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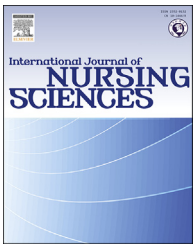

Original Article

Core competence evaluation standards for emergency nurse specialist: Developing and testing psychometric properties

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ABSTRACT

Introduction: Nurse specialists are being cultivated and trained in China to cope with the international development of nursing discipline. However, an empirical summary and reviews of literature have shown a lack of core competence evaluation standards for emergency nurse specialists (ENSs) in China. ENS training has been conducted in several regions without any effective competence evaluation standards. This paper describes the development and psychometric testing of the Core Competence Evaluation Standards for Emergency Nurse Specialists (CCESENS) in the Chinese context.

Methods: Several rigorous research methods were applied. The proposed evaluation process consisted of two phases with seven steps. First, the Core Competence Framework Model for Emergency Nurse Specialist (CCFMENS) was established, and 118 items were generated through a review of literature, theoretical analysis, and expert interviews. Drafts of the dimensions and items were evaluated by two-round Delphi methods. Analysis hierarchy process was used to determine the weight of each dimension. Second, field testing was performed among 138 senior emergency nurses. Internal consistency and correlation analysis were applied to test the reliability and validity of the model.

Results: The CCESENS consisted of five first-level dimensions, 16 second-level dimensions, and 55 items. Cronbach's α coefficient of overall standards was 0.972, and each dimension ranged from 0.508 to 0.972. Expert content validity index was 0.818, and the correlation coefficients of the five first-level dimensions with the overall standards CCESENS ranged from 0.701 to 0.886 ($P < 0.05$).

Discussion: The CCESENS demonstrated sound internal consistency reliability, content validity, and construct validity. The proposed standard provides an objective standard and reference for assessing, training, and evaluating core competence of ENS.

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1. Introduction

Advanced nursing management experience and model from western countries have attracted much attention from Chinese nursing researchers and administrators. Consequently, specific professional models are being developed in line with Chinese nursing practice [1–3]. The Ministry of Health in China published the *Chinese Nursing Developing Project Outline* in July 2005 and February 2012. The document clearly states that nursing administrators need to establish training projects for clinical nurse specialists (CNSs), such as those in the Emergency Department and Intensive Care Units. These projects also need to associate work duties with different skill levels and hierarchically supervise nurses at different levels.

Therefore, Chinese professional nurses, especially emergency nurses, are facing challenges. Emergency nurses in the Chinese health system should provide high quality care and ensure patient's safety in a dynamic environment with their core competence [4]. Several studies have documented that nurses' core competence could improve the quality of care and reduce health cost [5]. The United States, Canada, Australia, Hong Kong, and Taiwan have established core competence standards for CNSs. However, such standard has not been developed in China by 2011.

The Shanghai Nurse Association (SNA) has been conducting training for emergency nurse specialists (ENSs) since 2006, which is a milestone in the history of Chinese nursing. However, the project lacked an effective evaluation standard for core competence. Therefore, this study was performed to construct a core competence index system to evaluate ENSs in line with Chinese nursing practice using various methods.

2. Background

CNSs first emerged in the US over 60 years ago. These professionals have been recognized in many countries, such as the UK, Canada, Australia, Japan, Hong Kong, and Taiwan. Core competence evaluation of CNSs has been developed and amended constantly with the development of clinical nurse specialization.

Core competence standards for different CNSs, such as nurse anesthetists, midwives, cancer nurses, and public health nurses, have been proposed in the US since 1978. Core competence includes nurses' education background, practice scopes, and competence requirements. These competences are being been amended to meet changes in clinical practice. The American Emergency Nurses Association (ENA) published the *Scope of Emergency Nursing Practice* in 1999. This document is useful in defining the duties of registered nurses' in emergency settings and provides measurable criteria for high-quality emergency nursing practice. ENA also used a Delphi study in 2010 to develop the required competences for entry-level emergency nurse practitioners in emergency care [6,7]. The requirements stated that nurse practitioners (NPs) should be able to demonstrate their essential knowledge, behavior, and skills to undertake work in emergency care.

