). Leadership competencies include skills and behaviors that contribute to superior organizational performance. Organizations are better placed in the marketplace if they focus on developing their next generation of leaders (Herd, Adams-Pope, Bowers, & Sims, 2016).

This review focused on evaluating the existing core competency instruments. Various instruments have been designed to measure registered nurses' competencies (Cowan, Wilson-Barnett, Norma, & Murrells, 2008; Liu, Kunaiktikul, Senaratana, Tonmukayakul, & Eriksen, 2007; Meretoja, Isoaho, & Leino-Kilpi, 2004; Muller, 2012). Furthermore, some tools have been developed for advanced practice nurses (Sastre-Fullana et al., 2017), nurse managers (Shuman, Ploutz-Snyder, & Titler, 2017), and physicians (Tromp, Vernooij-Dassen, Grol, Kramer, & Bottema, 2012). Lombarts et al. (2014) developed a specific tool to measure the professional attitudes and behavior of nurses and physicians. There is some overlap between these instruments because most of the core competencies they target were defined on the basis of *Health Professions Education: A Bridge to Quality*, the *Oregon Consortium for Nursing Education in A response to the Nursing Shortage*, and AACN, published by the IOM (2003), Tanner, Gubrud-Howe, and Shores (2008), and AACN (2008), respectively. These reports and some recent fundamental work suggest that healthcare professionals' core competence must be demonstrated in quality improvement, patient safety, professionalism, patient-centered care, evidence-based practice, ethical and legal responsibility, personal and professional development, research, health information technology, communication, collaboration and team-work, and leadership (AACN, 2008; IOM, 2003, 2011; Lazarte, 2016; Sayed & Sleem, 2011; Tanner et al., 2008). Clearly defining the core competencies of healthcare professionals can facilitate and improve communication and coordination among disciplines (IOM, 2011).

These core competences collectively constitute the foundation of a healthcare organization's competitiveness (Flinkman et al., 2017). The level to which staff display these competencies profoundly affects the healthcare system's ability to achieve its key goals, that is, to provide high-quality care while ensuring patient safety (Senarath & Gunawardena, 2011; Smith, 2012). This research paper presents a methodological analysis of instruments for assessing core competencies based on current and emerging developments in the healthcare system.

1.2 | Aims and objectives

The purpose of this systematic review was to describe the character and psychometric properties of instruments for assessing the core competence of healthcare professionals in clinical settings. The review questions were as follows:

1. What are the core competencies of healthcare professionals addressed by existing competence instruments?
2. What are the psychometric properties of these competency instruments?

2 | INCLUSION CRITERIA

2.1 | Population

This systematic review considered studies focusing on healthcare professionals (physicians and nurses) working in hospitals and primary healthcare settings. Studies focusing on nursing or medical students, other classes of healthcare professionals (such as pharmacy, laboratory or radiology), or other healthcare settings (such as community healthcare or home-based care) were excluded.

2.2 | Instrument and construct

This systematic review included studies focusing on (i) validating and testing tools and (ii) core competencies. The following instruments were included the European Healthcare Training and Accreditation Network (EHTAN) Questionnaire Tool (EQT), Competency Inventory for Registered Nurse (CIRN), Professionalism Instrument, Nurse Competence Scale (NCS), German Version of NCS, Advanced Practice Nursing Competency Assessment Instrument (APNCAI), Nurse Manager EBP Competency Scale, Competency Assessment List (Compass), and Norwegian Nurse Competence Scale (NNCS). Excluded studies focused on technical competency, behavioural competency, or leadership competency.

2.3 | Outcomes

This systematic review assessed the methodological quality of psychometric properties using the COnsensus-based Standards for the Selection of Health Measurement INstruments (COSMIN) checklist (Mokkink et al., 2018).

2.4 | Study types

Quantitative studies that measured psychometric properties, and only studies published in English were considered in this systematic review.

It excluded all qualitative studies and all studies published over 10 years ago.

3 | METHODS

A systematic review was conducted and framed according to the Joanna Briggs Institute (JBI) manual (Stephenson et al., 2020).

In addition, the researchers used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist to structure the reporting of study selection in this systematic review (see Supplementary File 1).

3.1 | Search strategy

The researchers developed a literature search strategy in collaboration with information specialist to ensure specificity, sensibility, and replicability. It included the databases Cumulative Index of Nursing and Allied Health Literature (CINAHL) via EBSCOhost, Scopus (via Elsevier), and PubMed (including MEDLINE, via NCBI), considering works published between the years 2008 and 2019 (Meline, 2006). The following search terms were used in different combinations: competence, competency, core competency, core competence, nurses, physicians, assessment tool, instruments, clinical settings, and hospitals. These search terms covered three domains: (i) *construct of interest* – competence, competency, core competence, and core competency, (ii) *target population* – nurses and physicians, and (iii) *type of instrument* – assessment tool, instruments. We used Boolean operators in all databases, MeSH search terms for PubMed, and subject headings for CINAHL. The exact search strategies for all databases are presented in Supplementary File 2. The researchers used combined nurses AND physicians to address the first review question, that is to explore existing studies whose authors have made references to the combined application to both professions. In addition, the researchers conducted manual search from the reference lists of the identified studies.

