DEVELOPMENT AND VALIDATION OF THE CORE CLINICAL NURSING COMPETENCE (CCNC) SCALE

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The authors declare no conflict of interest.

INTRODUCTION

Advancements in medical technology and changes in the medical environment have led to the development of nursing competence, which has become the main focus of nursing education. Nurses play major and direct roles in clinical patient care; therefore, the main aim of nursing education is to produce nurses who are competent in meeting clinical care needs. By focusing on competence in nursing education, the gap between education and practice can be narrowed, thereby leading to improved patient outcomes, clinical judgments, and accountability of learners (Tilley, 2008). The assessment and evaluation of nursing competence have recently attracted attention. Several measures of nursing competence have been developed and discussed in the literature; however, they remain lacking in dimension

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International Research Journal of Natural and Applied Sciences (IRJNAS) ISSN: (2349-4077)

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(Wilkinson, 2013). In addition, no studies have examined changes in clinical competence from nursing students to more competent nurses (Yanhua & Watson, 2011). The aim of this study was to develop and validate a nursing competence instrument that focuses on core clinical competence and allows for further professional growth.

BACKGROUND/LITERATURE

The recent focus of nursing education has been the assessment and evaluation of clinical competence to ensure safe and effective practice. Although there is no universal definition of clinical competence in nursing, it is generally agreed as the ability to integrate knowledge, skills, attitudes and values required to safely and effectively practice nursing (Yanhua & Watson, 2011). To ensure that nurses are adequately trained to be competent in clinical practice, various approaches have been developed to evaluate nurses' performance.

The approaches developed to test nursing competence include portfolios, objective structured clinical examinations (OSCEs), and self-report instruments. Portfolios are widely used by schools of nursing and during professional registration; however, studies have shown that portfolios lack clear guidelines (Bowers & Jinks, 2004; McMullan, 2006; Timmins & Dunne, 2009), are ineffective in assessing student learning and competence (McMullan, 2006), and have low interrater reliability (Robertson, Elster, & Kruse, 2004). OSCEs are another approach that is internationally applied to evaluate medical and nursing competence; however, they tend to be costly to implement and lack psychometric property testing (Yanhua & Watson, 2011). Therefore, self-report instruments have recently become alternatives to measure nursing competence more consistently.

In recent years, more attention has been focused on the development and testing of nursing competence evaluation tools worldwide. The currently existing tools that have been psychometrically tested are listed in Table 1. The Nurse Competence Scale (NSC) was developed to measure the competence level of nurses by using a VAS (0–100, very low to very high) and the frequency of competency use (0–3, not applicable to very often) (Meretoja,

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International Research Journal of Natural and Applied Sciences (IRJNAS) ISSN: (2349-4077)

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Isoaho, & Leino-Kilpi, 2004). It has been used in Australia (Hengstberger-Sims et al., 2008) and translated into Italian (Dellai, Mortari, & Meretoja, 2009). In collaboration with five European countries, Cowan et al. (2008) developed a post-registration nursing competence questionnaire that was based on the competency frameworks of EU countries. However, the questionnaire comprises 108 items, making it relatively lengthy and therefore rather infeasible for use in clinical settings (Wilkinson, 2013). Another 27-item competence assessment scale was developed by Safadi et al. (2010) and tested in Jordan. The scale was based on hospital evaluation tools and cooperation with nurse supervisors, but its content validity remains unknown.

(See Table 1 in Annexure Part)

Researchers are also attempting to develop psychometrically sound nursing competency instruments in Asia as well. Based on the International Council of Nurses' competency guidelines, the Competency Inventory for Registered Nurses (CIRN) was developed and tested in China (Liu, Kunaiktikul, Senaratana, Tonmukayakul, & Eriksen, 2007). The CIRN comprises 58 items in 7 dimensions; unlike other nursing competency scales, one of the CIRN's dimensions is leadership. Hsu and Hsieh (2009) developed the Self-Evaluated Core Competencies Scale (SECC) in Taiwan. The SECC comprises 8 items to measure how competent nurses perceive themselves to be in eight core competencies specified by the Taiwan Nursing Accreditation Council. However, the content validity has not been reported for the SECC. In Japan, the Holistic Nursing Competence Scale (HNCS) was developed by Takase and Teraoka (2011) via a concept analysis of 60 international nursing publications. The HNCS comprises 36 items in 5 dimensions to test how frequently nurses engage in behaviours related to general aptitude, and how competently they demonstrate the attributes of a professional.