The Australian Nursing and Midwifery Council (ANMC) developed the first national competence standard for registered nurses in the early 1990s. The standard is revised regularly. Other standards, such as codes of professional conduct and ethics and a range of position statements and guidelines, have been adopted by the ANMC for enrolled nurses, midwives, and NPs [8]. O'Connell and Gardner conducted a pilot study in 2012 about the development of a competence framework for emergency NPs [9].

The Royal College of Nursing required certain competences for ENS in 2002. These competences included five scopes (adults, seniors, children, first aid, and mental) and four domains (abilities to use knowledge, professional skills, abilities to use evidence-based nursing, and the development of person, profession, and team) [10].

Emergency and clinical nursing specialists share the same competence standards in several countries, such as Canada, Australia, Hong Kong, and Taiwan [8,11–13].

Advanced nursing practice started late in China, and evaluation of nurses' competence was mainly based on clinical performance. Nursing practice in China is quite different from those in other countries and regions. Thus, Chinese nursing administrators should establish effective core competence standards for ENS in line with Chinese nursing settings.

3. Methods

3.1. *Research procedures*

The study was based on a rigorous design of methods. The process could be divided in two phases with seven steps. An evaluation index system was established in the first phase using the Delphi method to determine index weight by analysis hierarchy process. Psychometric testing of the Core Competence Evaluation Standards for Emergency Nurse Specialists (CCESENS) was performed in the second phase using items and correlation analysis.

3.1.1. *First phase*

Step 1: A focus group was first organized to construct the core competence framework and draft the evaluation index. Then, an expert inquiry form was prepared for further interview with the consultants. Related data collated after the interview were statistically analyzed. A conclusion report was accomplished based on the results.
Step 2: Relevant concepts and competence requirements for ENS were determined through the expert interview. The experts comprised nine nursing professionals with expertise in emergency nursing, nursing education, nursing management, clinical practice, and medical statistics. The expert should have at least a bachelor's degree and more than 10 years of work experience.

The index pool of the evaluation standards was established through rigorous review of literature, covering authoritative documents from the International Council of Nursing, US, UK, Australia, Hong Kong, and Taiwan, as well as from the professional nurse registration requirements in China [6–17]. Diverse framework of competence guideline or standards

were analyzed and integrated to form the contents of the index pool.

Step 3: Key concepts, as well as first-level and second-level dimensions, in the draft of the evaluation index system were defined by the research group. Eight first-level dimensions, 35 second-level dimensions, and overall 180 items were included in the draft. Then, an expert panel consisting of the nine professionals in step 2 held a seminar to discuss the dimensions and items. The seminar included three activities: (1) determination of the conformity of the expression and form of the draft to the criteria; (2) evaluation of the contents of the index draft; and (3) examination of whether the consultative table met the requirements of the statistical analysis. A refined version of the index draft was obtained and included six first-level dimensions, 22 second-level dimensions, and a total of 90 items.

The evaluation index system was further developed by two-rounds of Delphi method. Seventeen experts, including 15 nurse experts and 2 doctors from hospitals in Shanghai, were selected. The experts should have at least a bachelor's degree, high academic reputation in the field of nursing, and more than 10 years of work experience. E-mail or face-to-face interview with the experts was used for the Delphi method, and inquiry response was required within 2 weeks. Representative of the experts was evaluated by their familiarity with the study and basis of their judgment.

Likert 5-point rating scale was used for the experts' judgment, ranging from 1 (very unimportant) to 5 (very important). The screening of index dimensions and items were based on the results of variation coefficients and mean. Variation coefficients < 0.25 and mean > 3.5 were considered acceptable for inclusion. Several items were also excluded, extended, and modified according to the experts' advice. Thus, five first-level dimensions with 55 items were retained after two rounds of Delphi methods. These items included professional practice (n = 28), critical thinking (n = 10), management (n = 9), communication and coordination (n = 5), and professional development (n = 5).

Positive coefficient, authoritative coefficient of experts, and the Kendall's coefficient were used to ensure the results of Delphi method.

Step 4: The weight coefficients of the first-level and second-level dimensions were determined by the analysis hierarchy process after two rounds of Delphi method.