3.2 | Study selection

Overall, 227 publications were retrieved from the electronic databases after duplicates had been removed. Initially, the titles and abstracts of all studies were screened and assessed against the inclusion and exclusion criteria to select which were relevant to the review. If titles and abstracts had insufficient information to make a decision, the studies were included and screened in the following step. Full-text studies were reviewed and irrelevant studies excluded. A total of nine studies, seven from the electronic databases and another two from manual search of references lists, were included in the methodological quality assessment and all were eligible for data extraction and synthesis. The selection process was illustrated by the PRISMA flow chart presented in Figure 1.

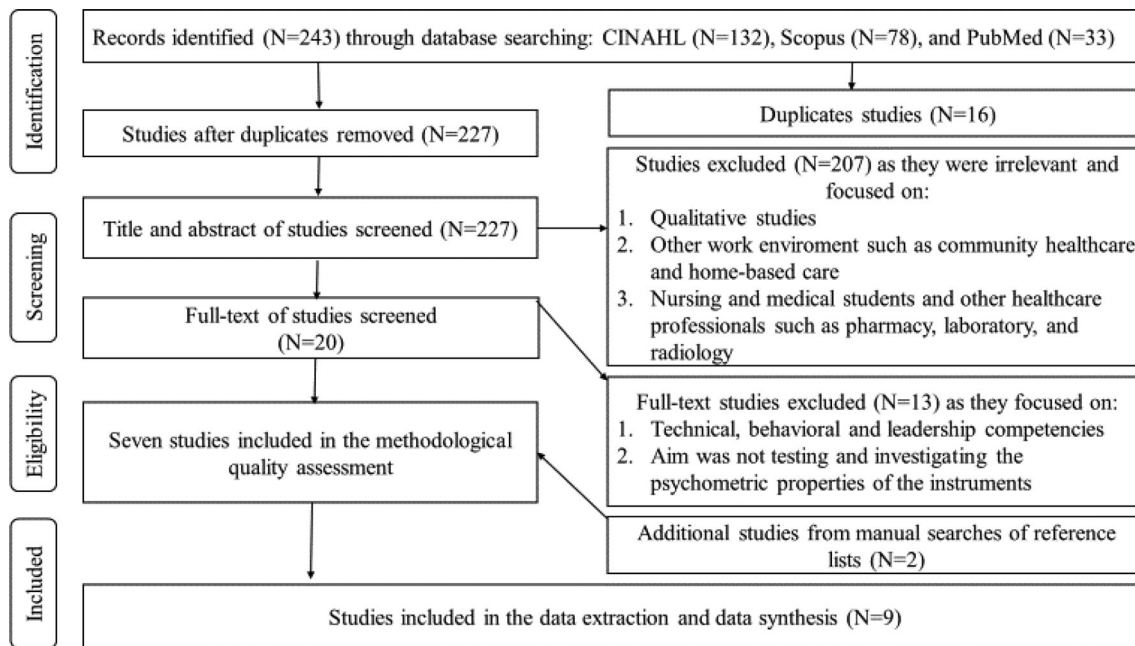


FIGURE 1 PRISMA flowchart of selection process

3.3 | Methodological quality of included studies

Two independent reviewers (F.A and M.A) assessed the methodological quality of all included studies based on the COSMIN Risk of Bias checklist and updated criteria for measurement properties (Mokkink et al., 2018). The checklist has 10 boxes: (i) instrument development, (ii) content validity, (iii) structural validity, (iv) internal consistency, (v) cross-cultural validity / measurement invariance, (vi) reliability, (vii) measurement error, (viii) criterion validity, (ix) hypothesis testing for construct validity, and (x) responsiveness. The checklist used a 4-point rating scale (very good, adequate, doubtful, inadequate). Both reviewers agreed on the rating method of the measurement properties and methodological quality scores of each study.

The quality of measurement properties of each study was then rated against the criteria for good measurement properties of sufficient (+), insufficient (-), or indeterminate (?) (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). Last, the quality of summarized results was graded using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

3.4 | Data extraction and synthesis

The data extraction was carried out by the principal researcher and subsequently reviewed by the other researchers using the standardized data extraction format (Mokkink et al., 2018). All included studies were summarized in Table 1, which includes information on study characteristics (author, instruments, study design, sample size, target population, settings, and measurement properties), and Table 2, which covers instruments characteristics (author, instruments, mode of

administration, recall period, sub-scales and number of items, response options, range of scores, original language and translation available, and theoretical framework). The data were presented through a narrative synthesis (Tables 1 and 2).

4 | RESULTS

COSMIN risk of bias checklist was used to evaluate the methodological quality of nine instruments in included studies (Mokkink et al., 2018). The scoring of the two independent reviewers was compiled and compared using the Cohen κ statistic, where the agreement coefficient was found to $\kappa = 0.654$, indicating substantial agreement (Warrens, 2015).

4.1 | Characteristics of included studies and instruments

The nine included studies (summarized in Table 1) targeted newly graduated nurses, registered nurses, advanced practice nurses, nurse managers, and physicians. One of them – the NCS – is widely used in a variety of contexts (Meretoja et al., 2004). Eight of the included studies had large sample sizes; the size of the remaining one was adequate (Tromp et al., 2012). All the studies were cross-sectional other than those of Liu et al., 2007 and Tromp et al. (2012). All reviewed studies were conducted at hospital settings in Europe except two: one was conducted in China (Liu et al., 2007) and the other in the United States (US) (Shuman et al., 2017).