As can be seen, there has been a gradual increase in the availability of tools. Furthermore, the aforementioned competence evaluation tools are all multidimensional.

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However, it should be noted that all were used in cross-sectional studies; thus, there is a need for additional longitudinal studies to assess clinical competence throughout nursing education (Yanhua & Watson, 2011). Additionally, most nursing competencies are measured in terms of the frequency of use, which might not be applicable for newly registered nurses, who have limited practical experience. The scales that contain dimensions of research or leadership also might not be suitable for a longitudinal evaluation of nursing competence. Assessments of nursing competency for newly graduated nurses should focus on the development of general nursing competencies rather than current expectations of advanced and workplace-specific nursing competencies (Hengstberger-Sims et al., 2008). Considering these points, the present study aimed to develop a nursing competence tool that focuses on general core nursing competencies and allows for the examination of changes in the clinical competence of nursing students as they develop into fully fledged nurses.

METHODS

A methodological study was conducted to develop a general core nursing competency scale. Items were generated via qualitative interviews, after which the content validity was tested based on expert opinions and a pilot study. The preliminary scale was then administered to a convenience sample of 260 clinical nurses from various clinical fields to determine its psychometric properties.

Step 1: Item construction

In this study, the Taiwan Nursing Accreditation Council's (2009) framework of core competencies was selected to define the dimensions of nursing competencies. The 8 dimensions of core competencies were critical thinking and reasoning, general clinical skills, basic biomedical science, communication and teamwork capability, caring, ethics, accountability, and lifelong learning. Each dimension comprised a single item rated by five statements, with each descriptive statement representing the nurse's competence level in that core competency. These competence levels were derived from Benner's (2001) framework,

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comprising novice, advanced beginner, competent, proficient, and expert; this ensured that participants' growth in terms of the eight core competencies could be measured (1 = novice and 5 = expert) and compared longitudinally.

Step 2: Expert opinion and a pilot study for content validity

After constructing the first draft of the Core Clinical Nursing Competence (CCNC) scale, we conducted content verification, including measurement of the face and content validity, by gathering consensus from experts. To ensure that experts agreed on the CCNC scale items, we had them perform two rounds of evaluation on the draft scale. Experts from nursing education and clinical settings were invited to complete the content validity assessment. They reviewed each item and determined if the item was appropriate for the CCNC in terms of representativeness, specificity, and concreteness. Using the technique recommended by Lynn (1986), the content validity index (I-CVI) was calculated for each item (participants rated each item by using a 4-point scale; 1 = *not relevant*, 2 = *unable to assess or in need of extensive revision such that the item would no longer be relevant*, 3 = *relevant but needs minor revision*, and 4 = *very relevant and succinct*). Items with an I-CVI of ≥ .78 according to three or more experts (S-CVI/Ave > .9) were considered to have satisfactory content validity (Polit & Beck, 2006; Polit, Beck, & Owen, 2007).

Face validity was assessed by 10 recent graduates selected purposively. These graduates were given the questionnaire and then asked to return it with written comments. Face validity and think-aloud assessments led to adjustments of the items and changes to the language of the questionnaire.

Step 3: Statistical analysis using data from a field study

Registered nurses who were currently working in clinical setting were invited to participate in the study through the snowball method. Google Drive was used to provide an Internet link for participants to access and complete the CCNC scale. They were asked to provide a unique identifier that was used to link responses for those who later completed the

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retest. The opening screen contained a consent form, followed by a radio button that, when selected, indicated their agreement to participate in the study.

Internal consistency reliability

The homogeneity amongst the items was tested with the corrected item-total correlation. In general, the higher the correlation, the more desirable is the item (DeVellis 2003, p. 93). Internal consistency reliability was calculated with Cronbach's α, setting a minimum acceptable value of > .70.