3.1.2. *Second phase*

Step 5: The questionnaire was developed based on the simplified index system. Ten of the 17 experts were selected to ensure the content validity of the questionnaire.
Step 6: Pre-test of CCESENS was administered to 15 ENSs to test internal consistency.
Step 7: A survey was conducted among 138 ENSs to test the reliability and validity of the CCESENS. Internal consistency and correlation were tested to establish the final version of CCESENS.

3.2. *Sample*

Cluster sampling method was conducted to reach a sample of 138 ENSs from the emergency departments of nine hospitals in Shanghai. These hospitals were all first-class hospitals, including two military medical university-affiliated hospitals and seven medical university-affiliated hospitals. Eligible ENS should have a certificate of emergency nurse granted by the SNA, be a licensed registered nurse, and have more than 5 years of experience in emergency nursing.

The questionnaires were distributed to 170 ENSs, and 155 nurses returned the questionnaire, yielding a response of 91%. Among the 155 returned questionnaires, 17 were excluded. Five excluded questionnaires showed the same answer for all items, and the rest had incomplete answers. Consequently, 138 questionnaires were analyzed with an effective response rate of 81%. Fifteen of the 138 ENSs were also selected for the pre-test.

3.3. *Ethical considerations*

The study was approved by the Hospital Ethics Committee of Gansu Province and SNA. No conflicts of interest with other individuals or institutions were reported in this study. Every participant signed a consent form before proceeding.

3.4. *Data analysis*

Statistical analysis was performed using SPSS 17.0 Analysis hierarchy process was conducted with AHP 5.0. Reliability was tested by Cronbach's α coefficients. Construct validity was tested by correlation analysis. Contrast-group validity was compared by t-test.

4. Results

4.1. *Delphi result*

The two rounds of Delphi methods had expert-positive coefficients of 0.89 and 1.0, with authoritative coefficients of experts reaching 0.85. In addition, the Kendall's coefficients of concordance (W) of the first-level and second-level dimensions were 0.37 and 0.61, respectively, ($P < 0.05$). One first-level dimension, six second-level dimensions, and 32 items were excluded (variation coefficients > 0.25, mean < 3.5). One second-level dimension and 44 items were amended (variation coefficients < 0.25, mean > 3.5).

Cronbanch's α coefficients for overall CCESENS in the pre-test and standards were 0.936 and 0.656–0.918, respectively.

4.2. *Core Competence Framework Model for Emergency Nurse Specialist (CCFMENS)*

CCFMENS is presented in the form of concentric circles in Fig. 1. The second layer of concentric circles was the key component of the emergency nurse's core competence based on the nurse' clinical practice, such as knowledge, skills, and abilities. The outer ring defined five specific competence modules consistent with the basic requirements of the nurse'

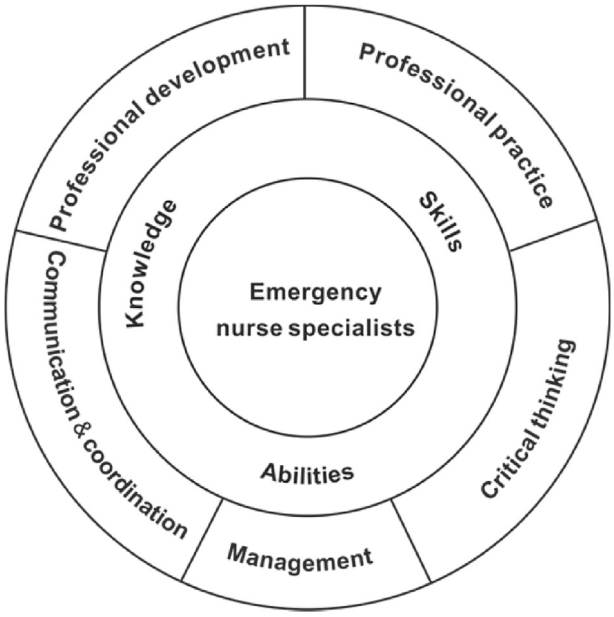

Fig. 1 – Core competence framework model for ENS.

knowledge, skills, and abilities. The connotations of the five modules were as follows. Professional practice indicated nursing behavior in line with legal and ethical principles of the profession. This behavior required expertise and professional skills to protect the rights of individuals and groups. Critical thinking involved the ability to solve nursing problems in a complex clinical situation, find solutions, and perform purposeful and meaningful self-regulation of judgment and reflection process. The main components of critical thinking included analysis, judgment, evaluation, reasoning, and prediction. Management was the ability to plan, organize, control, and coordinate nursing practices to improve the quality and ensure the safety of care. Communication and coordination was the ability to communicate and cooperate with patients or other health care professionals. Professional development was to actively participate in professional learning activities and training, constantly improve professional levels, and gradually develop into a nurse specialist.