The instruments of the included studies (summarized in Table 2) present self-reported tools, – which included sub-scales of core

TABLE 1 Characteristics of the included studies

References	Instrument	Study Design	Sample size	Target population	Setting	Measurement properties
Cowan et al. (2008)	EHTAN Questionnaire Tool (EQT)	A cross-sectional study design	588	Registered nurses	Acute care hospitals in five Europe countries (UK, Belgium, Germany, Greece, and Spain)	Content validity, structural validity, internal consistency, cross-cultural validity
Liu et al. (2007)	Competency Inventory for Registered Nurse (CIRN)	Repeated measurement	815	Registered nurses	4 hospitals in China: metropolitan central hospital, provincial tertiary hospital, and 2 university hospitals	Content validity, structural validity, internal consistency, reliability, criterion validity, construct validity
Lombarts et al. (2014)	The Professionalism Instrument	Cross-sectional multilevel studies	5,920	Physicians and registered nurses	74 European hospitals in (Czech Republic, France, Germany, Poland, Portugal, Spain and Turkey)	Content validity, structural validity, internal consistency, cross-cultural validity, construct validity
Meretoja et al. (2004)	Nurse Competence Scale (NCS)	A cross-sectional study design	593	Registered nurses	Finnish university hospital in Finland	Content validity, structural validity, internal consistency, criterion validity, construct validity
Muller (2012)	German version of NCS	A cross-sectional study design	679	Registered nurses	University hospital in Switzerland	Content validity, structural validity, internal consistency, cross-cultural validity, construct validity
Sastre-Fullana et al. (2017)	Advanced Practice Nursing Competency Assessment Instrument (APNCAI)	A cross-sectional study design	600	Registered nurses	Public healthcare in Balearic Islands	Content validity, structural validity, internal consistency
Shuman et al. (2017)	The Nurse Manager EBP Competency Scale	A cross-sectional study design	130	Nurse managers	Three hospitals in Midwest United States including large academic medical center, two large community hospitals	Content validity, structural validity, internal consistency
Tromp et al. (2012)	Competency Assessment List (Compass)	Repeated measurement	76	General Physicians	Hospitals in Netherlands	Content validity, internal consistency, reliability, responsiveness
Wangenstein, Johansson, and Nordstrom (2015)	A Norwegian Nurse Competence Scale (NNCS)	A cross-sectional study design	593	Registered nurses	Hospitals in Norway	Content validity, structural validity, internal consistency, cross-cultural validity

TABLE 2 Characteristics of the included instrument

Author	Instrument	Mode of administration	Recall period	Sub-scale (number of items)	Response options	Range of Scores	Original language and translation available	Theoretical framework
Cowan et al. (2008)	EHTAN Questionnaire Tool (EQT)	Self-reported tool	NA	8 sub-scales with 108 items: assessment, care delivery, communication, health promotion, personal and professional development, professional and ethical practice, research and development, and teamwork.	4- point Likert scale	1-4	English (translated into English, Flemish, German, Greek, Spanish)	European Healthcare Training and Accreditation Network (EHTAN) project
Liu et al. (2007)	Competency Inventory for Registered Nurse (CIRN)	Self-reported tool	10 days	7 sub-scales with 58 items: critical thinking and research aptitude, clinical care, leadership, interpersonal relationships, legal/ethical practice, professional development, and teaching/coaching.	5-point Likert scale	1-5	English (translated to Chinese)	ICN's framework of competencies
Lombarts et al. (2014)	The Professionalism Instrument	Self-reported tool	NA	Encompass of both professional attitude and behaviors. The attitude scale includes four subscales with 18 items: (improving quality of care, maintaining professional competence, fulfilling professional responsibilities, interprofessional collaboration). Professional behaviors include 6 primary questions and 2 feeder questions.	Attitude questions answered by 5-point Likert scale. The professional behaviors items required yes or no.	1-5	English (translated to Czech, French, German, Polish, Portuguese, Spanish and Turkish).	Literature review

TABLE 2 (Continued)

Author	Instrument	Mode of administration	Recall period	Sub-scale (number of items)	Response options	Range of Scores	Original language and translation available	Theoretical framework
Meretoja et al. (2004)	Nurse Competence Scale (NCS)	Self-reported tool	NA	7 sub-scales with 73 items: helping role, teaching-coaching, diagnostic functions, managing situations, therapeutic interventions, ensuring quality, and work role.	4- point scale	0-3	Finnish	Literature review and Benner's competency framework
Muller (2012)	German version of NCS	Self-reported tool	NA	6 sub-scales with 54 items: managing situation, organization and coordination, research and development, patient education, team training, quality.	4- point scale	0-3	Finnish (translated to German)	Literature review and Benner's competency framework
Sastre-Fullana et al. (2017)	Advanced Practice Nursing Competency Assessment Instrument (APNCAI)	Self-reported tool	NA	8 sub-scales with 44 items: research and evidence-based practice, clinical and professional leadership, interprofessional relationship and mentoring, professional autonomy, quality management, care management, professional teaching and education, health promotion.	5-point Likert scale	0-4	Spanish	Literature review
Shuman et al. (2017)	The Nurse Manager EBP Competency Scale	Self-reported tool	NA	2 sub-scales with 16 items: EBP knowledge and EBP activity.	4-point Likert scale	0-3	English	Promoting Action on Research Implementation in Health Services' (PARIHS) framework
Tromp et al. (2012)	Competency Assessment List (Compass)	Self-reported tool	3-months	7 sub-scales with 40 items: medical expertise, communication, management, collaboration, social	10-point scale	1-9	Dutch	Accreditation Council for Graduate Medical Education and the American Board of Medical Specialties (ACGME/ABMS)