Construct validity

To confirm the unidimensionality and construct validity of the CCNC scale, exploratory factor analysis was performed with the principal components method. Varimax rotation with Kaiser normalisation was performed if the exploratory factor analysis extracted more than two factors. The criterion for factor extraction was an eigenvalue of >1.

Criterion-related validity

Criterion-related validity was tested with Spearman rank correlations by using a part of the current instrument. Correlation levels were interpreted as follows: 0–.25, slight correlation; .26–.49, low correlation; .50–.69, moderate correlation; .70–.89, high correlation; and .90–1.00, very high correlation (Munro 2005). The original items were as follows: working satisfaction, self-evaluation regarding clinical ability, intention to stay, and nursing tenure. The first 3 items were answered on a 5-point Likert scale ranging from 1 (*very unsatisfied/very unconfident*, 0%) to 5 (*very satisfied/very confident*, 100%). The fourth item was coded as a continuous variable.

Test–retest reliability

To assess test–retest reliability, all participants completed the questionnaire again. The interval between the first and second administration of the questionnaire was approximately 1 to 2 weeks. In total, 177 participants responded to the online questionnaire twice. The

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test–retest reliability was tested with Spearman rank correlation and intraclass correlation coefficient (ICC); a value > .70 was considered acceptable for both.

RESULTS

Participant characteristics

Overall, 260 participants were recruited. Most participants were female, had completed 2-year technical programmes, were N0 in terms of clinical ladder status, and were staff in academic medical centres. The mean age was 28.8 years and the mean work duration was 90.6 months **(See Table 2 in Annexure Part)**

Descriptive statistics of items

The item means ranged from 2.93 (lifelong learning) to 3.70 (caring) with standard deviations ranging from .83 (accountability) to 1.04 (critical thinking and reasoning), indicating appropriate variability. These results showed that the most competent subjects perceived their competence level as being between competent and proficient, except for lifelong learning, in which they perceived their competence level as being between advanced beginner and competent **(See Table 2 in Annexure Part)**

Internal consistency reliability and construct validity

The corrected item-total correlations ranged from .69 to .85, indicating that all items showed satisfactory homogeneity. In addition, the Cronbach's α of the scale was .94, which suggested satisfactory internal consistency. The exploratory factor analysis revealed that only one factor was extracted, with factor loadings from .76 to .89; this factor accounted for 70.91% of the variance (eigenvalue = 5.67). Unidimensionality is supported when all items of a scale load onto a single factor (Netemeyer et al. 2003). Exploratory factor analysis did not extract any additional interpretable factors, which supports the notion that the CCNC scale is unidimensional. In addition, the considerable size of the factor loadings and variance explained indicated that the CCNC had acceptable convergent validity **(See Table 3 in Annexure Part)**

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Criterion-related validity

The four criterion-related validity items (work satisfaction, self-evaluation for clinical ability, intention to stay, and nursing tenure) from the current instrument were defined as external criteria. All Spearman rank correlation coefficients between the eight items and the four external criteria were significant, suggesting evidence of criterion-related validity. Furthermore, the correlations between the 8 items and self-evaluation and nursing tenure were moderately high, ranging from .47 to 67. In contrast, the correlations between the eight items and work satisfaction and intention to stay were weak ($> .30$; Table 2).

Test–retest reliability

Overall, 177 participants completed the questionnaire a second time, with a mean interval of 12.40 days ($SD = 8.31$) from the first completion. In comparing the two tests (the first and second completion), we noted strong correlations and high ICCs: The correlations between the first and second tests ranged from .73 to .81, while the ICCs ranged from .83 to .90. These results suggest adequate stability between the two tests **(See Table 3 in Annexure Part)**

DISCUSSION

The present study results suggested that our instrument is innovative, succinct, and valid for measuring clinical nursing competence. Compared with previous instruments, our newly developed instrument required fewer items and more descriptive content focusing on a specific situation. For the same eight core competencies stipulated by the Taiwan Nursing Accreditation Council, Hsu and Hsieh (2009) developed the SECC scale to measure the clinical competence of nursing students. However, unlike the SECC scale, the CCNC scale developed in this study can be used to both measure fresh graduates' current level with the eight core competencies and chart their growth in terms of competence (including novice, advanced beginner, competent, proficient, or expert). As such, the CCNC scale could be suitable for use in a longitudinal study design with all levels of nurses to evaluate their

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changes in competency.