4.3. *Weight coefficients of dimensions*

4.3.1. *The weight*

Coefficients of the dimensions are presented in Table 1. The weight coefficients of the first-level dimension ranged from 0.1067 to 0.5211. The weight coefficients of the second-level dimensions under higher-level dimensions ranged from 0.1106 to 0.5210. Combination of weights ranged from 0.0133 to 0.2791.

4.4. *Demographic characteristics of participants*

All 138 nurses from emergency departments were females, with ages ranging from 28 years to 50 years and average age of 34.7 years. Work experience ranged from 8 years to 30 years with an average of 14.8 years. A total of 116 participants attained a diploma degree, whereas 22 participants owned held a bachelor's degree. The professional title of 115 participants was senior nurse, and 23 participants were supervisor nurses. Only seventeen head nurses were among the 138 participants.

4.5. *Reliability*

The results of the internal consistency analysis of each first-level dimension are presented in Table 2. Cronbach's coefficients of the total scale and first-level dimensions were 0.966 and 0.508–0.972.

Table 1 – Weight coefficients of the first and second-level dimensions of CGCESENS.

Dimension	First-level dimension weight	Second-level dimension weight	Combination weight
I-1 Professional practice	0.5211		
II-1 Applying knowledge		0.4790	0.2420
II-2 Professional skills		0.5210	0.2791
I-2 Critical thinking	0.2184		
II-3 Assessment & prediction		0.2441	0.0518
II-4 Dealing with changes		0.2947	0.0685
II-5 Analysis & comprehension		0.1842	0.0386
II-6 Judgment & decision		0.1664	0.0540
II-7 Evaluation		0.1106	0.0241
I-3 Management	0,0658		
II-8 Planning		0.5165	0.0333
II-9 Organization		0.2749	0.0192
II-10 Supervision		0.2086	0.0133
I-4 Communication & coordination	0.1067		
II-11 Communication		0.4315	0.0420
II-12 Coordination & cooperation		0.3346	0.0320
II-13 Self-adjustment		0.2339	0.0233
I-5 Professional development	0.0879		
II-14 Learning		0.4688	0.0409
II-15 Research ability		0.1787	0.0147
II-16 Teaching		0.3526	0.0324

Table 2 – Internal consistency of the CCESENS as estimated by Cronbach's α coefficient (n = 138).

First-level dimension	Number of items	Cronbach's α
Professional practice	28	0.972
Critical thinking	10	0.801
Management	5	0.675
Communication & cooperation	9	0.726
Professional development	5	0.508
Overall	57	0.966

4.6. *Validity*

Some studies have shown that validity was over than 0.7 to prove a good construct validity [18,19].

Content validity index of CCESENS was 0.818. Correlation coefficients between each two of the five first-level dimensions, as well as the first-level dimensions and the total scale, are presented in Table 3.

Correlation coefficients between the 16 second-level dimensions and the first-level dimensions are presented in Table 4.

Correlation coefficients between 55 items and the total scale ranged from 0.085 to 0.795, except for Items 40 and 56, which had 0.121 and 0.085, respectively. Most of the items had significant positive correlation with the total scale.

5. Discussion

CCFMENS was created before the development of the evaluation standards to establish a theoretical foundation. Moreover, the concepts, connotation, and core competence of ENS were refined. The scope of clinical practice undertaken by domestic and foreign emergency nurses was clarified.

The CCESENS consisted of four parts, including competence dimensions, evaluation items, weight coefficients of dimensions and evaluation method. The findings were not only in line with nursing practice and role functions of ENS in China, but also reflected the development guidelines for ENS from the Ministry of Health. Several similarities and differences exist among relevant studies locally and abroad [16]. Advanced nursing education and the role of CNS are still being developed in China. Professional practice needs to be more emphasized, because nurses' duties are just limited to patient care. By contrast, little attention has been paid to nurses' management abilities and career development.