(Continues)

TABLE 2 (Continued)

Author	Instrument	Mode of administration	Recall period	Sub-scale (number of items)	Response options	Range of Scores	Original language and translation available	Theoretical framework
Wangensteen et al. (2015)	A Norwegian Nurse Competence Scale (NNCS)	Self-reported tool	NA	5 sub-scales with 46 items: planning and delivery of care, teaching functions, professional leadership, research utilization and nursing values, and professional awareness.	4- point scale	0–3	Finnish (translated to Norwegian)	competencies and the Canadian Medical Education Directives of Specialists (CanMEDS) Literature review

competencies. Among nine instruments, EQT is lengthy, with 108 items, and its use may not be feasible in clinical settings. All instruments had structured response options, and the majority used 4- to 5-point Likert scales, while only two studies had recall period (Liu et al., 2007; Tromp et al., 2012).

4.2 | Core competencies assessed by existing competency instruments

Common competencies targeted by the nine instruments include professionalism, ethical and legal issues, research and evidence-based practice, personal and professional development, teamwork and collaboration, leadership and management, and patient-centered care. However, some core competencies were mentioned only by a few instruments; examples include quality improvement, safety, communication, and health information technology. Table 3 lists the core competencies targeted by each instrument.

Professionalism is the ability of a healthcare professional to deliver care in accordance with the best humanistic, moral, ethical, regulatory, and legal practices (Lombarts et al., 2014). This competence was referred to (using a variety of synonyms) by all instruments other than the Nurse Manager EBP Competency Scale developed by Shuman et al. (2017).

Ethical and legal issues refer to healthcare professional compliance with laws relating to healthcare providers and regulations including national organizational policies and procedures (Pozgar, 2016). Six competency instruments (EQT, CIRN Instrument, NCS, NCS [German Version], APNCAI, NNCS) addressed legal and ethical issues.

Research and evidence-based practice are fundamental drivers of quality and safe practice in healthcare delivery systems. A specific instrument was designed to assess evidence-based practice among nurse managers (Shuman et al., 2017). However, all of the competency instruments other than the Professionalism Instrument address this competence domain in some capacity.

Personal and professional development relates to the healthcare professional's ability to identify his/her own learning needs, pursue continuing education, hold a positive attitude towards change and criticism, and perform according to professional standards (Khan, 2010). All of the reviewed instruments other than the Nurse Manager EBP Competency Scale addressed the personal and professional development theme.

Teamwork and collaboration indicates to the healthcare professional's capacity to collaborate effectively with colleagues and other healthcare team members by stimulating mutual understanding, a shared vision, team bonding, and delivery (Morley & Cashell, 2017). Seven of the instruments address teamwork and collaboration; the exceptions are the German version of the NCS and NNCS.

Leadership and management refer to the healthcare professional's ability to ensure performance and drive organizational change by establishing common ground, setting clear targets, and displaying positive behaviors (Sfantou et al., 2017). This theme was addressed in seven of the instruments but was absent from the EQT and the Professionalism Instrument.

TABLE 3 Core competency themes addressed by the included instruments

Author, Year, Instrument	Quality Improvement	Safety	Professionalism	Communication	Ethical and Legal Issue	Research and Evidence Based Practice	Personal and Professional Development	Teamwork and Collaboration	Leadership and Management	Patient-Centered Care	Health Information Technology
(1). Cowan et al. (2008), EQT	-	-	X	X	X	X	X	X	-	X	-
(2). Liu et al. (2007), CIRN Instrument	-	-	X	X	X	X	X	X	X	X	X
(3). Lombarts et al. (2014), The Professional Instrument	X	X	X	-	-	-	X	X	-	-	-
(4). Meretoja et al. (2004), NCS	X	-	X	-	X	X	X	X	X	X	X
(5). Muller (2012), NCS (German Version)	X	-	X	-	X	X	X	-	X	-	-
(6). Sastre-Fullana et al. (2017), APNCAI	X	-	X	-	X	X	X	X	X	X	-
(7). Shuman et al. (2017), The Nurse Manager EBP	-	-	-	-	-	X	-	X	X	X	-
(8). Tromp et al. (2012), Compass Tool	-	-	X	X	-	X	X	X	X	X	-
(9). Wangensteen et al. (2015), NNCS	-	-	X	-	X	X	X	-	X	X	-

Note: X = addressed; - = not addressed.

Patient-centered care relates to the healthcare professional's ability to realize patients' expectations, preferences, and values and to work together with patients to deliver compassionate, safe, and effective care (Delaney, 2018). Seven instruments address the theme of patient-centered care (using various synonyms) other than those two: the Professionalism Instrument and the NCS (German Version).