Regarding the validity of the CCNC scale, exploratory factor analysis revealed that only one factor was extracted, with factor loadings from .76 to .89 and a variance explained of 70.91%. As noted, above, unidimensionality is supported when a set of items fits within a single factor model, and only one factor was extracted in the present study, which was labelled 'clinical core competence'. Gonczi (1994) advocated that evaluating competency should be a holistic integrated approach because competence is context-bound and requires knowledge, skills, attitudes, values, professional judgments, and related abilities performed in specific situations (Gonczi 1994). This suggests that the 8-item CCNC was psychometrically effective in measuring the general clinical core competencies of currently registered nurses.

The stability of the psychometric findings of the CCNC scale obtained across two time points within 1 week was confirmed by a satisfactory ICC. In addition, a Cronbach's α of .94 for the instrument indicated its internal consistency (Cronbach 1971)—in other words, that all items measured the same construct (core nursing competence) and correctly reflected the degree of a given competency.

Internet data collection enables easy access to potential subjects working in different shifts and hospitals, thus increasing the diversity of participants. Based on the Taiwan Nursing Accreditation Council's (2009) framework of core competencies, the CCNC scale is a new instrument that measures clinical patient-care-related competencies of nurses instead of their administration- or academic-related competencies. Therefore, the scale would be helpful in direct comparison of outcomes of nursing education programmes at schools and in eliminating the gap between nursing schools and clinical settings. Furthermore, unlike other measuring scales, the CCNC scale is designed for currently employed full-time nurses, and it determines their clinical patient-care competencies.

Evaluation of competence by using self-report instruments is an essential and easy method of continuously assessing the professional capability of clinical nurses (Allen et al.

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2008). It must be noted, however, that objective instruments are increasing in number, including OSCEs, the mini-Clinical Evaluation Exercise, and the Direct Observation of Procedural Skills tools. More valid evaluation schemes would combine self-reported instruments and objective appraisal methods, which is essential in the future.

CONCLUSION

An innovative, succinct, valid, and reliable instrument for measuring clinical nursing competence, the CCNC scale, was developed. The trajectories of nursing competencies can be captured using the CCNC scale; therefore, clinical nursing managers or leaders can develop effective continued education programmes for registered nurses according to their clinical ladder status at various stages of their career.

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Annexure- Tables & Figures

Table 1

Current nursing competence evaluation tools developed with psychometric testing

Tool name	Author /Year	Items	Theoretical framework	Dimensions		Measures	Validity/ Reliability
Nurse Competence Scale (NSC)	Meretoja et al., 2004	73	Benner's stages of clinical competence	1. 2. 3. 4. 5. 6. 7.	Helping role Teaching-coaching Diagnostic functions Managing situations Therapeutic interventions Ensuring quality Work role	Level of competence (VAS 0-100) & frequency of use (0-3 Likert Scale)	Content validity Concurrent validity Internal consistency
Competency Inventory for Registered Nurses (CIRN)	Liu et al., 2007	58	ICN Framework of Competences for the Generalist Nurse	1. 2. 3. 4. 5. 6. 7. 8.	Leadership Clinical care International relationships Legal/ ethical practice Teaching-coaching Professional development Critical thinking Research aptitude	5-point Likert Scale	Content validity Test-retest reliability Criterion-related validity Contrast-group validity Internal consistency
Post-registration nurse competence questionnaire (EQT)	Cowan et al., 2008	108	EU competence frameworks	1. 2. 3. 4.	Assessment Care delivery Communication Health promotion	Frequency of use (4-point Likert Scale)	Content validity Construct validity Internal consistency

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				5. Personal and professional development
				6. Professional and ethical practice
				7. Research and development
				8. Teamwork