Evaluation standards covering 55 observable and measurable items were assessed using various evaluation methods. Therefore, the evaluation standards were practical and feasible.

Content validity is the most important type of validity because it ensures consistency between research objectives and evaluation tools. The evidence of content validity for

Table 3 – Correlation coefficients between five first-dimensions and dimension to total scale (n = 138, $P < 0.05$).

Dimension	D1	D2	D3	D4	D5	Total scale
Professional practice (D1)	1.000					
Critical thinking (D2)	0.744	1.000				
Management (D3)	0.700	0.665	1.000			
Communication & cooperation (D4)	0.614	0.611	0.488	1.000		
Professional Development (D5)	0.470	0.423	0.537	0.433	1.000	
Total scale	0.886	0.846	0.838	0.772	0.701	1.000

Table 4 – Correlation coefficients between second-dimensions and first-dimensions (n = 138, $P < 0.05$).

Second dimension	D1	D2	D3	D4	D5
II-1 Applying knowledge	**0.993***	0.748	0.695	0.611	0.458
II-2 Professional skills	**0.973***	0.715	0.689	0.591	0.466
II-3 Assessment & prediction	0.626	**0.767***	0.565	0.359	0.237
II-4 Dealing with changes	0.514	**0.760***	0.612	0.412	0.332
II-5 Analysis & comprehension	0.524	**0.736***	0.435	0.585	0.356
II-6 Judgment and decision	0.403	**0.781***	0.368	0.462	0.328
II-7 Evaluation	0.843	**0.748***	0.611	0.513	0.364
II-8 Planning	0.555	0.554	**0.737***	0.353	0.468
II-9 Organization	0.656	0.595	**0.853***	0.474	0.493
II-10 Supervision	0.479	0.463	**0.794***	0.341	0.349
II-11 Communication	0.464	0.405	0.388	**0.725***	0.451
II-12 Coordination & cooperation	0.633	0.693	0.573	**0.847***	0.451
II-13 Self-adjustment	0.262	0.229	0.108	**0.681***	0.078
II-14 Learning	0.347	0.261	0.348	0.364	**0.566***
II-15 Research ability	0.098	0.067	0.178	0.177	**0.773***
II-16 Teaching	0.609	0.605	0.646	0.430	**0.729***

Bold means the highest correlation coefficient of those between one second-level dimension with the five first-level dimensions. *means $P < 0.05$.

CCESENS was based on the theory and methodology of nursing, sociology, and surveying. The CCFMENS and dimensions and items of CCESENS were developed through extensive review of literature and the two-round Delphi methods. Data of the two-round Delphi methods met statistical requirements.

The CCESENS produced an overall Cronbach's α coefficient of 0.966 with five dimensions ranging from 0.508 to 0.972. Correlation analysis indicated that the correlation coefficient between each of the five first-level dimensions and the total scale ranged from 0.701 to 0.886. Cronbach's α coefficient of the total scale was higher than the correlation coefficient of the first-level dimension. Cronbach's α coefficient of each dimension was higher than the other dimensions. Therefore, the total scale and dimensions can be considered to have good internal consistency. Generally speaking, two variables have strong correlation when correlation coefficient is greater than 0.7 [20]. Studies have reported that the results of a study are reliable if Cronbach's α coefficient is greater more than 0.7 [18,19]. However, Cronbach's α coefficients of dimensions "Management" and "Professional Development" were less than 0.7. The reasons may reflect a real situation in which the two dimensions covered several abilities Chinese nurses neglect to foster in nursing practice, such as research ability, management, and leadership. Although Cronbach's α coefficient of the two dimensions was less than 0.7, the focus group discussed the three dimensions that should be emphasized because Chinese nurses should be trained in these competences to reduce the gap between China and west countries.