Quality improvement indicates to the healthcare provider's ability to use specific measures that reflect performance and delivery processes and to use continuous improvement procedures to evaluate and implement changes that leverage the healthcare delivery system (The Health Foundation, 2013). Four of the reviewed instruments (The Professional Instrument, the original and German versions of the NCS, and APNCAI) address this theme, using the following synonyms: Improving Quality of care, Ensuring Quality, Quality, and Quality Management, respectively.

Safety implies to the ability of healthcare professionals to prevent risks and adverse effects to patients through delivery competence and system effectiveness (Kalra & Adams, 2016). One instrument (The Professional Instrument) addresses safety items under the theme of Fulfilling Professional Responsibilities.

Communication pertains to the ability of healthcare professionals to interact effectively with patients, families, and colleagues to ensure delivery performance, satisfaction, and optimal healthcare outcomes (Sheldon & Hilaire, 2015). The only tools with items addressing the communication domain are EQT and the Compass Tool. However, a statement relating to communication is addressed in the CIRN Instrument.

Health information technology implies to the ability of healthcare professional to use information technology in the way that is most appropriate for improving healthcare quality and effectiveness (Lavin, Harper & Barr, 2015). Health information technology is addressed by items from the CIRN Instrument and by a statement in the NCS.

4.3 | Psychometric properties of instruments

Measurement properties of these instruments were summarized and assessed based on criteria for good measurement properties, and the quality of evidence was graded using a modified GRADE approach. The methodological quality of psychometric properties and level of evidence results from all included studies is presented in Table 4.

The content validity and internal consistency was assessed by all instrument developers ($n = 9$), structural validity ($n = 8$), cross-cultural validity ($n = 4$), reliability ($n = 2$), criterion validity ($n = 2$), hypothesis testing for construct validity ($n = 4$), and responsiveness ($n = 1$), whereas the measurement error was not evaluated by any tool developer (Supplementary File 3).

4.3.1 | Instrument development

The instrument development box assesses (i) the quality of instrument design to ensure relevance and (ii) the quality of a cognitive interview

study or pilot test performance to evaluate the comprehensibility and comprehensiveness of an instrument (Mokkink et al., 2018). All nine included studies presented information on instrument development. A pilot study was conducted in four studies in a sample representing the target population, and therefore the process was rated "very good" (Liu et al., 2007; Meretoja et al., 2004; Sastre-Fullana et al., 2017; Shuman et al., 2017). While the other five studies were given a score of "inadequate" due to that a cognitive interview or other pilot test was lacking (Cowan et al., 2008; Lombarts et al., 2014; Muller, 2012; Tromp et al., 2012; Wangensteen et al., 2015); and these studies were consequently not further considered in the assessment of remaining items of this psychometric property box.

4.3.2 | Content validity

Content validity is defined as the degree to which the content of an instrument is an adequate reflection of the construct to be measured (Mokkink et al., 2018). The content validity of all included instruments was rated separately for relevance, comprehensiveness, and comprehensibility. Overall, in terms of methodological quality, all of the studies were rated as having "sufficient" content validity and were given "high" scores in terms of quality of evidence, as all were evaluated on the basis of literature reviews and the judgements of expert groups.

4.3.3 | Structural validity

Structural validity is defined as the degree to which the scores of an instrument are an adequate reflection of the dimensionality of the construct to be measured (Mokkink et al., 2018). Structural validity was tested in eight studies. Three studies used both confirmatory factor analysis (CFA) and exploratory factor analysis (EFA) and were given a "very good" rating (Muller, 2012; Sastre-Fullana et al., 2017; Wangensteen et al., 2015). Four studies met the structural validity criteria and were given a rating of "sufficient" in terms of methodological quality and "high" for quality of evidence (Liu et al., 2007; Muller, 2012; Sastre-Fullana et al., 2017; Shuman et al., 2017). The other four studies were given an "indeterminate" rating and downgraded to "moderate" in terms of quality of evidence as it was not clear whether the chosen model suits the research question (Cowan et al., 2008; Lombarts et al., 2014; Meretoja et al., 2004; Wangensteen et al., 2015).

4.3.4 | Internal consistency

Internal consistency is defined as the interrelatedness among the items and it is usually assessed by applying Cronbach's α (Mokkink et al., 2018). All instruments were assessed for internal consistency and Cronbach's α was calculated for each unidimensional scale separately in eight studies and given a "very good" rating, while study conducted by

TABLE 4 Methodological quality of psychometric properties and level of evidence of included studies