Scale	Author	Items	Source	Dimensions	Response scale	Validity/Reliability
Self-Evaluated Core Competencies Scale (SECC)	Hsu and Hsieh, 2009	8	Taiwan Nursing Accreditation Council's core competence framework	1. Humanity/responsibility 2. Cognitive/performance	Level of competence (4-point Likert Scale)	Test-retest reliability Internal consistency Principal component analysis Confirmatory factor analysis
Competence assessment scale	Safadi et al. 2010	27	Currently used hospitals' evaluation tools Cooperation of supervisors	1. Management 2. Professionalism 3. Problem-solving 4. Nursing process 5. Knowledge of basic nursing principles	Level of competence (5-point Likert Scale)	Face validity Internal consistency
Holistic Nursing Competence Scale (HNCS)	Takase and Teraoka, 2011	36	concept analysis with 60 international nursing publications	1. Staff education & management 2. Ethically-oriented practice 3. General aptitude 4. Nursing care in a team 5. Professional development	Frequency & competence (7-point Likert Scale)	Content validity Construct validity Criterion-related validity Internal consistency

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Table 2

Characteristic for the study participant ($N = 260$).

Variable	n (%) or *Mean* $\pm$ *SD* (Range)
Gender	
Female	254 (97.7)
Male	6 (2.3)
Age (year)	28.8 $\pm$ 6.9 (21–51)
Education completed	
5-year junior colleges	51 (19.6)
2-year technical programs	150 (57.7)
4-year technical programs	11 (4.2)
4-year baccalaureate programs	39 (15.0)
Graduate schools	9 (3.5)
Level of Hospital	
Academic medical centres	190 (73.1)
Metropolitan hospitals	38 (14.6)
Local Community hospitals	26 (10.0)
Clinics	6 (2.3)
Clinical Ladder Status	
N0	78 (30.0)
N1	54 (20.8)

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N2	75 (28.8)
N3	41 (15.8)
N4	12 (4.6)
Nursing tenure (month)	90.6 ± 85.9 (1–408)

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Table 3

The summary of results of the descriptive statistics, construct validity, criterion-related validity, and test-retest reliability of the CCNC scale ($N = 260$).

Item	Descriptive statistics		Construct validity		Criterion-related validity				Test-retest reliability ($n = 177$)	
	Mean	SD	Item-total correlation	Factor loading	Work satisfaction	Self-evaluation	Intention to stay	Nursing tenure	ρ	ICC (95% CI)
1. Critical thinking and reasoning	3.51	1.04	.77	.83	.29***	.62***	.16*	.67***	.81	.90 (.86 ~ .92)
2. General clinical skills	3.30	0.91	.82	.87	.30***	.58***	.20***	.66***	.81	.88 (.84 ~ .91)
3. Basic biomedical science	3.44	1.00	.82	.87	.24***	.59***	.16**	.63***	.75	.84 (.79 ~ .88)
4. Communication and teamwork capability	3.65	0.95	.82	.87	.28***	.56***	.27***	.63***	.73	.84 (.78 ~ .88)
5. Caring	3.70	0.92	.77	.83	.26***	.51***	.18**	.52***	.73	.85 (.79 ~ .89)
6. Ethics	3.32	0.87	.76	.82	.22***	.47***	.15*	.50***	.74	.84 (.78 ~ .88)
7. Accountability	3.51	0.83	.85	.89	.23***	.57***	.17**	.67***	.79	.86 (.82 ~ .90)
8. Life-long learning	2.93	0.97	.69	.76	.24***	.50***	.16**	.52***	.74	.83 (.78 ~ .88)

Note. CCNC = Core Clinical Nursing Competence scale; ρ = Spearman's rank correlation; ICC = intraclass correlation coefficient; CI = confidence interval. Cronbach's α = .94; Total variance explained = 70.91%. All values of item-total correlation, Spearman's rank correlation, and ICC were $p < .001$.

*$p < .05$, **$p < .01$, ***$p < .001$

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories.
International Research Journal of Natural and Applied Sciences (IRJNAS) ISSN: (2349-4077)

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