Most of the second-level dimensions were strongly correlated with their upper-level dimension, but had weaker correlation with other first-level dimensions. Most items had positive correlations with the total scale of standards with correlation coefficients ranging from 0.273 to 0.738. Items 40 and 56 had low correlation coefficients (Item 40, 0.121; Item 56, 0.085; $P > 0.05$), indicating that the two items had no significantly strong correlations with the total standards. Item 40 was "*I can use stress management method for self-adjustment under pressure*.", and item 56 was "*I never seek help from others under pressure*." These items belong to the same dimension "self-adjustment", that is, to use *stress management method for self-adjustment and ask someone for help if necessary*. The results indicated emergency nurses suffer severe pressure, and their ability to reduce pressure and self-adjust was poor. Thus, the focus group discussed that the two items should be reserved, because these competences are essential for emergency nurse.

Professional practice consists of applying knowledge and professional skills. This behavior mainly refers to the required knowledge and skills under the scope of legal and ethical norms in emergency nursing, such as those on common critical diseases in the emergency department. Compared with other similar studies, the standards added the application of high technology and the knowledge of spirit, culture, and health education in this dimension [21]. Critical thinking consists of assessment and prediction, dealing with changes, analysis and comprehension, judgment and decision, and evaluation. These five second-level dimensions are based on the holistic care procedure. They reflect the application of critical thinking in the nursing assessment, diagnosis, implementation, and evaluation. Dealing with changes is the most important and essential core competence for ENS, because it reflects the unique characteristic of emergency nursing. One of the roles of an ENS is the participation in management work to evaluate nursing quality and effects and conduct cost-benefit practice. Therefore, management is a necessary core competence. However, results of the study showed that the weight coefficient of management was only 0.0658, ranking least in the five first-level dimensions. The reasons might be relevant to the current Chinese nursing management model and some misconceptions that only nursing administrators, such as head nurses, need to possess management ability. Communication & coordination consists of communication, coordination and cooperation, and self-adjustment. Communication and coordination is a necessary quality for team work and cooperation with other health professionals. Self-adjustment is indispensable to an ENS who not only need to undertake heavy mental and physical working loads but also needs to tackle complex interpersonal conflicts [22]. Emergency nurses are under relatively higher pressure than nurses from other sections [23]. Professional development composes learning, research ability, and teaching, which are associated with the nurses' career planning. Research ability is a necessary core ability for an ENS, while the ability is pretty poor for Chinese nurses.

Table 1 indicates that the weight of professional practice was up to 0.5211 and the highest among the five first-level dimension. By contrast, management had the least weight of only 0.0658. The results were quite different from those of similar foreign studies [6,17]. These results showed that Chinese administrators and clinical nurses have different perceptions on what competence was more important. Moreover, the results of our study were not consistent with relevant foreign studies. Emergency nursing is a nursing role that requires critical thinking, management, and professional development. However, related studies showed that professional practice ranked the most important for nurse specialists and new nurses in China [24]. The weight coefficient of research ability was only 0.0147, ranking the 14th of the 16 second-level dimensions. This dimension also attained the lowest score in the two groups, showing that research ability was the weakest core competence for ENSs in China. The results also suggested that nurse administrators perceived that nurses should strengthen their research ability. However, this competence has not been paid sufficient attention.

6. Limitations and recommendations

The study applied various rigorous research methods to develop the standards, but the sampling process was conducted only in Shanghai. Therefore, the results could not represent the overall situation of a Chinese ENS.

Sample size should be increased, and targeted groups from other regions should be selected in future studies to further test the psychometric properties of CCESENS. In addition, the development of appropriate tools was based on the standards. Thus, the tool should be revised and developed constantly in nursing practice. Cross-sectional studies should be performed to explore the correlations between nurse core competence, training for nurses, and quality of care.

7. Conclusion

A series of standards with five first-level dimensions, 16 second-level dimensions, and 55 items were constructed to evaluate the core competence for ENSs. The CCESENS demonstrated appropriate properties of internal consistency reliability, content validity, and construct validity. This tool distinguished the differences in the emergency nurses' levels of ability. The CCESENS also provided references and guides for nurse administrators to train and evaluate core competence of clinical emergency nurses. Meanwhile, emergency nurses can use CCESENS for self-evaluation based on the objective criteria to improve and regulate their caring behavior and promote the improvement of comprehensive care quality. The CCESENS has been applied by several nursing associations in China and in many hospitals in Shanghai, Fujian, Gansu, and Jiangsu, among others.

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