Psychometric Properties	Summarized Results	Overall rating	Quality of evidence
EHTAN Questionnaire Tool			
Content Validity	Relevance ± Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Not all information for sufficient rating reported	?	Moderate ^a
Internal consistency	Cronbach's α 0.95–0.97	+	High
Cross-cultural validity	No multiple group factor analysis OR DIF analysis performed	?	Moderate ^a
Competency Inventory for Registered Nurse			
Content Validity	Relevance + Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Multidimensional scale (7 sub-scales with 58 item)	+	High
Internal consistency	Cronbach's α from 0.79–0.86	+	High
Reliability	ICC 0.79–0.91	+	High
Criterion validity	Correlation with the gold standard	–	Moderate ^a
Construct validity	Hypothesis confirmed	+	High
Professionalism Instrument			
Content Validity	Relevance ± Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Not all information for sufficient rating reported	?	Moderate ^a
Internal consistency	Cronbach's α 0.49–0.83	–	High
Construct validity	Hypothesis confirmed	+	High
Cross-cultural validity	No multiple group factor analysis OR DIF analysis performed	?	Moderate ^a
Nurse Competence Scale			
Content Validity	Relevance + Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Not all information for sufficient rating reported	?	Moderate ^a
Internal consistency	Cronbach's α 0.79–0.91	+	High
Criterion validity	Correlation with the gold standard	+	High
Construct validity	Hypothesis confirmed	+	High
German Version of Nurse Competence Scale			
Content Validity	Relevance ± Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Multidimensional scale (6 sub-scales with 54 items)	+	High
Internal consistency	Cronbach's α 0.84–0.92	+	High
Construct validity	Hypothesis confirmed	+	High
Cross-cultural validity	Important differences between group factors and DIF was found	–	High
Advanced Practice Nursing Competency Assessment Instrument			
Content Validity	Relevance + Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Multidimensional scale (8 sub-scales with 44 items)	+	High
Internal consistency	Cronbach's α 0.84–0.92	+	High

(Continues)

TABLE 4 (Continued)

Psychometric Properties	Summarized Results	Overall rating	Quality of evidence
Nurse Manager EBP Competency Scale			
Content Validity	Relevance + Comprehensiveness + Comprehensibility +	+	High
Structural Validity	2 sub-scales with 16 items	?	High
Internal consistency	Cronbach's α of 0.95	+	High
Competency Assessment List (Compass)			
Content Validity	Relevance \pm Comprehensiveness + Comprehensibility +	+	High
Internal consistency	Cronbach's α 0.89–0.94	+	High
Reliability	ICC not reported	?	Moderate ^a
Responsiveness	Effect size was reported	+	High
Norwegian Nurse Competence Scale			
Content Validity	Relevance \pm Comprehensiveness + Comprehensibility +	+	High
Structural Validity	Multidimensional scale (5 sub-scales with 46 items)	+	Moderate ^a
Internal consistency	Cronbach's α 0.72–0.92	+	High
Cross-cultural validity	No multiple group factor analysis OR DIF analysis performed	?	Moderate ^a

Abbreviations: + = sufficient result; - = insufficient result; ? = indeterminate; ^a = downgrading for risk of bias; DIF = differential item function; ICC = interclass correlation coefficient.

Shuman et al. (2017) was given a “doubtful” rating, as that study only calculated and reported the item-total correlations. Overall, the methodological quality of all studies was rated as “sufficient” for internal consistency and was given a rating of “high” for quality evidence, as the total Cronbach's α value for all included instruments were ≥ 0.70 .

4.3.5 | Cross-cultural validity / Measurement invariance

Cross-cultural validity refers to the extent to which the performance of the items on a translated or culturally adapted instrument is an adequate reflection of the performance of the items of the original version of the instrument (Mokkink et al., 2018). Cross-cultural validity was tested in four reviewed studies (Cowan et al., 2008; Lombarts et al., 2014; Muller, 2012; Wangensteen et al., 2015).

Although the translations were produced by expert translators working independently, and multiple forward and backward translations were performed, the quality of three studies was rated as “indeterminate” as no multiple group factor analysis OR differential item functioning (DIF) analysis was reported. Therefore, these studies were downgraded to a rating of “moderate” for quality of evidence (Cowan et al., 2008; Lombarts et al., 2014; Wangensteen et al., 2015). Muller (2012) was rated “insufficient” for methodological quality and “high” for quality of evidence, as there was an important difference

between group factor analysis and local dependency, and DIF analysis was calculated and reported.

4.3.6 | Reliability

Reliability is defined as the proportion of the total variance in the measurements that is due to “true” differences between professionals (Mokkink et al., 2018). The reliability of the CIRN instrument was tested by distributing questionnaires to participants on two occasions separated by 10 days, with Pearson's product-moment r ranging from 0.79 to 0.91 (Liu et al., 2007). Additionally, Tromp et al. (2012) stated that the test-retest and interrater reliability of the Compass instrument was tested at 3-month intervals, and that the resulting ratings increased over time. Both studies were rated as “doubtful” as it was unclear whether professionals were stable in the interim period. The time interval was not appropriate and was rated as “doubtful” in the study conducted by Liu et al. (2007). The time interval was rated “very good” by Tromp et al. (2012), as the study was conducted every 3 months. Overall, CIRN was rated as “sufficient” for methodological quality because the interclass correlation coefficient (ICC) ≥ 0.70 , so it was rated “high” for quality of evidence. The Compass instrument was rated as “indeterminate” as the correlations from the ICC, Pearson, and Spearman were not reported. Therefore, it was downgraded to “moderate” for quality of evidence.

4.3.7 | Criterion validity

Criterion validity is defined as the degree to which the scores of a scale are an adequate reflection of a gold standard (Mokkink et al., 2018). Criterion validity is assessed through the comparison of instrument's results against a "gold standard." Only two of the included studies considered and reported the gold standard (Liu et al., 2007; Meretoja et al., 2004). The criterion validity of the CIRN scale was tested against the Six-Dimension (Six-D) scale of nursing performance, yielding strong correlation coefficient of ($r = 0.44$, $p = 0.04$) and ($r = 0.829$, $p = 0.00$), respectively. The methodological quality of CIRN was rated as "insufficient" for criterion validity as the correlation with the 6D scale was <0.7 and it was downgraded to "moderate" for quality of evidence, while NCS was given "high" for quality evidence for "sufficient" criterion validity, as the correlation was ≥ 0.7 .

4.3.8 | Hypothesis testing for construct validity

Hypothesis testing for construct validity refers to the degree to which the scores of an instrument are consistent with a hypothesis based on the assumption that the instrument validly measures the construct to be measured (Mokkink et al., 2018). Hypothesis testing was reported in four studies, by comparing the results of included studies with other outcome measurement instrument (convergent validity) (Liu et al., 2007; Meretoja et al., 2004; Muller, 2012) or comparing the results between subgroups within the included study (discriminative or known-group validity) (Lombarts et al., 2014). The study led by Liu et al. (2007) showed a positive correlation ($r = 0.44$, $p = 0.04$) between the Six-D and the CIRN. Hypothesis testing conducted by Lombarts et al. (2014) revealed positive relationships between instrument scores and professional attitudes among group of nurses ($b = 0.01$, $p < 0.0001$) and physicians ($b = 0.02$, $p < 0.0001$). Meretoja et al. (2004) performed hypothesis testing of the NCS against the Six-D scale and showed that they correlate very strongly ($r = 0.829$, $p = 0.00$). In addition, hypothesis testing based on a comparison of the original NCS and the six unidimensional scale revealed a statistically significant correlation between the two measures (Muller, 2012). The hypothesized model was estimated by maximum likelihood with robust standard error and the Satorra-Bentler scaled chi-square test statistic to adjust for normality. The hypothesized model was $\chi^2 = 7,473$ (d.f. = 2,555), $p < 0.0001$. Overall, the methodological quality of all four studies was rated as "sufficient" for construct validity and "high" for quality evidence, as the hypothesis was confirmed.

4.3.9 | Responsiveness

Responsiveness relates to the capability of the instrument to recognize the changes over period of time in the measured constructs (Mokkink et al., 2018). Only one of included studies measured the responsiveness data before and after intervention with the effect size (Tromp et al., 2012). This study reported a medium to large effect size,

comparing the first 3-month period (T1) and the second period (T2), and effect sizes were all large when we compared T1 and the third period (T3). These results showed that the trainees' scores on the instrument increased over time as they advanced through their training. The methodological quality of this study was rated as "sufficient" as an adequate description was provided of the intervention, so it was also rated as "high" for quality of evidence.

5 | DISCUSSION

Existing valid and reliable instruments may address core competency themes (in whole or in part) and be suitable for integratively assessing the competence of both nurses and physicians. All reviewed instruments covered multithemes, and most of them address the following themes: professionalism, ethical and legal issues, leadership and management, teamwork and collaboration, research and evidence-based practice, personal and professional development, and patient-centered care, although these themes were sometimes referred to using different synonyms. However, only a few of the instruments addressed quality improvement, safety, communication, and health information technology.

Quality improvement was addressed by four instruments (Lombarts et al., 2014; Meretoja et al., 2004; Muller, 2012; Sastre-Fullana et al., 2017). This theme is giving more attention as the provision of quality healthcare is a key challenge for healthcare system around the world (The Health Foundation, 2013). Quality improvement involves using data to measure healthcare service outcomes and to improve or maintain the quality of care and patient safety (The Health Foundation, 2013). In modern healthcare systems, healthcare providers must have knowledge, skills, and suitable attitudes relating to all of the core competencies, including quality improvement. Several international healthcare institutions have recognized healthcare quality as a key concern, including the WHO, ICN, AACN, and other national organizations (IOM, 2011). The IOM stated that healthcare professionals must be able to work effectively in teams in order to bridge the quality gap in the US healthcare system.

Safety was (surprisingly) only addressed by one of the reviewed instruments (Lombarts et al., 2014). Despite increasing attention to healthcare quality and patient safety, the incidence of errors and adverse outcomes in clinical practice continues to increase (Kalra & Adams, 2016). While it is difficult to reliably estimate error rates, clinical malpractices continue to affect millions of patients around the world with injuries, disabilities, and deaths, and approximately half of these adverse outcomes are preventable (Goedecke, Ord, Newbould, Brosch, & Arlett, 2016). To reduce the incidence of these patient safety outcomes, healthcare professionals must communicate and report any incidents and adverse events. However, such events are frequently underreported, making it difficult to evaluate trends and changes over time, (Kalra & Adams, 2016). Healthcare professionals have important roles in promoting safe care to their patients and increase the quality care of healthcare system (IOM, 2011). Accordingly, Gulf Corporation Council Countries (GCC) such as the Sultanate

of Oman have recently increased their emphasis on assessing aspects of patient safety including report and response to an error, prevention of infection, the use of evidence-based practice, precise communication during handover, and promotion of patient safety and prevention strategies (Al-Lawati, Dennis, Short, & Abdulhadi, 2018). Assessing patient safety in a healthcare organization is the first step toward identifying gaps and areas for improvement.

Communication was addressed by three instruments (Cowan et al., 2008; Liu et al., 2007 & Tromp et al., 2012). Communication skills enable effective interaction between healthcare professionals and patients to increase healthcare efficiency, upgrade quality services, and provide safe clinical practice (Sheldon & Hilaire, 2015). Good communication can improve patient satisfaction, patient compliance, and patient healthcare outcomes. The literature demonstrates that many patients value healthcare professionals' communication skills even more highly than their technical skills (McCorry & Mason, 2011). The communication skills of nurses (and the assessment of those skills) are particularly important as they make up 80% of the healthcare workforce worldwide (Sheldon & Hilaire, 2015).

Health information technology (HIT) was addressed by only two of the instruments, via the "Clinical Care" and "Work Role" themes (Liu et al., 2007; Meretoja et al., 2004). HIT is increasingly important and widely used to increase healthcare quality and patient safety by identifying and preventing adverse events and enabling staff to react on any issue previously considered unavoidable (Feldman, Buchalter, & Hayes, 2018). Healthcare professionals must have technical skills and competence with HIT that guide practitioners for implementing the principles of evidence practice at clinical setting (Lavin et al., 2015). HIT can have a particularly strong impact on how healthcare professionals plan, deliver, document, and measure patient outcomes. The efficiency of work in clinical settings can be increased by introducing digitized workforce services and providing computerized knowledge management and decision support. Such measures can reduce the time hospital nurses spend on documentation by 23–24% (IOM, 2011).

Comprehensive methodological quality reviews are powerful tools for identifying the most appropriate measurement instrument for a given case (Flinkman et al., 2017). The COSMIN checklist was used to assess the methodological quality of the nine included studies; all instruments' developers assessed the content validity and internal consistency of the checklist's measurement properties. The independent reviewers' evaluation of the included studies ranged from "doubtful" to "very good" and the majority were given a rating of "sufficient" for methodological quality. Therefore, most of the psychometric properties of instruments were rated as "high" for quality of evidence, while a few were downgraded to "moderate." All of the instruments exhibited strong validity because they were reviewed by expert groups and some were pretested. Furthermore, most of the authors reported adequate values of Cronbach's α , ranging from 0.70 to 0.95. It should be noted that most of the included studies had large sample sizes and were conducted in hospital settings and multiple countries, which could increase the external and cross-cultural validity of their findings (Dambi et al., 2018).

The analysis of the reviewed nine studies demonstrates that the enclosed instruments either (i) were specific in scope and/or (ii) do not cover every critical and emerging theme relating to the competencies of nurses and physicians. The identified themes include quality improvement, safety, professionalism, leadership and management, communication, teamwork and collaboration, ethical and legal issues, research and evidence-based practice, personal and professional development, HIT, and patient-centered care.

Nurses and physicians are the key professionals within healthcare systems, and they both work toward shared objectives and business drivers (Smith, 2012). This work provides meaningful insights of competencies for nurses and physicians with the associated psychometric properties that increase the validity and reliability of the competency instruments. Such work would also provide a robust basis for future work to incorporate competence aspects relevant to other healthcare professionals such as social workers, therapists, and dieticians to produce a global tool for assessing the end-to-end performance of any healthcare system.

6 | STRENGTHS AND LIMITATIONS

The researchers used the COSMIN checklist, a useful tool widely used for assessing the methodological quality of reviewed studies, which strengthened this systematic review of measurement properties (Mokkink et al., 2018). The data selection processes were performed systematically with a consulting librarian expert, following PRISMA guidelines and reviewed by the other researchers. Two reviewers independently assessed the methodological quality of the included studies and agreed on the rating scores.

All nine reviewed studies were conducted in a hospital context. Findings may be different for studies conducted in home-based care and community health care. The initial data extraction was performed by the principal researcher, creating a risk of bias, and reviewed by the other researchers thereafter. The researchers did not contact the authors of included studies to verify these issues.

7 | CONCLUSION

This systematic review has provided meaningful insights about core competencies for nurses and physicians with the associated psychometric properties that indicate the instruments were valid and reliable based on COSMIN checklist (2018). All these reviewed instruments measured important themes of core competencies that include professionalism, ethical and legal issues, research and evidence-based practice, personal and professional development, teamwork and collaboration, leadership and management, patient-centered care, quality improvement, safety, communication, and HIT.

Continuous evaluation and assessment of these core competencies shall contribute to healthcare organizations' competitiveness. This may indicate that the level to which professionals demonstrate these competencies might impact quality of care and patient safety.

8 | RELEVANCE TO CLINICAL PRACTICE

Core competencies of healthcare professionals lie at the heart of healthcare delivery efficiency and transformation. This systematic review shares insights into how the current clinical practice measures core competencies that are not necessarily comprehensive. In addition, it advocates for the establishment of a professional framework that is based on validated matrices to be professionally incorporated.

AUTHORSHIP STATEMENT

All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of the Medical Journal Editors and that all authors are in agreement with the manuscript.

AUTHOR CONTRIBUTIONS

Study design: F.A., T.K., and H.T.

Data collection: F.A., T.K., and H.T.

Data analysis: F.A., M.A., T.K., and H.T.

Manuscript writing: F.A., T.K., and H.T.

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CONFLICT OF INTERESTS

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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